Appendix M

Alternative Technologies
Supplemental Information

Agricultural Practices Supplemental Information:

COMET Farm Testing Matrix

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COMET-Farm - Testing Matrix

Test #	Project ID	Description	Acres Con	Acres Alt/regen	Historical	Baseline	Future
1	AlternativeAg_Scenario1	Business As Usual - conventional	1000	0	conventional	conventional	conventional
2	AlternativeAg_Scenario2	25% acreage of alt practices	750	250	conventional	conventional	No till, Cover Crop, 50% reduced fertilizer
3	AlternativeAg_Scenario3	50% acreage of alt practices	500	500	conventional	conventional	No till, cover crop, 50% reduced fertilizer
4	AlternativeAg_Scenario4	75% acreage of alt practices	250	750	conventional	conventional	No till, cover crop, 50% reduced fertilizer

Agricultural Practices Supplemental Information:

Estimated Acres for Corn Production

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Estimated acres required for maximum ethanol production

Green Plains Ethanol Plant Results

	Value	Units	ref
Air permit max production of EtOH	65,000,000	gals/yr	
EtOH produced per bushel	2.9	gals/bu	
MN corn yield 2023	180	bu/acre	https://downloads.usda.library.cornell.edu/usda-esmis/files/tm70mv177/5x21w011c/9306vh649/crop1123.pdf
acreage needed	124521.0728	acres	

$$\frac{65 M galsEtOH}{1 year} \times \frac{1 bu}{2.9 galsEtOH} \times \frac{1 acre}{180 bu} = 124{,}521 acres annually$$

2017 USDA Census estimation results

	Value	Units	ref
Air permit max production of EtOH	65,000,000	gals/yr	
EtOH produced per bushel	2.9	gals/bu	
MN corn yield 2023	150	bu/acre	2017 USDA Census averages for Otter Tail & Wilkin County - see Baseline Corn Yield tab
acreage needed	149425.2874	acres	

Agricultural Practices Supplemental Information:

Estimated Farming Practices

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Farming Practice Estimations

Data sourced from 2017 USDA Census
Minnesota: Chapter 2 table 41

Source Data: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Minnesota/st27_2_0041_0041.pdf

Appendix B - General Explanation and Census of Agriculture Report Form:
https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usappxb.pdf

Otter Tail County

state	county	data item	value
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, NO-TILL - ACRES	33,515
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, NO-TILL - AREA, MEASURED IN ACRES / OPERATION	193
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, (EXCL NO-TILL) - NUMBER OF OPERATIONS	502
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, (EXCL NO-TILL) - ACRES	204,850
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, (EXCL NO-TILL) - AREA, MEASURED IN ACRES / OPERATION	408
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONVENTIONAL TILLAGE - NUMBER OF OPERATIONS	784
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONVENTIONAL TILLAGE - ACRES	194,118
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, CONVENTIONAL TILLAGE - AREA, MEASURED IN ACRES / OPERATION	248
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, COVER CROP PLANTED, (EXCL CRP) - NUMBER OF OPERATIONS	186
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, COVER CROP PLANTED, (EXCL CRP) - ACRES	19,501
MINNESOTA	OTTER TAIL	PRACTICES, LAND USE, CROPLAND, COVER CROP PLANTED, (EXCL CRP) - AREA, MEASURED IN ACRES / OPERATION	105
MINNESOTA	OTTER TAIL	FARM OPERATIONS - ACRES OPERATED	794,496
MINNESOTA	OTTER TAIL	LAND AREA, INCL NON-AG - ACRES	1,262,075
MINNESOTA	OTTER TAIL	AG LAND, CROPLAND - ACRES	576,163
MINNESOTA	OTTER TAIL	AG LAND, CROPLAND, HARVESTED - ACRES	502,572

MINNESOTA	OTTER TAIL	CORN, GRAIN - OPERATIONS WITH AREA HARVESTED	781
MINNESOTA	OTTER TAIL	CORN, GRAIN - ACRES HARVESTED	168,402
MINNESOTA	OTTER TAIL	CORN, GRAIN - PRODUCTION, MEASURED IN BU	28,739,618
MINNESOTA	OTTER TAIL	CORN, GRAIN, IRRIGATED - OPERATIONS WITH AREA HARVESTED	143
MINNESOTA	OTTER TAIL	CORN, GRAIN, IRRIGATED - ACRES HARVESTED	31,347

% Total Cropland Acreage that harvested corn	29.23
% Total Corn Grain harvested was irrigated	18.61
% Total Cropland Acreage using Conventional Tillage	33.69
% Total Cropland Acreage using Reduced Tillage	35.55
% Total Cropland Acreage using No Till	5.82
% of Total Farm Acreage Cover Crop Planted	3.38

Wilkin County

state	county	data item	value
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, NO-TILL - ACRES	10,772
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, NO-TILL - AREA, MEASURED IN ACRES / OPERATION	634

MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, (EXCL NO-TILL) - NUMBER OF OPERATIONS	104
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, (EXCL NO-TILL) - ACRES	129,298
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONSERVATION TILLAGE, (EXCL NO-TILL) - AREA, MEASURED IN ACRES / OPERATION	1,243
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONVENTIONAL TILLAGE - NUMBER OF OPERATIONS	199
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONVENTIONAL TILLAGE - ACRES	250,641
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, CONVENTIONAL TILLAGE - AREA, MEASURED IN ACRES / OPERATION	1,260
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, COVER CROP PLANTED, (EXCL CRP) - NUMBER OF OPERATIONS	44
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, COVER CROP PLANTED, (EXCL CRP) - ACRES	16,957
MINNESOTA	WILKIN	PRACTICES, LAND USE, CROPLAND, COVER CROP PLANTED, (EXCL CRP) - AREA, MEASURED IN ACRES / OPERATION	385
MINNESOTA	WILKIN	LAND AREA, INCL NON-AG - ACRES	480,640
MINNESOTA	WILKIN	AG LAND, CROPLAND - NUMBER OF OPERATIONS	381
MINNESOTA	WILKIN	AG LAND, CROPLAND - ACRES	414,596
MINNESOTA	WILKIN	AG LAND, CROPLAND, HARVESTED - NUMBER OF OPERATIONS	298
MINNESOTA	WILKIN	AG LAND, CROPLAND, HARVESTED - ACRES	394,883
MINNESOTA	WILKIN	CORN, GRAIN - OPERATIONS WITH AREA HARVESTED	204
MINNESOTA	WILKIN	CORN, GRAIN - ACRES HARVESTED	115,407
MINNESOTA	WILKIN	CORN, GRAIN - PRODUCTION, MEASURED IN BU	21,100,394
MINNESOTA	WILKIN	CORN, GRAIN, IRRIGATED - OPERATIONS WITH AREA HARVESTED	5
MINNESOTA	WILKIN	CORN, GRAIN, IRRIGATED - ACRES HARVESTED	718
% Total Cropland Acreage that harvested corn	27.84		
% Total Corn Grain harvested was irrigated	0.62		

% Total Cropland Acreage using Conventional Tillage	60.45
% Total Cropland Acreage using Reduced Tillage	31.19
% Total Cropland Acreage using No Till	2.60
% of Total Farm Acreage Cover Crop Planted	4.09

AVG for Otter Tail and Wilkin County

% Total Cropland Acreage that harvested corn	28.53
% Total Corn Grain harvested was irrigated	9.62
% Total Cropland Acreage using Conventional Tillage	47.07
% Total Cropland Acreage using Reduced Tillage	33.37
% Total Cropland Acreage using No Till	4.21

% of Total Farm Acreage Cover Crop Planted	3.74

Agricultural Practices Supplemental Information:

COMET Farm Model Assumptions

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COMET-Farm Model Assumptions

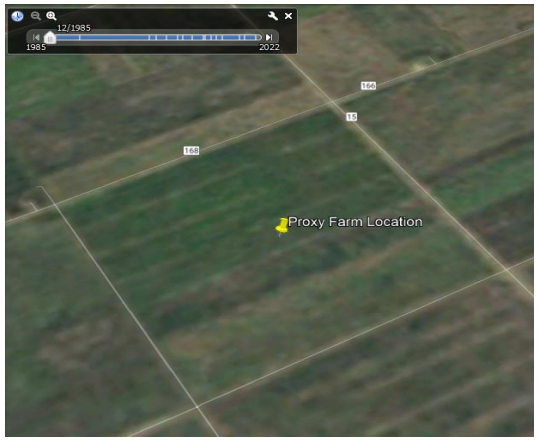
Proxy Farm Parcel Locations

Farming Practice Type	Location	parcel size (acres)	Content/Notes	Reference(s)
Conventional Plot	Otter Tail County	0	45.7% of county covered by cropland - 168,402 acres of corn	https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Minnesota/cp27111.pdf
	Wilkin County	1000, 850,500,250	86.3% of county covered by cropland - 115,407 acres of corn	https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Minnesota/cp27167.pdf
	Location	**parcel size (acres)**	**Content/Notes**	**Reference(s)**
Alternative Plot	Otter Tail County	0	45.7% of county covered by cropland - 168,402 acres of corn	https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Minnesota/cp27111.pdf
	Wilkin County	0,250,500,750	86.3% of county covered by cropland - 115,407 acres of corn	https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Minnesota/cp27167.pdf

Point location chosen: 46.304064° N, 96.394091° W

Municipality: Andrea Township, Wilkin County

Evidence of land use change in past 10+ years: no LUC



Dec-85

Aug-22

	Model Input Field	Assumption	Content/Notes	Reference(s)
Conventional Plot	**Historic Management (Pre-2000)**			
	Type (Upland or lowland):	upland	Upland is considered >660 ft above sea level. Wilkin County avg elevation above sea level is 1,050 ft Otter Tail County avg elevation above sea level is 1,355 ft	https://en.wikipedia.org/wiki/Upland_and_lowland Wilkin County topographic map, elevation, terrain (topographic-map.com) Otter Tail County topographic map, elevation, terrain (topographic-map.com)
	Tillage:	Horse & Mule/Tractor plowing: Intensive Tilling	Historical research shows evidence of intensive tillage/plowing. Pre 1980 using disk chisel plow and after 1980 employing strip-till for corn and some no-till for soybeans. We will assume intensive tillage for pre 2000 by plow and disk chisel which is considered deep tillage (deeper than 10 inches) and soil inversion with less than 15% of soil surface protected from crop residue	https://extension.umn.edu/soil-management-and-health/tillage-implements-purpose-and-ideal-use#history-1202760
	Irrigation:	none	approximately 1.5% cropland irrigated in 1997 approximately 1.4% cropland irrigated in 1992, 0.06% cropland irrigated in 1964	https://agcensus.library.cornell.edu/wp-content/uploads/1997-Minnesota- https://agcensus.library.cornell.edu/wp-content/uploads/1992-Minnesota-CHAPTER_1_State_Data-1569-Table-01.pdf

Conventional Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Baseline Management (2000-2022)			
Crop and Planting Date:	April 30th planting and October 30th harvest; 1	corn crop and planting data consistent each year and cannot overlap with seeding of cover crop	https://extension.umn.edu/corn-planting/planting-date-considerations-corn
Yield (bu/ac):	150	Based on avgerage annual bushels per acre across Otter Tail and Wilkin counties for data spanning 2000-2022	see Baseline Corn Yield tab for calculations and data references
Residue Removal:	50%	Some researchers have previously recommended harvesting only about 30% under conventional tillage, while values up to 50% could be sustainably collected in no-till systems while others have estimated that up to 60% of corn stover could be sustainably removed	https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CSES/CSES-180/CSES-180-PDF_rev2.pdf#:~:text=Some%20researchers%20have%20previously%20recommended%20harvesting%20only%20about,60%25%20of%20corn%20stover%20could%20be%20sustainably%20removed.
Irrigation:	None	Irrigation variable removed for simplification - assume well-watered. Data supports small number of corn farmers in Otter Tail and Wilkin County irrigate the farm (~9%)	see Farming Practice Estimation tab for calculations and data references

Conventional Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Manure/compost application:	Farmyard Manure, solid: 1 ton/acre resulting in 24 lbs N/acre in fall	Broadcasting manure onto the surface of a field is the oldest method of spreading. It is easy, cheap, and can be done during almost any season - using default 1 ton/acre application with C/N ratio 11.7 - high organic matter input	https://extension.umn.edu/manure-management/manure-application-methods-and-nitrogen-losses
Fertilizer Application:		user guide recommendations	https://comet-farm.com/data/Cropland/FertilizerHelp.pdf
	Nitrogen is added to fields	Nitrogen was applied to 99 percent of the total 1997 corn acreage in the ten States surveyed. South Dakota with 96 percent of the corn acreage treated was the lowest. The next lowest was Minnesota, where growers treated 97 percent of the planted corn acreage.	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
Element-N:	Element-N (N): 146 lbsN/acre Farmyard Manure, Solid: 24 lbsN/acre Total N: 170 lbsN/acre	Nitrogen was applied in spring. Combined Sources of Nitrogen inputs of Ammonia, Urea, Ammonium Nitrate, Ammonium Sulfate, Urea-ammonium nitrate solution. The same GREET derived default values are used in FD-CIC model as input parameters.	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
Element-P (P):	0	Of the three primary macronutrients, not used for GHG calculations	https://www.nass.usda.gov/Statistics_by_State/Minnes

Conventional Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Liming	none	Few subsoils are acidic and require liming in Otter Tail and Wilkin Counties	https://extension.umn.edu/liming/lime-needs-minnesota#:~:text=When%20needed%2C%20liming%20materials%20are%20major%20inputs,acid%2C%20there%20are%20many%20benefits%20from%20liming.
Burning	none		
Future Scenario Management (2023-2033)			
Crop and Planting Date:	April 30th planting and October 30th harvest; 1 harvest per year	corn crop and planting data consistent each year and cannot overlap with seeding of cover crop	https://extension.umn.edu/corn-planting/planting-date-considerations-corn
Yield (bu/ac):	150	Based on avgerage annual bushels per acre across Otter Tail and Wilkin counties	see Baseline Corn Yield tab for calculations and data references
Residue Removal:	50%	Some researchers have previously recommended harvesting only about 30% under conventional tillage, while values up to 50% could be sustainably collected in no-till systems while others have estimated that up to 60% of corn stover could be sustainably removed	https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CSES/CSES-180/CSES-180-PDF_rev2.pdf#:~:text=Some%20researchers%20have%20previously%20recommended%20harvesting%20only%20about,60%25%20of%20corn%20stover%20could%20be%20sustainably%20removed.
Tillage:	Intensive	Intensive tillage in spring	https://extension.umn.edu/soil-management-and-health/tillage-implements-purpose-and-ideal-use#history-1202760

Conventional Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Irrigation:	None	Irrigation variable removed for simplification - assume well-watered. Data supports small number of corn farmers in Otter Tail and Wilkin County irrigate the farm (~9%)	see Farming Practice Estimation tab for calculations and data references
Manure/compost application:	Farmyard Manure, solid: 1 ton/acre resulting in 24 lbs N/acre in fall	Broadcasting manure onto the surface of a field is the oldest method of spreading. It is easy, cheap, and can be done during almost any season - using default 1 ton/acre application with C/N ratio 11.7 - high organic matter input	https://extension.umn.edu/manure-management/manure-application-methods-and-nitrogen-losses
Fertilizer Application:			https://comet-farm.com/data/Cropland/FertilizerHelp.pdf
	Nitrogen is added to fields	Nitrogen was applied to 99 percent of the total 1997 corn acreage in the ten States surveyed. South Dakota with 96 percent of the corn acreage treated was the lowest. The next lowest was Minnesota, where growers treated 97 percent of the planted corn acreage	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
Element-N:	Element-N (N): 146 lbsN/acre Farmyard Manure, Solid: 24 lbsN/acre Total N: 170 lbsN/acre	Nitrogen was applied in spring. Combined Sources of Nitrogen inputs of Ammonia, Urea, Ammonium Nitrate, Ammonium Sulfate, Urea-ammonium nitrate solution. The same GREET derived default values are used in FD-CIC model as input parameters.	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf

	Model Input Field	Assumption	Content/Notes	Reference(s)
Conventional Plot			Of the three primary macronutrients, nitrogen (N) was the most widely used on corn. Minnesota farmers applied nitrogen to 98 percent of planted acres at an average rate of 146 pounds per acre per year. Macronutrients phosphate (P2O5) and potash (K2O) were applied to the majority of acres, at an average rate of 62 and 89 pounds per acre per year, respectively. The secondary macronutrient, sulfur (S), was applied to 28 percent of acres planted to corn.	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
	Element-P (P):	0	not used for GHG calculations	
	Liming	none	Few subsoils are acidic and require liming in Otter Tail and Wilkin Counties	https://extension.umn.edu/liming/lime-needs-minnesota#:~:text=When%20needed%2C%20liming%20materials%20are%20major%20inputs,acid%2C%20there%20are%20many%20benefits%20from%20liming.
	Burning	none	removed major source of GHG	https://extension.umn.edu/corn-harvest/crop-residue-management
	Cover Crop	none	no data to support wide range utilization of cover cropping practices for Green Plains Ethanol Plant corn producers	

	Model Input Field	Assumption	Content/Notes	Reference(s)
Regenerative Plot	**Historic Management (Pre-2000)**			
	Type (Upland or lowland):	upland	Upland is considered >660 ft above sea level.	https://en.wikipedia.org/wiki/Upland_and_lowland
			Wilkin County avg elevation above sea level is 1,050 ft	Wilkin County topographic map, elevation, terrain (topographic-map.com)
			Otter Tail County avg elevation above sea level is 1,355 ft	Otter Tail County topographic map, elevation, terrain (topographic-map.com)
	Tillage:	Horse & Mule/Tractor plowing: Intensive Tilling	Historical research shows evidence of intensive tillage/plowing. Pre 1980 using disk chisel plow and after 1980 employing strip-till for corn and some no-till for soybeans. We will assume intensive tillage for pre 2000 by plow and disk chisel which is considered deep tillage (deeper than 10 inches) and soil inversion with less than 15% of soil surface protected from crop residue	https://extension.umn.edu/soil-management-and-health/tillage-implements-purpose-and-ideal-use#history-1202760
	Irrigation:	none	approximately 1.5% cropland irrigated in 1997	https://agcensus.library.cornell.edu/wp-content/uploads/1997-Minnesota-CHAPTER_1_State_Data-1599-Table-01.pdf
			approximately 1.4% cropland irrigated in 1992, 0.06% cropland irrigated in 1964	https://agcensus.library.cornell.edu/wp-content/uploads/1992-Minnesota-CHAPTER_1_State_Data-1569-Table-01.pdf
	Baseline Management (2000-2022)			
	Crop and Planting Date:	April 30th planting and September 15th harvest; 1 harvest per year	corn crop and planting data consistent each year and cannot overlap with seeding of cover crop	University of Minnesota Extension - Planting date considerations for corn

Regenerative Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Tillage:	Intensive	Intensive tillage in spring	https://extension.umn.edu/soil-management-and-health/tillage-implements-purpose-and-ideal-use#history-1202760
Yield (bu/ac):	150	Based on avgerage annual bushels per acre across Otter Tail and Wilkin counties for data spanning 2000-2022	see Baseline Corn Yield tab for calculations and data references
Residue Removal:	50%	n Minnesota, about 450,000 acres of aboveground residues are removed from the corn fields for forage for livestock, in addition to some unknown amount of other crop residues removed for bedding.	
Irrigation:	None	Irrigation variable removed for simplification - assume well-watered. Data supports small number of corn farmers in Otter Tail and Wilkin County irrigate the farm (~9%)	
Manure/compost application:	Farmyard Manure, solid: 1 ton/acre resulting in 24 lbs N/acre in fall	Broadcasting manure onto the surface of a field is the oldest method of spreading. It is easy, cheap, and can be done during almost any season - using default 1 ton/acre application with C/N ratio 11.7 - high organic matter input	https://extension.umn.edu/manure-management/manure-application-methods-and-nitrogen-losses

Regenerative Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Fertilizer Application:			https://comet-farm.com/data/Cropland/FertilizerHelp.pdf
	Nitrogen is added to fields	Nitrogen was applied to 99 percent of the total 1997 corn acreage in the ten States surveyed. South Dakota with 96 percent of the corn acreage treated was the lowest. The next lowest was Minnesota, where growers treated 97 percent of the planted corn acreage	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
Element-N:	Element-N (N): 146 lbsN/acre Farmyard Manure, Solid: 24 lbsN/acre Total N: 170 lbsN/acre	Nitrogen was applied in spring. Combined Sources of Nitrogen inputs of Ammonia, Urea, Ammonium Nitrate, Ammonium Sulfate, Urea-ammonium nitrate solution. The same GREET derived default values are used in FD-CIC model as input parameters.	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
Element-P (P):	0	not used for GHG calculations	
Liming:	none	Few subsoils are acidic and require liming in Otter Tail and Wilkin Counties	https://extension.umn.edu/liming/lime-needs-minnesota#:~:text=When%20needed%2C%20liming%20materials%20are%20major%20inputs,acid%2C%20there%20are%20many%20benefits%20from%20liming.
Burning:	none	removed major source of GHG	https://extension.umn.edu/corn-harvest/crop-residue-management
Cover Crop:	none	no data to support wide range utilization of cover cropping practices for Green Plains Ethanol Plant corn producers.	

Regenerative Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Future Scenario (2023-2033)			
Crop and Planting Date:	April 30th planting and October 30th harvest; 1 harvest per year	corn crop and planting data consistent each year and cannot overlap with seeding of cover crop	https://extension.umn.edu/corn-planting/planting-date-considerations-corn
Tillage:	No Tillage		
Yield (bu/ac):	150	Based on avgerage annual bushels per acre across Otter Tail and Wilkin counties for data spanning 2000-2022	see Baseline Corn Yield tab for calculations and data references
Residue Removal:	50%	Some researchers have previously recommended harvesting only about 30% under conventional tillage, while values up to 50% could be sustainably collected in no-till systems while others have estimated that up to 60% of corn stover could be sustainably removed	https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CSES/CSES-180/CSES-180-PDF_rev2.pdf#:~:text=Some%20researchers%20have%20previously%20recommended%20harvesting%20only%20about,60%25%20of%20corn%20stover%20could%20be%20sustainably%20removed.
Irrigation:	None	Irrigation variable removed for simplification - assume well-watered. Data supports small number of corn farmers in Otter Tail and Wilkin County irrigate the farm (~9%)	see Farming Practice Estimation tab for calculations and data references

Regenerative Plot

Model Input Field	Assumption	Content/Notes	Reference(s)
Manure/compost application:	Farmyard Manure, solid: 1 ton/acre resulting in 24 lbs N/acre in fall	Broadcasting manure onto the surface of a field is the oldest method of spreading. It is easy, cheap, and can be done during almost any season - using default 1 ton/acre application with C/N ratio 11.7 - high organic matter input	https://extension.umn.edu/manure-management/manure-application-methods-and-nitrogen-losses
Fertilizer Application:			
Element-N:	Element-N (N): 73 lbsN/acre Farmyard Manure, Solid: 24 lbsN/acre Total N: 97 lbsN/acre	50% reduction in synthetic nirtogen compared to conventional. Nitrogen was applied in spring. Combined Sources of Nitrogen inputs of Ammonia, Urea, Ammonium Nitrate, Ammonium Sulfate, Urea-ammonium nitrate solution. The same GREET derived default values are used in FD-CIC model as input parameters	https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/Other_Press_Releases/2022/MN-Ag-Chem-Corn-2022.pdf
Element-P (P):	0	not used for GHG calculations	
Liming:	none	Few subsoils are acidic and require liming in Otter Tail and Wilkin Counties	https://extension.umn.edu/liming/lime-needs-minnesota#:~:text=When%20needed%2C%20liming%20materials%20are%20major%20inputs,acid%2C%20there%20are%20many%20benefits%20from%20liming.
Burning:	none	removed major source of GHG	https://extension.umn.edu/corn-harvest/crop-residue-management
Cover Crop:	clover planted after harvest	cover crop must be planted after corn harvest and before frost - ~ September 16th planting	https://extension.umn.edu/soil-and-water/cover-crops

Agricultural Practices
Supplemental Information:

COMET Farm Guide

Appendix M
Otter Tail to Wilkin Carbon Dioxide Pipeline Project
Final Environmental Impact Statement /
Docket No. IP7093/PPL-22-422

January 8, 2024

HDR prepared this Step-By-Step Guide for the use of USDA's COMET-Farm process-based greenhouse gas (GHG) accounting system for the Otter Tail to Wilkin CO_2 Pipeline Project. https://comet-farm.com/

COMET-Farm GHG accounting system works with user inputs and default values. Depending on available data, either custom inputs are provided, or default values can be chosen.

There are 3 steps in the COMET-Farm Tool:

Step 1 ACTIVITIES

Step 2 FIELD MANAGEMENT

Step 3 REPORT

This document describes how the COMET-Farm tool was used to determine an estimated change in greenhouse gas emissions associated with test case scenarios of corn feedstock producers implementing alternative agricultural practices within 40 miles of Fergus Falls, MN.

This document is a step-by-step guide detailing the process and assumed inputs into the COMET-Farm to best represent the test cases described in Chapter 6 Table 6-3. Each test case is shown with images to guide the user to recreate the same project description and results.

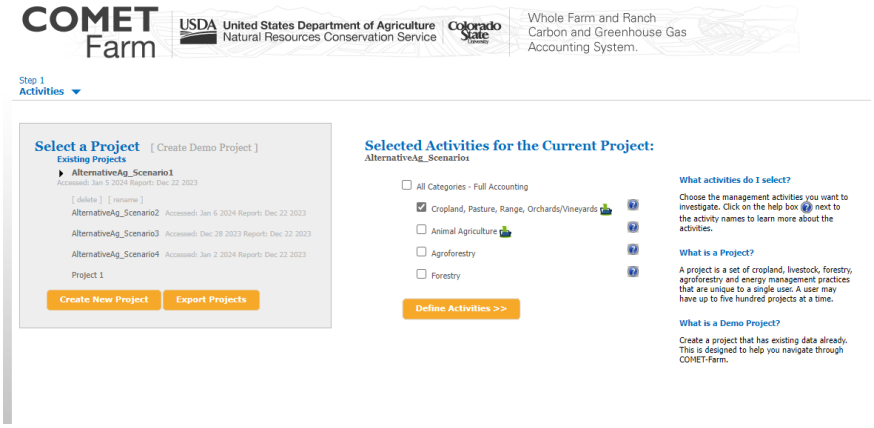
Test Case Inputs

AlternativeAg_Scenario 1

*1,000 acre parcel where there are no future changes in farming practices - a.k.a. business as usual (BAU) of conventional management

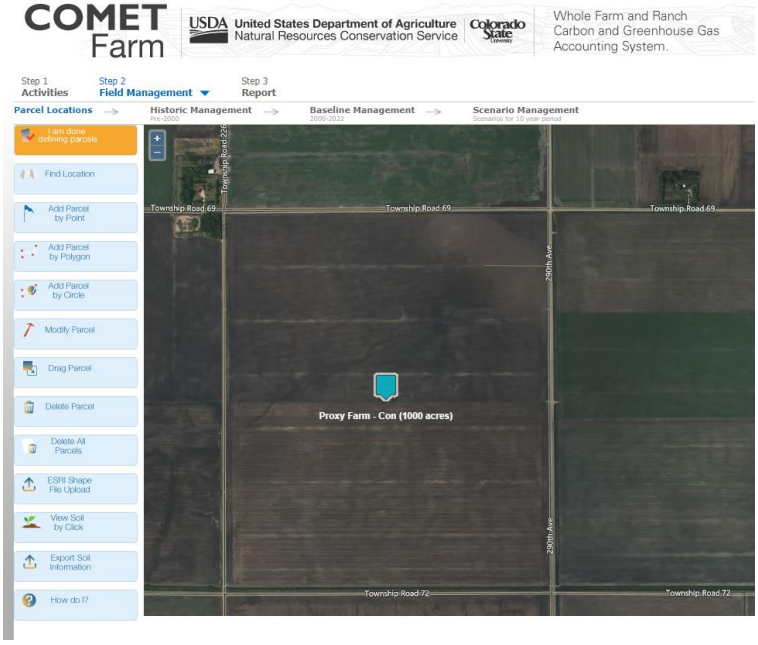
Step 1: ACTIVITIES

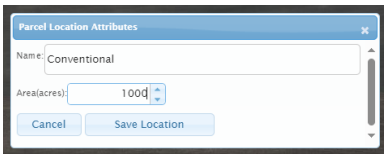
- Select the project file and select activities
    - choose Cropland



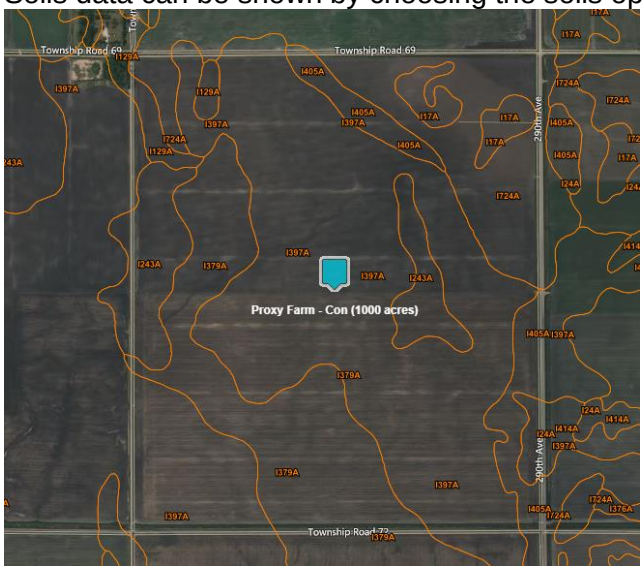
Step 2: FIELD MANAGEMENT

- Choose parcel location by point, polygon (if actual acreage is known), or circle
    - Choose a location by **Add Parcel by Point**





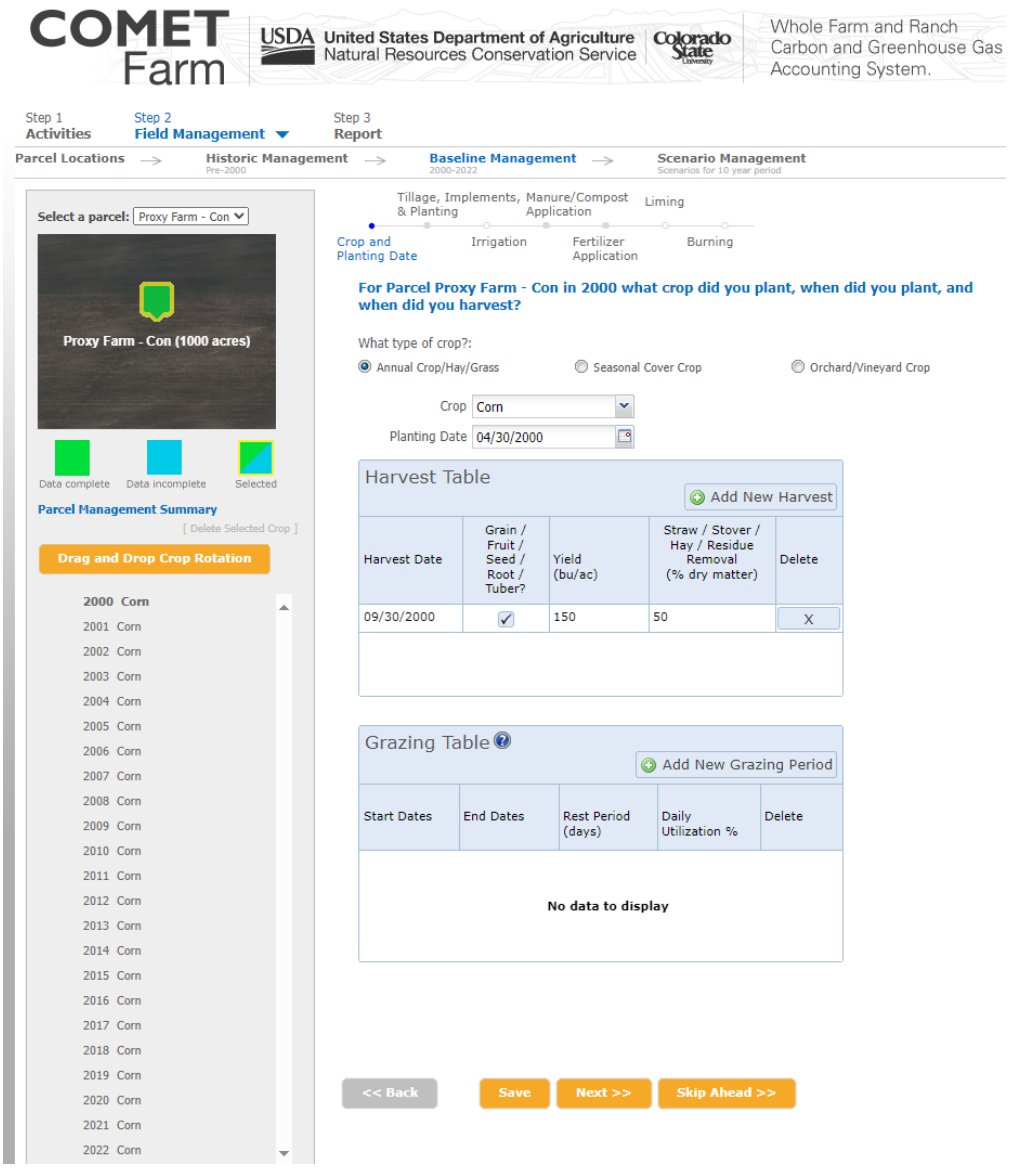
Soils data can be shown by choosing the soils option



When selected choose **I am done defining parcels**

- Define Historic Management (Pre-2000)
  - Choose
    - Pre-1980 Management: upland non-irrigated
    - CRP enrollment: no
    - 1980-2000 Management: Non-irrigated – Annual Crops in Rotation

