



*NutrientNet:*  
A Nutrient Trading Tool for the  
Chesapeake Bay

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World Resources Institute



# N and P Discharges

<b>Source</b>	<b>Nitrogen</b>	<b>Phosphorus</b>
<b>Total non-point discharges</b>	<b>6,663</b>	<b>1,658</b>
<b>Total point sources</b>	<b>1,495</b>	<b>330</b>
<b>Total discharge (point + non-point)</b>	<b>8,158</b>	<b>2,015</b>
<b>Non-point as a percentage of total</b>	<b>82</b>	<b>84</b>

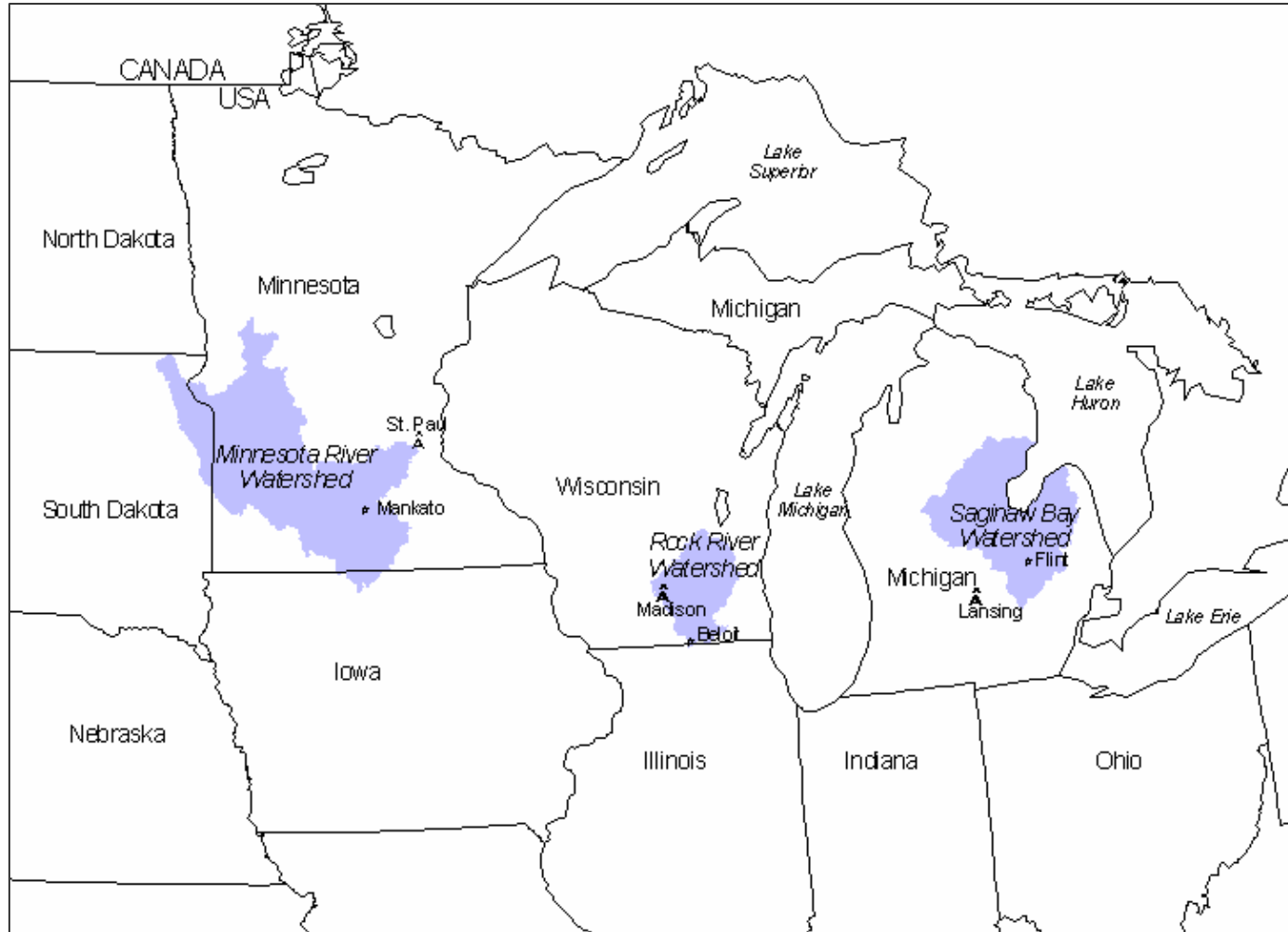