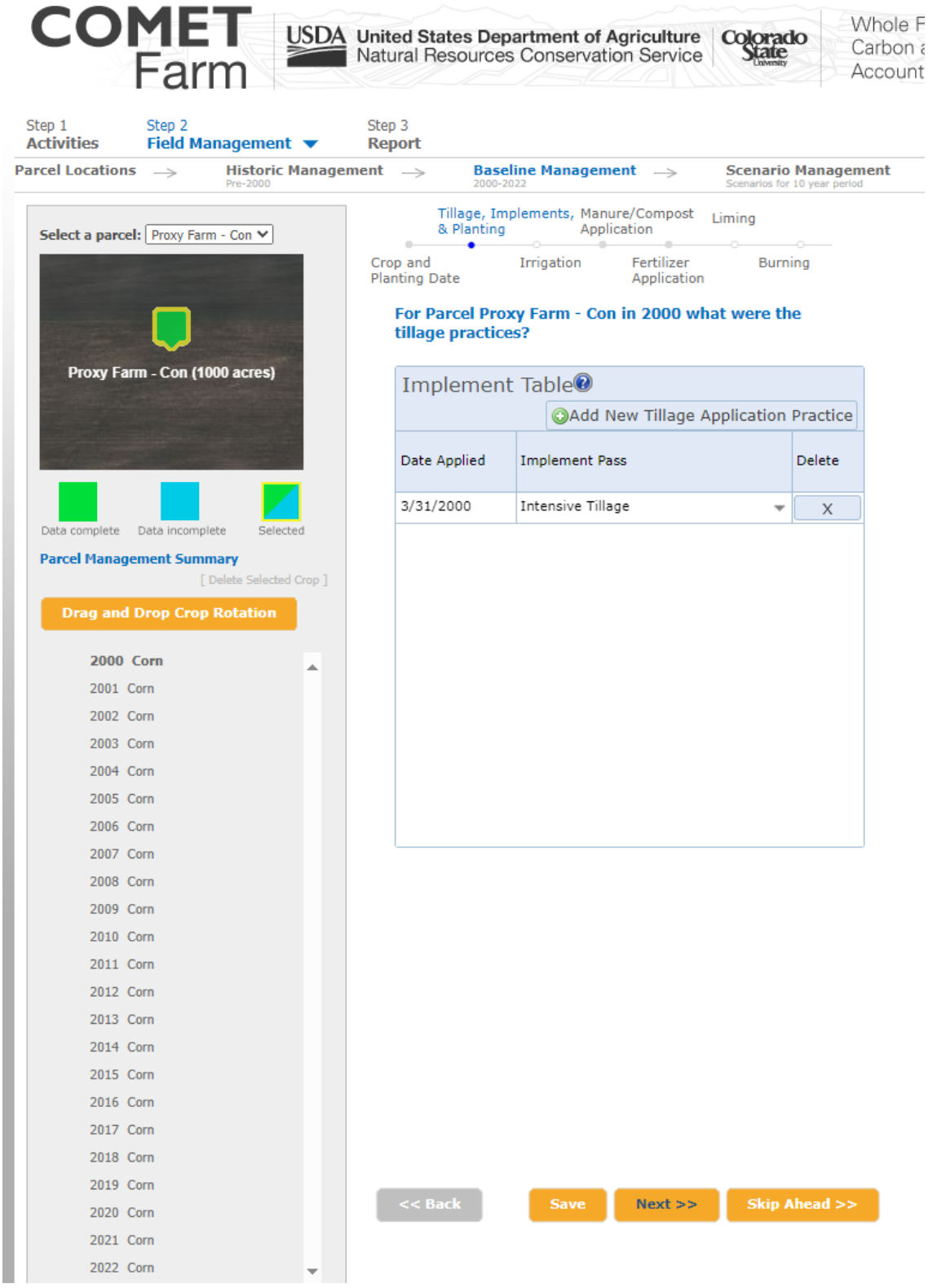
- Define Baseline Management (2000 - 2022)
    - Choose Crop and Planting Date
        - Annual Crop: Corn
        - Planting Date: 04/30/2000
        - Harvest Table
            - Harvest Date: 09/30/2000
            - Grain?: check
            - Yield (bu/ac): 150
            - Stover removal (% dry matter): 50%



NEXT

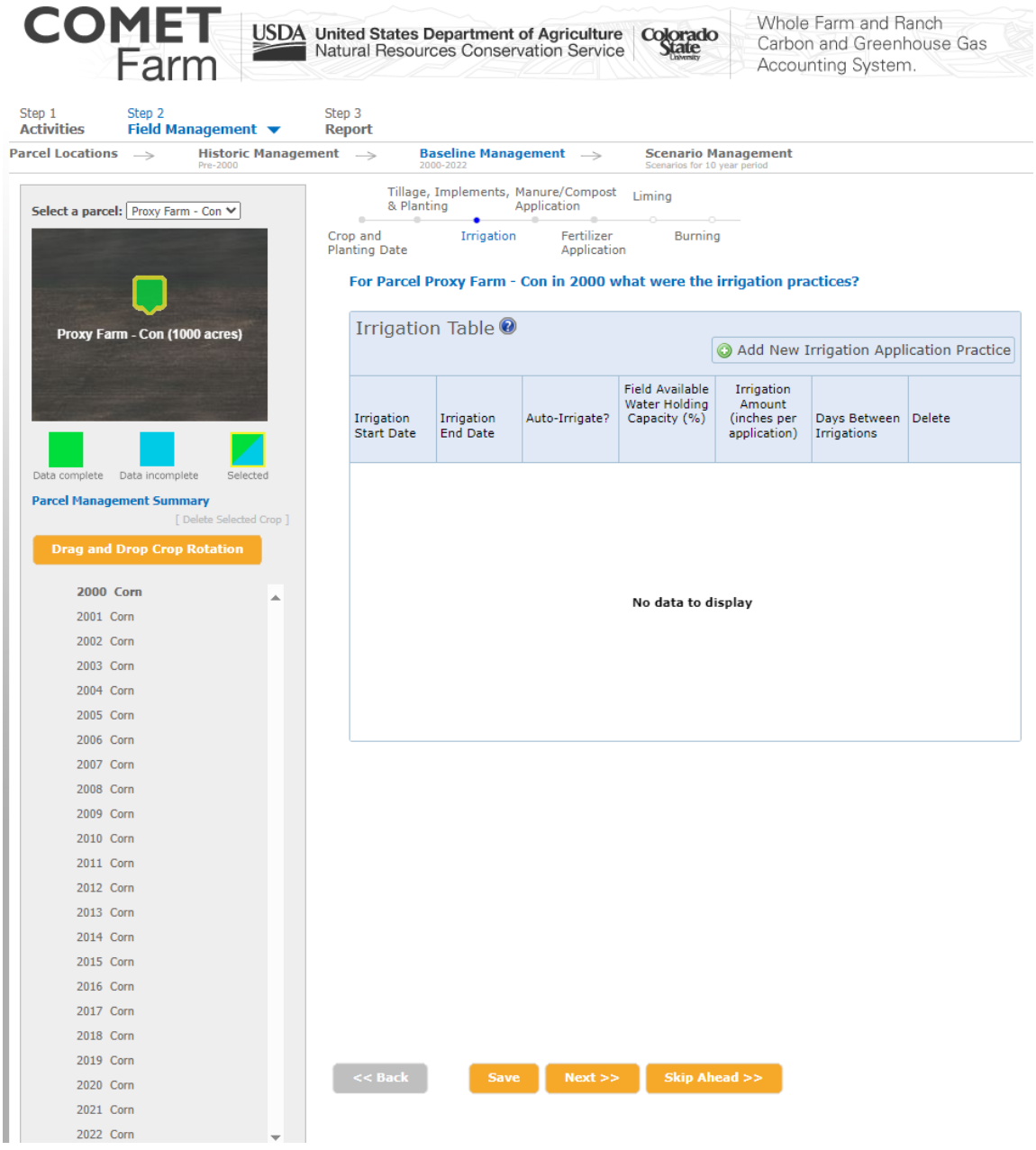
- Choose Tillage, Implements, & Planting:
    - Implement Table:
        - Date Applied: 3/31/2000

- Implement Pass: Intensive Tillage



NEXT

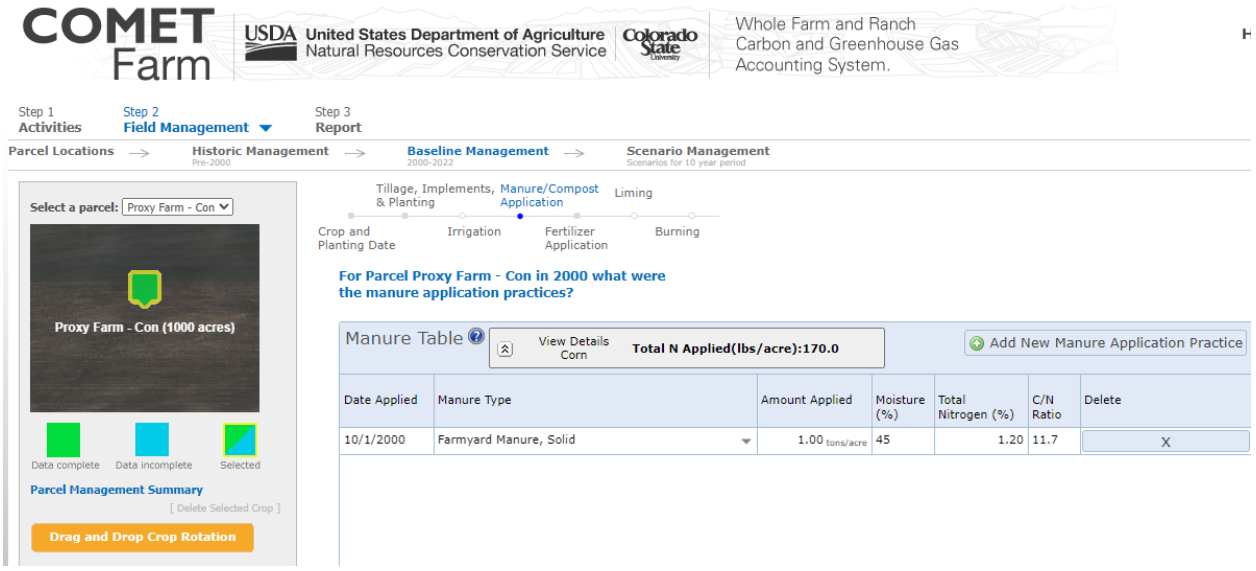
- Irrigation: None



NEXT

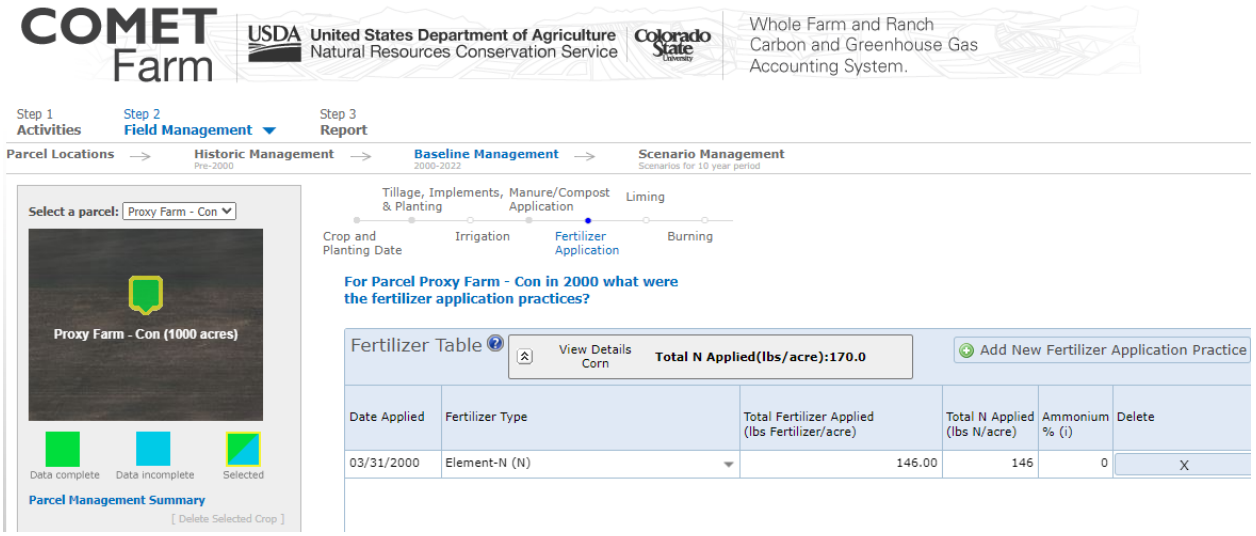
- Manure/Compost Application
  - Manure Table:
    - Date Applied: 10/1/2000
    - Manure Type: Farmyard Manure, Solid
    - Amount Applied: 1.00 tons/acre
    - Moisture (%): 45
    - Total Nitrogen (%): 1.20

- C/N Ratio: 11.7



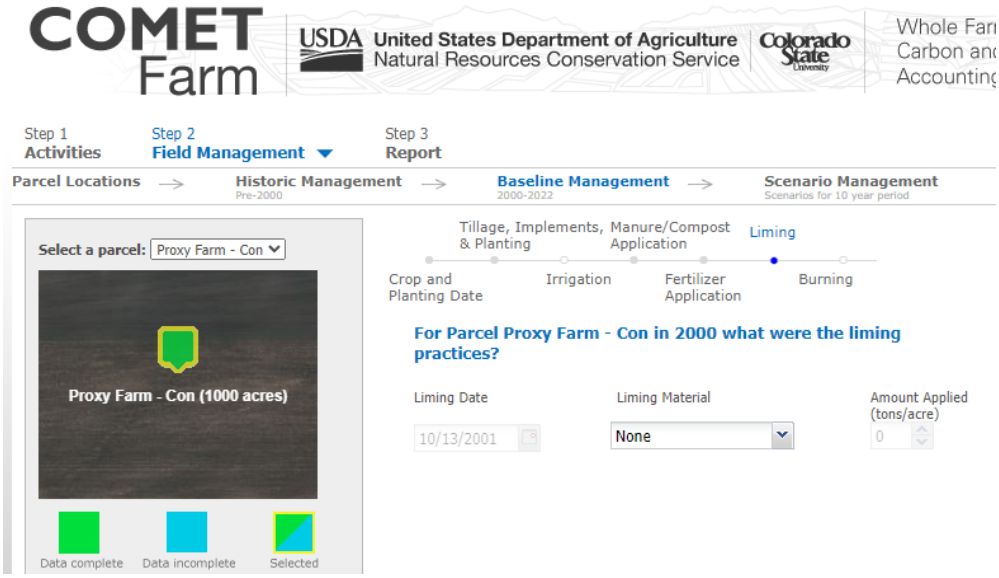
NEXT

- Fertilizer Application
  - Fertilizer Table:
    - Date Applied: 3/31/2000
    - Fertilizer Type: Element-N (N)
    - Total Fertilizer Applied (lbs Fertilizer/acre): 146.00
    - Total N Applied (lbs N/Acre): 146
    - Ammonium %: 0



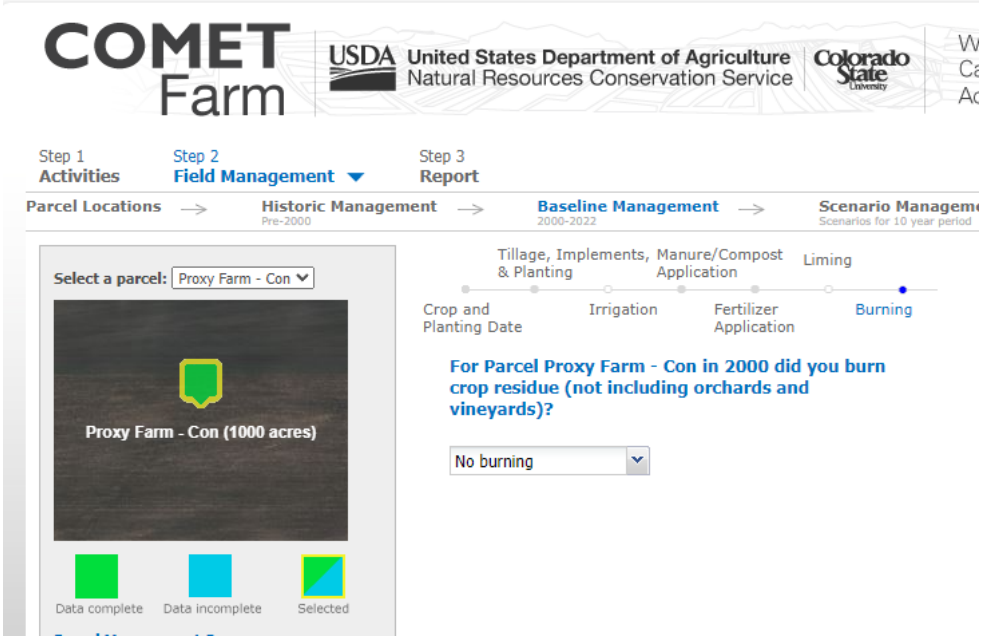
NEXT

- Liming: None



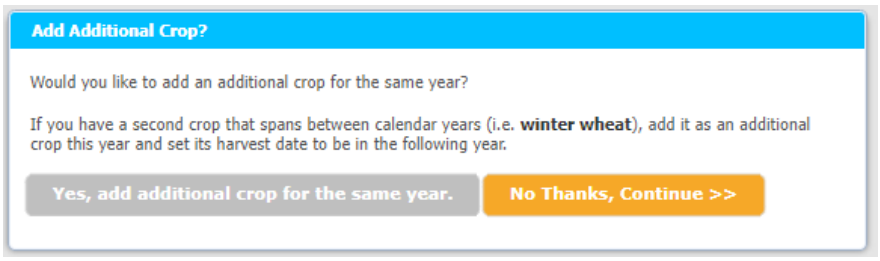
NEXT

- Burning: None



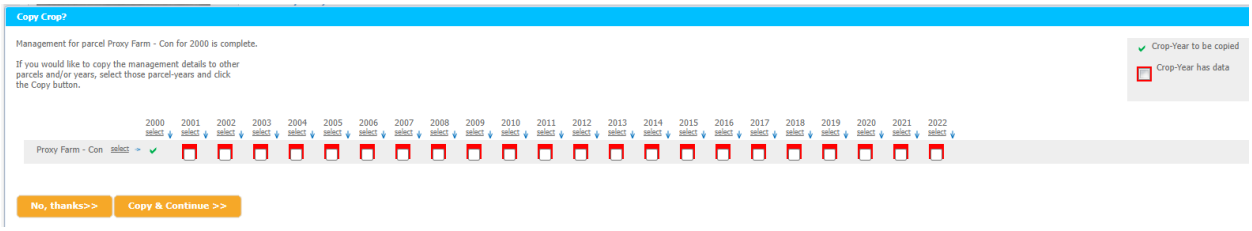
NEXT

NEW PROMPT
Add Additional Crop for same year?: No

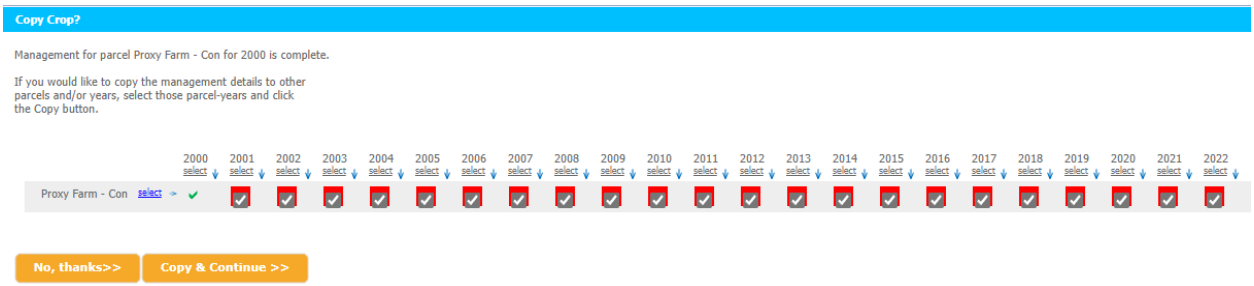


No Thanks, Continue

NEW PROMPT

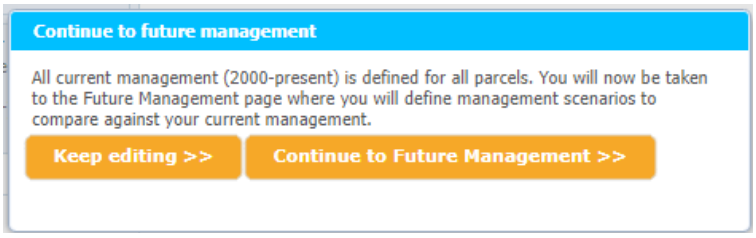


Select all years



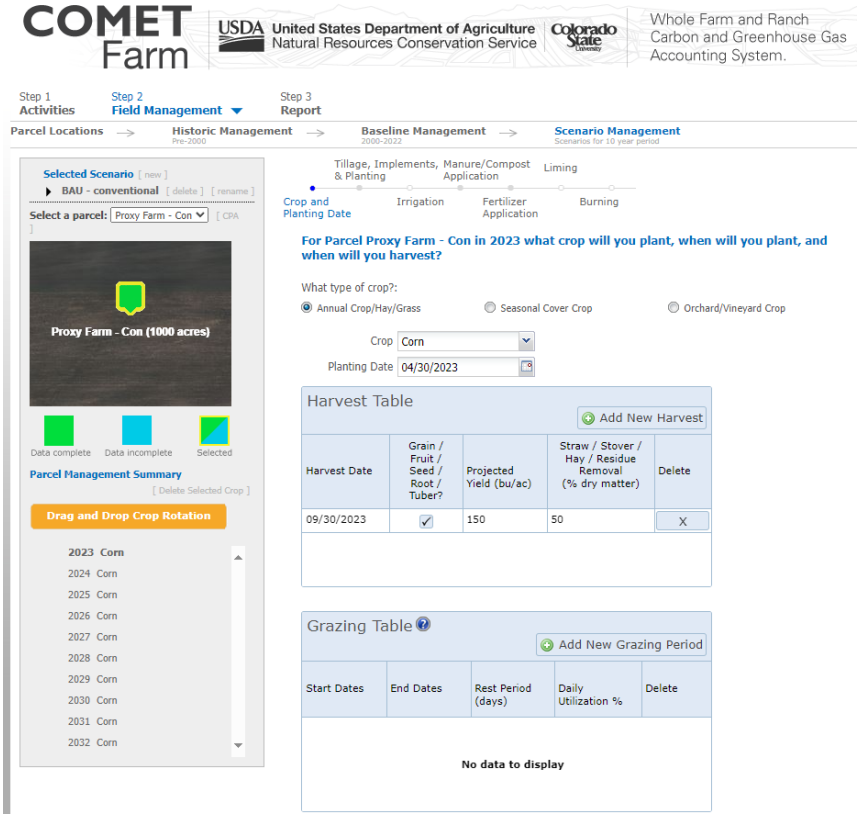
Copy & Continue

NEW PROMPT

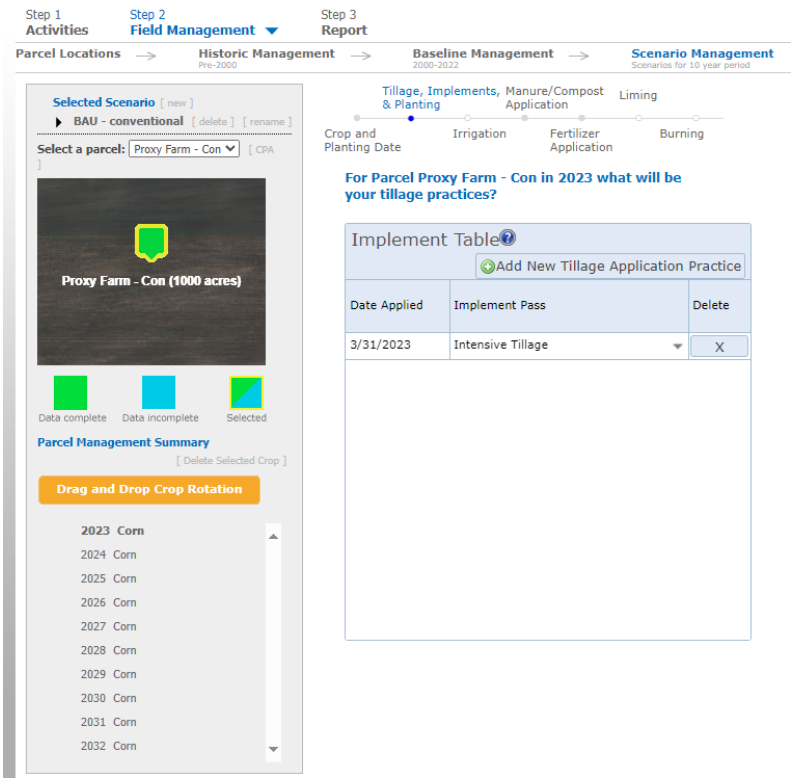


Continue to Future Management

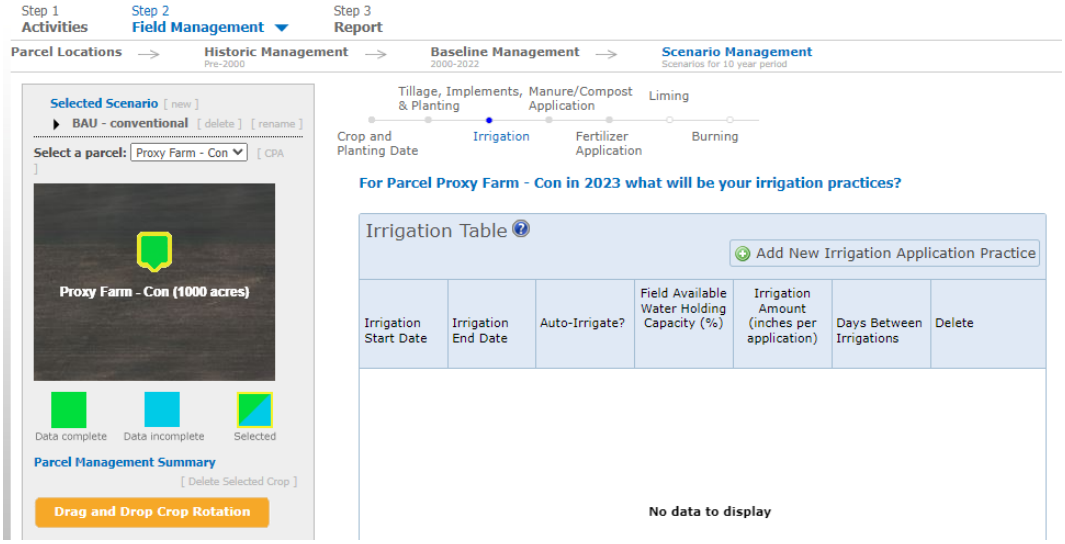
- Define Scenario Management – Scenarios for 10 year period (future)
*****All inputs for Scenario Management are the same as the Baseline Management (2000 - 2022) in the BAU Test Case


COMET Farm
USDA United States Department of Agriculture Natural Resources Conservation Service
Colorado State University
Whole Farm and Ranch Carbon and Greenhouse Gas Accounting System.
Step 1 Activities
Step 2 Field Management
Step 3 Report
Parcel Locations
Historic Management Pre-2000
Baseline Management 2000-2022
Scenario Management Scenarios for 10 year period
Selected Scenario [new]
BAU - conventional [delete] [rename]
Select a parcel: Proxy Farm - Con [CPA]
Proxy Farm - Con (1000 acres)
Data complete
Data incomplete
Selected
Parcel Management Summary
[Delete Selected Crop]
Drag and Drop Crop Rotation
2023 Corn
2024 Corn
2025 Corn
2026 Corn
2027 Corn
2028 Corn
2029 Corn
2030 Corn
2031 Corn
2032 Corn
Crop and Planting Date
Tillage, Implements, & Planting
Irrigation
Manure/Compost Application
Fertilizer Application
Liming
Burning
For Parcel Proxy Farm - Con in 2023 what crop will you plant, when will you plant, and when will you harvest?
What type of crop?:
Annual Crop/Hay/Grass
Seasonal Cover Crop
Orchard/Vineyard Crop
Crop Corn
Planting Date 04/30/2023
Harvest Table
Add New Harvest
Harvest Date
Grain / Fruit / Seed / Root / Tuber?
Projected Yield (bu/ac)
Straw / Stover / Hay / Residue Removal (% dry matter)
Delete
09/30/2023
150
50
X
Grazing Table
Add New Grazing Period
Start Dates
End Dates
Rest Period (days)
Daily Utilization %
Delete
No data to display

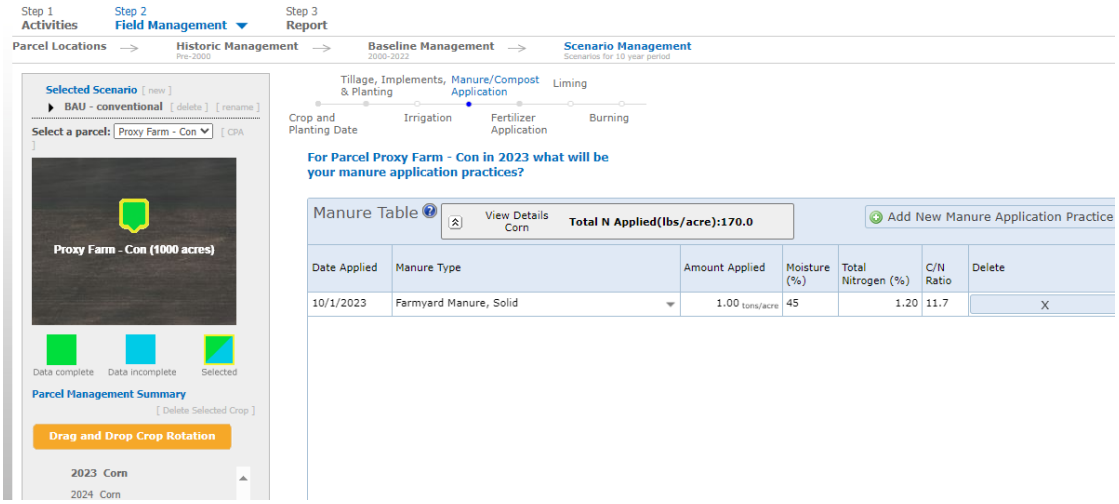
NEXT


Step 1 Activities
Step 2 Field Management
Step 3 Report
Parcel Locations
Historic Management Pre-2000
Baseline Management 2000-2022
Scenario Management Scenarios for 10 year period
Selected Scenario [new]
BAU - conventional [delete] [rename]
Select a parcel: Proxy Farm - Con [CPA]
Proxy Farm - Con (1000 acres)
Data complete
Data incomplete
Selected
Parcel Management Summary
[Delete Selected Crop]
Drag and Drop Crop Rotation
2023 Corn
2024 Corn
2025 Corn
2026 Corn
2027 Corn
2028 Corn
2029 Corn
2030 Corn
2031 Corn
2032 Corn
Crop and Planting Date
Tillage, Implements, & Planting
Irrigation
Manure/Compost Application
Fertilizer Application
Liming
Burning
For Parcel Proxy Farm - Con in 2023 what will be your tillage practices?
Implement Table
Add New Tillage Application Practice
Date Applied
Implement Pass
Delete
3/31/2023
Intensive Tillage
X

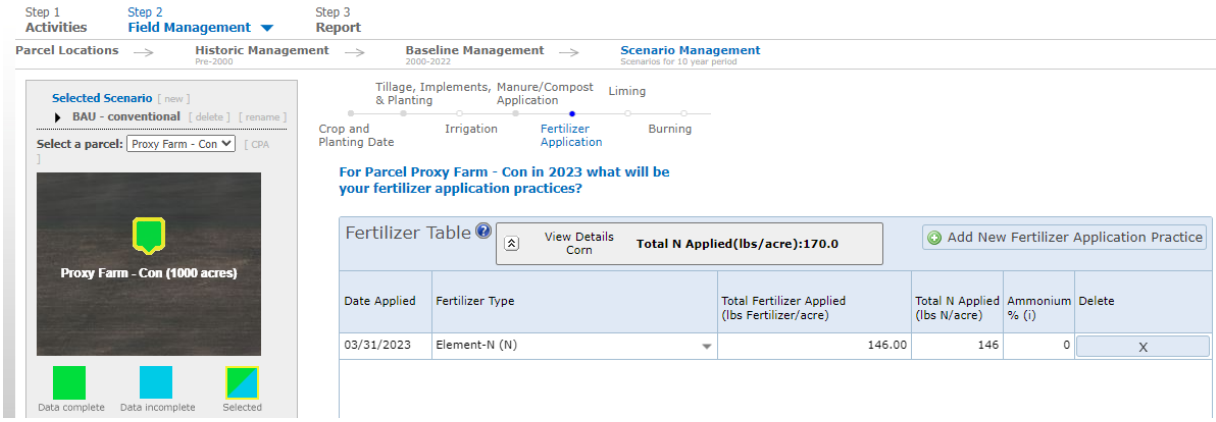
NEXT



NEXT



NEXT



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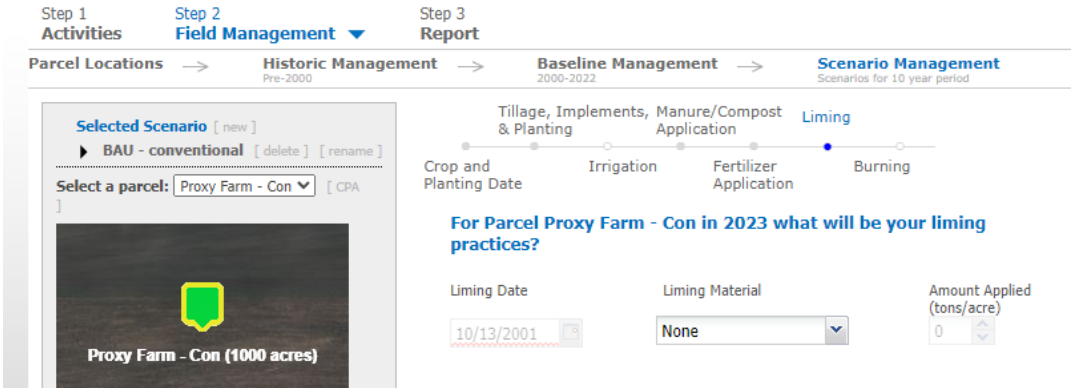

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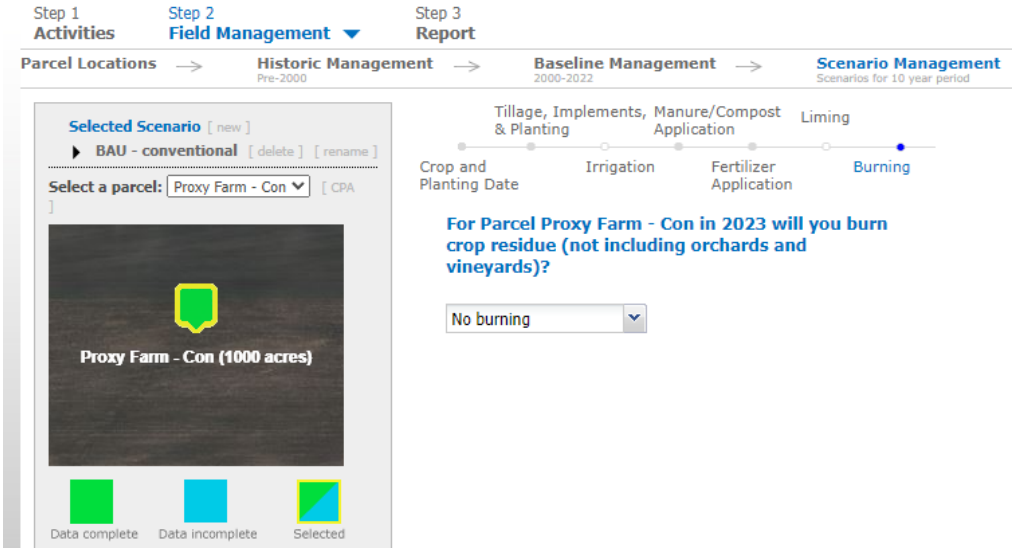
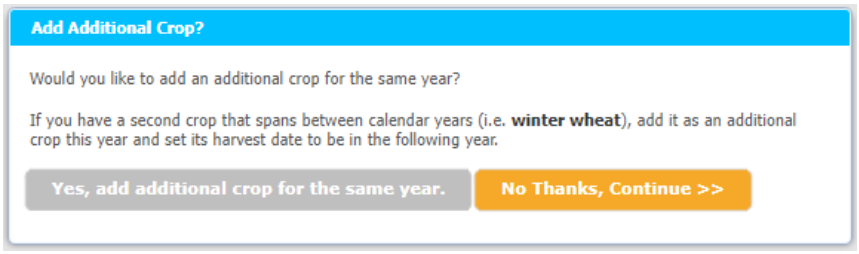