Source: Carpenter et al., 1998

Units: '000 metric tons per year





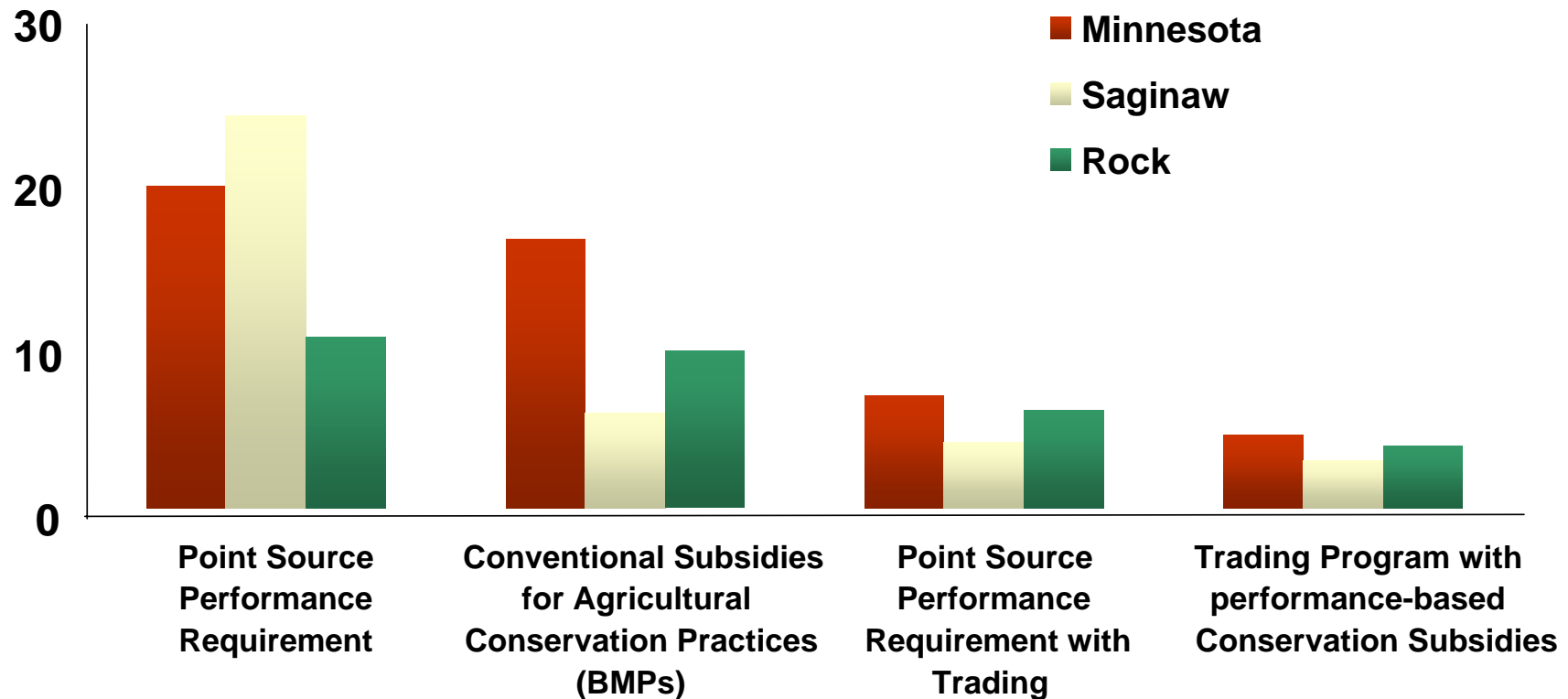
# Case Study Watersheds





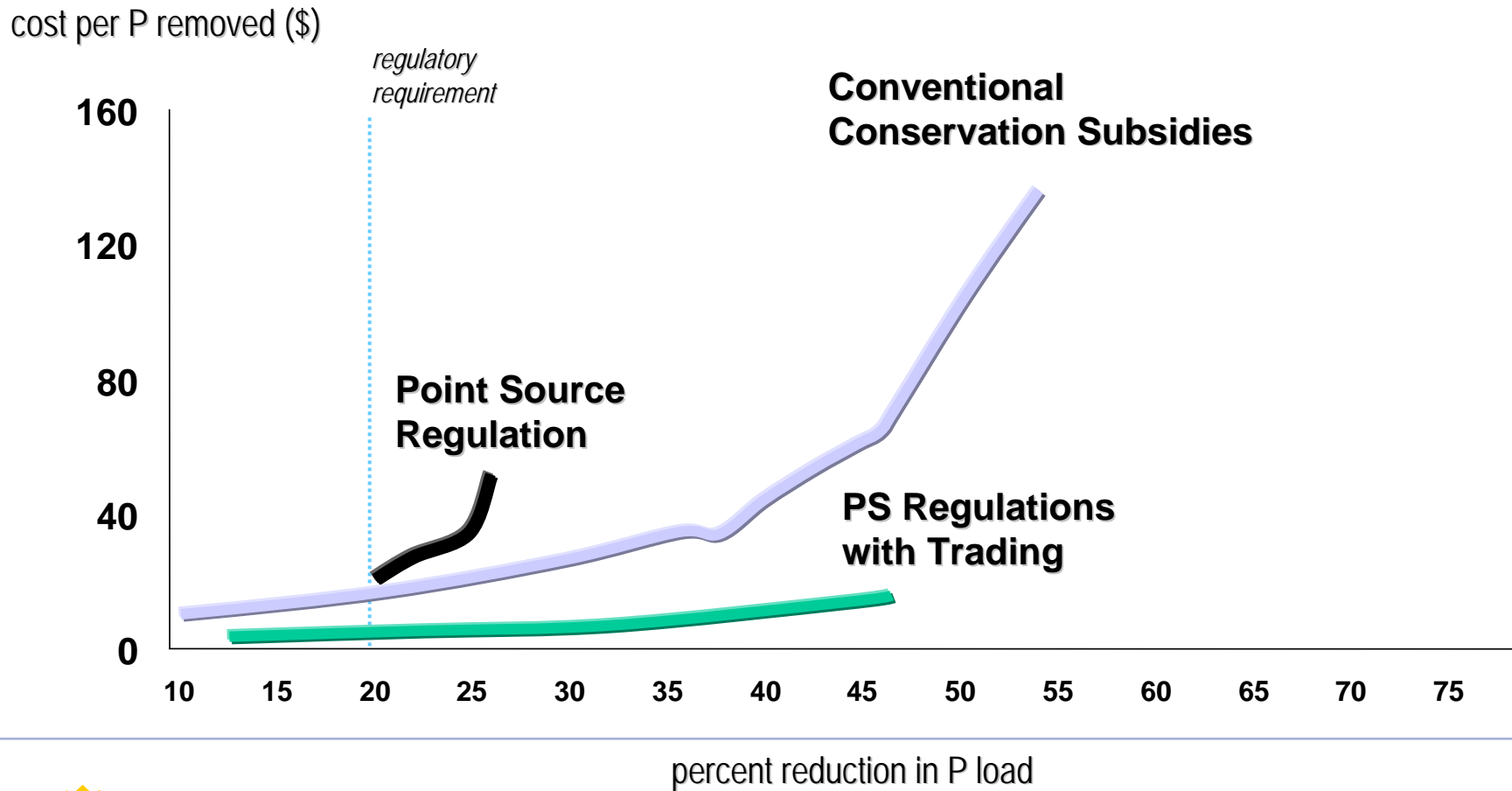
# Cost for Phosphorus Control Under Different Policies