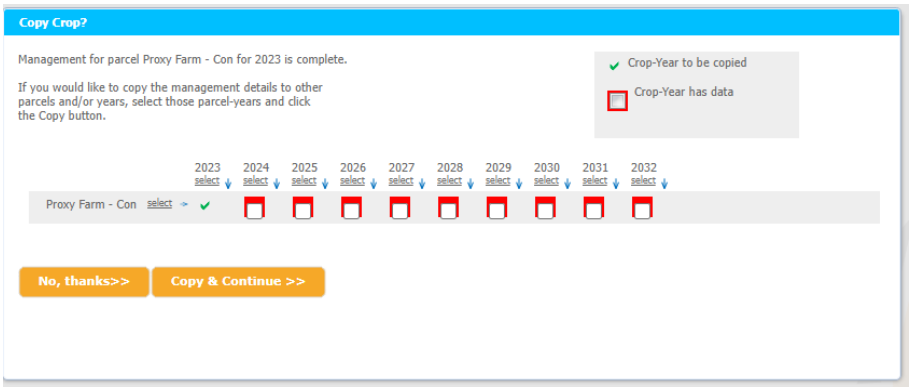
NEXT

NEW PROMPT

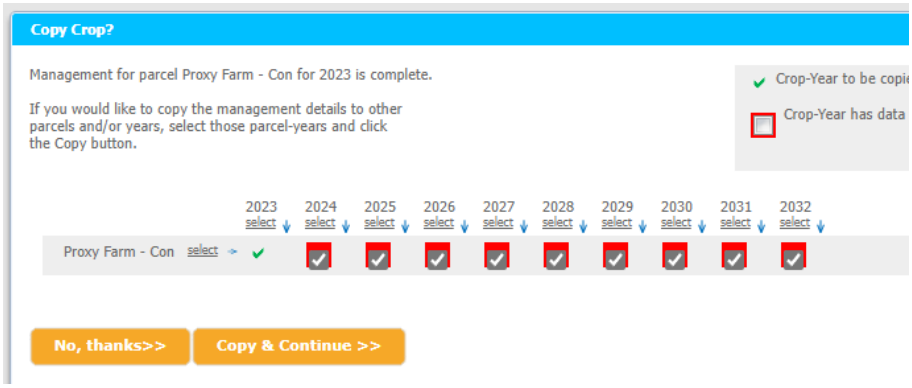


No Thanks, Continue

NEW PROMPT

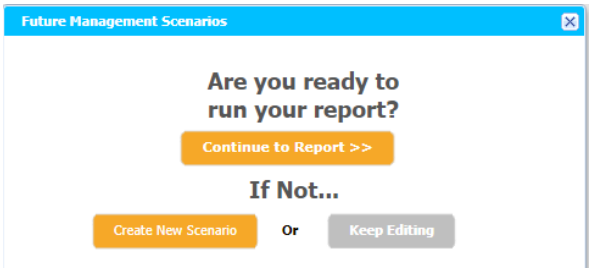


- Copy crop data to all years



Copy & Continue

NEW PROMPT



Continue to Report

Step 3: Report

Step 1 Activities | Step 2 Field Management | Step 3 Report

Cropland, Pasture, Range, Orchards/Vineyards | Cropland Graphical Report | Available Water Holding Capacity

Report finished: 00:02:41 100% Complete

NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario1
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_69782_272740
Time: Mon Jan 08 2024 12:46:00 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

USDA United States Department Natural Resources Conse

Source	Baseline Emissions		BAU - conventional			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - Con (1000 acres - Corn)						
C (tonnes CO_2 equiv./yr.)	-205.1	+0/-0	-205.1	+0/-0	0.0	+0/-0
Soil	-205.1	+0/-0	-205.1	+0/-0	0.0	+0/-0
CO_2 (tonnes/yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O (tonnes CO_2 equiv./yr.)	1882.5	NR[1]	1882.5	NR[1]	0.0	NR[1]
Direct N_2O Emissions	1765.3	+0/-0	1765.3	+0/-0	0.0	+0/-0
Direct - Soil	1765.3	+0/-0	1765.3	+0/-0	0.0	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	117.2	+185/-94.5	117.2	+185/-94.5	0.0	+0/-0
Indirect - Volatilization	117.2	+185/-94.5	117.2	+185/-94.5	0.0	+0/-0
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**1677.4**	**NR[1]**	**1677.4**	**NR[1]**	**0.0**	**NR[1]**
Total (all parcels)	***1677.4***	***NR[1]***	***1677.4***	***NR[1]***	***0.0***	***NR[1]***

AlternativeAg_Scenario 2

*250 acres where a suite of alternative agricultural practices are implemented in the next 10 years and 750 acres where there are no future changes in farming practices a.k.a. business as usual (BAU) of conventional management

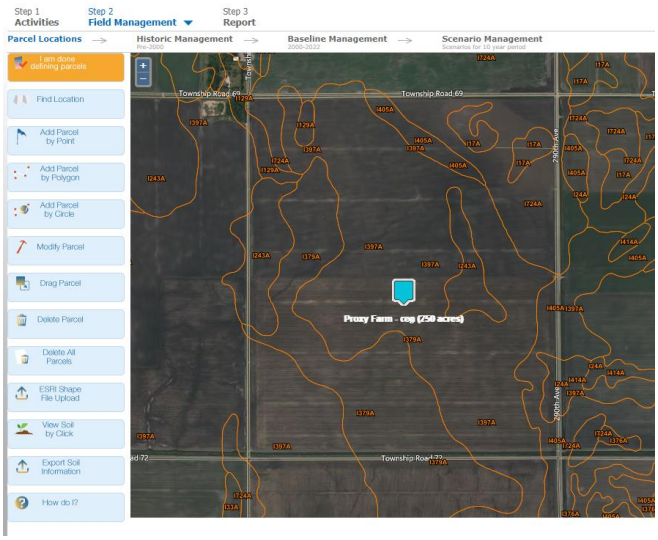
Step 1: ACTIVITIES

- Select the project file and select activities
    - choose Cropland

Define Activities

Step 2: FIELD MANAGEMENT

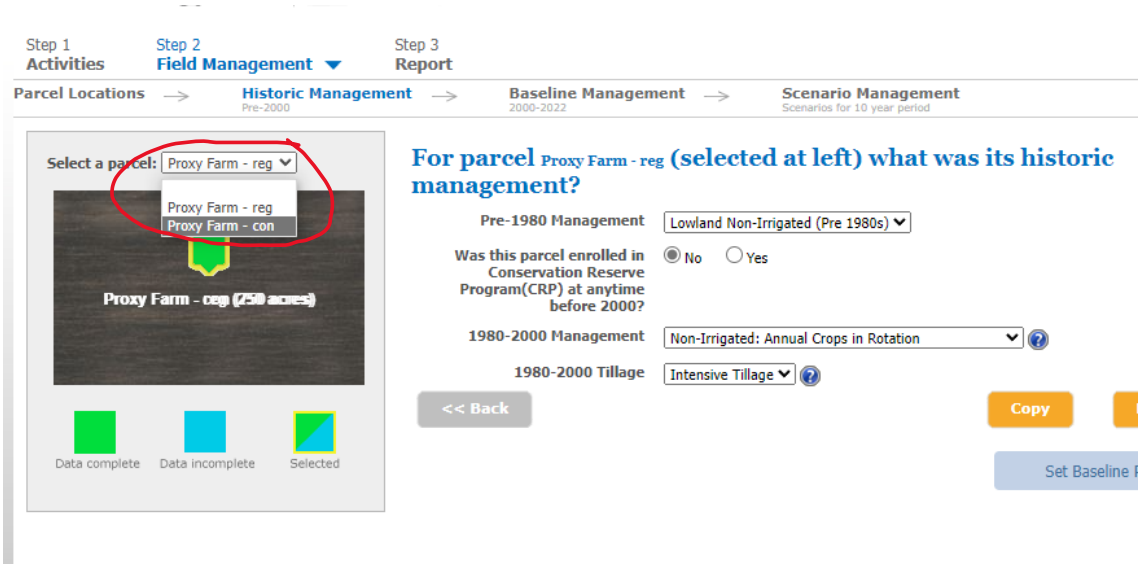
- Choose parcel location by point, polygon (if actual acreage is known), or circle
    - Choose point location and indicate total acres
    - Create two parcels at the same location to represent two different management choices; conventional and alternative/regenerative.



- Ensure all test parcels are located at the same location and share the same soil data.

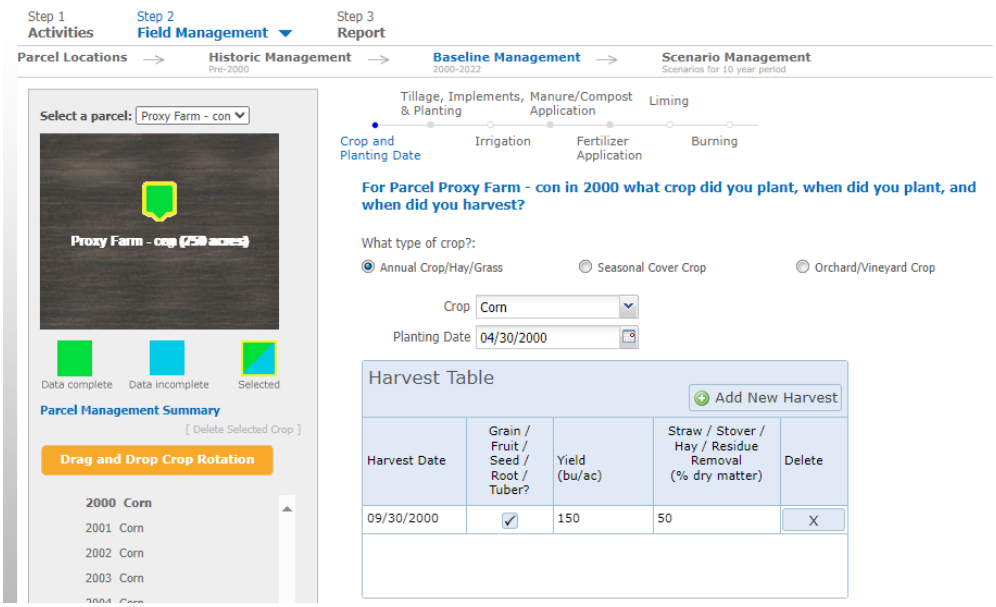
- When both parcels are created, select **I am done defining parcels**

- Select the parcel to define field management:
  - First, choose conventional parcel – this one will not change in the future. All inputs are the same as AlternativeAg_Scenario 1.
- Define Historic Management (Pre-2000)
  - Choose
    - Pre-1980 Management: upland non-irrigated
    - CRP enrollment: no
    - 1980-2000 Management: Non-irrigated – Annual Crops in Rotation



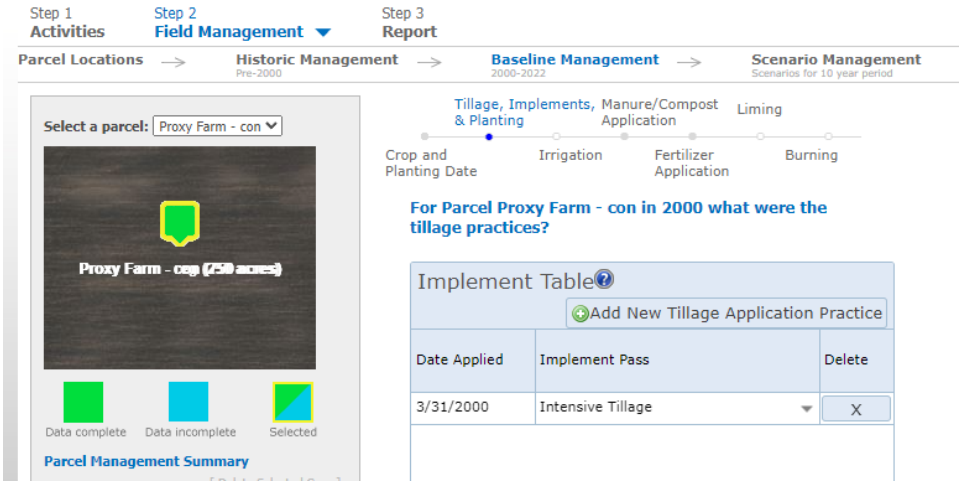
NEXT

- Define Baseline Management (2000 - 2022)
  - Choose Crop and Planting Date:
    - Annual Crop: Corn
    - Planting Date: 04/30/2000
    - Harvest Table:
      - Harvest Date: 09/30/2000
      - Grain?: check
      - Yield (bu/ac): 150
      - Stover removal (% dry matter): 50%



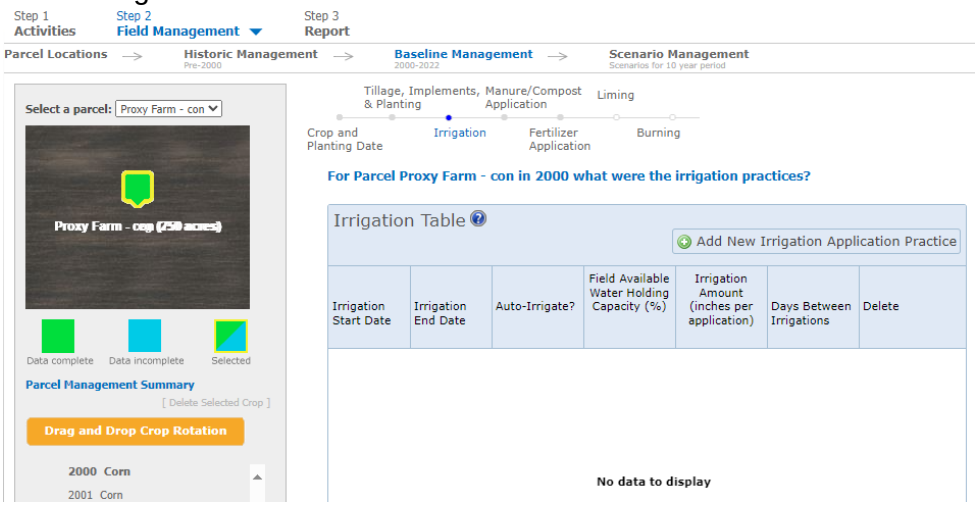
NEXT

- Choose Tillage, Implements, & Planting
  - Implement Table:
    - Date Applied: 3/31/2000
    - Implement Pass: Intensive Tillage



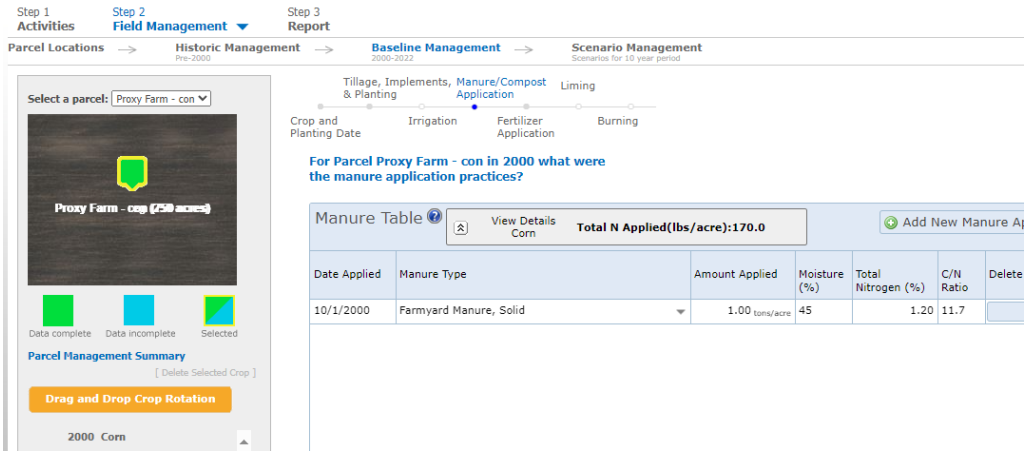
NEXT

- Irrigation: None



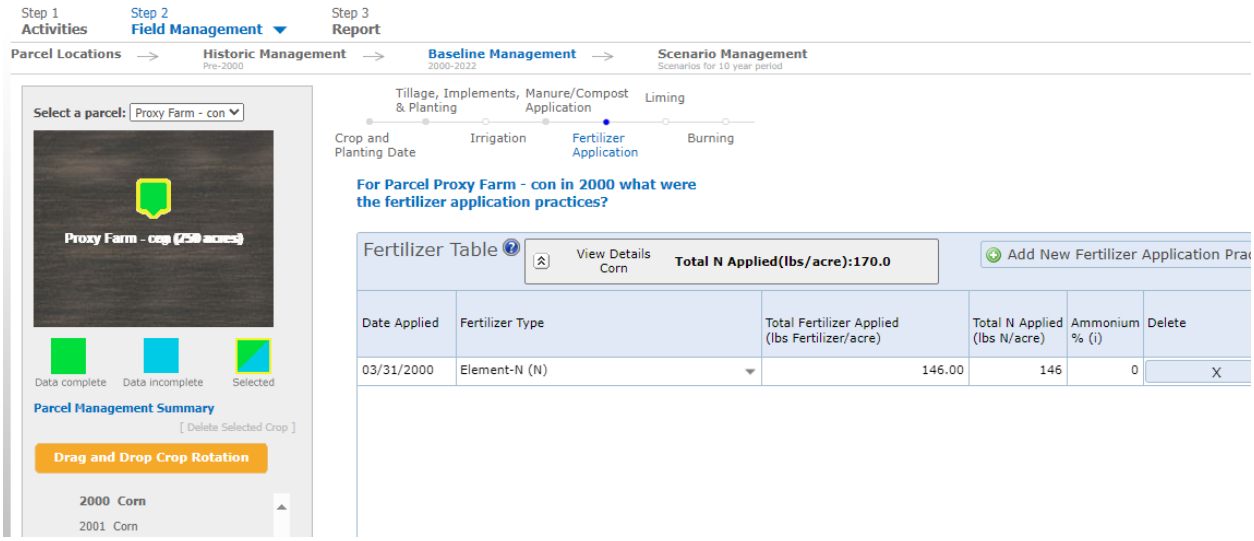
NEXT

- Manure/Compost Application
  - Manure Table:
    - Date Applied: 10/1/2000
    - Manure Type: Farmyard Manure, Solid
    - Amount Applied: 1.00 tons/acre
    - Moisture (%): 45
    - Total Nitrogen (%): 1.20



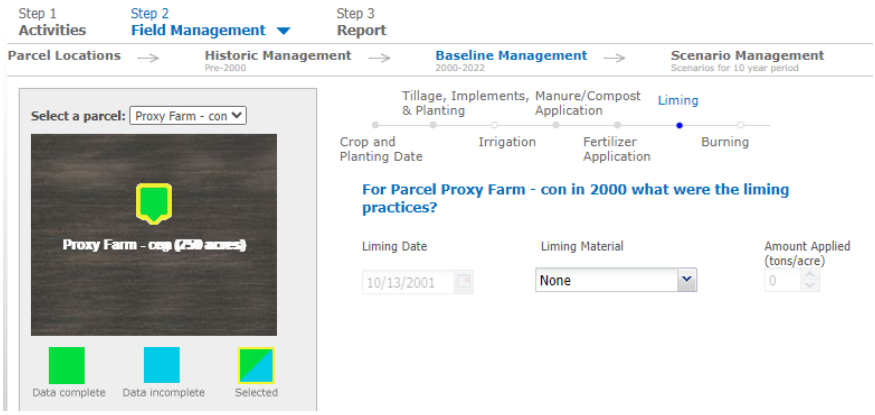
NEXT

- Fertilizer Application:
  - Fertilizer Table:
    - Date Applied: 3/31/2000
    - Fertilizer Type: Element-N (N)
    - Total Fertilizer Applied (lbs Fertilizer/acre): 146.00
    - Total N Applied (lbs N/Acre): 146
    - Ammonium %: 0



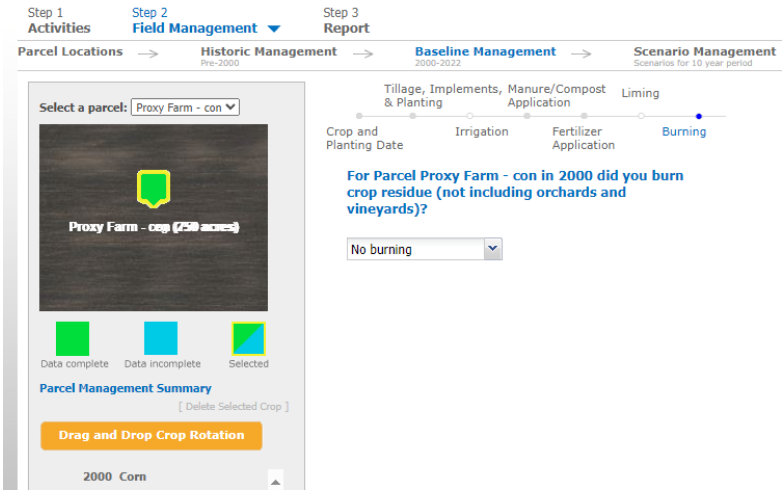
NEXT

- Liming: None



NEXT

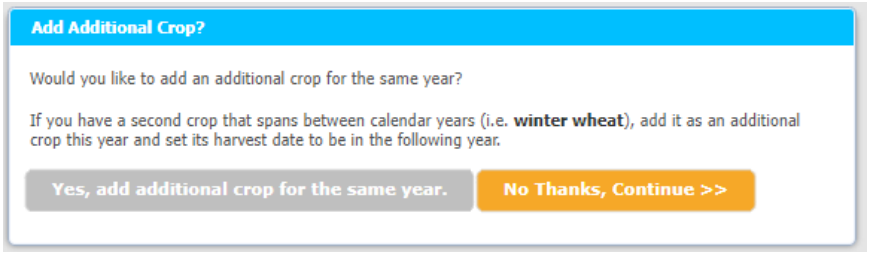
- Burning: None



NEXT

NEW PROMPT

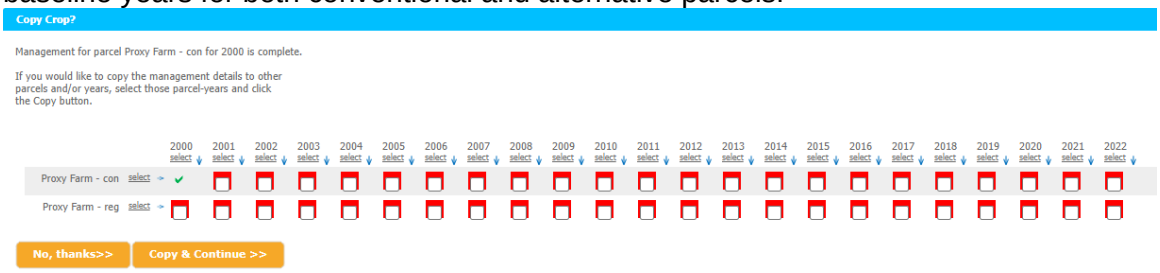
Add Additional Crop for same year?
No



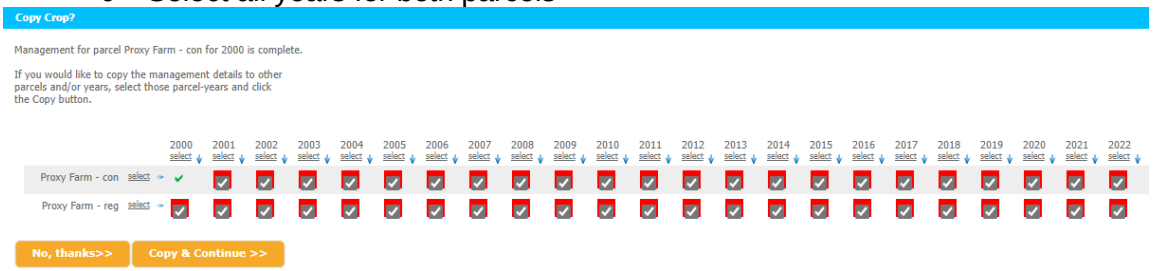
No Thanks, Continue

NEW PROMPT

Both parcels are available to copy to.
For the baseline management, copy the conventional practices that were just input to all baseline years for both conventional and alternative parcels.

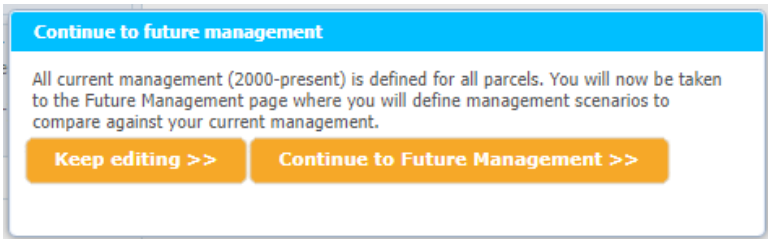


- Select all years for both parcels



Copy & Continue

NEW PROMPT



Continue to Future Management

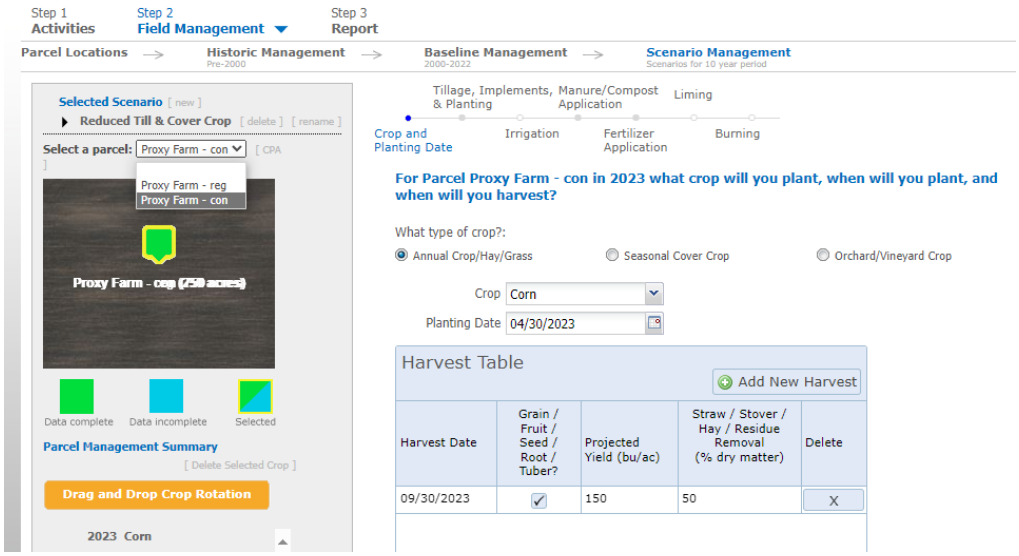
- Define Scenario Management – Scenarios for 10 year period (future)

  ***All inputs for Scenario Management are the same as the Baseline Management (2000 - 2022) in the BAU Test Case

- Select the parcel to define field management
  - choose conventional parcel – All inputs are same as AlternativeAg_Scenario 1

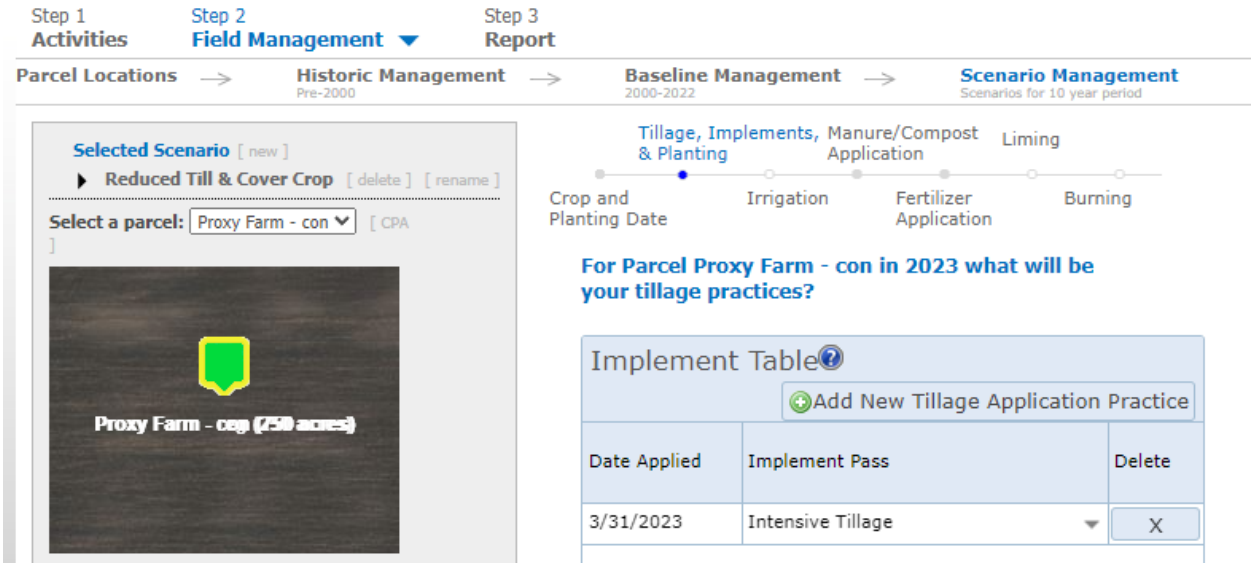
  - Choose Crop and Planting Date
    - Annual Crop: Corn
    - Planting Date: 04/30/2023

- Harvest Table
  - Harvest Date: 09/30/2023
  - Grain?: check
  - Yield (bu/ac): 150
  - Stover removal (% dry matter): 50%



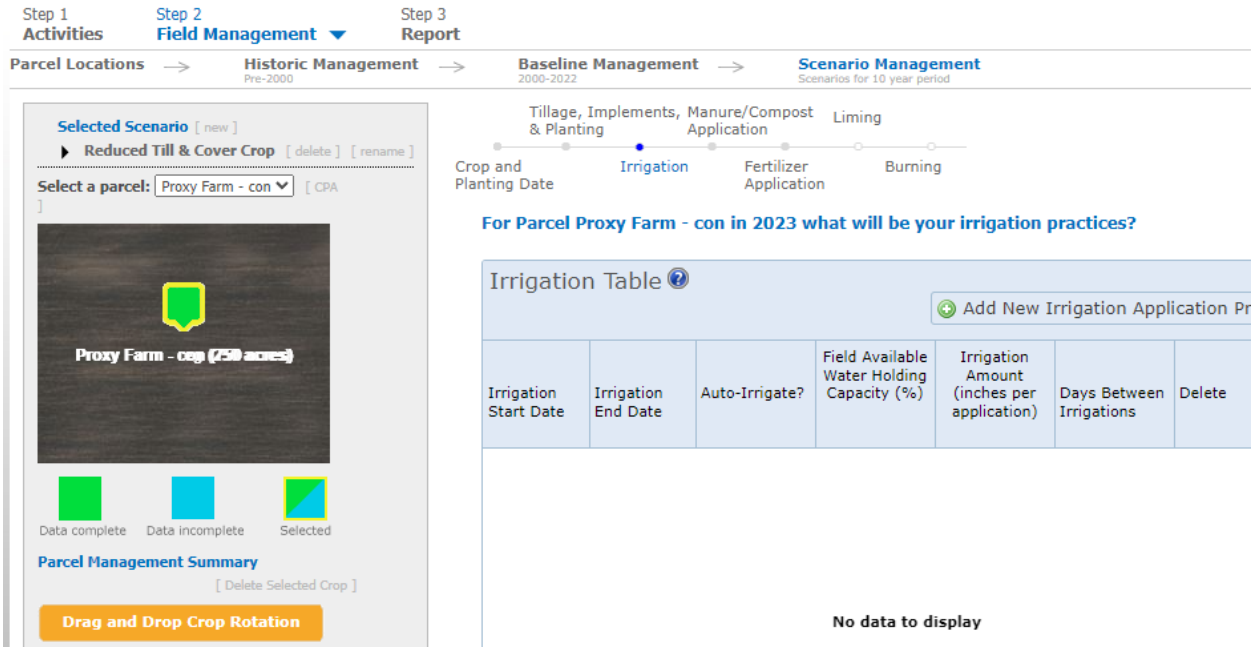
NEXT

- Choose Tillage, Implements, & Planting
  - Implement Table:
    - Date Applied: 3/31/2023
    - Implement Pass: Intensive Tillage



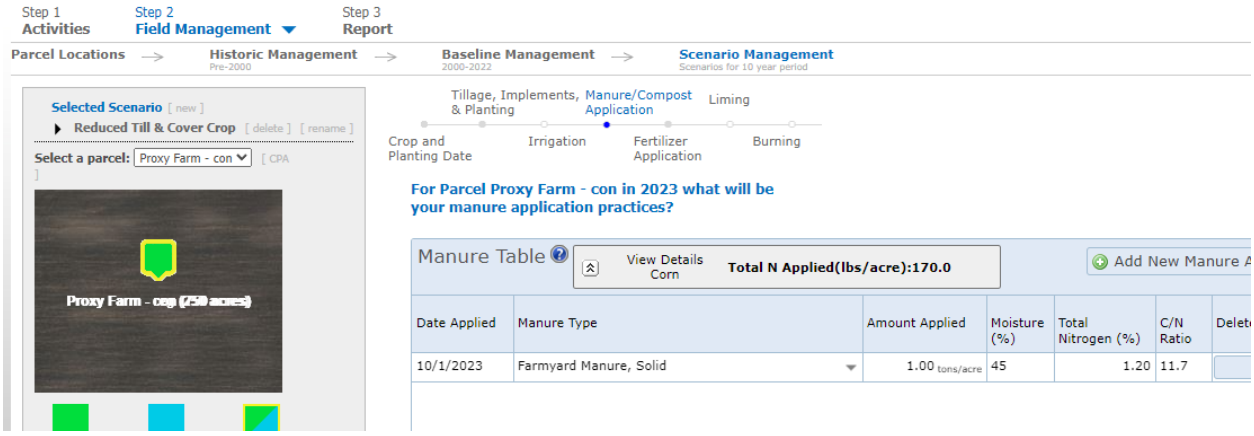
NEXT

- Irrigation: None



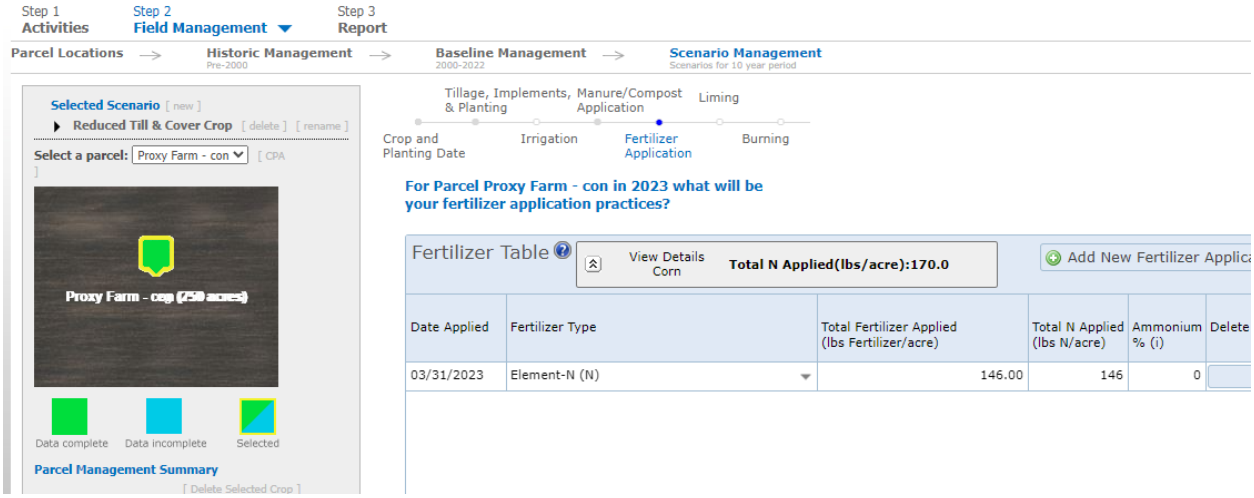
NEXT

- Manure/Compost Application
  - Manure Table:
    - Date Applied: 10/1/2023
    - Manure Type: Farmyard Manure, Solid
    - Amount Applied: 1.00 tons/acre
    - Moisture (%): 45
    - Total Nitrogen (%): 1.20
    - C/N ratio: 11.7



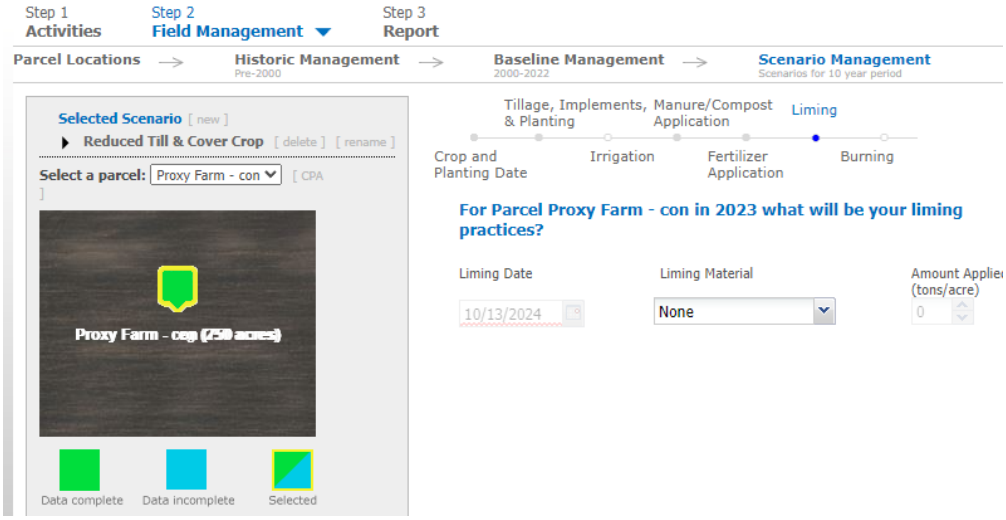
NEXT

- Fertilizer Application
  - Fertilizer Table:
    - Date Applied: 3/31/2023
    - Fertilizer Type: Element-N (N)
    - Total Fertilizer Applied (lbs Fertilizer/acre): 146.00
    - Total N Applied (lbs N/Acre): 146
    - Ammonium %: 0



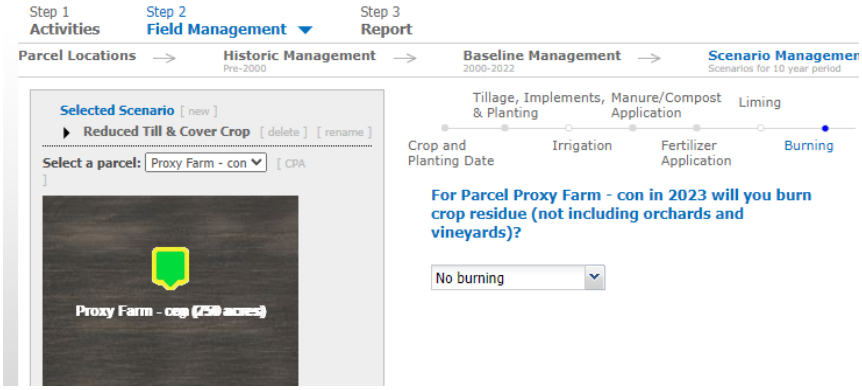
NEXT

- Liming: None



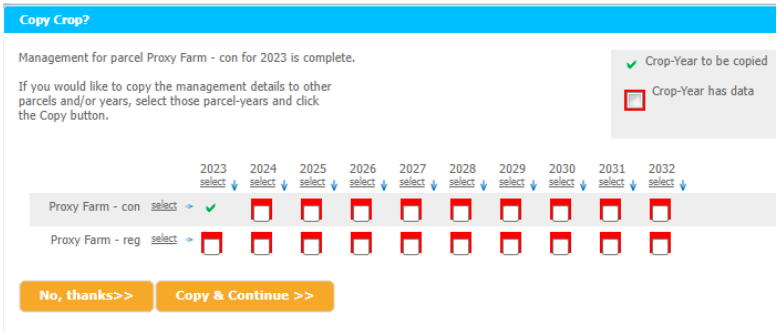
NEXT

- Burning: None



NEXT

NEW PROMPT

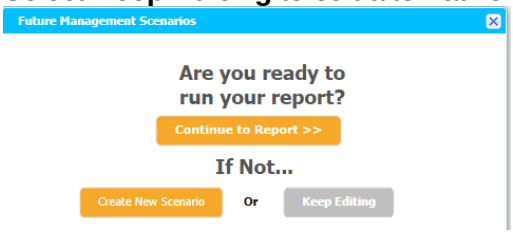


- Select all future years for conventional parcel only

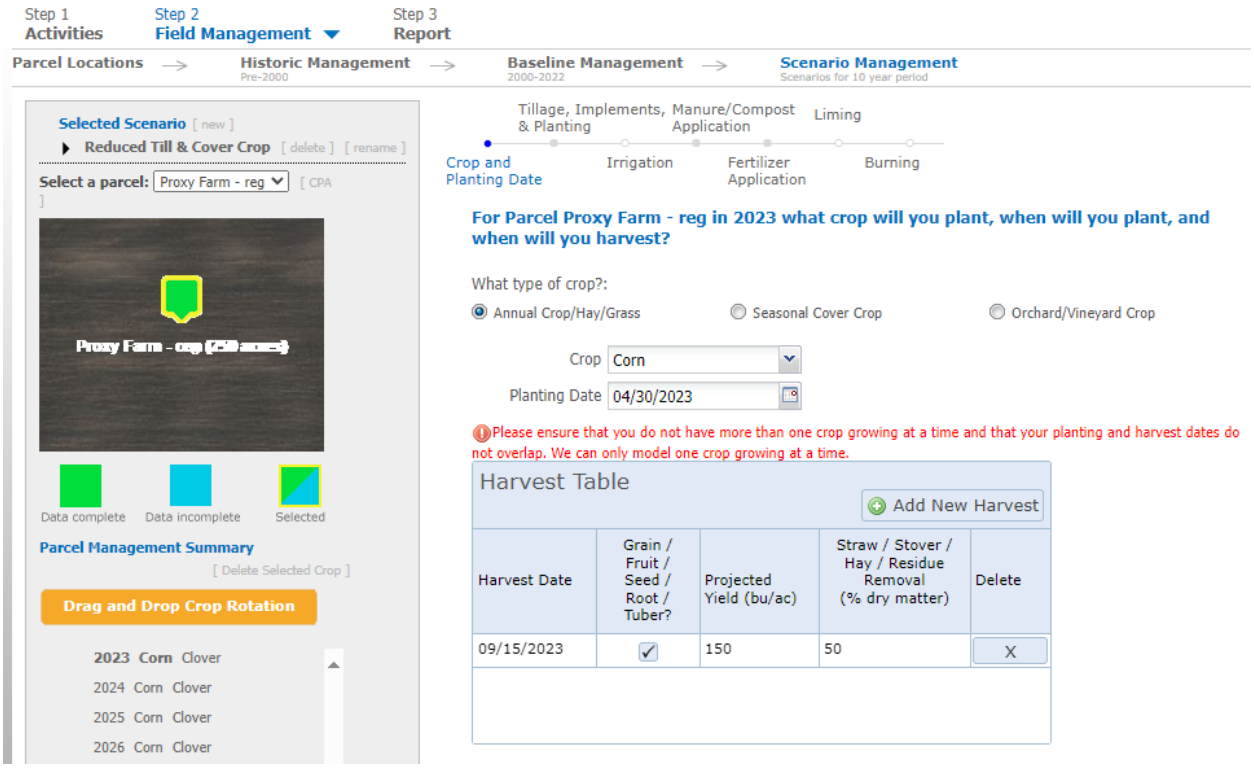
Copy & Continue

NEW PROMPT

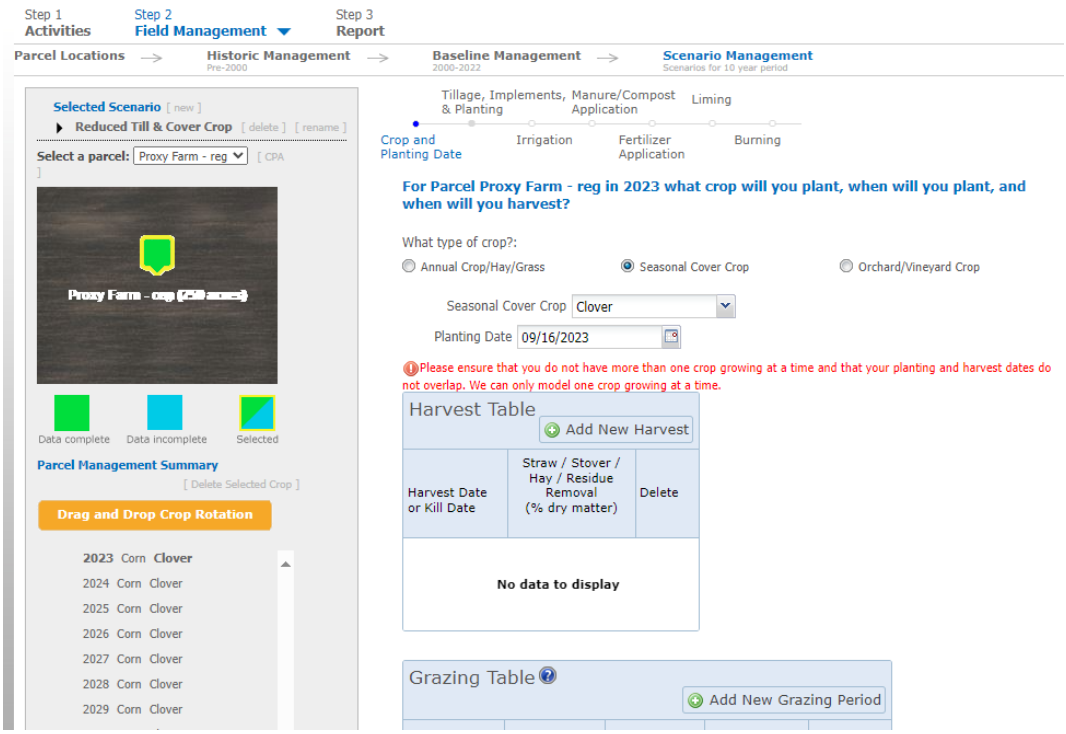
Select **Keep Editing** to edit alternative parcel



- Select the parcel to define field management
    - Next, choose the alternative parcel – this one will change to reflect implementation of alternative practices in the future

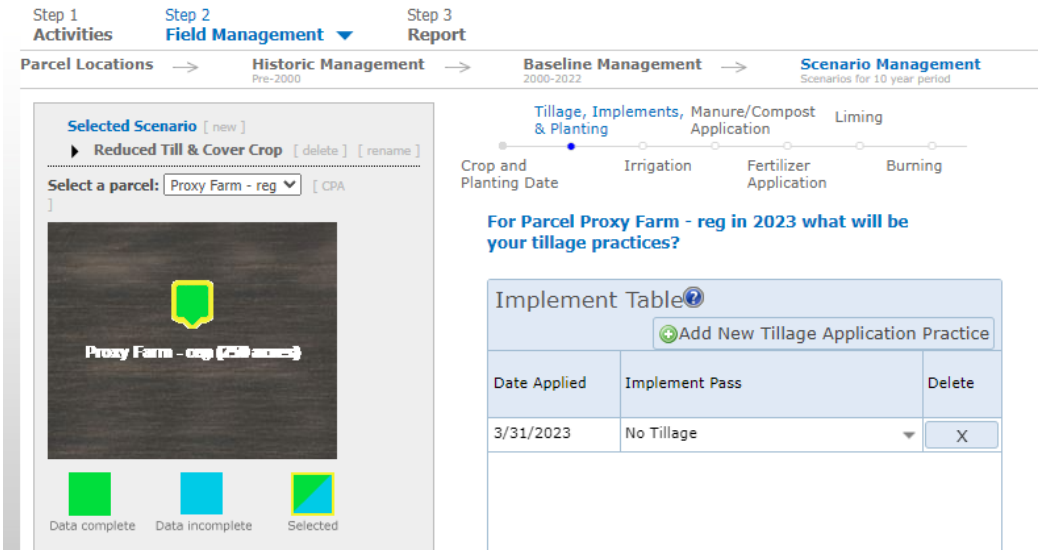


- Define Scenario Management - Scenarios for 10 year period (future)
    - Choose Crop and Planting Date
        - Annual Crop: Corn
        - Planting Date: 04/30/2023
        - Harvest Table
            - Harvest Date: 09/15/2023
            - Grain?: check
            - Yield (bu/ac): 150
            - Stover removal (% dry matter): 50%
    - Choose Cover Crop and Planting Date
        - Seasonal Cover Crop: Clover
        - Planting Date: 09/16/2023
        - Harvest Table: no harvest



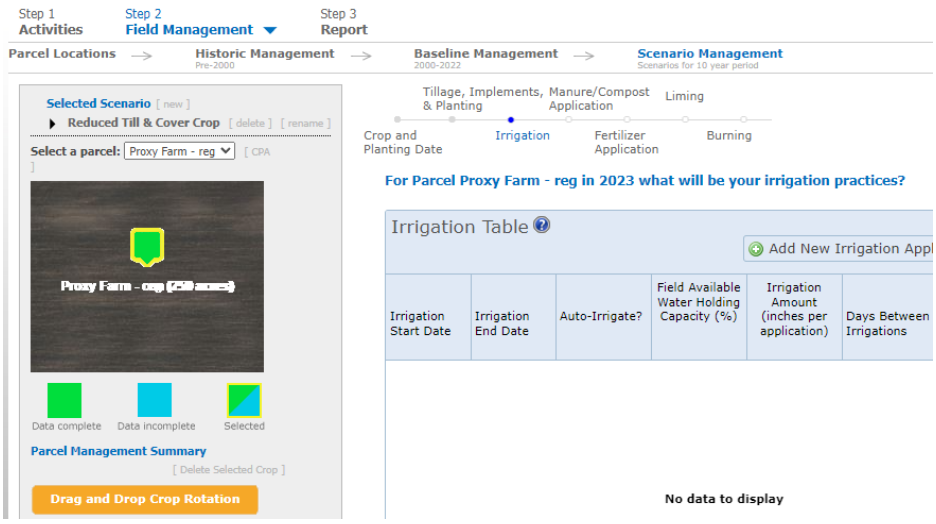
NEXT

- Choose Tillage, Implements, & Planting
  - Implement Table:
    - Date Applied: 3/31/2023
    - Implement Pass: No Tillage



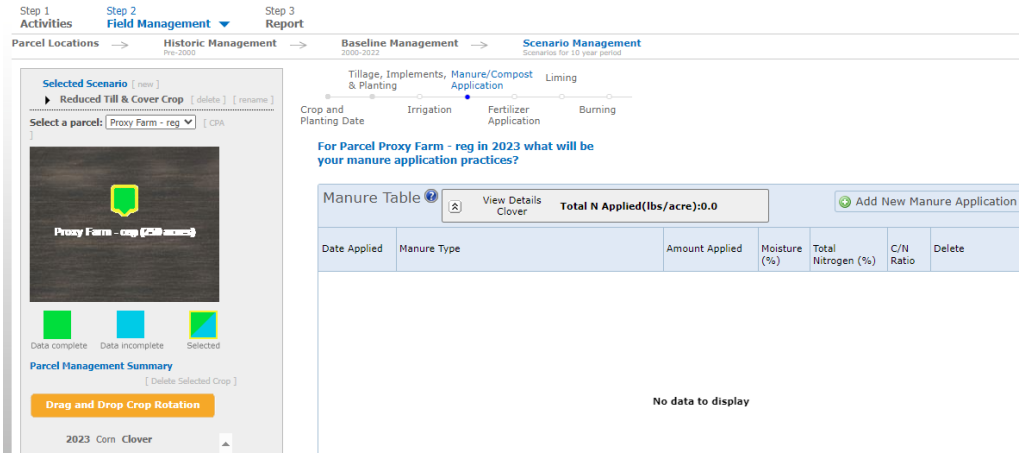
NEXT

- Irrigation: None



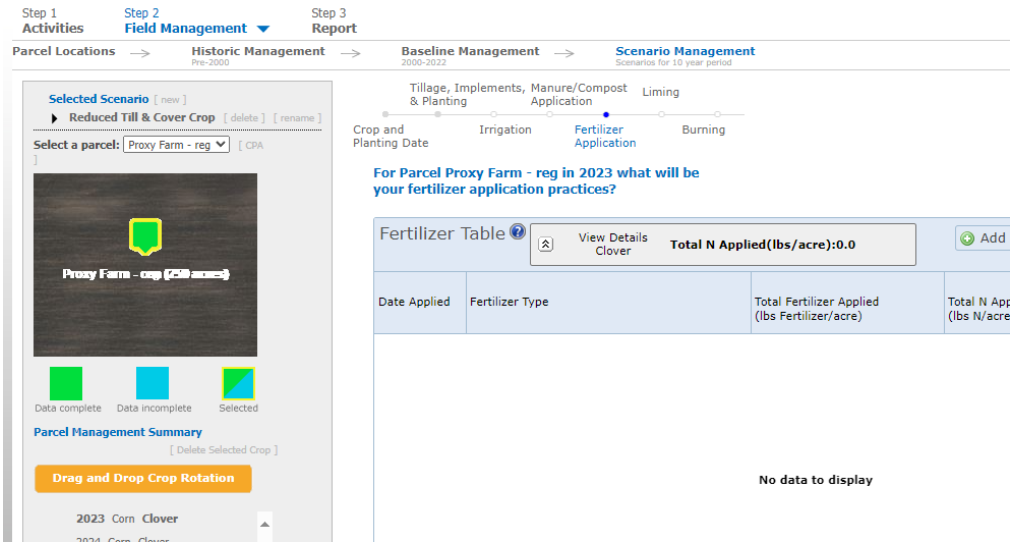
NEXT

- Manure/Compost Application: no manure added to cover crop



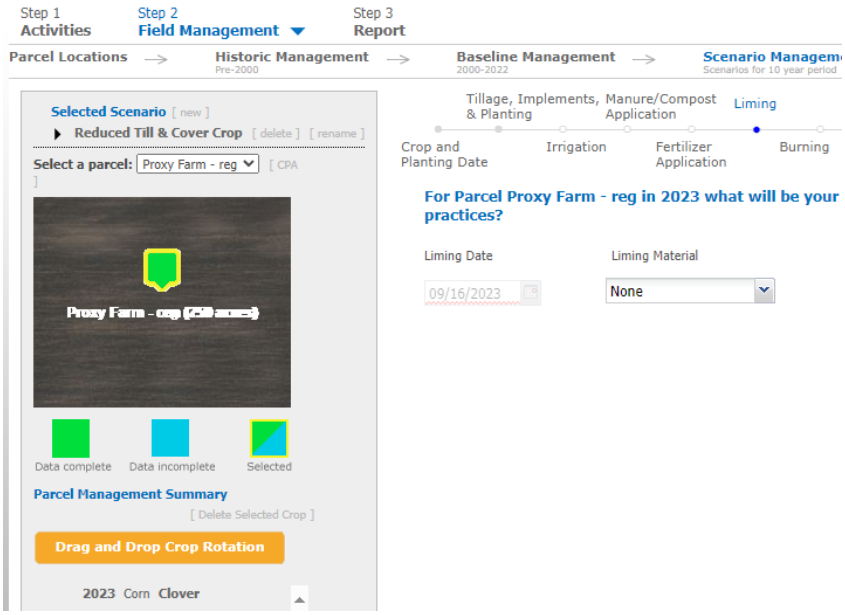
NEXT

- Fertilizer Application: no fertilizer added to cover crop



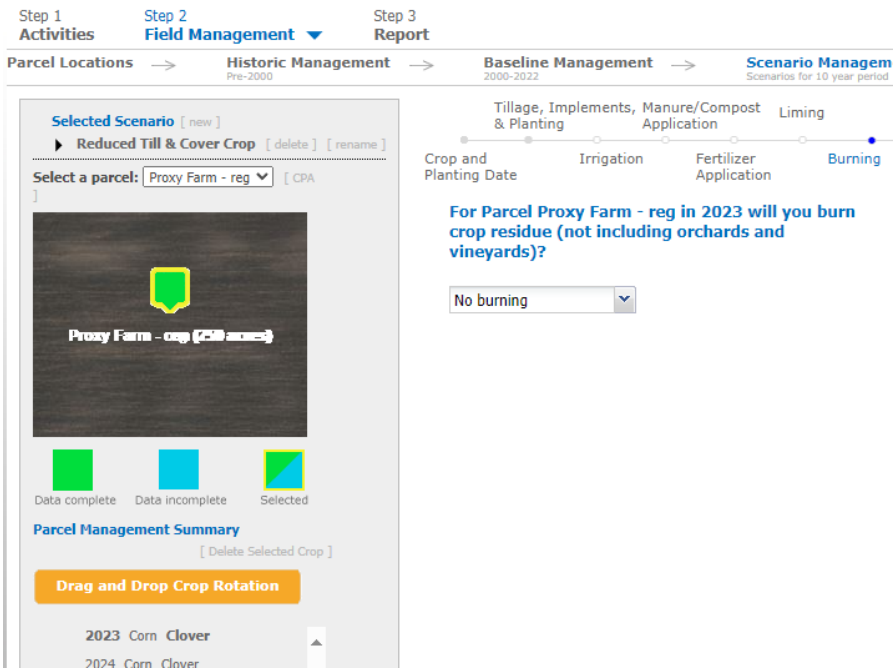
NEXT

- Liming: None



NEXT

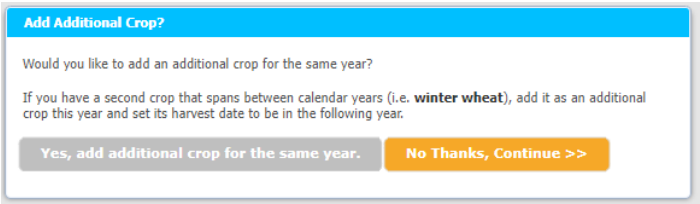
- Burning: None



NEXT

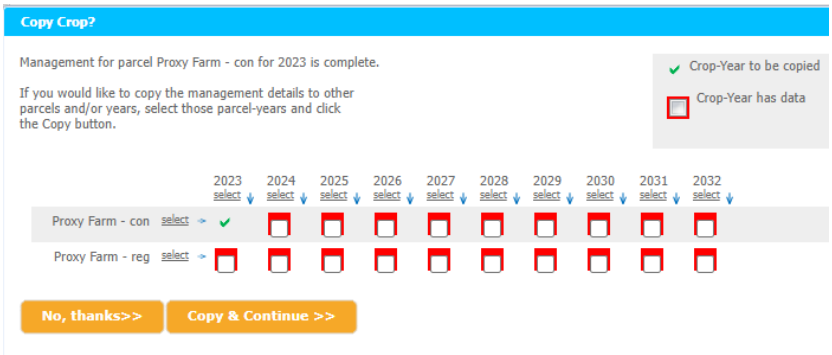
NEW PROMPT

Add Additional Crop for same year?
No

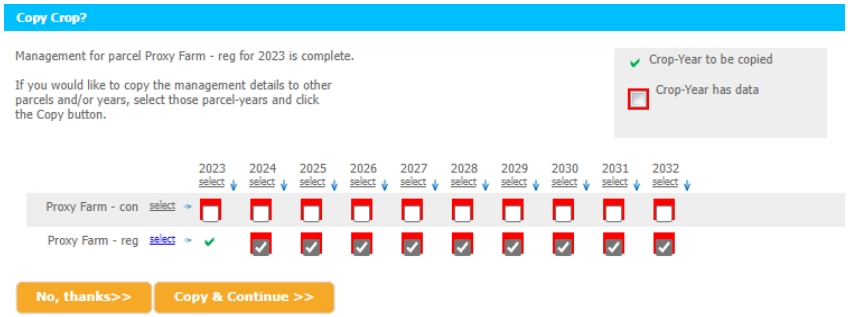


No Thanks, Continue

NEW PROMPT

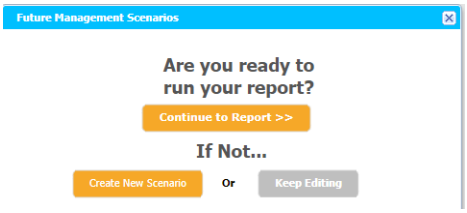


- Select all future years for alternative (reg) parcel only



Copy & Continue

NEW PROMPT



Continue to Report

Step 1 Activities | Step 2 Field Management | Step 3 Report

Cropland, Pasture, Range, Orchards/Vineyards | Cropland Graphical Report | Available Water Holding Capacity

Report finished: 00:03:38 100% Complete

NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario2
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_70433_272736
Time: Mon Jan 08 2024 17:15:27 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

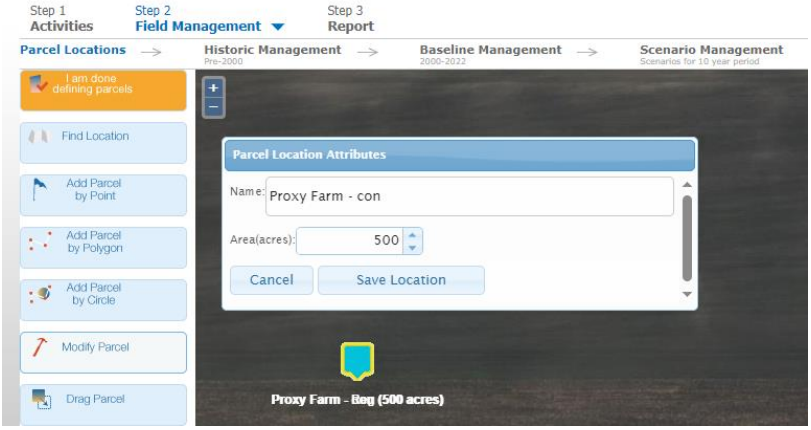
USDA United States Departmen Natural Resources Conse

Source	Baseline Emissions		Reduced Till & Cover Crop			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - reg (250 acres - Corn, Clover)						
C *(tonnes CO_2 equiv./yr.)*	-54.8	+0/-0	-186.4	+0/-0	-131.6	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	563.7	NR[1]	347.0	NR[1]	-216.7	NR[1]
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**508.9**	**NR[1]**	**160.5**	**NR[1]**	**-348.4**	**NR[1]**
Proxy Farm - con (750 acres - Corn)						
C *(tonnes CO_2 equiv./yr.)*	-159.9	+0/-0	-159.9	+0/-0	0.0	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	1529.5	NR[1]	1529.5	NR[1]	0.0	NR[1]
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**1369.5**	**NR[1]**	**1369.5**	**NR[1]**	**0.0**	**NR[1]**
Total (all parcels)	***1878.4***	***NR[1]***	***1530.1***	***NR[1]***	***-348.4***	***NR[1]***

AlternativeAg_Scenario 3

*500 acres where a suite of alternative agricultural practices is implemented in the next 10 years and 500 acres where there are no future changes in farming practices a.k.a. business as usual (BAU) of conventional management

- Create two parcels at the same location to represent two different management choices; conventional and alternative/regenerative.



*Follow the same steps for Historic, Baseline, and Scenario Management for AlternativeAg_Scenario 2. The only difference between inputs for test cases 2-4 is the acreage value for the parcel locations.

Report

Source	Baseline Emissions		Reduced Tillage			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - Reg (500 acres - Corn, Clover)						
C (tonnes CO_2 equiv./yr.)	-106.9	+0/-0	-359.7	+0/-0	-252.8	+0/-0
CO_2 (tonnes/yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O (tonnes CO_2 equiv./yr.)	1024.5	NR[1]	620.2	NR[1]	-404.3	NR[1]
CH_4 (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**917.6**	**NR[1]**	**260.5**	**NR[1]**	**-657.1**	**NR[1]**
Proxy Farm - con (500 acres - Corn)						
C (tonnes CO_2 equiv./yr.)	-106.9	+0/-0	-106.9	+0/-0	0.0	+0/-0
CO_2 (tonnes/yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O (tonnes CO_2 equiv./yr.)	1024.6	NR[1]	1024.6	NR[1]	0.0	NR[1]
CH_4 (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**917.7**	**NR[1]**	**917.7**	**NR[1]**	**0.0**	**NR[1]**
Total (all parcels)	***1835.3***	***NR[1]***	***1178.2***	***NR[1]***	***-657.1***	***NR[1]***

AlternativeAg_Scenario 4

*750 acres where a suite of alternative agricultural practices are implemented in the next 10 years and 250 acres where there are no future changes in farming practices a.k.a. business as usual (BAU) of conventional management

*Follow the same steps for Historic, Baseline, and Scenario Management for AlternativeAg_Scenario 2. The only difference between inputs for test cases 2-4 is the acreage value for the parcel locations.

Report

Step 1 Activities | Step 2 Field Management | Step 3 Report

Cropland, Pasture, Range, Orchards/Vineyards | Cropland Graphical Report | Available Water Holding Capacity

Report finished: 00:00:05 100% Complete

NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario4
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_70520_272789
TIME: Fri Dec 22 2023 12:30:56 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

USDA United States Departm Natural Resources Cor

Source	Baseline Emissions		No Till			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - reg (750 acres - Corn, Clover)						
C (tonnes CO_2 equiv./yr.)	-155.8	+0/-0	-528.4	+0/-0	-372.6	+0/-0
CO_2 (tonnes/yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O (tonnes CO_2 equiv./yr.)	1454.1	NR†	876.7	NR†	-577.4	NR†
CH_4 (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**1298.3**	**NR†**	**348.2**	**NR†**	**-950.0**	**NR†**
Proxy Farm - con (250 acres - Corn)						
C (tonnes CO_2 equiv./yr.)	-55.4	+0/-0	-55.4	+0/-0	0.0	+0/-0
CO_2 (tonnes/yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O (tonnes CO_2 equiv./yr.)	551.4	NR†	551.4	NR†	0.0	NR†
CH_4 (tonnes CO_2 equiv./yr.)	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**496.0**	**NR†**	**496.0**	**NR†**	**0.0**	**NR†**
Total (all parcels)	***1794.2***	***NR†***	***844.2***	***NR†***	***-950.0***	***NR†***

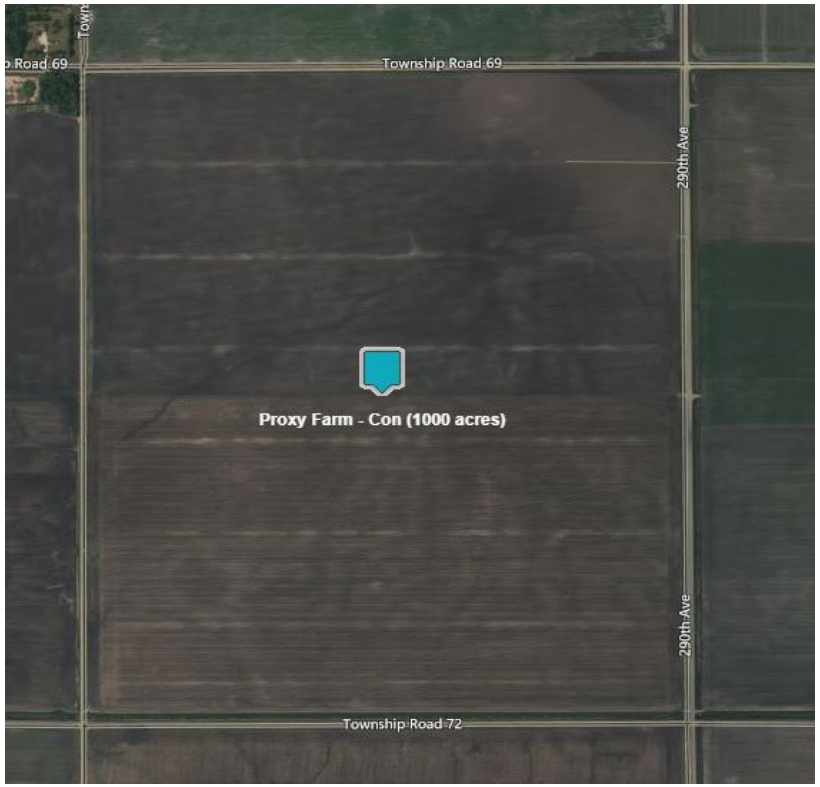
Agricultural Practices Supplemental Information:

COMET-Farm Results with Scaled CI score

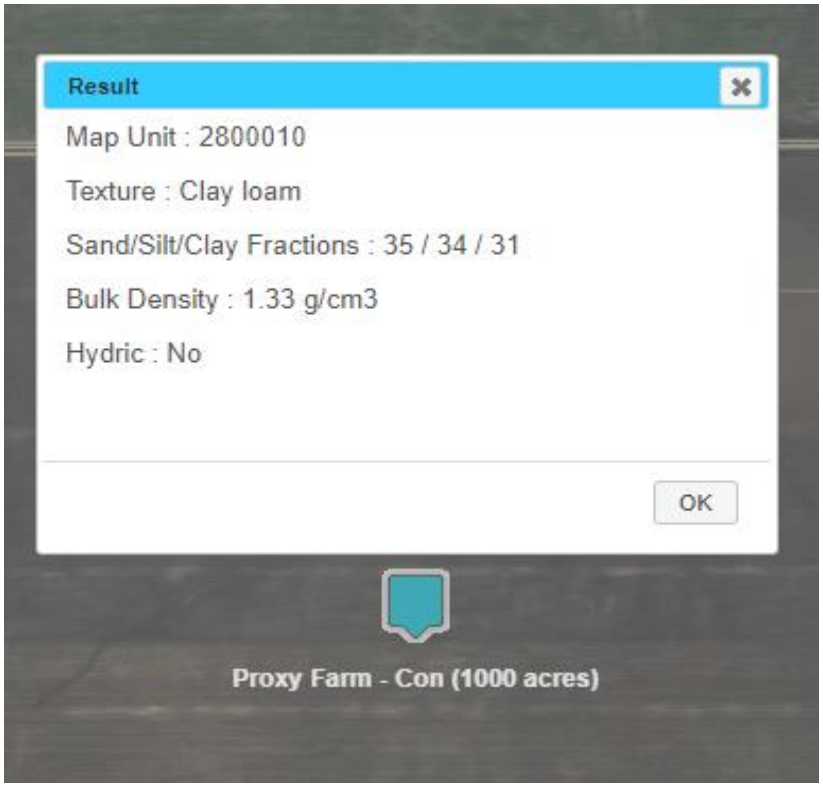
Appendix M
Otter Tail to Wilkin Carbon Dioxide Pipeline Project
Final Environmental Impact Statement /
Docket No. IP7093/PPL-22-422

Test Scenario #1 - 0%AltAgPrac

Proxy Farm Location



Soil Data Summary



NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario1
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_69782_272657
Time: Fri Dec 22 2023 09:39:59 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

USDA United States Department of Agriculture Natural Resources Conservation Service | Colorado State University

Source	Baseline Emissions		BAU - conventional			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - Con (1000 acres - Corn)						
C *(tonnes CO_2 equiv./yr.)*	-205.1	+0/-0	-205.1	+0/-0	0.0	+0/-0
Soil	-205.1	+0/-0	-205.1	+0/-0	0.0	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	1882.5	NR†	1882.5	NR†	0.0	NR†
Direct N_2O Emissions	1765.3	+0/-0	1765.3	+0/-0	0.0	+0/-0
Direct - Soil	1765.3	+0/-0	1765.3	+0/-0	0.0	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	117.2	+185/-94.5	117.2	+185/-94.5	0.0	+0/-0
Indirect - Volatilization	117.2	+185/-94.5	117.2	+185/-94.5	0.0	+0/-0
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**1677.4**	**NR†**	**1677.4**	**NR†**	**0.0**	**NR†**
Total (all parcels)	***1677.4***	***NR†***	***1677.4***	***NR†***	***0.0***	***NR†***

CAUTION This report is still in development and the values within may not reflect actual values.