*(US\$ per pound of phosphorus removed)*



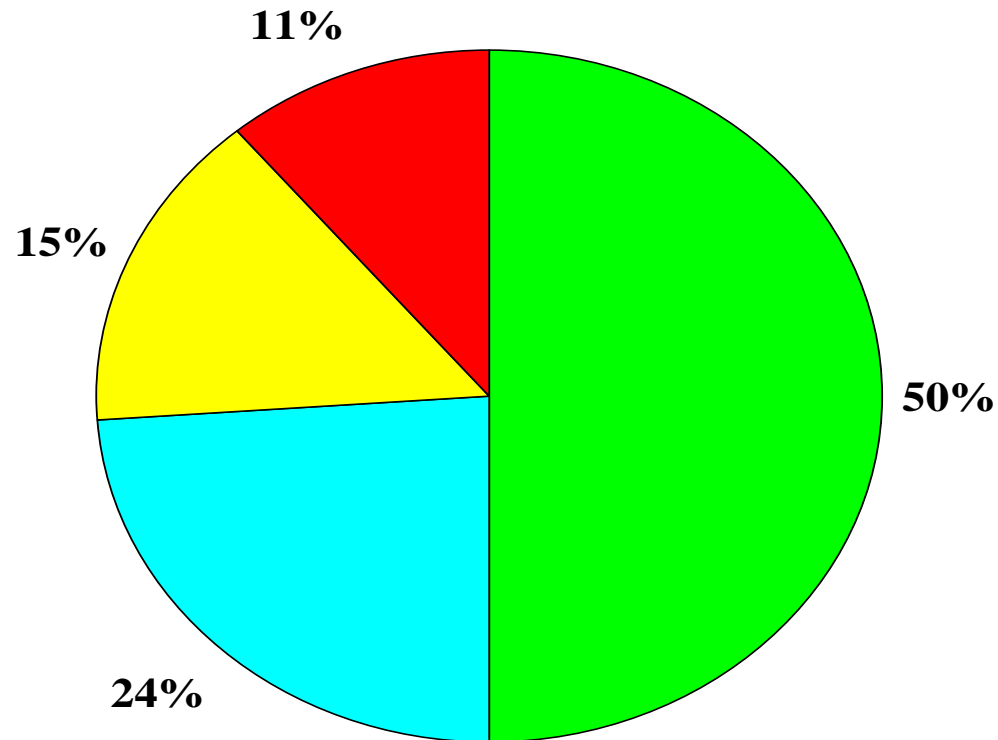


# Model Solutions for Michigan





# Hypoxia: Sources of N in MRB

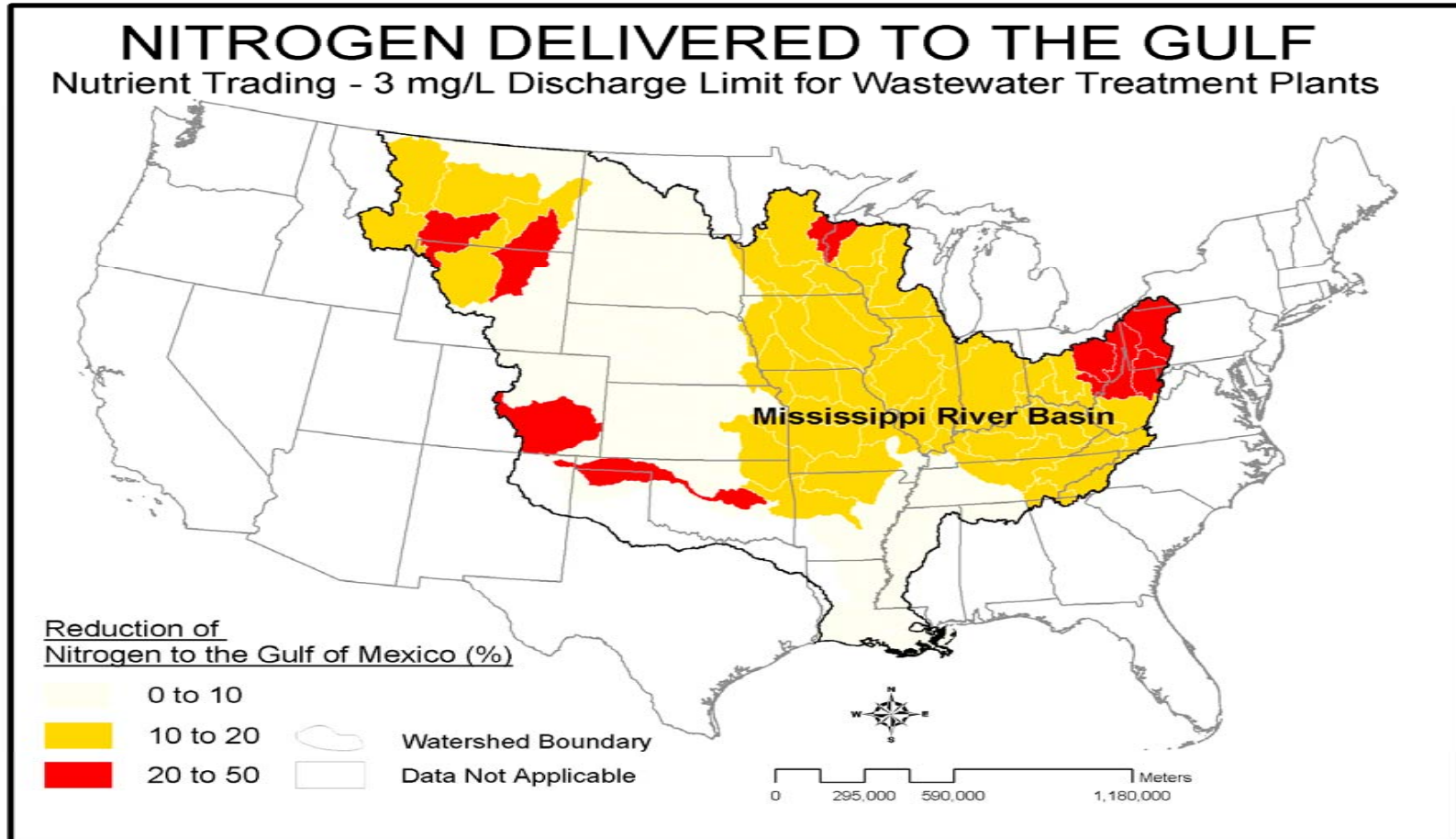


- fertilizer+mineralized soil organic N
- atmospheric deposition, ground water discharge, soil erosion
- animal manure
- municipal and industrial point sources