* Yearly results are unavailable for categories which have monte-carlo uncertainty

period averages are presented instead.

1. General Information

Report versior	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template vers	[-]	1
Creation date	[date]	12/22/2023
Name	[-]	Proxy Farm - Con
Area	[acres]	1000
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (N	[-]	POINT (-10730530.915146995 5829165.567618263)

Parcel Name: Proxy Farm - Con

TimeFrame	Parcel	acres	Scenario	Year	Crop 1	Crop 1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - Con	1000	Baseline	2000	Corn	150	(09/30/2000	-668.58734	80.20107	13.83833	-574.548
Current	Proxy Farm - Con	1000	Baseline	2001	Corn	150	(09/30/2001	-699.7072	2277.8572	13.83833	1591.9883
Current	Proxy Farm - Con	1000	Baseline	2002	Corn	150	(09/30/2002	-851.15784	1214.516	13.83833	377.19647
Current	Proxy Farm - Con	1000	Baseline	2003	Corn	150	(09/30/2003	-814.78986	201.1346	13.83833	-599.817

Current	Proxy Farm - Con	1000	Baseline	2004	Corn	150	(09/30/2004	-809.23083	361.6815	13.83833	-433.711
Current	Proxy Farm - Con	1000	Baseline	2005	Corn	150	(09/30/2005	-478.95654	467.37967	13.83833	2.2614565
Current	Proxy Farm - Con	1000	Baseline	2006	Corn	150	(09/30/2006	-683.59924	1207.4653	13.83833	537.7044
Current	Proxy Farm - Con	1000	Baseline	2007	Corn	150	(09/30/2007	-822.7576	244.71552	13.83833	-564.2038
Current	Proxy Farm - Con	1000	Baseline	2008	Corn	150	(09/30/2008	-504.42007	3194.6904	13.83833	2704.1086
Current	Proxy Farm - Con	1000	Baseline	2009	Corn	150	(09/30/2009	-474.63147	2352.9712	13.83833	1892.1781
Current	Proxy Farm - Con	1000	Baseline	2010	Corn	150	(09/30/2010	-391.28262	412.31073	13.83833	34.866436
Current	Proxy Farm - Con	1000	Baseline	2011	Corn	150	(09/30/2011	-342.9121	2408.2188	13.83833	2079.145
Current	Proxy Farm - Con	1000	Baseline	2012	Corn	150	(09/30/2012	-596.37836	330.66537	13.83833	-251.8747
Current	Proxy Farm - Con	1000	Baseline	2013	Corn	150	(09/30/2013	-617.8741	1901.4924	13.83833	1297.4568
Current	Proxy Farm - Con	1000	Baseline	2014	Corn	150	(09/30/2014	-421.02686	3852.3262	13.83833	3445.1377
Current	Proxy Farm - Con	1000	Baseline	2015	Corn	150	(09/30/2015	-437.77628	296.31628	13.83833	-127.6217
Current	Proxy Farm - Con	1000	Baseline	2016	Corn	150	(09/30/2016	-352.15503	445.4497	13.83833	107.13301
Current	Proxy Farm - Con	1000	Baseline	2017	Corn	150	(09/30/2017	-192.2129	295.88184	13.83833	117.50726
Current	Proxy Farm - Con	1000	Baseline	2018	Corn	150	(09/30/2018	-236.01862	6169.06	13.83833	5946.88
Current	Proxy Farm - Con	1000	Baseline	2019	Corn	150	(09/30/2019	-337.90442	3626.5195	13.83833	3302.4536
Current	Proxy Farm - Con	1000	Baseline	2020	Corn	150	(09/30/2020	-209.23682	187.68057	13.83833	-7.717914
Current	Proxy Farm - Con	1000	Baseline	2021	Corn	150	(09/30/2021	-574.1709	2043.347	13.83833	1483.0145
Current	Proxy Farm - Con	1000	Baseline	2022	Corn	150	(09/30/2022	-274.8919	3890.2104	13.83833	3629.157
							AVG:	-512.6816913	1628.7866	13.83833	1129.9432

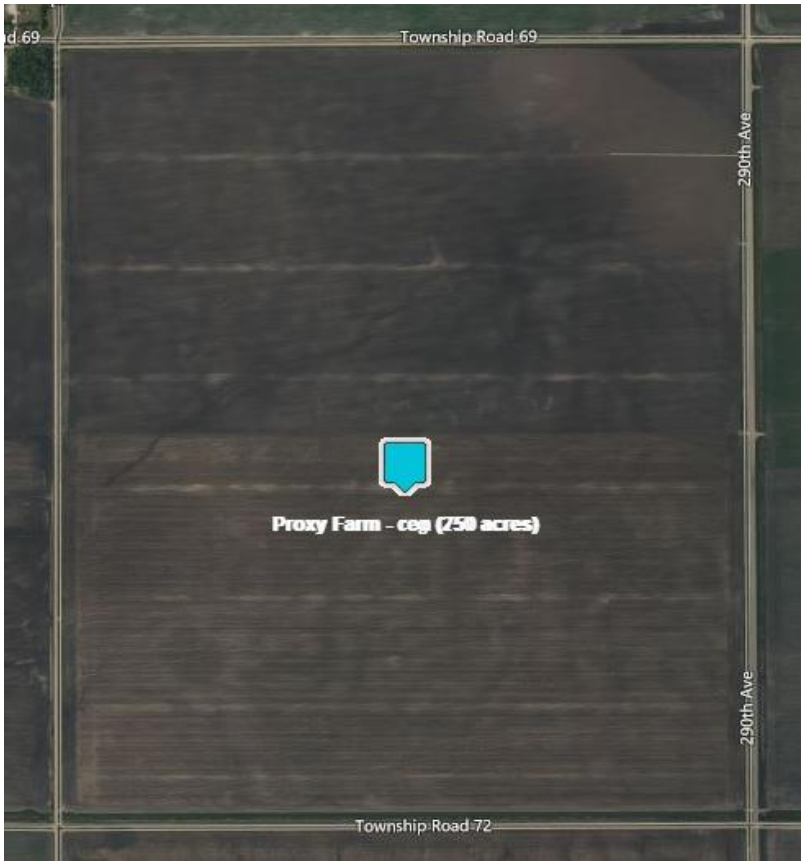
Future	Proxy Farm - Con	1000	Baseline	2023	Corn	150	(09/30/2023	-297.68973	249.5622	117.17799	69.05046
Future	Proxy Farm - Con	1000	Baseline	2024	Corn	150	(09/30/2024	-221.77522	470.67017	117.17799	366.07294
Future	Proxy Farm - Con	1000	Baseline	2025	Corn	150	(09/30/2025	-68.72771	313.8534	117.17799	362.30368
Future	Proxy Farm - Con	1000	Baseline	2026	Corn	150	(09/30/2026	-118.63441	6233.786	117.17799	6232.33
Future	Proxy Farm - Con	1000	Baseline	2027	Corn	150	(09/30/2027	-227.0732	3675.0444	117.17799	3565.1492
Future	Proxy Farm - Con	1000	Baseline	2028	Corn	150	(09/30/2028	-108.37039	197.6201	117.17799	206.4277
Future	Proxy Farm - Con	1000	Baseline	2029	Corn	150	(09/30/2029	-478.84448	1750.8981	117.17799	1389.2316
Future	Proxy Farm - Con	1000	Baseline	2030	Corn	150	(09/30/2030	-185.80627	3936.2817	117.17799	3867.6536
Future	Proxy Farm - Con	1000	Baseline	2031	Corn	150	(09/30/2031	-211.72638	332.84744	117.17799	238.29906
Future	Proxy Farm - Con	1000	Baseline	2032	Corn	150	(09/30/2032	-131.85265	492.5601	117.17799	477.88544
							AVG:	-205.050044	1765.3124	117.17799	1677.4404
									Acres	125,000	209680

									Acres	150,000	251616
Future	Proxy Farm - Con	1000	BAU - conv	2023	Corn	150	(09/30/2023	-297.68973	249.5622	117.17799	69.05046
Future	Proxy Farm - Con	1000	BAU - conv	2024	Corn	150	(09/30/2024	-221.77522	470.67017	117.17799	366.07294
Future	Proxy Farm - Con	1000	BAU - conv	2025	Corn	150	(09/30/2025	-68.72771	313.8534	117.17799	362.30368
Future	Proxy Farm - Con	1000	BAU - conv	2026	Corn	150	(09/30/2026	-118.63441	6233.786	117.17799	6232.33
Future	Proxy Farm - Con	1000	BAU - conv	2027	Corn	150	(09/30/2027	-227.0732	3675.0444	117.17799	3565.1492
Future	Proxy Farm - Con	1000	BAU - conv	2028	Corn	150	(09/30/2028	-108.37039	197.6201	117.17799	206.4277
Future	Proxy Farm - Con	1000	BAU - conv	2029	Corn	150	(09/30/2029	-478.84448	1750.8981	117.17799	1389.2316
Future	Proxy Farm - Con	1000	BAU - conv	2030	Corn	150	(09/30/2030	-185.80627	3936.2817	117.17799	3867.6536
Future	Proxy Farm - Con	1000	BAU - conv	2031	Corn	150	(09/30/2031	-211.72638	332.84744	117.17799	238.29906
Future	Proxy Farm - Con	1000	BAU - conv	2032	Corn	150	(09/30/2032	-131.85265	492.5601	117.17799	477.88544
							AVG:	-205.050044	1765.3124	117.17799	1677.4404
									Acres	125,000	209680
										150,000	251616
										Change	0

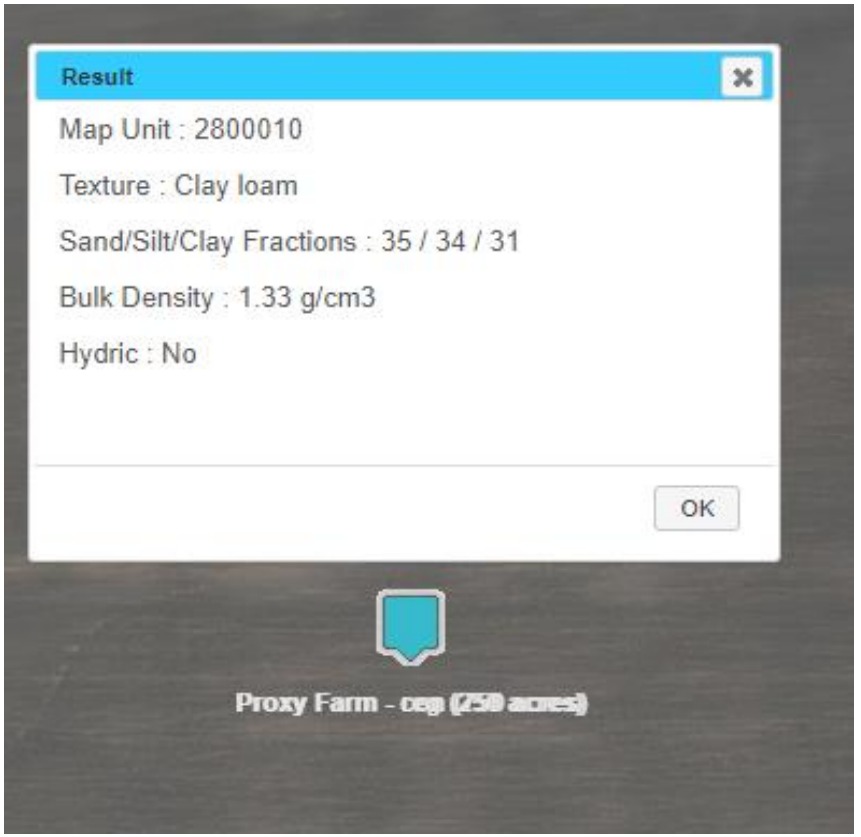
Scaled Emissions:	Acres	Scenario	Project Scale Emissions (tonnes	CI score (gCO2e/MJ)
1000 acre proxy scaled by estimated total acres needed to supply the max feedstock required for maximum ethanol production	125,000	Baseline	209680	40.06
	150,000		251616	48.07
	125,000	Future	209680	40.06
	150,000		251616	48.07
	125,000	Change	0	0.00
	150,000		0	0.00

Test Scenario #2 - 25%AltAgPrac

Proxy Farm Location



Soil Data Summary



NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario2
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_70433_272736
TIME: Thu Dec 21 2023 16:49:51 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

USDA United States Department of Agriculture Natural Resources Conservation Service | Colorado State University

Source	Baseline Emissions		Reduced Till & Cover Crop			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - reg (250 acres - Corn, Clover)						
C *(tonnes CO_2 equiv./yr.)*	-56.4	+0/-0	-186.9	+0/-0	-130.5	+0/-0
Soil	-56.4	+0/-0	-186.9	+0/-0	-130.5	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	562.9	NR†	346.6	NR†	-216.3	NR†
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**506.5**	**NR†**	**159.7**	**NR†**	**-346.8**	**NR†**
Proxy Farm - con (750 acres - Corn)						
C *(tonnes CO_2 equiv./yr.)*	-159.9	+0/-0	-159.9	+0/-0	0.0	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	1529.5	NR†	1529.5	NR†	0.0	NR†
Direct N_2O Emissions	1441.6	+0/-0	1441.6	+0/-0	0.0	+0/-0
Direct - Soil	1441.6	+0/-0	1441.6	+0/-0	0.0	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	87.9	+138.7/-70.9	87.9	+138.7/-70.9	0.0	+0/-0
Indirect - Volatilization	87.9	+138.7/-70.9	87.9	+138.7/-70.9	0.0	+0/-0
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**1369.5**	**NR†**	**1369.5**	**NR†**	**0.0**	**NR†**
Total (all parcels)	***1876.0***	***NR†***	***1529.2***	***NR†***	***-346.8***	***NR†***

CAUTION This report is still in development and the values within may not reflect actual values.

* Yearly results are unavailable for categories which have monte-carlo uncertainty

period averages are presented instead.

1. General Information

Report version	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template version	[-]	1
Creation date	[date]	12/22/2023
Name	[-]	Proxy Farm - con
Area	[acres]	750
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (Mercator)	[-]	POINT (-10730516.224198114 5828979.39561049)

Parcel Name: Proxy Farm - con

TimeFrame	Parcel	acres	Scenario	Year	Crop1	Crop1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - con	750	Baseline	2000	Corn	150	(09/30/2000;	-546.9406	63.90022	10.37875	-472.662
Current	Proxy Farm - con	750	Baseline	2001	Corn	150	(09/30/2001;	-523.0107	1895.678	10.37875	1383.047
Current	Proxy Farm - con	750	Baseline	2002	Corn	150	(09/30/2002;	-664.2	998.0082	10.37875	344.187
Current	Proxy Farm - con	750	Baseline	2003	Corn	150	(09/30/2003;	-631.6164	160.1674	10.37875	-461.07
Current	Proxy Farm - con	750	Baseline	2004	Corn	150	(09/30/2004;	-622.3025	289.7942	10.37875	-322.13
Current	Proxy Farm - con	750	Baseline	2005	Corn	150	(09/30/2005;	-370.8524	376.2428	10.37875	15.76916
Current	Proxy Farm - con	750	Baseline	2006	Corn	150	(09/30/2006;	-533.0186	967.9932	10.37875	445.3533
Current	Proxy Farm - con	750	Baseline	2007	Corn	150	(09/30/2007;	-641.4052	192.3129	10.37875	-438.714
Current	Proxy Farm - con	750	Baseline	2008	Corn	150	(09/30/2008;	-411.729	2608.098	10.37875	2206.748

Current	Proxy Farm - con	750	Baseline	2009	Corn	150	(09/30/2009;	-363.5001	1956.988	10.37875	1603.867
Current	Proxy Farm - con	750	Baseline	2010	Corn	150	(09/30/2010;	-303.8266	317.1204	10.37875	23.67257
Current	Proxy Farm - con	750	Baseline	2011	Corn	150	(09/30/2011;	-268.7345	2002.407	10.37875	1744.052
Current	Proxy Farm - con	750	Baseline	2012	Corn	150	(09/30/2012;	-452.2901	268.2908	10.37875	-173.621
Current	Proxy Farm - con	750	Baseline	2013	Corn	150	(09/30/2013;	-484.4534	1531.443	10.37875	1057.369
Current	Proxy Farm - con	750	Baseline	2014	Corn	150	(09/30/2014;	-343.0878	3163.117	10.37875	2830.408
Current	Proxy Farm - con	750	Baseline	2015	Corn	150	(09/30/2015;	-338.822	236.5903	10.37875	-91.853
Current	Proxy Farm - con	750	Baseline	2016	Corn	150	(09/30/2016;	-271.3613	350.465	10.37875	89.48241
Current	Proxy Farm - con	750	Baseline	2017	Corn	150	(09/30/2017;	-151.7033	234.6889	10.37875	93.3643
Current	Proxy Farm - con	750	Baseline	2018	Corn	150	(09/30/2018;	-182.8937	5036.145	10.37875	4863.63
Current	Proxy Farm - con	750	Baseline	2019	Corn	150	(09/30/2019;	-262.9429	3021.95	10.37875	2769.386
Current	Proxy Farm - con	750	Baseline	2020	Corn	150	(09/30/2020;	-158.8199	147.3283	10.37875	-1.11283
Current	Proxy Farm - con	750	Baseline	2021	Corn	150	(09/30/2021;	-447.6309	1702.078	10.37875	1264.826
Current	Proxy Farm - con	750	Baseline	2022	Corn	150	(09/30/2022;	-229.9857	3194.258	10.37875	2974.651
							AVG:	-400.2229	1335.438	10.37875	945.5935
Future	Proxy Farm - con	750	Baseline	2023	Corn	150	(09/30/2023;	-228.9953	195.8785	87.88349	54.76664
Future	Proxy Farm - con	750	Baseline	2024	Corn	150	(09/30/2024;	-170.0086	370.3333	87.88349	288.2081
Future	Proxy Farm - con	750	Baseline	2025	Corn	150	(09/30/2025;	-56.00983	249.0266	87.88349	280.9002
Future	Proxy Farm - con	750	Baseline	2026	Corn	150	(09/30/2026;	-91.9253	5090.016	87.88349	5085.974
Future	Proxy Farm - con	750	Baseline	2027	Corn	150	(09/30/2027;	-177.0914	3062.04	87.88349	2972.832
Future	Proxy Farm - con	750	Baseline	2028	Corn	150	(09/30/2028;	-80.38798	155.1263	87.88349	162.6218
Future	Proxy Farm - con	750	Baseline	2029	Corn	150	(09/30/2029;	-373.4686	1407.736	87.88349	1122.151
Future	Proxy Farm - con	750	Baseline	2030	Corn	150	(09/30/2030;	-160.2695	3232.032	87.88349	3159.646
Future	Proxy Farm - con	750	Baseline	2031	Corn	150	(09/30/2031;	-161.1161	265.9503	87.88349	192.7177
Future	Proxy Farm - con	750	Baseline	2032	Corn	150	(09/30/2032;	-100.1578	387.8811	87.88349	375.6068
							AVG:	-159.943	1441.602	87.88349	1369.542
								Scaled Emissions	Acres	125,000	171193
										150,000	205431
Future	Proxy Farm - con	750	Reduced Ti	2023	Corn	150	(09/30/2023;	-228.9953	195.8785	87.88349	54.76664
Future	Proxy Farm - con	750	Reduced Ti	2024	Corn	150	(09/30/2024;	-170.0086	370.3333	87.88349	288.2081
Future	Proxy Farm - con	750	Reduced Ti	2025	Corn	150	(09/30/2025;	-56.00983	249.0266	87.88349	280.9002

Future	Proxy Farm - con	750	Reduced Ti	2026	Corn	150	(09/30/2026;	-91.9253	5090.016	87.88349	5085.974	
Future	Proxy Farm - con	750	Reduced Ti	2027	Corn	150	(09/30/2027;	-177.0914	3062.04	87.88349	2972.832	
Future	Proxy Farm - con	750	Reduced Ti	2028	Corn	150	(09/30/2028;	-80.38798	155.1263	87.88349	162.6218	
Future	Proxy Farm - con	750	Reduced Ti	2029	Corn	150	(09/30/2029;	-373.4686	1407.736	87.88349	1122.151	
Future	Proxy Farm - con	750	Reduced Ti	2030	Corn	150	(09/30/2030;	-160.2695	3232.032	87.88349	3159.646	
Future	Proxy Farm - con	750	Reduced Ti	2031	Corn	150	(09/30/2031;	-161.1161	265.9503	87.88349	192.7177	
Future	Proxy Farm - con	750	Reduced Ti	2032	Corn	150	(09/30/2032;	-100.1578	387.8811	87.88349	375.6068	
								AVG:	-159.943	1441.602	87.88349	1369.542

Scaled Emissions	Acres	
	125,000	171193
	150,000	205431
	Change:	0

1. General Information

Report version	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template version	[-]	1
Creation date	[date]	12/22/2023
Name	[-]	Proxy Farm - reg
Area	[acres]	250
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (Mercator)	[-]	POINT (-10730517.09438146 5828979.75918612)

Parcel Name: Proxy Farm - reg

TimeFrame	Parcel	acres	Scenario	Year	Crop1	Crop1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - reg	250	Baseline	2000	Corn	150	(09/30/2000;	-205.1363	23.31297	3.459583	-178.364
Current	Proxy Farm - reg	250	Baseline	2001	Corn	150	(09/30/2001;	-173.0081	724.3635	3.459583	554.8149
Current	Proxy Farm - reg	250	Baseline	2002	Corn	150	(09/30/2002;	-233.8227	376.8276	3.459583	146.4644
Current	Proxy Farm - reg	250	Baseline	2003	Corn	150	(09/30/2003;	-220.5902	58.13047	3.459583	-159

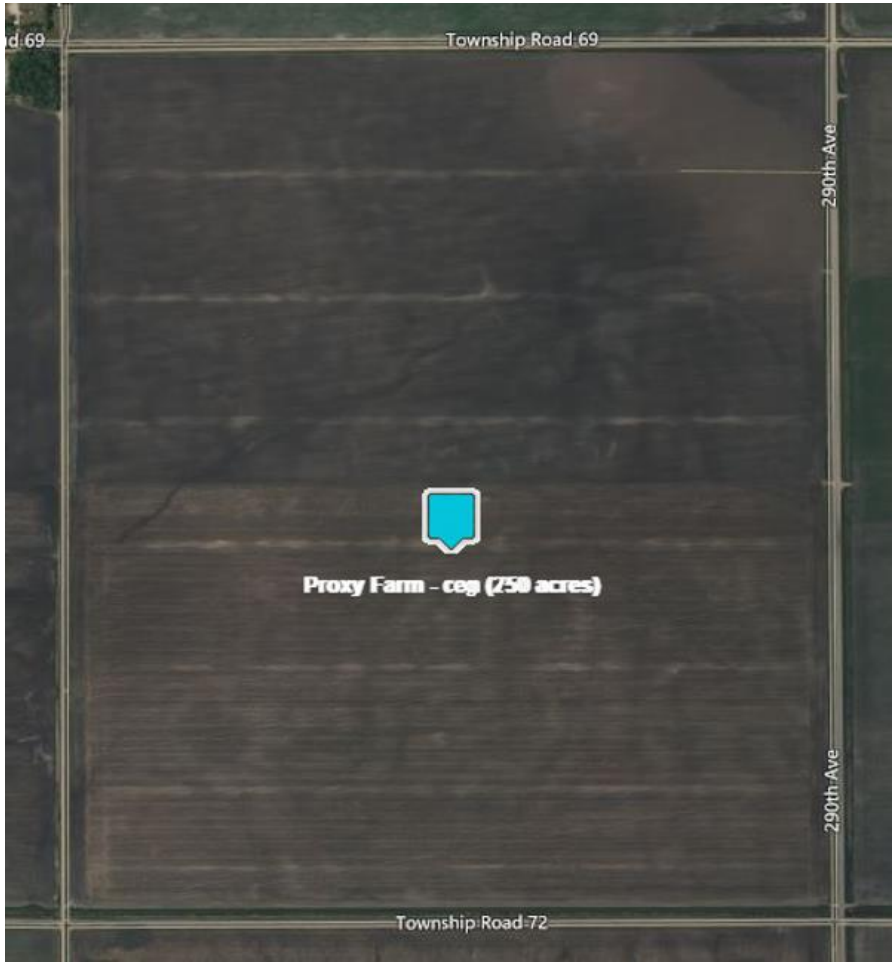
Current	Proxy Farm - reg	250	Baseline	2004	Corn	150	(09/30/2004;	-215.1007	104.996	3.459583	-106.645
Current	Proxy Farm - reg	250	Baseline	2005	Corn	150	(09/30/2005;	-129.4392	137.3425	3.459583	11.3629
Current	Proxy Farm - reg	250	Baseline	2006	Corn	150	(09/30/2006;	-187.266	345.8634	3.459583	162.057
Current	Proxy Farm - reg	250	Baseline	2007	Corn	150	(09/30/2007;	-225.5425	69.79719	3.459583	-152.286
Current	Proxy Farm - reg	250	Baseline	2008	Corn	150	(09/30/2008;	-153.5757	963.6422	3.459583	813.5261
Current	Proxy Farm - reg	250	Baseline	2009	Corn	150	(09/30/2009;	-125.1124	746.8815	3.459583	625.2287
Current	Proxy Farm - reg	250	Baseline	2010	Corn	150	(09/30/2010;	-106.3904	109.627	3.459583	6.696185
Current	Proxy Farm - reg	250	Baseline	2011	Corn	150	(09/30/2011;	-95.27042	763.9717	3.459583	672.1609
Current	Proxy Farm - reg	250	Baseline	2012	Corn	150	(09/30/2012;	-153.1917	99.66023	3.459583	-50.0719
Current	Proxy Farm - reg	250	Baseline	2013	Corn	150	(09/30/2013;	-172.1326	546.2211	3.459583	377.5481
Current	Proxy Farm - reg	250	Baseline	2014	Corn	150	(09/30/2014;	-127.7848	1188.359	3.459583	1064.034
Current	Proxy Farm - reg	250	Baseline	2015	Corn	150	(09/30/2015;	-117.9576	86.02016	3.459583	-28.4779
Current	Proxy Farm - reg	250	Baseline	2016	Corn	150	(09/30/2016;	-94.33585	124.8384	3.459583	33.96214
Current	Proxy Farm - reg	250	Baseline	2017	Corn	150	(09/30/2017;	-54.51491	84.96592	3.459583	33.91059
Current	Proxy Farm - reg	250	Baseline	2018	Corn	150	(09/30/2018;	-63.791	1845.322	3.459583	1784.991
Current	Proxy Farm - reg	250	Baseline	2019	Corn	150	(09/30/2019;	-92.37151	1157.503	3.459583	1068.591
Current	Proxy Farm - reg	250	Baseline	2020	Corn	150	(09/30/2020;	-53.93921	52.55088	3.459583	2.07125
Current	Proxy Farm - reg	250	Baseline	2021	Corn	150	(09/30/2021;	-157.6322	652.4096	3.459583	498.237
Current	Proxy Farm - reg	250	Baseline	2022	Corn	150	(09/30/2022;	-88.37473	1199.918	3.459583	1115.003
							AVG:	-141.1426	498.3706	3.459583	360.6876
Future	Proxy Farm - reg	250	Baseline	2023	Corn	150	(09/30/2023;	-79.09055	69.63326	29.2945	19.8372
Future	Proxy Farm - reg	250	Baseline	2024	Corn	150	(09/30/2024;	-58.76355	131.9421	29.2945	102.473
Future	Proxy Farm - reg	250	Baseline	2025	Corn	150	(09/30/2025;	-21.11107	90.18942	29.2945	98.37285
Future	Proxy Farm - reg	250	Baseline	2026	Corn	150	(09/30/2026;	-32.03272	1866.176	29.2945	1863.438
Future	Proxy Farm - reg	250	Baseline	2027	Corn	150	(09/30/2027;	-62.41854	1172.689	29.2945	1139.565
Future	Proxy Farm - reg	250	Baseline	2028	Corn	150	(09/30/2028;	-26.4187	55.32817	29.2945	58.20397
Future	Proxy Farm - reg	250	Baseline	2029	Corn	150	(09/30/2029;	-131.604	500.8962	29.2945	398.5867
Future	Proxy Farm - reg	250	Baseline	2030	Corn	150	(09/30/2030;	-63.72097	1214.023	29.2945	1179.596
Future	Proxy Farm - reg	250	Baseline	2031	Corn	150	(09/30/2031;	-54.83438	96.75941	29.2945	71.21953
Future	Proxy Farm - reg	250	Baseline	2032	Corn	150	(09/30/2032;	-34.28297	138.3672	29.2945	133.3787
							AVG:	-56.42774	533.6003	29.2945	506.4671
								Scaled	Acres	125,000	63308

							Emissions	Acres	150,000	75970
Future	Proxy Farm - reg	250	Reduced Ti	2023	Corn	150 (09/15/2023;	-117.6406	56.92877	17.92232	-42.7895
Future	Proxy Farm - reg	250	Reduced Ti	2024	Corn	150 (09/15/2024;	-133.7022	94.54151	17.92232	-21.2384
Future	Proxy Farm - reg	250	Reduced Ti	2025	Corn	150 (09/15/2025;	-155.6002	68.40384	17.92232	-69.2741
Future	Proxy Farm - reg	250	Reduced Ti	2026	Corn	150 (09/15/2026;	-177.5272	1139.226	17.92232	979.6213
Future	Proxy Farm - reg	250	Reduced Ti	2027	Corn	150 (09/15/2027;	-198.8526	615.114	17.92232	434.1838
Future	Proxy Farm - reg	250	Reduced Ti	2028	Corn	150 (09/15/2028;	-165.9421	35.9631	17.92232	-112.057
Future	Proxy Farm - reg	250	Reduced Ti	2029	Corn	150 (09/15/2029;	-287.7827	331.3943	17.92232	61.53386
Future	Proxy Farm - reg	250	Reduced Ti	2030	Corn	150 (09/15/2030;	-197.6753	797.1423	17.92232	617.3892
Future	Proxy Farm - reg	250	Reduced Ti	2031	Corn	150 (09/15/2031;	-217.1732	66.04348	17.92232	-133.207
Future	Proxy Farm - reg	250	Reduced Ti	2032	Corn	150 (09/15/2032;	-217.133	81.96846	17.92232	-117.242
						AVG:	-186.9029	328.6726	17.92232	159.692
							Scaled Emissions	Acres	125,000	19961
									150,000	23954
									Change:	-347

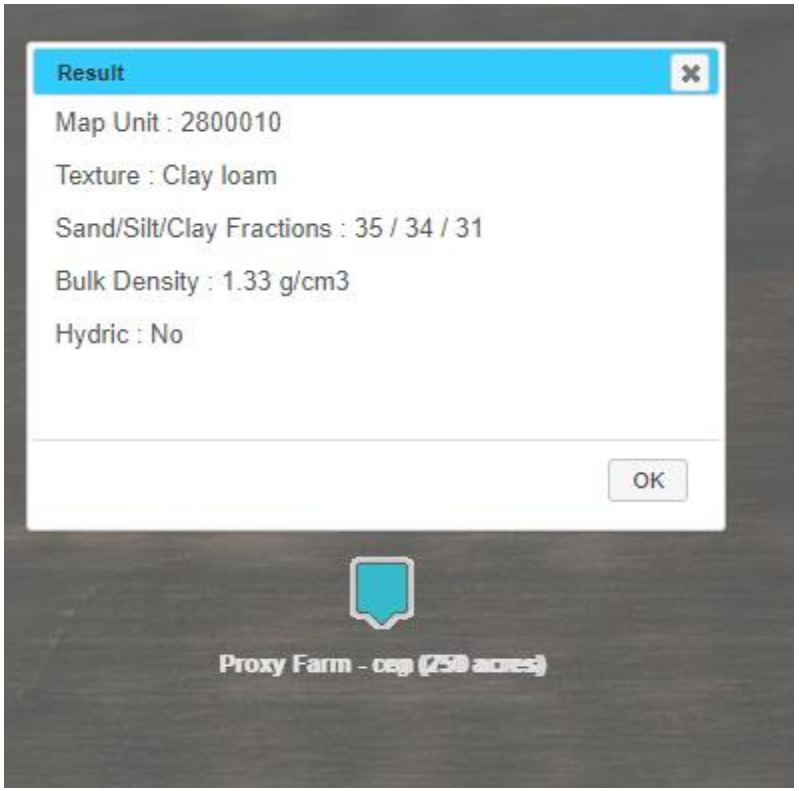
Scaled Emissions:	Acres	Scenario	Project Scale Emissions (tonnes CO2e/year	CI score (gCO2e/MJ)
1000 acre proxy scaled by estimated total acres needed to supply the max feedstock required for maximum ethanol production	125,000	Baseline	234501	44.80
	150,000		281401	53.76
	125,000	Future	191154	36.52
	150,000		229385	43.82
	125,000	Change	-43347	-8.28
	150,000		-52016	-9.94
	125,000	Con	0	-
	150,000		0	-
	125,000	AltAg	-43347	-
	150,000		-52016	-

Test Scenario #3 - 50%AltAgPrac

Proxy Farm Location



Soil Data Summary



NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario3
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_70474_272787
TIME: Fri Dec 22 2023 12:01:00 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

USDA United States Department of Agriculture Natural Resources Conservation Service | Colorado State University

Source	Baseline Emissions		Reduced Tillage			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - con (500 acres - Corn)						
C *(tonnes CO_2 equiv./yr.)*	-106.9	+0/-0	-106.9	+0/-0	0.0	+0/-0
Soil	-106.9	+0/-0	-106.9	+0/-0	0.0	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	1024.6	NR*	1024.6	NR*	0.0	NR*
Direct N_2O Emissions	966.0	+0/-0	966.0	+0/-0	0.0	+0/-0
Direct - Soil	966.0	+0/-0	966.0	+0/-0	0.0	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	58.6	+92.5/-47.3	58.6	+92.5/-47.3	0.0	+0/-0
Indirect - Volatilization	58.6	+92.5/-47.3	58.6	+92.5/-47.3	0.0	+0/-0
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**917.7**	**NR***	**917.7**	**NR***	**0.0**	**NR***
Proxy Farm - Reg (500 acres - Corn, Clover)						
C *(tonnes CO_2 equiv./yr.)*	-106.9	+0/-0	-359.7	+0/-0	-252.8	+0/-0
Soil	-106.9	+0/-0	-359.7	+0/-0	-252.8	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	1024.5	NR*	620.2	NR*	-404.3	NR*
Direct N_2O Emissions	966.0	+0/-0	584.4	+0/-0	-381.6	+0/-0
Direct - Soil	966.0	+0/-0	584.4	+0/-0	-381.6	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	58.6	+92.5/-47.3	35.8	+53.8/-28.6	-22.7	+18.9/-40.3
Indirect - Volatilization	58.6	+92.5/-47.3	35.8	+53.8/-28.6	-22.7	+18.9/-40.3
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**917.6**	**NR***	**260.5**	**NR***	**-657.1**	**NR***
Total (all parcels)	***1835.3***	***NR****	***1178.2***	***NR****	***-657.1***	***NR****

CAUTION This report is still in development and the values within may not reflect actual values.

* Yearly results are unavailable for categories which have monte-carlo uncertainty

period averages are presented instead.

1. General Information

Report version	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template version	[-]	1
Creation date	[date]	12/22/2023
Name	[-]	Proxy Farm - con
Area	[acres]	500
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (Mercator)	[-]	POINT (-10730568.275822932 5829200.427514785)

Parcel Name: Proxy Farm - con

TimeFrame	Parcel	acres	Scenario	Year	Crop1	Crop 1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - con	500	Baseline	2000	Corn	150	(09/30/2000;	-365.675	42.6436	6.919165	-316.112
Current	Proxy Farm - con	500	Baseline	2001	Corn	150	(09/30/2001;	-348.505	1265.893	6.919165	924.3064
Current	Proxy Farm - con	500	Baseline	2002	Corn	150	(09/30/2002;	-444.492	665.2873	6.919165	227.7148
Current	Proxy Farm - con	500	Baseline	2003	Corn	150	(09/30/2003;	-422.138	106.8036	6.919165	-308.415
Current	Proxy Farm - con	500	Baseline	2004	Corn	150	(09/30/2004;	-415.501	193.6464	6.919165	-214.935
Current	Proxy Farm - con	500	Baseline	2005	Corn	150	(09/30/2005;	-248.012	251.7507	6.919165	10.65748
Current	Proxy Farm - con	500	Baseline	2006	Corn	150	(09/30/2006;	-356.289	649.7017	6.919165	300.3318
Current	Proxy Farm - con	500	Baseline	2007	Corn	150	(09/30/2007;	-428.446	127.8407	6.919165	-293.687
Current	Proxy Farm - con	500	Baseline	2008	Corn	150	(09/30/2008;	-275.913	1744.867	6.919165	1475.872

Current	Proxy Farm - con	500	Baseline	2009	Corn	150	(09/30/2009;	-242.605	1306.56	6.919165	1070.874
Current	Proxy Farm - con	500	Baseline	2010	Corn	150	(09/30/2010;	-203.134	211.6548	6.919165	15.4401
Current	Proxy Farm - con	500	Baseline	2011	Corn	150	(09/30/2011;	-179.333	1337.464	6.919165	1165.05
Current	Proxy Farm - con	500	Baseline	2012	Corn	150	(09/30/2012;	-301.951	180.0007	6.919165	-115.031
Current	Proxy Farm - con	500	Baseline	2013	Corn	150	(09/30/2013;	-323.856	1033.34	6.919165	716.4023
Current	Proxy Farm - con	500	Baseline	2014	Corn	150	(09/30/2014;	-230.042	2114.771	6.919165	1891.648
Current	Proxy Farm - con	500	Baseline	2015	Corn	150	(09/30/2015;	-226.414	159.2252	6.919165	-60.2697
Current	Proxy Farm - con	500	Baseline	2016	Corn	150	(09/30/2016;	-182.067	234.3741	6.919165	59.2259
Current	Proxy Farm - con	500	Baseline	2017	Corn	150	(09/30/2017;	-101.56	156.2923	6.919165	61.65142
Current	Proxy Farm - con	500	Baseline	2018	Corn	150	(09/30/2018;	-121.732	3388.735	6.919165	3273.922
Current	Proxy Farm - con	500	Baseline	2019	Corn	150	(09/30/2019;	-175.386	2016.405	6.919165	1847.938
Current	Proxy Farm - con	500	Baseline	2020	Corn	150	(09/30/2020;	-105.636	98.3297	6.919165	-0.38717
Current	Proxy Farm - con	500	Baseline	2021	Corn	150	(09/30/2021;	-299.139	1139.231	6.919165	847.011
Current	Proxy Farm - con	500	Baseline	2022	Corn	150	(09/30/2022;	-154.493	2135.367	6.919165	1987.793
							AVG:	-267.492	893.9209	6.919165	633.3479
Future	Proxy Farm - con	500	Baseline	2023	Corn	150	(09/30/2023;	-152.957	131.0568	58.588997	36.68874
Future	Proxy Farm - con	500	Baseline	2024	Corn	150	(09/30/2024;	-114.131	247.716	58.588997	192.1735
Future	Proxy Farm - con	500	Baseline	2025	Corn	150	(09/30/2025;	-37.5958	165.8097	58.588997	186.8029
Future	Proxy Farm - con	500	Baseline	2026	Corn	150	(09/30/2026;	-60.9312	3424.444	58.588997	3422.102
Future	Proxy Farm - con	500	Baseline	2027	Corn	150	(09/30/2027;	-118.01	2043.18	58.588997	1983.759
Future	Proxy Farm - con	500	Baseline	2028	Corn	150	(09/30/2028;	-53.1754	103.5485	58.588997	108.9621
Future	Proxy Farm - con	500	Baseline	2029	Corn	150	(09/30/2029;	-249.566	945.2569	58.588997	754.2802
Future	Proxy Farm - con	500	Baseline	2030	Corn	150	(09/30/2030;	-107.84	2160.582	58.588997	2111.331
Future	Proxy Farm - con	500	Baseline	2031	Corn	150	(09/30/2031;	-107.524	179.0109	58.588997	130.0759
Future	Proxy Farm - con	500	Baseline	2032	Corn	150	(09/30/2032;	-67.4341	259.45	58.588997	250.6049
							AVG:	-106.916	966.0053	58.588997	917.678
									Acres	125,000	114710
										150,000	137652
Future	Proxy Farm - con	500	Reduced Ti	2023	Corn	150	(09/30/2023;	-152.957	131.0568	58.588997	36.68874
Future	Proxy Farm - con	500	Reduced Ti	2024	Corn	150	(09/30/2024;	-114.131	247.716	58.588997	192.1735
Future	Proxy Farm - con	500	Reduced Ti	2025	Corn	150	(09/30/2025;	-37.5958	165.8097	58.588997	186.8029

Future	Proxy Farm - con	500	Reduced Ti	2026	Corn	150	(09/30/2026;	-60.9312	3424.444	58.588997	3422.102
Future	Proxy Farm - con	500	Reduced Ti	2027	Corn	150	(09/30/2027;	-118.01	2043.18	58.588997	1983.759
Future	Proxy Farm - con	500	Reduced Ti	2028	Corn	150	(09/30/2028;	-53.1754	103.5485	58.588997	108.9621
Future	Proxy Farm - con	500	Reduced Ti	2029	Corn	150	(09/30/2029;	-249.566	945.2569	58.588997	754.2802
Future	Proxy Farm - con	500	Reduced Ti	2030	Corn	150	(09/30/2030;	-107.84	2160.582	58.588997	2111.331
Future	Proxy Farm - con	500	Reduced Ti	2031	Corn	150	(09/30/2031;	-107.524	179.0109	58.588997	130.0759
Future	Proxy Farm - con	500	Reduced Ti	2032	Corn	150	(09/30/2032;	-67.4341	259.45	58.588997	250.6049
							AVG:	-106.916	966.0053	58.588997	917.678

Acres	125,000	114710
	150,000	137652
Change		0

1. General Information

Report version	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template version	[-]	1
Creation date	[date]	12/22/2023
Name	[-]	Proxy Farm - Reg
Area	[acres]	500
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (Mercator)	[-]	POINT (-10730568.211665994 5829200.590476191)

Parcel Name: Proxy Farm - Reg

TimeFrame	Parcel	acres	Scenario	Year	Crop1	Crop 1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - Reg	500	Baseline	2000	Corn	150	(09/30/2000;	-365.654	42.64185	6.919165	-316.093
Current	Proxy Farm - Reg	500	Baseline	2001	Corn	150	(09/30/2001;	-348.507	1265.806	6.919165	924.218
Current	Proxy Farm - Reg	500	Baseline	2002	Corn	150	(09/30/2002;	-444.48	665.2464	6.919165	227.6856
Current	Proxy Farm - Reg	500	Baseline	2003	Corn	150	(09/30/2003;	-422.128	106.7993	6.919165	-308.41
Current	Proxy Farm - Reg	500	Baseline	2004	Corn	150	(09/30/2004;	-415.494	193.6378	6.919165	-214.937

Current	Proxy Farm - Reg	500	Baseline	2005	Corn	150	(09/30/2005;	-248.007	251.7388	6.919165	10.65063
Current	Proxy Farm - Reg	500	Baseline	2006	Corn	150	(09/30/2006;	-356.28	649.6718	6.919165	300.311
Current	Proxy Farm - Reg	500	Baseline	2007	Corn	150	(09/30/2007;	-428.435	127.8369	6.919165	-293.679
Current	Proxy Farm - Reg	500	Baseline	2008	Corn	150	(09/30/2008;	-275.898	1744.767	6.919165	1475.788
Current	Proxy Farm - Reg	500	Baseline	2009	Corn	150	(09/30/2009;	-242.602	1306.471	6.919165	1070.788
Current	Proxy Farm - Reg	500	Baseline	2010	Corn	150	(09/30/2010;	-203.129	211.6512	6.919165	15.44141
Current	Proxy Farm - Reg	500	Baseline	2011	Corn	150	(09/30/2011;	-179.327	1337.372	6.919165	1164.964
Current	Proxy Farm - Reg	500	Baseline	2012	Corn	150	(09/30/2012;	-301.949	179.9914	6.919165	-115.039
Current	Proxy Farm - Reg	500	Baseline	2013	Corn	150	(09/30/2013;	-323.847	1033.289	6.919165	716.3611
Current	Proxy Farm - Reg	500	Baseline	2014	Corn	150	(09/30/2014;	-230.029	2114.644	6.919165	1891.534
Current	Proxy Farm - Reg	500	Baseline	2015	Corn	150	(09/30/2015;	-226.41	159.2187	6.919165	-60.2718
Current	Proxy Farm - Reg	500	Baseline	2016	Corn	150	(09/30/2016;	-182.064	234.3666	6.919165	59.2219
Current	Proxy Farm - Reg	500	Baseline	2017	Corn	150	(09/30/2017;	-101.556	156.2863	6.919165	61.64904
Current	Proxy Farm - Reg	500	Baseline	2018	Corn	150	(09/30/2018;	-121.729	3388.542	6.919165	3273.732
Current	Proxy Farm - Reg	500	Baseline	2019	Corn	150	(09/30/2019;	-175.381	2016.264	6.919165	1847.802
Current	Proxy Farm - Reg	500	Baseline	2020	Corn	150	(09/30/2020;	-105.635	98.32663	6.919165	-0.38922
Current	Proxy Farm - Reg	500	Baseline	2021	Corn	150	(09/30/2021;	-299.131	1139.153	6.919165	846.941
Current	Proxy Farm - Reg	500	Baseline	2022	Corn	150	(09/30/2022;	-154.482	2135.239	6.919165	1987.675
							AVG:	-267.485	893.8678	6.919165	633.3019
Future	Proxy Farm - Reg	500	Baseline	2023	Corn	150	(09/30/2023;	-152.955	131.0528	58.588997	36.6869
Future	Proxy Farm - Reg	500	Baseline	2024	Corn	150	(09/30/2024;	-114.13	247.708	58.588997	192.1673
Future	Proxy Farm - Reg	500	Baseline	2025	Corn	150	(09/30/2025;	-37.5936	165.8033	58.588997	186.7987
Future	Proxy Farm - Reg	500	Baseline	2026	Corn	150	(09/30/2026;	-60.9296	3424.248	58.588997	3421.908
Future	Proxy Farm - Reg	500	Baseline	2027	Corn	150	(09/30/2027;	-118.007	2043.037	58.588997	1983.62
Future	Proxy Farm - Reg	500	Baseline	2028	Corn	150	(09/30/2028;	-53.1756	103.5452	58.588997	108.9586
Future	Proxy Farm - Reg	500	Baseline	2029	Corn	150	(09/30/2029;	-249.559	945.2111	58.588997	754.2408
Future	Proxy Farm - Reg	500	Baseline	2030	Corn	150	(09/30/2030;	-107.83	2160.452	58.588997	2111.211
Future	Proxy Farm - Reg	500	Baseline	2031	Corn	150	(09/30/2031;	-107.523	179.0035	58.588997	130.0692
Future	Proxy Farm - Reg	500	Baseline	2032	Corn	150	(09/30/2032;	-67.4334	259.4415	58.588997	250.5971
							AVG:	-106.914	965.9502	58.588997	917.6256
									Acres	125,000	114703
										150,000	137644

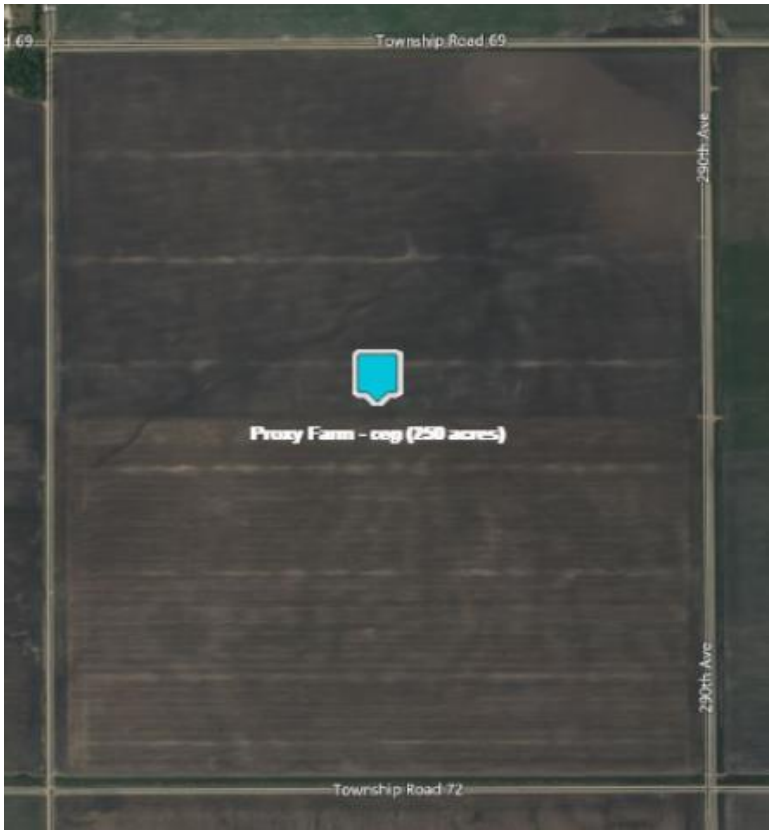
Future	Proxy Farm - Reg	500	Reduced Ti	2023	Corn	150	(09/15/2023;	-227.392	105.5032	35.84464	-86.0441
Future	Proxy Farm - Reg	500	Reduced Ti	2024	Corn	150	(09/15/2024;	-254.581	178.9354	35.84464	-39.8012
Future	Proxy Farm - Reg	500	Reduced Ti	2025	Corn	150	(09/15/2025;	-296.936	125.9574	35.84464	-135.133
Future	Proxy Farm - Reg	500	Reduced Ti	2026	Corn	150	(09/15/2026;	-340.97	2030.42	35.84464	1725.295
Future	Proxy Farm - Reg	500	Reduced Ti	2027	Corn	150	(09/15/2027;	-384.545	1066.449	35.84464	717.7487
Future	Proxy Farm - Reg	500	Reduced Ti	2028	Corn	150	(09/15/2028;	-322.019	67.43733	35.84464	-218.737
Future	Proxy Farm - Reg	500	Reduced Ti	2029	Corn	150	(09/15/2029;	-554.783	566.5681	35.84464	47.62943
Future	Proxy Farm - Reg	500	Reduced Ti	2030	Corn	150	(09/15/2030;	-374.926	1422.37	35.84464	1083.289
Future	Proxy Farm - Reg	500	Reduced Ti	2031	Corn	150	(09/15/2031;	-420.991	121.1792	35.84464	-263.967
Future	Proxy Farm - Reg	500	Reduced Ti	2032	Corn	150	(09/15/2032;	-419.765	158.8046	35.84464	-225.116
							AVG:	-359.691	584.3624	35.84464	260.5163

Acres	125,000	32565
	150,000	39077
Change		-657.1

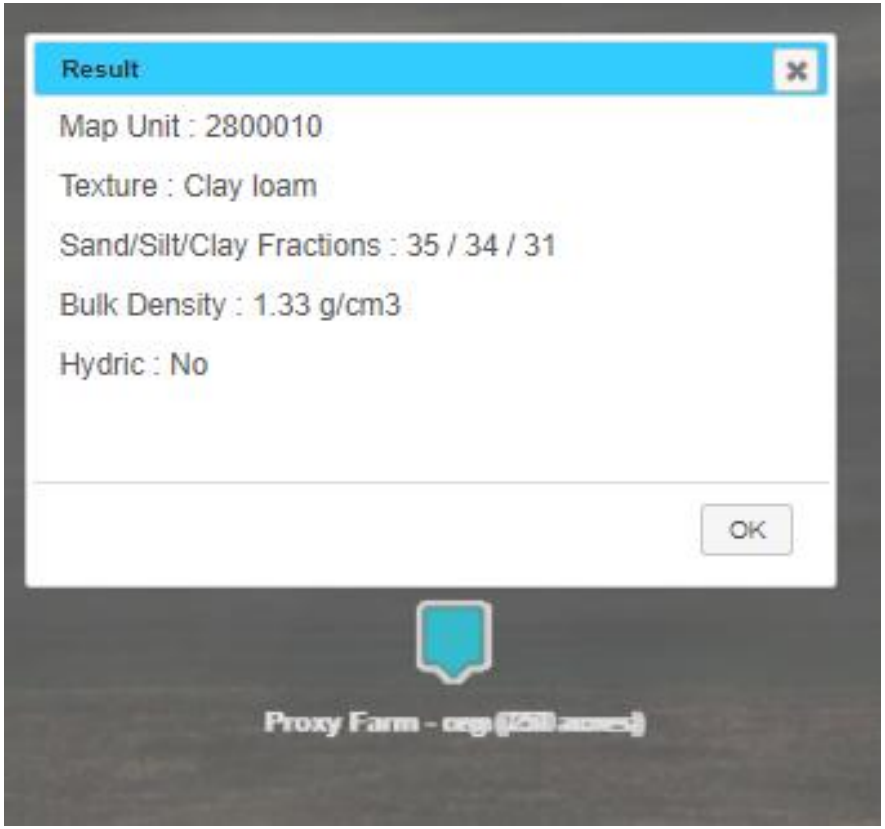
Scaled Emissions:	Acres	Scenario	Project Scale Emissions (tonnes CO2e/year)	CI score (gCO2e/MJ)
1000 acre proxy scaled by estimated total acres needed to supply the max feedstock required for maximum ethanol production	125,000	Baseline	229413	43.83
	150,000		275296	52.59
	125,000	Future	147274	28.14
	150,000		176729	33.76
	125,000	Change	-82139	-15.69
	150,000		-98566	-18.83
	125,000	Con	0	-
	150,000		0	-
	125,000	AltAg	-82139	-
	150,000		-98566	-

Test Scenario #4 - 75%AltAgPrac

Proxy Farm Location



Soil Data Summary



NAME: Danlyn Brennan
PROJECT: AlternativeAg_Scenario4
REPORTING YEARS: 2023 - 2032
Daycent Service Version: 30cm Daycent Service

JOBID: 32863_70520_271213
Time: Fri Dec 22 2023 12:30:49 GMT-0800 (Pacific Standard Time)
Version: appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)

USDA United States Department of Agriculture Natural Resources Conservation Service | Colorado State University

Source	Baseline Emissions		No Till			
	Emissions	+/-	Emissions	+/-	Change	+/-
Proxy Farm - con (250 acres - Corn)						
C *(tonnes CO_2 equiv./yr.)*	-55.4	+0/-0	-55.4	+0/-0	0.0	+0/-0
Soil	-55.4	+0/-0	-55.4	+0/-0	0.0	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	551.4	NR[†]	551.4	NR[†]	0.0	NR[†]
Direct N_2O Emissions	522.1	+0/-0	522.1	+0/-0	0.0	+0/-0
Direct - Soil	522.1	+0/-0	522.1	+0/-0	0.0	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	29.3	+46.2/-23.6	29.3	+46.2/-23.6	0.0	+0/-0
Indirect - Volatilization	29.3	+46.2/-23.6	29.3	+46.2/-23.6	0.0	+0/-0
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**496.0**	**NR[†]**	**496.0**	**NR[†]**	**0.0**	**NR[†]**
Proxy Farm - reg (750 acres - Corn, Clover)						
C *(tonnes CO_2 equiv./yr.)*	-155.8	+0/-0	-528.4	+0/-0	-372.6	+0/-0
Soil	-155.8	+0/-0	-528.4	+0/-0	-372.6	+0/-0
CO_2 *(tonnes/yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CO *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
N_2O *(tonnes CO_2 equiv./yr.)*	1454.1	NR[†]	876.7	NR[†]	-577.4	NR[†]
Direct N_2O Emissions	1366.2	+0/-0	822.9	+0/-0	-543.3	+0/-0
Direct - Soil	1366.2	+0/-0	822.9	+0/-0	-543.3	+0/-0
Direct - Biomass Burning	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Direct - Drained Organic Soil	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Indirect N_2O Emissons	87.9	+138.7/-70.9	53.8	+80.7/-42.9	-34.1	+28.4/-60.5
Indirect - Volatilization	87.9	+138.7/-70.9	53.8	+80.7/-42.9	-34.1	+28.4/-60.5
Indirect - LeachingandRunoff	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
CH_4 *(tonnes CO_2 equiv./yr.)*	0.0	+0/-0	0.0	+0/-0	0.0	+0/-0
Total	**1298.3**	**NR[†]**	**348.2**	**NR[†]**	**-950.0**	**NR[†]**

CAUTION This report is still in development and the values within may not reflect actual values.

* Yearly results are unavailable for categories which have monte-carlo uncertainty

period averages are presented instead.

1. General Information

Report version	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template version	[-]	1
Creation date	[date]	#########
Name	[-]	Proxy Farm - reg
Area	[acres]	750
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (Mercator)	[-]	POINT (-10730526.35042785 5829202.949337069)

Parcel Name: Proxy Farm - reg

TimeFrame	Parcel	acres	Scenario	Year	Crop1	Crop 1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - reg	750	Baseline	2000	Corn	150	(09/30/2000;	-516.349	61.23182	10.378748	-444.739
Current	Proxy Farm - reg	750	Baseline	2001	Corn	150	(09/30/2001;	-524.772	1768.953	10.378748	1254.561
Current	Proxy Farm - reg	750	Baseline	2002	Corn	150	(09/30/2002;	-647.567	937.2529	10.378748	300.065
Current	Proxy Farm - reg	750	Baseline	2003	Corn	150	(09/30/2003;	-618.118	153.7268	10.378748	-454.013
Current	Proxy Farm - reg	750	Baseline	2004	Corn	150	(09/30/2004;	-612.188	277.8552	10.378748	-323.954
Current	Proxy Farm - reg	750	Baseline	2005	Corn	150	(09/30/2005;	-363.296	359.6308	10.378748	6.713129
Current	Proxy Farm - reg	750	Baseline	2006	Corn	150	(09/30/2006;	-519.907	930.7513	10.378748	421.223
Current	Proxy Farm - reg	750	Baseline	2007	Corn	150	(09/30/2007;	-625.497	185.4029	10.378748	-429.715
Current	Proxy Farm - reg	750	Baseline	2008	Corn	150	(09/30/2008;	-389.675	2471.782	10.378748	2092.486
Current	Proxy Farm - reg	750	Baseline	2009	Corn	150	(09/30/2009;	-358.471	1826.9	10.378748	1478.808

Current	Proxy Farm - reg	750	Baseline	2010	Corn	150	(09/30/2010;	-296.887	311.9033	10.378748	25.39544
Current	Proxy Farm - reg	750	Baseline	2011	Corn	150	(09/30/2011;	-260.928	1869.914	10.378748	1619.365
Current	Proxy Farm - reg	750	Baseline	2012	Corn	150	(09/30/2012;	-449.051	254.5214	10.378748	-184.151
Current	Proxy Farm - reg	750	Baseline	2013	Corn	150	(09/30/2013;	-470.545	1470.855	10.378748	1010.689
Current	Proxy Farm - reg	750	Baseline	2014	Corn	150	(09/30/2014;	-325.167	2979.589	10.378748	2664.8
Current	Proxy Farm - reg	750	Baseline	2015	Corn	150	(09/30/2015;	-332.1	227.1238	10.378748	-94.5973
Current	Proxy Farm - reg	750	Baseline	2016	Corn	150	(09/30/2016;	-266.38	339.6852	10.378748	83.68404
Current	Proxy Farm - reg	750	Baseline	2017	Corn	150	(09/30/2017;	-146.49	225.612	10.378748	89.50086
Current	Proxy Farm - reg	750	Baseline	2018	Corn	150	(09/30/2018;	-178.902	4790.992	10.378748	4622.469
Current	Proxy Farm - reg	750	Baseline	2019	Corn	150	(09/30/2019;	-256.47	2815.33	10.378748	2569.239
Current	Proxy Farm - reg	750	Baseline	2020	Corn	150	(09/30/2020;	-157.401	142.7325	10.378748	-4.28977
Current	Proxy Farm - reg	750	Baseline	2021	Corn	150	(09/30/2021;	-436.363	1589.524	10.378748	1163.54
Current	Proxy Farm - reg	750	Baseline	2022	Corn	150	(09/30/2022;	-214.406	3008.988	10.378748	2804.96
							AVG:	-389.866	1260.881	10.378748	881.3931
Future	Proxy Farm - reg	750	Baseline	2023	Corn	150	(09/30/2023;	-225.377	189.995	87.88349	52.50192
Future	Proxy Farm - reg	750	Baseline	2024	Corn	150	(09/30/2024;	-167.382	358.9046	87.88349	279.4062
Future	Proxy Farm - reg	750	Baseline	2025	Corn	150	(09/30/2025;	-52.8255	239.3423	87.88349	274.4002
Future	Proxy Farm - reg	750	Baseline	2026	Corn	150	(09/30/2026;	-89.8676	4840.877	87.88349	4838.893
Future	Proxy Farm - reg	750	Baseline	2027	Corn	150	(09/30/2027;	-172.417	2852.912	87.88349	2768.379
Future	Proxy Farm - reg	750	Baseline	2028	Corn	150	(09/30/2028;	-80.8147	150.2921	87.88349	157.3609
Future	Proxy Farm - reg	750	Baseline	2029	Corn	150	(09/30/2029;	-363.963	1353.883	87.88349	1077.804
Future	Proxy Farm - reg	750	Baseline	2030	Corn	150	(09/30/2030;	-146.595	3044.66	87.88349	2985.949
Future	Proxy Farm - reg	750	Baseline	2031	Corn	150	(09/30/2031;	-159.718	255.2111	87.88349	183.3765
Future	Proxy Farm - reg	750	Baseline	2032	Corn	150	(09/30/2032;	-99.1336	375.6885	87.88349	364.4384
							AVG:	-155.809	1366.177	87.88349	1298.251
									Acres	125,000	162281
										150,000	194738
Future	Proxy Farm - reg	750	No Till	2023	Corn	150	(09/15/2023;	-334.931	151.8698	53.76696	-129.294
Future	Proxy Farm - reg	750	No Till	2024	Corn	150	(09/15/2024;	-370.998	261.4365	53.76696	-55.7944
Future	Proxy Farm - reg	750	No Till	2025	Corn	150	(09/15/2025;	-434.057	182.4637	53.76696	-197.827
Future	Proxy Farm - reg	750	No Till	2026	Corn	150	(09/15/2026;	-500.783	2846.786	53.76696	2399.77

Future	Proxy Farm - reg	750	No Till	2027	Corn	150	(09/15/2027;	-566.55	1486.357	53.76696	973.5741
Future	Proxy Farm - reg	750	No Till	2028	Corn	150	(09/15/2028;	-475.516	98.03682	53.76696	-323.713
Future	Proxy Farm - reg	750	No Till	2029	Corn	150	(09/15/2029;	-815.469	789.5477	53.76696	27.84563
Future	Proxy Farm - reg	750	No Till	2030	Corn	150	(09/15/2030;	-546.717	2004.232	53.76696	1511.282
Future	Proxy Farm - reg	750	No Till	2031	Corn	150	(09/15/2031;	-621.592	173.6302	53.76696	-394.195
Future	Proxy Farm - reg	750	No Till	2032	Corn	150	(09/15/2032;	-617.615	234.5631	53.76696	-329.285
							AVG:	-528.423	822.8923	53.76696	348.2365
									Acres	125,000	43530
										150,000	52235
										Change:	-950.014

1. General Information

Report version	appengine cometfarm v0-10 build 4.1.8753.32391 (12/19/2023 17:59:47)	
Template version	[-]	1
Creation date	[date]	#########
Name	[-]	Proxy Farm - con
Area	[acres]	250
State	[-]	Minnesota
County	[-]	Wilkin County
Coordinates (Mercator)	[-]	POINT (-10730525.604074221 5829202.799944259)

Parcel Name: Proxy Farm - con

TimeFrame	Parcel	acres	Scenario	Year	Crop1	Crop 1 Yield	Crop1 Harvest	Soil Carbon Stock Change (tonnes CO2e/yr)	Soil Direct N2O (tonnes CO2e/yr)	N2O Indirect Emissions (tonnes CO2e/yr)*	GHG Balance Total (tonnes CO2e/yr)*
Current	Proxy Farm - con	250	Baseline	2000	Corn	150	(09/30/2000;	-197.143	22.46865	3.4595826	-171.215
Current	Proxy Farm - con	250	Baseline	2001	Corn	150	(09/30/2001;	-173.523	693.248	3.4595826	523.1844
Current	Proxy Farm - con	250	Baseline	2002	Corn	150	(09/30/2002;	-230.299	360.839	3.4595826	134
Current	Proxy Farm - con	250	Baseline	2003	Corn	150	(09/30/2003;	-217.571	56.35991	3.4595826	-157.752
Current	Proxy Farm - con	250	Baseline	2004	Corn	150	(09/30/2004;	-212.323	102.9484	3.4595826	-105.915

Current	Proxy Farm - con	250	Baseline	2005	Corn	150	(09/30/2005;	-127.461	134.34	3.4595826	10.33816
Current	Proxy Farm - con	250	Baseline	2006	Corn	150	(09/30/2006;	-184.734	346.9281	3.4595826	165.6538
Current	Proxy Farm - con	250	Baseline	2007	Corn	150	(09/30/2007;	-221.942	66.29614	3.4595826	-152.187
Current	Proxy Farm - con	250	Baseline	2008	Corn	150	(09/30/2008;	-148.538	943.8473	3.4595826	798.7686
Current	Proxy Farm - con	250	Baseline	2009	Corn	150	(09/30/2009;	-123.574	715.3709	3.4595826	595.256
Current	Proxy Farm - con	250	Baseline	2010	Corn	150	(09/30/2010;	-104.959	108.3205	3.4595826	6.821139
Current	Proxy Farm - con	250	Baseline	2011	Corn	150	(09/30/2011;	-93.4511	731.9666	3.4595826	641.975
Current	Proxy Farm - con	250	Baseline	2012	Corn	150	(09/30/2012;	-152.553	96.16526	3.4595826	-52.9281
Current	Proxy Farm - con	250	Baseline	2013	Corn	150	(09/30/2013;	-168.107	553.5524	3.4595826	388.9045
Current	Proxy Farm - con	250	Baseline	2014	Corn	150	(09/30/2014;	-123.54	1145.537	3.4595826	1025.456
Current	Proxy Farm - con	250	Baseline	2015	Corn	150	(09/30/2015;	-116.435	83.82504	3.4595826	-29.1503
Current	Proxy Farm - con	250	Baseline	2016	Corn	150	(09/30/2016;	-93.3157	122.4068	3.4595826	32.55072
Current	Proxy Farm - con	250	Baseline	2017	Corn	150	(09/30/2017;	-53.0121	82.17049	3.4595826	32.618
Current	Proxy Farm - con	250	Baseline	2018	Corn	150	(09/30/2018;	-62.9654	1834.406	3.4595826	1774.9
Current	Proxy Farm - con	250	Baseline	2019	Corn	150	(09/30/2019;	-90.8898	1105.44	3.4595826	1018.01
Current	Proxy Farm - con	250	Baseline	2020	Corn	150	(09/30/2020;	-53.587	51.19198	3.4595826	1.064613
Current	Proxy Farm - con	250	Baseline	2021	Corn	150	(09/30/2021;	-154.792	623.4712	3.4595826	472.1388
Current	Proxy Farm - con	250	Baseline	2022	Corn	150	(09/30/2022;	-84.6196	1156.842	3.4595826	1075.682
							AVG:	-138.667	484.2583	3.4595826	349.0511
Future	Proxy Farm - con	250	Baseline	2023	Corn	150	(09/30/2023;	-78.1748	68.23634	29.294498	19.356
Future	Proxy Farm - con	250	Baseline	2024	Corn	150	(09/30/2024;	-58.2184	129.37	29.294498	100.4462
Future	Proxy Farm - con	250	Baseline	2025	Corn	150	(09/30/2025;	-20.0505	87.21259	29.294498	96.45657
Future	Proxy Farm - con	250	Baseline	2026	Corn	150	(09/30/2026;	-31.6341	1853.846	29.294498	1851.507
Future	Proxy Farm - con	250	Baseline	2027	Corn	150	(09/30/2027;	-61.3313	1120.023	29.294498	1087.986
Future	Proxy Farm - con	250	Baseline	2028	Corn	150	(09/30/2028;	-26.4893	53.90636	29.294498	56.7116
Future	Proxy Farm - con	250	Baseline	2029	Corn	150	(09/30/2029;	-129.159	507.5874	29.294498	407.7225
Future	Proxy Farm - con	250	Baseline	2030	Corn	150	(09/30/2030;	-60.3742	1170.486	29.294498	1139.406
Future	Proxy Farm - con	250	Baseline	2031	Corn	150	(09/30/2031;	-54.3613	94.30614	29.294498	69.23938
Future	Proxy Farm - con	250	Baseline	2032	Corn	150	(09/30/2032;	-34.0984	135.5927	29.294498	130.7888
							AVG:	-55.3892	522.0566	29.294498	495.962
									Acres	125,000	61995
										150,000	74394

Future	Proxy Farm - con	250	No Till	2023	Corn	150	(09/30/2023;	-78.1748	68.23634	29.294498	19.356
Future	Proxy Farm - con	250	No Till	2024	Corn	150	(09/30/2024;	-58.2184	129.37	29.294498	100.4462
Future	Proxy Farm - con	250	No Till	2025	Corn	150	(09/30/2025;	-20.0505	87.21259	29.294498	96.45657
Future	Proxy Farm - con	250	No Till	2026	Corn	150	(09/30/2026;	-31.6341	1853.846	29.294498	1851.507
Future	Proxy Farm - con	250	No Till	2027	Corn	150	(09/30/2027;	-61.3313	1120.023	29.294498	1087.986
Future	Proxy Farm - con	250	No Till	2028	Corn	150	(09/30/2028;	-26.4893	53.90636	29.294498	56.7116
Future	Proxy Farm - con	250	No Till	2029	Corn	150	(09/30/2029;	-129.159	507.5874	29.294498	407.7225
Future	Proxy Farm - con	250	No Till	2030	Corn	150	(09/30/2030;	-60.3742	1170.486	29.294498	1139.406
Future	Proxy Farm - con	250	No Till	2031	Corn	150	(09/30/2031;	-54.3613	94.30614	29.294498	69.23938
Future	Proxy Farm - con	250	No Till	2032	Corn	150	(09/30/2032;	-34.0984	135.5927	29.294498	130.7888
							AVG:	-55.3892	522.0566	29.294498	495.962

Acres	125,000	61995
	150,000	74394
	Change:	0

Scaled Emissions:	Acres	Scenario	Project Scale Emissions (tonnes CO2e/year)	CI score (gCO2e/MJ)
1000 acre proxy scaled by estimated total acres needed to supply the max feedstock required for maximum ethanol production	125,000	Baseline	224277	42.85
	150,000		269132	51.42
	125,000	Future	105525	20.16
	150,000		126630	24.19
	125,000	Change	-118752	-22.69
	150,000		-142502	-27.22
	125,000	Con	0	-
	150,000		0	-
	125,000	AltAg	-118752	-
	150,000		-142502	-

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Energy and Energy Efficiencies Supplemental Information:

Energy Projections

Appendix M
Otter Tail to Wilkin Carbon Dioxide Pipeline Project
Final Environmental Impact Statement /
Docket No. IP7093/PPL-22-422

Operational Energy Scenario Comparison

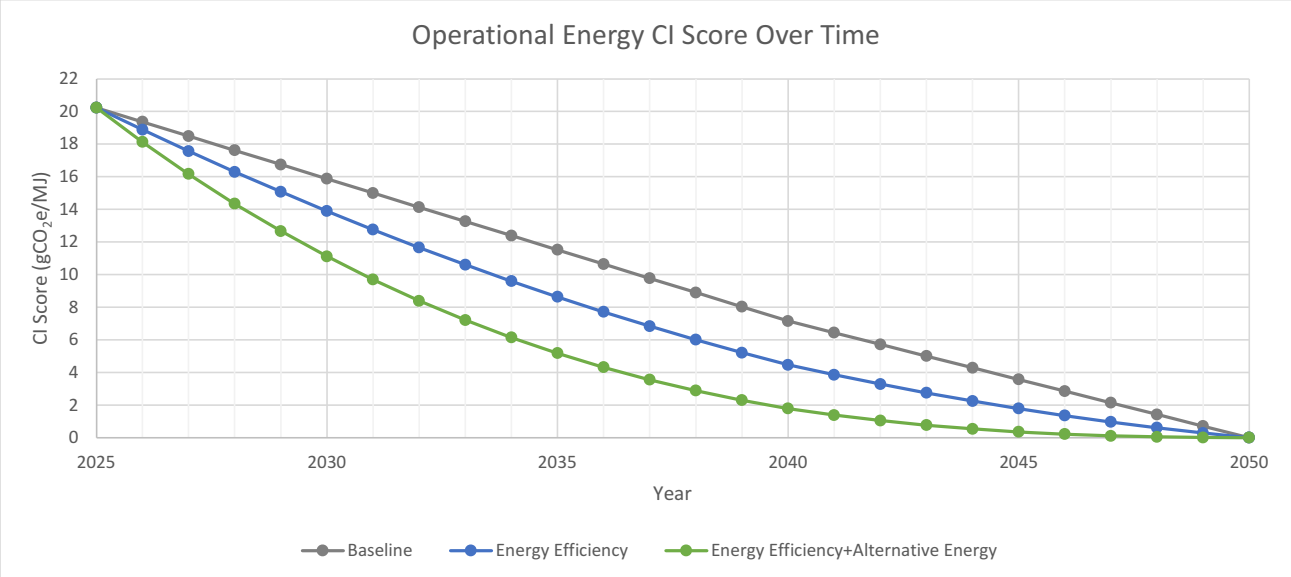
			Baseline Scenario			
Year	Electricity Emissions Rate (lbs CO_2e/MWh)	Natural Gas Emissions Rate (lbs CO2e/MWh)	Electric Energy Consumption (MWh/year)	Natural Gas Consumption (MWh/year)	CO2e (Metric Ton)	CI (gCO_2e/MJ)
2023	684.35	398.00	38064	473808	97353	22.0
2024	644.09	383.26	38064	473808	93490	21.1
2025	603.84	368.52	38064	473808	89627	20.2
2026	563.58	353.78	38064	473808	85764	19.4
2027	523.33	339.04	38064	473808	81901	18.5
2028	483.07	324.30	38064	473808	78038	17.6
2029	442.81	309.56	38064	473808	74175	16.7
2030	402.56	294.81	38064	473808	70311	15.9
2031	362.30	280.07	38064	473808	66448	15.0
2032	322.05	265.33	38064	473808	62585	14.1
2033	281.79	250.59	38064	473808	58722	13.3
2034	241.54	235.85	38064	473808	54859	12.4
2035	201.28	221.11	38064	473808	50996	11.5
2036	161.02	206.37	38064	473808	47133	10.6
2037	120.77	191.63	38064	473808	43270	9.8
2038	80.51	176.89	38064	473808	39407	8.9
2039	40.26	162.15	38064	473808	35544	8.0
2040	0.00	147.41	38064	473808	31680	7.2
2041	0.00	132.67	38064	473808	28512	6.4
2042	0.00	117.93	38064	473808	25344	5.7
2043	0.00	103.19	38064	473808	22176	5.0
2044	0.00	88.44	38064	473808	19008	4.3
2045	0.00	73.70	38064	473808	15840	3.6
2046	0.00	58.96	38064	473808	12672	2.9
2047	0.00	44.22	38064	473808	9504	2.1
2048	0.00	29.48	38064	473808	6336	1.4
2049	0.00	14.74	38064	473808	3168	0.7
2050	0.00	0.00	38064	473808	0	0.0

			Energy Efficiency Scenario			
Year	Electricity Emissions Rate (lbs CO_2e/MWh)	Natural Gas Emissions Rate (lbs CO2e/MWh)	Electric Energy Consumption[1] (MWh/year)	Natural Gas Consumption[2] (MWh/year)	CO2e (Metric Ton)	CI (gCO_2e/MJ)
2023	684.35	398.00	38064	473808	97353	22.0
2024	644.09	383.26	38064	473808	93490	21.1
2025	603.84	368.52	38064	473808	89627	20.2
2026	563.58	353.78	37112.4	461962.8	83620	18.9
2027	523.33	339.04	36160.8	450117.6	77806	17.6
2028	483.07	324.30	35209.2	438272.4	72185	16.3
2029	442.81	309.56	34257.6	426427.2	66757	15.1
2030	402.56	294.81	33306	414582	61523	13.9
2031	362.30	280.07	32354.4	402736.8	56481	12.8
2032	322.05	265.33	31402.8	390891.6	51633	11.7
2033	281.79	250.59	30451.2	379046.4	46978	10.6
2034	241.54	235.85	29499.6	367201.2	42516	9.6
2035	201.28	221.11	28548	355356	38247	8.6
2036	161.02	206.37	27596.4	343510.8	34171	7.7
2037	120.77	191.63	26644.8	331665.6	30289	6.8
2038	80.51	176.89	25693.2	319820.4	26600	6.0
2039	40.26	162.15	24741.6	307975.2	23103	5.2
2040	0.00	147.41	23790	296130	19800	4.5
2041	0.00	132.67	22838.4	284284.8	17107	3.9
2042	0.00	117.93	21886.8	272439.6	14573	3.3
2043	0.00	103.19	20935.2	260594.4	12197	2.8
2044	0.00	88.44	19983.6	248749.2	9979	2.3
2045	0.00	73.70	19032	236904	7920	1.8
2046	0.00	58.96	18080.4	225058.8	6019	1.4
2047	0.00	44.22	17128.8	213213.6	4277	1.0
2048	0.00	29.48	16177.2	201368.4	2693	0.6
2049	0.00	14.74	15225.6	189523.2	1267	0.3
2050	0.00	0.00	14274	177678	0	0.0

1. Energy Reduction for electricity is based on achieving 62.5% reduction over the 25 year period. This results in a 2.5% reduction each year. 62.5% is the mid-point between the estimated reduction range of 50-75%.

2. Energy Reduction for natural gas is based on achieving 62.5% reduction over the 25 year period. This results in a 2.5% reduction each year. 62.5% is the mid-point between the estimated reduction range of 50-75%.

			Energy Efficiency and Alternative Energy Scenario			
Year	Electricity Emissions Rate (lbs CO_2e/MWh)	Natural Gas Emissions Rate (lbs CO2e/MWh)	Electric Energy Consumption (MWh/year)	Natural Gas Consumption (MWh/year)	CO2e (Metric Ton)	CI (gCO_2e/MJ)
2023	684.35	398.00	38064	473808	97353	22.0
2024	644.09	383.26	38064	473808	93490	21.1
2025	603.84	368.52	38064	473808	89627	20.2
2026	563.58	353.78	35628	443484	80275	18.1
2027	523.33	339.04	33268	414108	71581	16.2
2028	483.07	324.30	30984	385680	63523	14.3
2029	442.81	309.56	28776	358199	56076	12.7
2030	402.56	294.81	26645	331666	49218	11.1
2031	362.30	280.07	24589	306080	42926	9.7
2032	322.05	265.33	22610	281442	37176	8.4
2033	281.79	250.59	20707	257752	31945	7.2
2034	241.54	235.85	18880	235009	27210	6.1
2035	201.28	221.11	17129	213214	22948	5.2
2036	161.02	206.37	15454	192366	19136	4.3
2037	120.77	191.63	13855	172466	15750	3.6
2038	80.51	176.89	12333	153514	12768	2.9
2039	40.26	162.15	10886	135509	10165	2.3
2040	0.00	147.41	9516	118452	7920	1.8
2041	0.00	132.67	8222	102343	6159	1.4
2042	0.00	117.93	7004	87181	4663	1.1
2043	0.00	103.19	5862	72966	3415	0.8
2044	0.00	88.44	4796	59700	2395	0.5
2045	0.00	73.70	3806	47381	1584	0.4
2046	0.00	58.96	2893	36009	963	0.2
2047	0.00	44.22	2055	25586	513	0.1
2048	0.00	29.48	1294	16109	215	0.0
2049	0.00	14.74	609	7581	51	0.0
2050	0.00	0.00	0	0	0	0.0



Energy and Energy Efficiencies
Supplemental Information:

PVWatts
Energy Projections

Appendix M
Otter Tail to Wilkin Carbon Dioxide Pipeline Project
Final Environmental Impact Statement /
Docket No. IP7093/PPL-22-422

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

PVWatts Calculator Inputs and Results

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at //sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

The energy output range is based on analysis of 30 years of historical weather data, and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

14,397,356 kWh/Year*

System output may range from 13,769,631 to 15,220,884 kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)
January	2.18	656,159
February	3.43	929,050
March	4.88	1,389,681
April	5.44	1,453,068
May	5.88	1,558,525
June	6.19	1,563,567
July	6.63	1,703,029
August	6.05	1,564,253
September	5.21	1,348,247
October	3.44	959,936
November	2.50	697,384
December	1.93	574,456
Annual	4.48	14,397,355

Location and Station Identification

Requested Location	24096 170th ave, fergus falls, mn
Weather Data Source	Lat, Lng: 46.33, -96.14 1.3 mi
Latitude	46.33° N
Longitude	96.14° W

PV System Specifications

DC System Size	11000 kW
Module Type	Premium
Array Type	Fixed (open rack)
System Losses	14.08%
Array Tilt	20°
Array Azimuth	180°
DC to AC Size Ratio	1.2
Inverter Efficiency	96%
Ground Coverage Ratio	0.4
Albedo	*From weather file*
Bifacial	No (0)
Monthly Irradiance Loss	Jan 0% Feb 0% Mar 0% Apr 0% May 0% June 0% July 0% Aug 0% Sept 0% Oct 0% Nov 0% Dec 0%

Performance Metrics

DC Capacity Factor	14.9%

Possible Siting for 11MWdc PV Array at Green Plains Ethanol Plant

System Capacity: 11 MWdc (18 acres)

Appendix N

Applicant's Draft Emergency Response Plan

Appendix 6 –
Emergency Response Plan (DRAFT)

Emergency Response Plan

Project Name:
Summit Carbon Solutions Otter Tail to Wilkin Project

MPUC Docket Number:
IP7093/PPL-22-422

SCS Document Number:
SCS-0500-SM-01-PLN-002

Date
September 12, 2022

REVISION HISTORY

DATE	REVISION	REVISION DESCRIPTION	PREPARED BY:	REVIEWED BY:	APPROVED BY:
2022-09-12	A	Draft Plan	SP	JS	RD

Acronyms and Abbreviations

AOC	Abnormal Operating Conditions
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CST	Company Support Team
ERP or Plan	Emergency Response Plan
FSC	Finance Section Chief
Green Plains Ethanol Plant	Green Plains Otter Tail LLC Ethanol Plant
IAP	Incident Action Plan
IC	Incident Commander
ICS	Incident Command System
IDLH	Immediately Dangerous to Life and Health
LOFR	Liaison Officer
LSC	Logistics Section Chief
LRT	Local Response Team
MCE	Midwest Carbon Express
MNOSHA	Minnesota Occupational Safety and Health Administration
MNOPS	Minnesota Office of Pipeline Safety
NRC	National Response Center
OPID	operator identification number
OPS	Operations Section Chief
OSHA	Occupational Safety and Health Administration
PHMSA	Pipeline and Hazardous Materials Administration
PIO	Public Information Officer
ppm	parts per million
Project	Otter Tail to Wilkin Project
PSAP	Public Safety Answering Point
QI	Qualified Individual
SCS or Company	Summit Carbon Solutions
SOFR	Safety Officer
UC	Unified Command

Glossary of Terms

Term	Description
Agency Personnel	Agency personnel refers to local, county, state, and/or federal employees, contractors, or businesses employed by governmental entities.
Blowdown	The act of releasing gas from the pipeline system so work can be done safely on the depressurized facilities.
Controlled Release	Often occurs due to safety reasons surrounding facility design, or intentional venting to perform maintenance or inspection of equipment.
Immediately Dangerous to Life and Health (IDLH)	The National Institute of Occupational Safety and Health defines an IDLH condition as a situation "that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment". The IDLH limit represents the concentration of a chemical in the air to which healthy adult workers could be exposed (if their respirators fail) without suffering permanent or escape-impairing health effects.
Unintentional Release	A release caused by equipment leaks, defective seals, damaged pipeline, or other abnormal operating conditions.

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1 Purpose

Summit Carbon Solutions, LLC (SCS) is proposing to construct and operate an approximately 28.1-mile carbon dioxide (CO_2) pipeline and associated facilities in portions of Wilkin and Otter Tail counties (the Otter Tail to Wilkin Project [Project]). The Project will capture and transport CO_2 from the Green Plains Otter Tail LLC Ethanol Plant (Green Plains Ethanol Plant) near Fergus Falls, Minnesota to the North Dakota and Minnesota border just south of the City of Breckenridge in Wilkin County. The CO_2 will ultimately be safely and permanently stored deep underground utilizing separately permitted Class VI injection wells in a sequestration site area in North Dakota.

This Emergency Response Plan (ERP or Plan) is for the Otter Tail to Wilkin Project pipeline system operated by SCS. The purpose of the ERP is to provide guidance for quick, safe, and effective response to an emergency to protect the public, all responders, SCS personnel, and the environment.

2 Scope of the Plan

This plan been developed to meet the requirements of Title 49 Code of Federal Regulations (CFR) 195.402(e) and is intended to cover incidents that could occur along the Otter Tail to Wilkin pipeline system.

This Plan is intended to provide the necessary information for pre-emergency planning as well as procedures for Company personnel to respond to and mitigate incidents during an emergency. A description of the pipeline system operations is included in Figure 1. Response procedures and guidelines are provided in Section 4 of this Plan.

Figure 1: General Pipeline System

General Pipeline System Information	
Pipeline Name:	Midwest Carbon Express – Otter Tail to Wilkin Project
Operator Name:	Summit Carbon Solutions, LLC
Operator Address:	2321 North Loop Drive Suite 221 Ames, IA 50010
Mainline Number	24-hour Emergency: [TBD before system startup] Corporate Headquarters: 515-531-2635
Qualified Individual(s):	Director, Regulatory Compliance (see Section 5 for contact information)
States Traversed:	Minnesota
Counties Traversed:	Otter Tail and Wilkin
Pipeline Description	
The Summit Carbon Solutions Midwest Carbon Express – Otter Tail to Wilkin Project pipeline consists of approximately 28.1 miles of a high-strength carbon steel 4-inch diameter carbon dioxide (CO_2) pipeline. The line originates at the Green Plains Ethanol Plant near Fergus Falls, Otter Tail County, MN. The pipeline traverses generally south and west through Otter Tail and Wilkin Counties to the North Dakota and Minnesota border south of the City of Breckenridge in Wilkin County. The pipeline will be operated with a maximum operating pressure of 2,183 pounds per square inch and the CO_2 will be maintained in a dense phase or supercritical state during normal operations. See Section 9 for a map depicting the pipeline and facility locations and high populated and other populated areas.	
Product Description	
CO_2 is naturally occurring in the atmosphere, used in the food and beverage industry, and produced by the human body during ordinary respiration, so it is commonly perceived by the general public to be a relatively harmless gas. However, at concentrations of 4% by volume (40,000 parts per million [ppm]), CO_2 is Immediately Dangerous to Life or Health (IDLH), and at concentrations of 8% by volume (80,000 ppm) can cause dimmed sight, sweating, tremor, unconsciousness, and possible death by asphyxiation.[1] Because CO_2 is colorless, odorless, and heavier than air, a significant uncontrolled release may cause CO_2 to temporarily accumulate near the ground in low lying outdoor areas, and in confined spaces such as caverns, tunnels, and basements until it dissipates into the atmosphere. CO_2 is not flammable, combustible, or explosive.	

[1] https://www.fsis.usda.gov/sites/default/files/media_file/2020-08/Carbon-Dioxide.pdf.

3 Response Teams

3.1 Introduction

This section describes organization features and duties of the Company's Qualified Individual (QI), Local Response Team (LRT), and Company Support Team (CST). The Company's initial response to an incident will be provided by the LRT, once activated by the QI. The Incident Commander (IC) will activate a CST if an incident exceeds the local capabilities. In some cases, the initial responders to an incident may include local law enforcement and/or local fire department(s). SCS will work with these agencies to manage a coordinated response effort.

The National Incident Management System Incident Command System (ICS) will be used to manage emergency response activities. Because ICS is a management tool that is readily adaptable to incidents of varying magnitude, it will be used for all emergency incidents. Staffing levels will be adjusted to meet specific response team needs based on incident size, severity, and type of emergency. Local agencies are also trained on using ICS and may fill roles during a coordinated response effort. ICS principles include:

- Common Terminology
- Manageable Span of Control
- Management by Objectives
- Incident Action Planning
- Comprehensive Resource Management
- Established Incident Facilities
- Integrated Communications

As a component of an ICS, the Unified Command (UC) is a structure that brings together the responsible party (i.e., SCS) and agencies at the command level. The UC links the organizations responding to the incident and provides a forum for the responsible party and responding agencies to make consensus decisions. Under the UC, the various responding agencies and company personnel may blend together throughout the organization to create an integrated response team. The ICS process requires the UC to set clear objectives to guide the on-scene response resources. The primary entities of a UC may be two or more of the following:

- Federal On-Scene Coordinator
- State On-Scene Coordinator
- Local On-Scene Coordinator
- Company IC (Responsible Party IC)

3.2 Qualified Individual

The QI is defined by the U.S. Department of Transportation, Pipeline and Hazardous Materials Administration (PHMSA) as a company employee that has been given authority to fund response efforts without consulting Company leadership for further authorization and knows how to commence the response procedures of this Plan. The QI is responsible for activating the ICS response organization, including the LRT and CST.

The QI will be an English-speaking SCS employee that is available on a 24-hour basis with the full authority to activate and deploy the necessary emergency response contractors. The QI or Alternate QI

will activate personnel and equipment, act as a liaison with the UC, and obligate any funds required to carry out all the required or direct emergency response activities.

3.3 Local Response Team

The first Company person on scene will function as the IC and person-in-charge until relieved by an authorized person who will then assume the position of IC. The number of positions/personnel required to staff the LRT will depend on the size and complexity of the incident. The duties of each position may be performed by the IC directly or delegated as the situation demands. The IC is always responsible for directing response activities and will assume the duties of all the primary positions until the duties can be delegated to other qualified personnel.

A typical ICS organization is shown in Figure 2. The LRT will fill the necessary positions and request additional support from the CST to fill/back up any additional positions necessitated by the incident. Detailed job descriptions of the response team positions are provided in this Section.

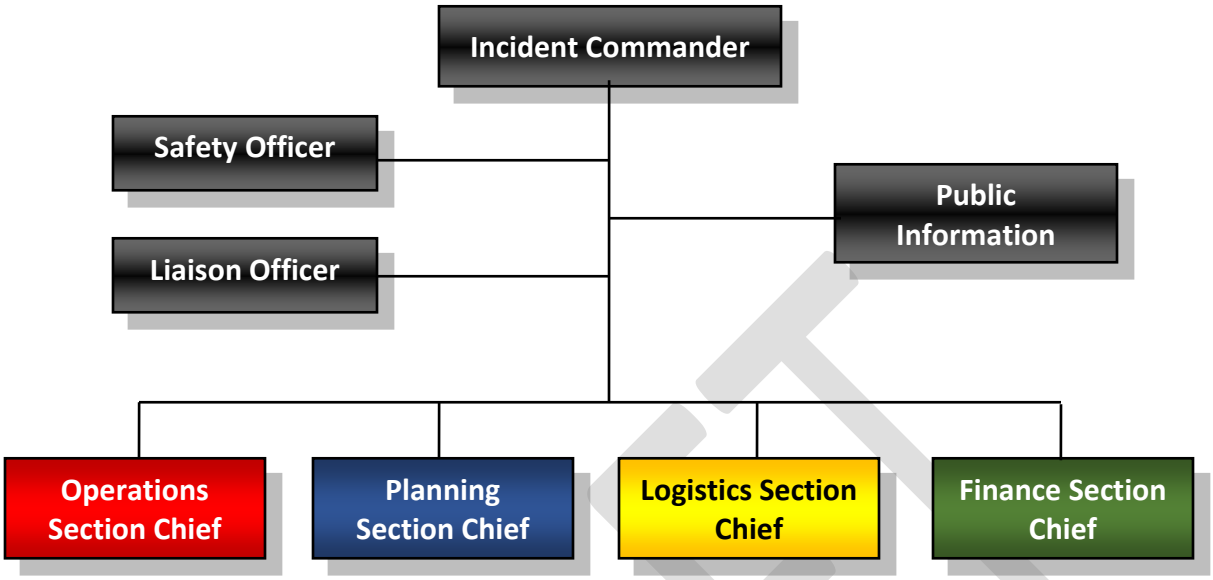
3.4 Company Support Team

For response operations outside of the capabilities of the LRT, the QI and IC will determine the need for mobilization of a CST. The members of the LRT will typically become members of the CST.

The CST, once fully staffed, is designed to cover all aspects of a comprehensive and prolonged incident response. The number of positions/personnel required to staff the CST will depend on the size and complexity of the incident. During a prolonged response, additional personnel may be cascaded in to fill additional ICS positions or relieve responding personnel.

The CST is staffed by trained personnel from various Company locations and by various contract resources as the situation requires.

Figure 2: Incident Commend System Organization



Incident Command System Roles and Responsibilities

Incident Commander	
The IC has responsibility for overall management of the incident. The IC has the authority to approve the use of a contractor even if no "open-end" contract exists, as well as the authority to commit monies to initiate response and clean-up activities. The first employee on- site will assume the responsibilities of IC until properly relieved. Generally, the most senior employee on-site will assume the IC position. The IC also has overall responsibility for the health and safety of responders.	
○	Assess the situation and/or obtain a briefing from the prior IC.
○	Determine incident objectives and strategy.
○	Establish the immediate priorities.
○	Establish an Incident Command Post.
○	Brief Command Staff and Section Chiefs.
○	Establish an appropriate response organization commensurate with the severity of the incident and potential for impact to public health and/or the environment
○	Ensure planning meetings are scheduled as required.
○	Approve and authorize the implementation of an Incident Action Plan (IAP).
○	Ensure that adequate safety measures are in place.
○	Coordinate activity for all Command and General Staff.
○	Coordinate with key people and officials
○	Approve requests for additional resources or for the release of resources.
○	Keep appropriate agencies/organizations informed of incident status.
○	Approve the use of trainees, volunteers, and auxiliary personnel.
○	Authorize release of information to the news media
○	Ensure Incident Status Summary (ICS Form 209) is completed and forwarded to appropriate higher authority
○	Order the demobilization of the incident response when appropriate.

Safety Officer	
The Safety Officer's (SOFR) function is to develop and recommend measures for assuring personnel safety, and to assess and/or anticipate hazardous and unsafe situations. Only one SOFR will be assigned for each incident; however, there may be assistants.	
○	Participate in planning meetings.
○	Identify hazardous situations associated with the incident.
○	Review the IAP for safety implications.
○	Exercise emergency authority to stop and prevent unsafe acts.

Safety Officer	
□	Investigate accidents that have occurred within the incident area.
○	Review and approve the medical plan.
○	Develop the Site Safety Plan and publish Site Safety Plan summary (ICS Form 208) as required.

Public Information Officer	
The Public Information Officer (PIO) is responsible for developing and releasing information about the incident to the news media, incident personnel, and other appropriate agencies and organizations. *Only one PIO will be assigned for each incident. The PIO may have assistants as necessary. The assistants may represent assisting agencies, companies, or jurisdictions. The PIO and assistants will establish a Joint Information Center to assist with developing information releases.*	
○	Determine from the IC if there are any limits on information release.
○	Develop material for use in media briefings.
○	Obtain IC approval of media releases.
○	Inform media and conduct media briefings.
○	Arrange for tours and other interviews or briefings that may be required.
○	Obtain media information that may be useful to incident planning.
○	Maintain current information summaries and/or displays on the incident and provide information on the status of the incident to assigned personnel.

Liaison Officer	
The Liaison Officer (LOFR) serves as a "go-between" linking the IC to various agencies. These are agencies that do not have a direct tactical assignment within the UC but have an interest in the response activities or wish to offer assistance. *The LOFR intercepts, greets, and briefs agency representatives as they arrive on scene. It is the responsibility of the LOFR to notify the IC before escorting anyone to the Command Post. A separate Liaison Area may need to be established to accommodate agency representatives not directly involved in the UC.*	
○	Be a contact point for Agency Representatives.
○	Maintain a list of assisting and cooperating agencies and Agency Representatives. Monitor check-in sheets daily to ensure that all Agency Representatives are identified.
○	Assist in establishing and coordinating interagency contacts.
○	Keep federal, state, local agencies supporting the incident aware of incident status.
○	Monitor incident operations to identify current or potential inter-organizational problems.

Liaison Officer	
□	Participate in planning meetings, providing current resource status, including limitations and capability of assisting agency resources.
○	Coordinate response resource needs for incident investigation activities with the Operations Section Chief (OPS).
○	Ensure that all required agency forms, reports, and documents are completed prior to demobilization.
○	Coordinate activities of visiting agencies or government officials arriving to survey the response.

Operations Section Chief	
The OPS is responsible for the management of all operations directly applicable to the primary mission (e.g., clean-up, recovery). The OPS activates and supervises tactical response elements in accordance with the IAP and directs its execution. The OPS also requests or releases resources; makes expedient changes to the IAP (as necessary); and reports these actions to the IC.	
○	Develop operations portion of IAP.
○	Brief and assign Operations Section personnel in accordance with the IAP.
○	Supervise Operations Section.
○	Determine need and request additional resources.
○	Review suggested list of resources to be released and initiate recommendation for release of resources.
○	Assemble and disassemble Strike Teams assigned to the Operations Section.
○	Report information about special activities, events, and occurrences to the IC.

Planning Section Chief	
The Planning Section Chief is responsible for the collection, evaluation, dissemination, and use of information; particularly with regard to the development of the incident and the status resources. This information is needed to: 1) understand the current situation, 2) predict the probable course of incident events; and 3) prepare alternative strategies for the incident.	
○	Collect and process situation information about the incident.
○	Supervise preparation of the IAP.
○	Provide input to the IC and the OPS in preparing the IAP.
○	Chair planning meetings and participate in other meetings as required.
○	Assign available personnel already on-site to ICS organizational positions as appropriate.
○	Establish information requirements and reporting schedules for Planning Section Units (e.g., Resources, Situation Units).

Planning Section Chief	
□	Determine the need for any specialized resources in support of the incident.
○	If requested, assemble and disassemble Strike Teams and Task Forces not assigned to Operations.
○	Establish special information collection activities as necessary (e.g., weather, environmental, toxics).
○	Assemble information on alternative strategies to meet response objectives.
○	Provide periodic predictions on incident potential. The incident potential examines the current situation and the potential future situation based on the incident specifics (e.g., adverse weather, potential community impacts, duration of incident response operations, legal concerns)
○	Report any significant changes in incident status or any Critical Reporting Requirements to the IC (e.g., injury, public health impacts, special request from agencies).
○	Compile and display incident status information.
○	Oversee preparation and implementation of the Incident Demobilization Plan.
○	Based on incident severity and site-specific conditions, incorporate ICS forms and plans (e.g., Traffic, Medical ICS 206, Communications ICS 205, Site Safety ICS 208) into the IAP.

Logistics Section Chief	
The Logistics Section Chief (LSC) is responsible for providing facilities, services, and material in support of the incident. The LSC participates in the development and implementation of the IAP. *Resources are divided into Support and Services. Support resources are used in support of the IAP (e.g., boom, vacuum trucks, skimmers). Service resources include food/water, communication, and medical resources.*	
○	Plan the organization of the Logistics Section.
○	Assign work locations and preliminary work tasks to Section personnel.
○	Notify the Resources Unit of the Logistics Section units activated including names and locations of assigned personnel.
○	Assemble and brief Branch Directors and Unit Leaders.
○	Participate in preparation of the IAP.
○	Identify service and support requirements for planned and expected operations
○	Provide input to and review the Communications Plan, Medical Plan and Traffic Plan.
○	Coordinate and process requests for additional resources.
○	Review the IAP and estimate Section needs for the next operational period.
○	Advise on current service and support capabilities.

Logistics Section Chief	
○	Prepare service and support elements of the IAP.
○	Estimate future service and support requirements.
○	Recommend release of Unit resources in conformity with Incident Demobilization Plan.
○	Ensure the general welfare and safety of Logistics Section personnel.

Finance Section Chief	
The Finance Section Chief (FSC) is responsible for all financial, administrative, and cost analysis aspects of the incident and for supervising members of the Finance Section. Depending on the incident, the FSC position may or may not be assigned. Agencies within the UC may require and staff the FSC position.	
○	Attend planning meetings as required.
○	Manage all financial aspects of an incident.
○	Provide financial and cost analysis information as requested.
○	Gather pertinent information from briefings with responsible agencies.
○	Develop an operating plan for the Finance/Administration Section; fill supply and support needs.
○	Determine the need to set up and operate an incident commissary.
○	Meet with Assisting and Cooperating Agency Representatives, as needed.
○	Ensure that all personnel time records are accurately completed and transmitted, according to policy.
○	Provide financial input to demobilization planning.
○	Ensure that all obligation documents initiated at the incident are properly prepared and completed.
○	Brief administrative personnel on all incident-related financial issues needing attention or follow-up prior to leaving incident.

4 Procedure

4.1 Receiving, Identifying, and Classifying Incidents

Generally, an incident is a chain of events which has caused, or could have caused, injury, illness, and/or damage to the environment or the public. In this Plan, an incident refers to an event requiring some form of action on behalf of the Company. Notification of incidents may occur via phone from external sources (the public or emergency response agencies such as fire or police), phone from employees or contractors, or operational monitoring by the Pipeline Control Center. Regardless of the source, each incident's relative risk will be continually evaluated and characterized until it has been controlled and resolved. The initial IC role will be filled by the first Company employee to arrive at the incident scene.

An emergency is defined as an urgent, sudden, and serious event that requires immediate action that may result in harm to employees or the public, environmental degradation, and/or property damage. If

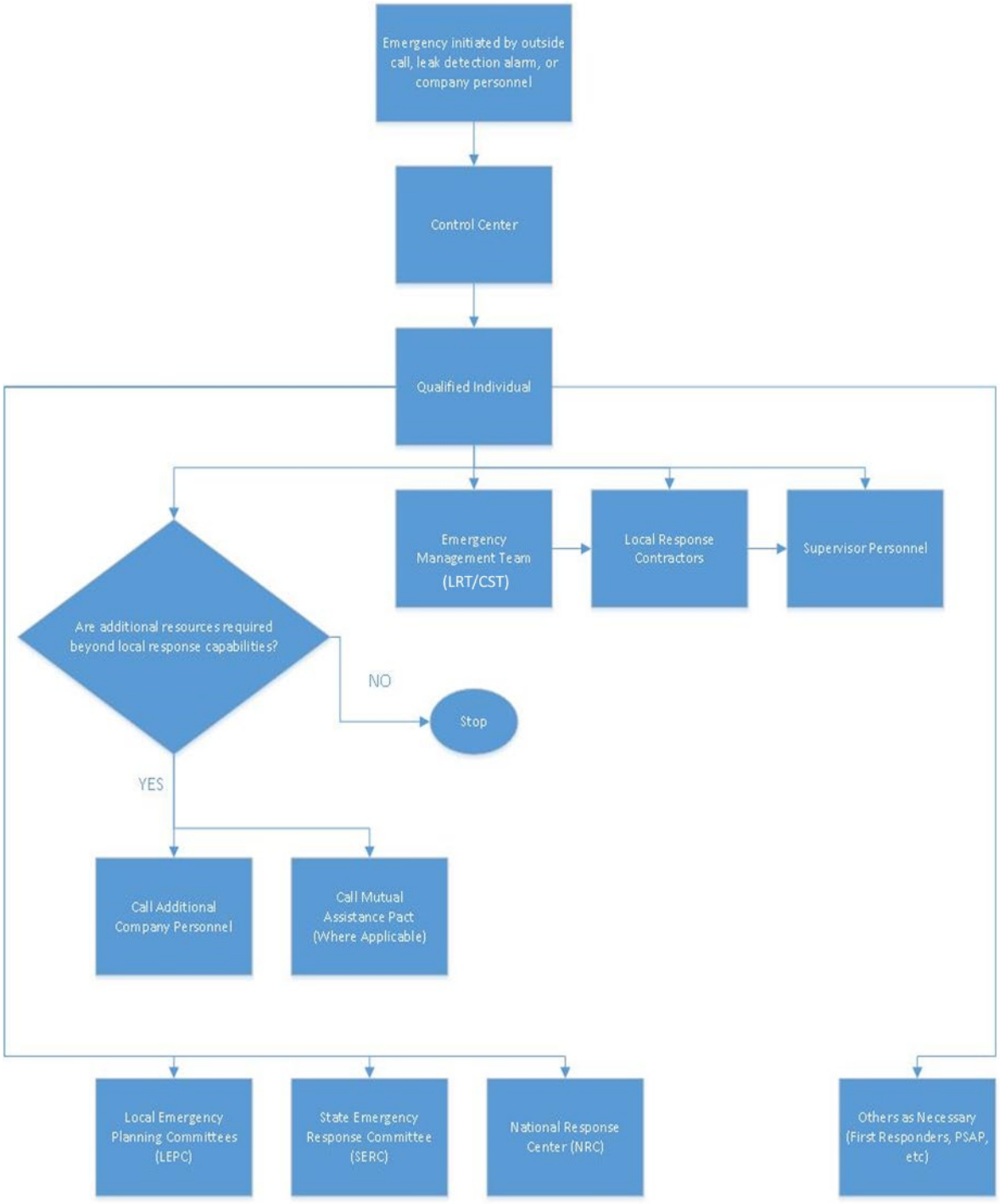
an emergency is reported, SCS will shut down the impacted system and make immediate notifications to ensure protection of the public and company personnel.

Incident Classification	
Low Risk	Incidents that will not need to involve outside agencies, such as Police, Fire, etc. Incidents that can be secured by the Pipeline Operations field personnel that do not impact the public or environment. Examples may include: 1. Incipient stage fires addressed with hand-held extinguishers 2. Small spills of fuel, lube oil, or other regulated materials that remain in containment or small releases that disperse immediately into the atmosphere 3. Minor injuries not requiring hospitalization
High Risk	Incidents that require an immediate response by the Pipeline Controller and Pipeline Operations Field personnel, such as: 1. Accidental/uncontrolled release of CO_2 from the pipeline 2. Fire beyond the capabilities of a handheld extinguisher or explosion occurring near or directly involving a pipeline facility 3. Operational failure causing a hazardous condition

4.2 Communicating to Appropriate Operator Personnel

Should notification of an event relating to a pipeline leak or potential emergency which requires immediate response be received, the following Emergency Notification Flowchart, located in Figure 3, provides guidance regarding notification of appropriate operator personnel, contractors, emergency, and public officials.

Figure 3: Emergency Notification Flowchart



4.3 Prompt and Effective Response

A prompt and effective response to each type of incident identified in Section 4.1 is critical to minimizing any adverse effect to public health, the environment, and property.

- All immediate response events (high risk) identified in Section 4.1 should be mitigated by shutting down the pipeline segment(s) involved as soon as possible.
- If the notification is taken by the Pipeline Controller, the pipeline segment(s) involved will be shut down immediately.
- Any other individual receiving notification will immediately notify the Pipeline Controller for immediate shutdown of the affected pipeline segment(s).
- The Control Center shall determine the external notification that need to be made based on the incident type and severity. See Section 6 for the public safety answering point (PSAP) for each county and Section 7 for regulatory notifications, both federal and state, including the public.

Initial response actions are those taken by local personnel immediately upon becoming aware of a discharge or emergency incident before the LRT Team (described in Section 3) is formed and functioning.

The first SCS employee on-scene will function as the IC until properly relieved. The person functioning as the IC during the initial response period has the authority to take the steps necessary to control the situation and must not be constrained by these general guidelines.

Initial Response Actions

Initial Response Action Checklist	
❑	Take appropriate personal protective measures and utilize CO_2 monitoring equipment to ensure public and responder safety, as the situation demands.
❑	Confirm Control Center has been notified.
❑	Call for medical assistance if an injury has occurred.
❑	Restrict access to the incident site and adjacent areas as the situation demands. Take additional steps necessary to minimize any threat to health and safety. Contact local police or fire to assist as needed.
❑	Assess the magnitude of the incident and quantity released.
❑	Advise public/personnel in the area of any potential threat and/or initiate evacuation procedures.
❑	Use testing and sampling equipment to determine potential safety hazards, as the situation demands.
❑	Identify/Isolate the source and minimize the loss of product, as appropriate.
❑	Take necessary fire response actions and/or contact the local fire department to assist as needed
❑	Notify Management of the incident.
❑	Utilize the ICS 201 form to begin logging all field activities and decisions.

Incident Specific Response Actions

Should notification be received of high risk incident, the following procedures will be followed.

- Accidental/Uncontrolled release of CO_2 from the pipeline.
  - Confirmation will be made by personnel on-scene that Pipeline Control is aware of the incident to effectuate shut down of the pipeline and closure of mainline valves to isolate the release and minimize the amount of CO_2 released.
  - Consideration should be given to notifying and evacuating the public downwind of the release and closing roads. Coordinate with nearby fire departments and law enforcement to aid in any evacuation efforts.
  - Pipeline Control will call the appropriate PSAP and nearby fire departments, law enforcement, and other appropriate agencies. See Section 6 for a listing of PSAPs and Section 7 for agency contacts. Personnel on-scene during an incident may call 911 directly.
  - Pipeline Control dispatches Company Response Crew to investigate the incident and notifies the QI.
  - Company Response Crew arrives at the incident site and completes initial response actions. A designated Company person from the response crew will fill the initial IC position.
  - The IC will conduct a risk assessment and coordinate with the QI to determine what ICS positions need to be filled for the LRT.
  - The QI or IC will establish liaison with the local emergency coordinating agencies, such as the 911 emergency call centers or county emergency managers in lieu of communicating individually with each fire, police, or other public entity.
  - If the response exceeds local capabilities, the IC will coordinate with the QI to determine the need for mobilization of a CST.
- Fire or explosion occurring near or directly involving a pipeline facility. Note, CO_2 is not flammable, combustible, or explosive.
  - Call for assistance from nearby fire departments and company personnel as needed. Take all possible actions to keep fire from spreading to pipeline equipment. If fire still threatens the pipeline, activate shutdown procedure and depressurize threatened pipeline segments as practical.
  - For an explosion involving a pipeline facility, shut down the pipeline.
  - The IC will conduct a preliminary assessment of the situation upon arrival at the scene. Evaluate scene for potential hazards. Determine what product is involved.
  - Assemble the LRT at the Command Post.
  - Coordinate response efforts with on-scene fire department.
- Operational failure causing a hazardous condition.
  - Confirmation will be made by personnel on-scene that Pipeline Control is aware of the incident to effectuate shut down of the pipeline and closure of mainline valves to isolate the release and minimize a hazardous condition.

- Consideration should be given to evacuating the public downwind of the release and closing roads. Coordinate with nearby fire departments and law enforcement to aid in any evacuation efforts.
- Pipeline Control will call the appropriate PSAP and nearby fire departments, law enforcement, and other appropriate agencies. See Section 6 for a listing of PSAPs and Section 7 for agency contacts. Personnel on-scene during an incident may call 911 directly.
- Pipeline Control dispatches LRT to investigate the incident and notifies the QI.
- Company Response Crew arrives at the incident site and completes initial response actions. A designated Company person from the response crew will fill the initial IC position.
- The IC will conduct a risk assessment and coordinate with the QI to determine what ICS positions need to be filled for the LRT.
- The QI or IC will establish liaison with the local emergency coordinating agencies, such as the 911 emergency call centers or county emergency managers in lieu of communicating individually with each fire, police, or other public entity.
- If the response exceeds local capabilities, the IC will coordinate with the QI to determine the need for mobilization of a CST.

- Fire or explosion occurring near or directly involving a pipeline facility. Note, CO_2 is not flammable, combustible, or explosive.
  - Call for assistance from nearby fire departments and company personnel as needed. Take all possible actions to keep fire from spreading to pipeline equipment. If fire still threatens the pipeline, activate shutdown procedure, and depressurize threatened pipeline segments as practical.
  - For an explosion involving a pipeline facility, shut down the pipeline.
  - The IC will conduct a preliminary assessment of the situation upon arrival at the scene. Evaluate scene for potential hazards. Determine what product is involved.
  - Assemble the LRT at the Command Post.
  - Coordinate response efforts with on-scene fire department.

4.4 Personnel and Equipment

SCS will provide personnel, equipment, instruments, tools, and material as needed to respond to an emergency incident.

- All local company personnel are available for call-out as needed for duty on a 24-hour basis to support public safety agencies.
- Additional personnel, if required, will be acquired from agency responders from public safety agencies and/or response contractors.
- If public authorities are involved, they will be given full cooperation and assistance. In no event shall such cooperation and assistance violate safety rules or consist of actions that would endanger the public or employees.
- Company employees, contractors, and agency responders will be equipped with tools, supplies, and equipment available to be used in cases of emergency conditions existing on or near the pipeline system. CO_2/oxygen monitoring devices should be used in the event of an accidental/uncontrolled release of CO_2. Self-contained breathing apparatus may be required pending results from on site-specific hazards and monitoring results.

4.5 Release of Carbon Dioxide

In the event of a breach of pipeline integrity resulting in an uncontrolled release of CO_2, following actions will be coordinated to minimize hazards to public health, the environment, and property.

Pipeline Control will immediately identify any possible rupture and fully close any remote mitigation valves to minimize the volume of CO_2 released from the pipeline.

Pipeline Control will notify the PSAP and/or other agencies such as fire and law enforcement as well as aerial patrol to assist in identifying the location of the release. Aerial patrol will look for:

- blowing soil;
- presence of frost near the pipeline right of way;
- vapor cloud similar to that produced by dry ice; and
- dead or dying vegetation on or near the pipeline right of way in an otherwise green area.

Based upon the estimated volume of the release, topography, proximity of habitable structures, and weather conditions, work with the local emergency response agencies to effect orderly evacuation of the public. The safety of the public and the response team comes first.

Notify emergency agencies to help control traffic, establish danger zones to control sightseers, and determine if it is advisable to set up roadblocks. Roadblocks may be needed for pedestrian, automotive, and train traffic. If active train tracks are near or crossing the area of potential impact, the railroad dispatcher will be notified (telephone numbers of railroad dispatchers are included in Section 6 of this procedure).

As appropriate, deploy outside assistance such as construction contractors or additional air monitoring services.

If roadblocks are set up, advise the controlled points of any resources which have been contacted so they may be admitted to the controlled area.

4.6 Pre-planning Emergency Response Activities with Public Safety Answering Point, Fire, Police, and Other Public Officials

To enhance cooperation during an incident response, SCS will liaise with agency responders and public officials including participating in emergency tabletop exercises, coordinating meetings to discuss hazards and emergency response, and conducting facility tours or open houses. These and other public outreach activities will be included in the Public Awareness Program that will be developed and implemented prior to commencing operation of the pipeline.

4.7 Required Pipeline Controllers Actions

Pipeline Control actions during emergency response actions will be detailed in the Control Room Management Plan to be developed and implemented prior to commencing pipeline operations. Generally, the actions will include:

- Identifying abnormal operating conditions – including potential pipeline ruptures;
- Confirmation of abnormal conditions;
- Specific steps to take in response to certain abnormal conditions – including closing valves, notifications internal to SCS, and external to agency responders; and
- Specific steps to take following pipeline shutdown to re-establish pipeline operations.

5 SCS Internal Contacts

Internal Contacts			
Position/Title	**Name**	**Office**	**Cell**
Qualified Individual Director, Regulatory Compliance			
Alternate (QI) TBD			
TBD			
TBD			

6 Public Safety Answering Points and Railroad Contact Information

Public Safety Answering Points (PSAPs) - MINNESOTA	
Otter Tail County	218-998-8555 - Otter Tail County Sheriff's Office
Wilkin County	218-643-8544 - Wilken County Sheriff's Office

Railroad Emergency Contact – 24/7	
BNSF Railway	1-800-832-5452; then press 1 for emergency
Otter Tail Valley	866-527-3499 (will be answered as Genesee and Wyoming Railroad but this is the emergency number for Otter Tail Valley as well)

7 Federal and State Agency Notifications

7.1 Federal Agencies

FEDERAL PIPELINE SAFETY REPORT NATIONAL RESPONSE CENTER c/o United States Coast Guard (CG-5335) – Stop 7581 Washington, DC 20593-0001	
24 Hour Phone	(800) 424-8802
REPORTING REQUIREMENTS: The National Response Center (NRC) is the sole federal point of contact for reporting CO_2 releases which enter or threaten to enter the navigable waters of the United States and for pipeline related incidents/ accidents as defined by the U.S. Department of Transportation, Office of Pipeline Safety. If you have a release or a pipeline incident/accident to report, contact the NRC at the earliest practicable moment **(within 1 hour)** via the toll-free number, or visit the NRC website (https://nrc.uscg.mil/l) for additional information on reporting requirements and procedures. For those without 800 access, please contact the NRC at 202-267-2675. **Type:** Any discharge that has impacted or threatens to impact navigable waters or a release that meets the criteria of PHMSA's reporting requirements under 49 CFR 195 (see PHMSA reporting requirements on the next page). **Verbal Notification:** Immediately (not later than one (1) hour of confirmation discovery to meet 49 CFR 195.52(a)). See PHMSA notification for follow-up NRC notification criteria within 48 hours).	

Telephonic Reporting Must Include the Following Information:	
1	Name and address and operator identification number (OPID) of SCS
2	Name and telephone number of the reporter
3	The location of the failure
4	The time of the failure
5	The fatalities and personal injuries (if any)
6	All other significant facts known by SCS that are relevant to the cause of the failure or extent of the damages or extent of the damages.

PIPELINE AND HAZARDOUS MATERIALS ADMINISTRATION (PHMSA)
U.S. Department of Transportation
1200 New Jersey Avenue, SE. Washington, DC 20590
(800) 424-8802 – 24 hours to NRC/emergency number
202-373-2428

REPORTING REQUIREMENTS

Type:

In addition to the reporting of accidents to the NRC as noted below, a written accident report (PHMSA Forms 7000-1 via the online PHMSA Portal) must be submitted for releases resulting in any of the following:

- Explosion or fire not intentionally set by SCS.
- Release of five gallons or more of CO_2, except that no report is required for a release of less than five barrels resulting from a pipeline maintenance activity if the release is:
  - not one described under the NRC's reporting conditions
  - confined to company property or pipeline right-of-way; and
  - cleaned up promptly.
- Death of any person.
- Personal injury necessitating hospitalization.
- Estimated property damage, including cost of clean-up and recovery, value of lost product, and damage to the property of the operator or others, or both, exceeding $50,000
- Written reports are required to be submitted as soon as practicable but **no later than 30 days** after discovery of the accident on PHMSA Form 7000-1. Reports shall be filed by the Manager, EHS or designee. Changes or additions to the original report (PHMSA Form 7000-1) must be filed as a supplemental report within 30 days.

Verbal Notification:

Call to the NRC, within one (1) hour of confirmed discovery and within 48 hours revise or confirm initial report, meets the required verbal notification under PHMSA reporting requirements.

Written Notification:

As soon as practicable, an accident meeting any of the above criteria must be report via the PHMSA Portal at the following link:
https://portal.phmsa.dot.gov/portal

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)	
OSHA Hotline	(800) 321-6742
Basic requirement. ALL fatalities (regardless if they are work related or not) must be reported to OSHA within **8 hours** of occurrence. **Work-related inpatient hospitalizations, amputations and losses of an eye** occurring within 24 hours of the incident must be reported to OSHA within 24 hours.	

7.2 State Agencies

MINNESOTA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (MNOSHA)	
Reporting of workplace fatalities and certain injuries	877-470-6742 800-321-6742 (After hours, weekends, holidays)
Reporting Requirement: Verbal MNOSHA must be notified for work-related incidents resulting in: 1. Fatalities within eight hours 2. Inpatient hospitalizations, amputations, or loss of an eye within 24-hours	

MINNESOTA POLLUTION CONTROL AGENCY	
Spill reporting – 24/7 Immediately report	651-649-5451
Normal business hours	(800) 422-0798

Reporting Requirement:
Verbal
Immediately notify the Minnesota Pollution Control Agency for:

I. Any release that might cause environmental damage
II. Any amount of any substance that is released into the environment that could cause pollution of waters of the state

MINNESOTA DEPARTMENT OF PUBLIC SAFETY OFFICE OF PIPELINE SAFETY (MNOPS)	
Spill reporting 24/7 emergency	(800) 422-0798 statewide 651-649-5451 metro and out of state

MNOPS has authority for pipelines operated in the State of Minnesota. In the event of a release, if the spill is required to be reported to PHMSA/NRC, it should also be immediately reported to the MNOPS.
Telephonic:
Notification should be made as soon as possible and within 1 hour. A follow-up call shall be made within 48 hours of the initial notification to update and/or confirm information.

- All emergency releases
- All reportable accidents as required by PHMSA
- Any discharge of any substance or material which may cause water pollution

Written:
A copy of the 7000-1 report required by PHMSA shall be sent to the Minnesota Office of Pipeline Safety.

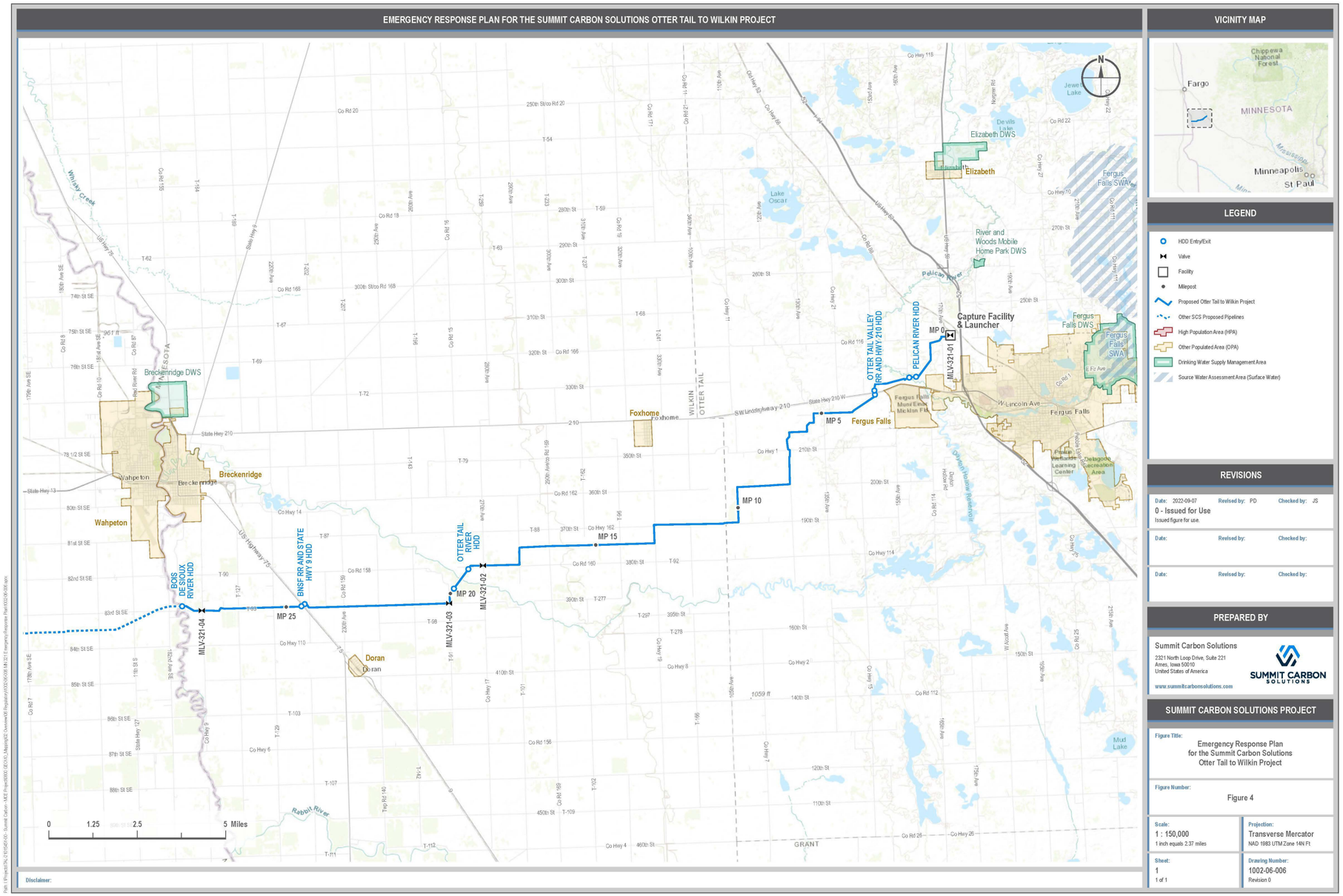
8 Contractor Contact Information

SCS to provide listing of contractors prior to operations.

Contractor Resources		
Company	Capability	Telephone
TBD		

9 Mapping

Figure 4: Project Overview Map



10 Training and Exercises

10.1 Training

The Director, Regulatory Compliance shall ensure that all required Company personnel have received Incident Command training and that all Company personnel working within the ICS response organization understand their roles and responsibilities and the chain of command.

Company personnel shall receive specialized initial training for their roles and will also receive annual training as required by the Company's training program. To remain active, all Company response personnel must meet all training requirements to maintain current certifications and response readiness.

As part of the training program, the Company will meet with agency personnel to discuss response preplanning and preparedness.

10.2 Exercises

A tabletop exercise is a facilitated discussion about what the Company would do in response to an emergency incident. The exercise leads participants through a simulated scenario and prompts them to examine plans, policies, and procedures without disrupting the work environment. It allows for a facilitated discussion of roles, procedures, and responsibilities in the context of a simulated scenario.

The goals of the tabletop exercise include:

- Evaluate the ability to prepare and respond using current plans, policies, procedures, and resources.
- Identify and document improvements for plans, policies, procedures, etc.

The tabletop should be designed to help identify strengths and areas for improvement. Example tabletop objectives may include:

- Evaluate the facility's response organization and operation within the response management system.
- Evaluate internal notifications and alerts, procedures, and training needs.
- Evaluate internal and external communications, including notifications to agencies and the public.
- Evaluate designated staging areas and other emergency response support locations, including activation of Company personnel.
- Evaluate response plans and procedures.
- Evaluate responder and equipment readiness.

Agency personnel will be given an opportunity to attend and participate in these exercises to help facilitate response actions, team integration, and agency expectations.

11 Operator Qualification Tasks

To comply with the Operator Qualification program requirements in 49 CFR 195 subpart G, an Operator must have written description of the processes used to determine the qualification of persons performing operations and maintenance tasks. These descriptions will be maintained in the following documents.

AOC ..... Abnormal Operating Condition (Field)

AOC ..... Abnormal Operating Condition (Control Center)

CT 63.1 ..... Start-up of a Liquid Pipeline (Field)

CT 63.2 ..... Shutdown of a Liquid Pipeline (Field)

CT 64.1 ..... Start-up of a Liquid Pipeline (Control Center)

CT 64.2 ..... Shutdown of a Liquid Pipeline (Control Center)

12 Records/Forms

Employees involved in emergency response should keep logs documenting the times of contacts and actions taken during the emergency. These logs may be useful when conducting the post- accident review.

- PHMSA Form 7000-1 Accident Notification Report
- Incident/Accident Investigation
- SCS Safety Manual

Figure 5: ICS 201 Incident Briefing

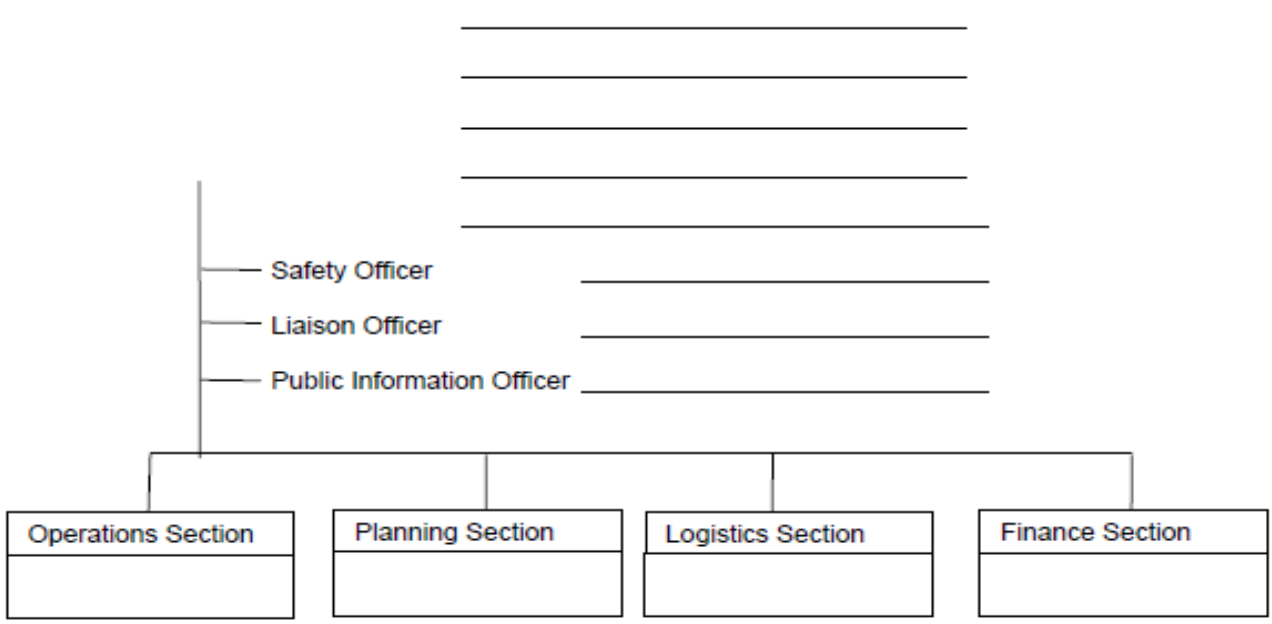
1. Incident Name	**2. Prepared by:** (name) Date: Time:	INCIDENT BRIEFING ICS 201-CG
3. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, overflight results, trajectories, impacted shorelines, or other graphics depicting situational and response status)		
4. Current Situation:		

1. Incident Name	**2. Prepared by:** (name) Date: Time:	INCIDENT BRIEFING ICS 201-CG

5. Initial Response Objectives, Current Actions, Planned Actions

1. Incident Name	2. Prepared by: (name) Date: Time:	INCIDENT BRIEFING ICS 201-CG

6. Current Organization (fill in additional appropriate organization)



1. Incident Name	**2. Prepared by:** (name) Date: Time:	INCIDENT BRIEFING ICS 201-CG

7. Resources Summary

Resource	Resource Identifier	Date Time Ordered	ETA	On-Scene (X)	NOTES: (Location/Assignment/Status)

Figure 6: ICS 214a Individual Log

1. Incident Name	2. Operational Period (Date / Time) From: To:	INDIVIDUAL LOG ICS 214a-OS
3. Individual Name	4. ICS Section	5. Assignment / Location

6. Activity Log	Page of
Time	Major Events

7. Prepared by:	Date / Time

INDIVIDUAL LOG June 2000 ICS 214a-OS

Figure 7: Incident Notification Form

Incident Report Form

Name (First/Last): _____ **Day Phone:** _____
Title: _____ **Evening Phone:** _____
Operator Name: _____ **Organization Type:** _____
Facility Name: _____ **Company:** _____
Address: _____ **Address** _____
_____ _____
Facility Latitude: **Facility Longitude:**

Incident Details

Date/Time of Incident: Date: Time
Spill Location/Address: _____
Nearest City: _____ **State:** _____ **County:** _____ **Zip:** _____
Section: _____ **Township** _____ **Range:** _____ **Borough** _____
Distance from City _____ **Direction from City** _____
Container Type: _____ **Container Storage Capacity** _____
Facility Oil Storage Capacity (gallons): _____

Materials

Discharge Amount	Unit of Measure	Impacted Water	Quantity Impacting Water
		☐ Yes ☐ No	
		☐ Yes ☐ No	
		☐ Yes ☐ No	

Response Actions

Actions Taken to Correct, Control or Mitigate Incident: _____

Impact

Number of Injuries _____ **Number of Deaths:** _____
Evacuation Required: ☐ Yes ☐ No **Number Evacuated:**
Areas to be Evacuated: _____
Damage Amount (approximate): _____
Medium Affected: _____
Medium Description: _____
More information on Medium:

Additional Information

Any information about the incident not recorded elsewhere in this report: _____

Call Notifications

National Response Center (NRC): 1-800-424-8802 **NRC Report #** _____
PHMSA ☐ Yes ☐ No **OSHA** ☐ Yes ☐ No **State:** ☐ Yes ☐ No
Additional Notifications:

Note: It is not necessary to wait for all information before calling NRC

Figure 8: Initial Notification Form

1. Event Name			Prepared by: Date: Time:		NOTIFICATION REPORT NOTIFICATIONS
Organization Name	Phone Number	Date/Time Notified	Person Contacted	Notified By	Notes

13 References or Related Documents

[Reference and Related Documents to be added]

14 Plan Maintenance

Responsibility

Single point accountability for the ERP development and maintenance rests with the Director, Regulatory Compliance. Accountabilities include:

- Development and maintenance of the ERP;
- Ensure systems (ex: ICS) and response structure can meet the requirements specified herein;
- Ensure the ERP is reviewed at least annually and revised/updated as necessary; and
- Ensure SCS employees, contractors, and responders are trained on and provided a copy of the ERP.

Plan Revisions

Initially, and at regular intervals, SCS will perform hazard assessments to identify possible incidents that have the potential to negatively impact people, the environment, and/or property. This plan will be updated to address any changes to or new hazards identified in the hazard assessments.

Initiating Revisions

All requests for change must be made through the Director, Regulatory Compliance using the Revision Request Form incorporated in this document.

Revision Distribution

Plan revisions are issued with an Acknowledgement of Receipt Form and a brief description of the itemized changes. The Acknowledgement of Receipt Form must be signed and returned to the Director, Regulatory Compliance. A revised date is shown at the bottom of each updated or new page. The original date of the manual is August 18, 2022.

Distribution List	
Copy Number	**Plan Holder**
1	Director, Regulatory Compliance Summit Carbon Solutions 2321 North Loop Drive, Suite 221 Ames, IA 50010
2	TBD Emergency Management/Response Agency Representative(s)
3 (Electronic)	TBD

Revision after Incident or Exercise

In the event SCS experiences an incident, or conducts an exercise or training session, the effectiveness of the plan will be evaluated and updated to include lessons learned as necessary. After each incident or exercise, a post incident/exercise review will be conducted in a timely manner. The Plan will be evaluated to determine its usefulness during the incident/exercise. Items discussed after an incident include but are not limited to effectiveness of detection and detection equipment, proper and timely notifications, initial and ongoing incident assessments, mobilization of resources, and/or response effectiveness. Consideration will be given to including agency responder personnel in the post-incident or training session review.

Changes in Operating Conditions

If an operating condition changes that would substantially affect the implementation of the plan, SCS will modify the Plan to address such a change. Updates would be implemented prior to the change or interim operating provisions would be instituted until the update is fully implemented.

Change Log

Date	Rev. No.	Change Location	Brief Description of Change	By

Disclaimer

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