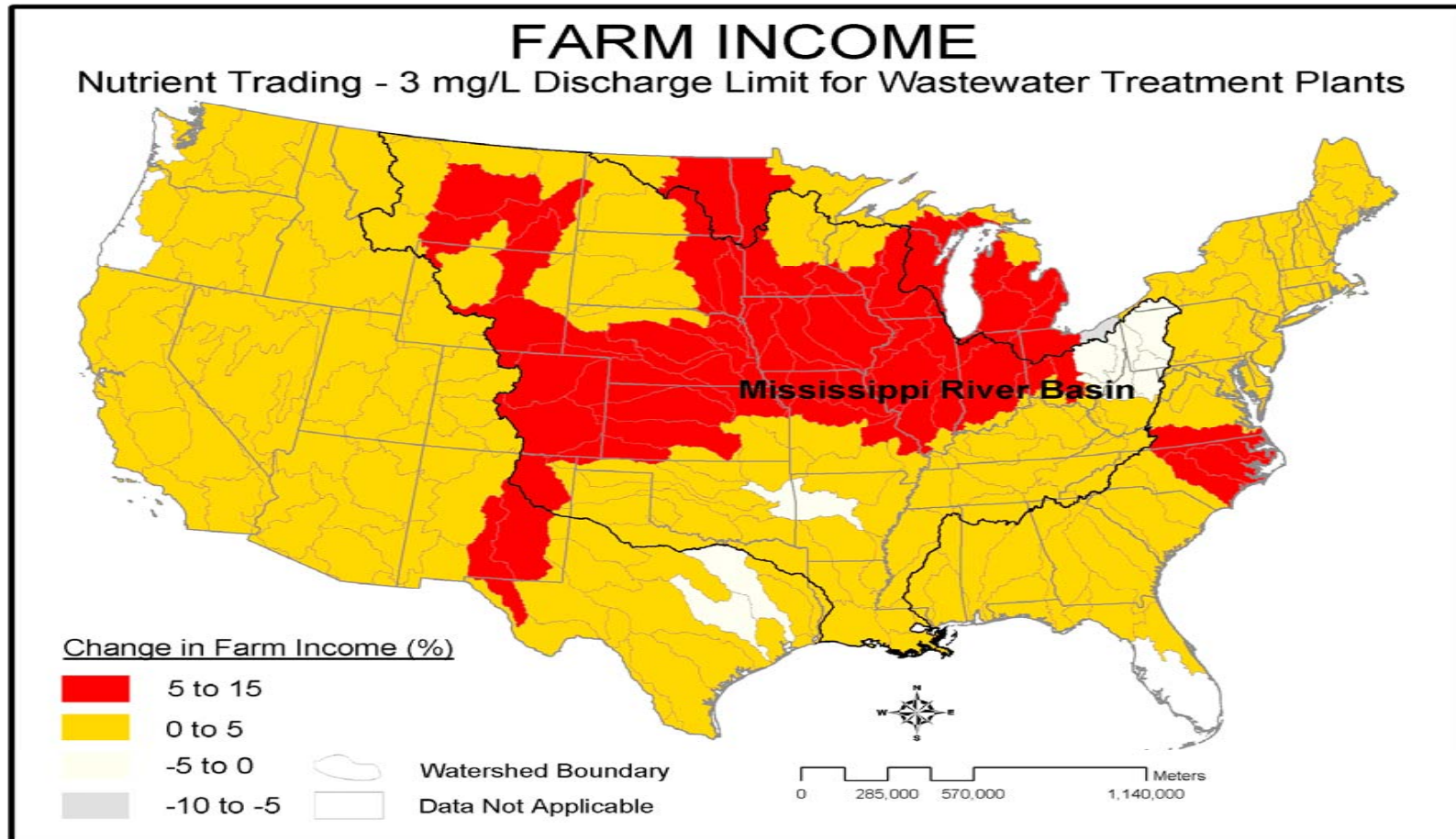


# Regional Impacts





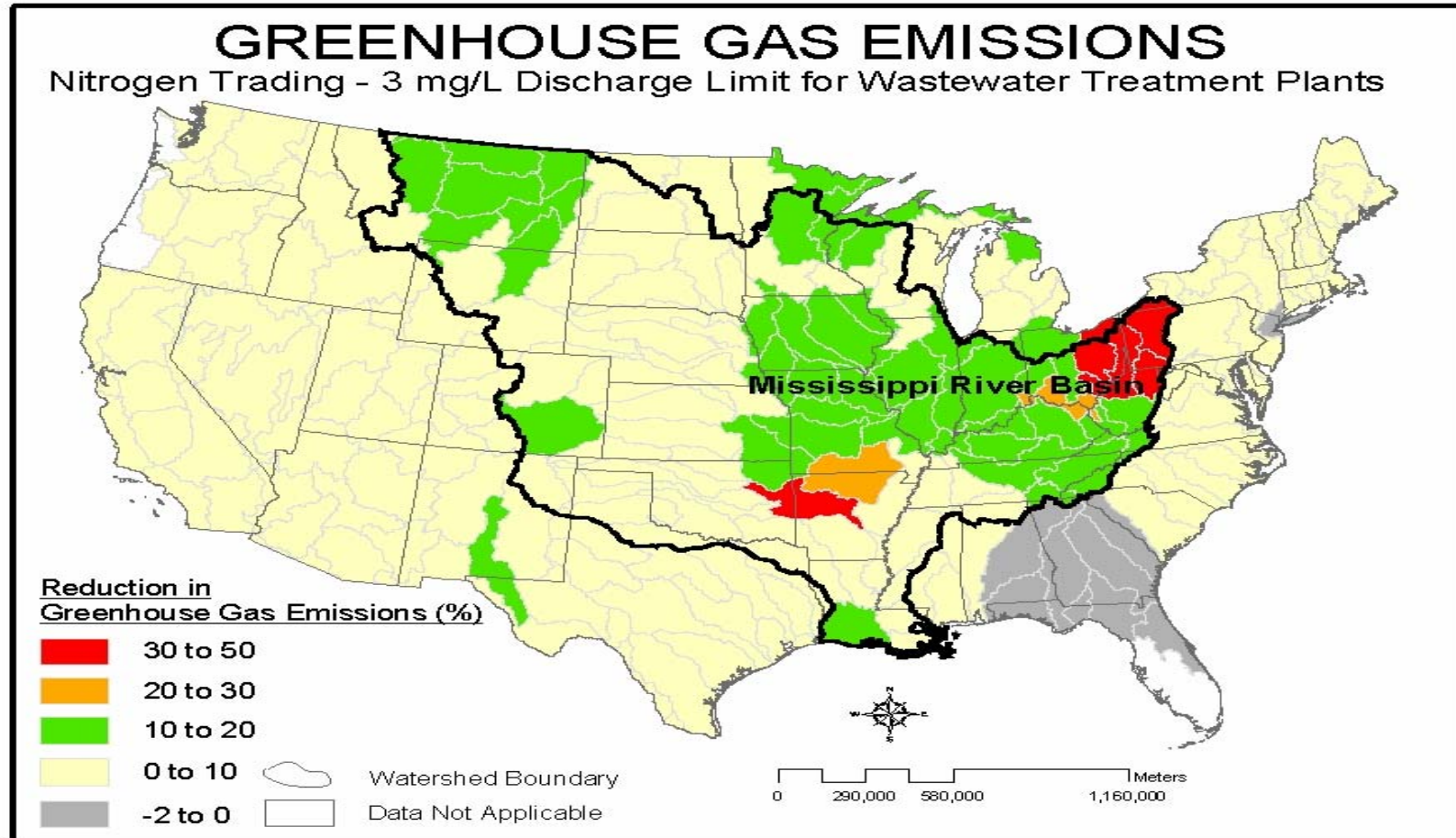
# Regional Impacts







# Regional Impacts





# Nutrient Trading

## **Two basic steps:**

- Setting a goal for the total amount of nutrients that enter surface waters
- Allowing sources with low-cost mitigation options to reduce beyond the required amount and sell excess reductions





# Advantages of *NutrientNet*

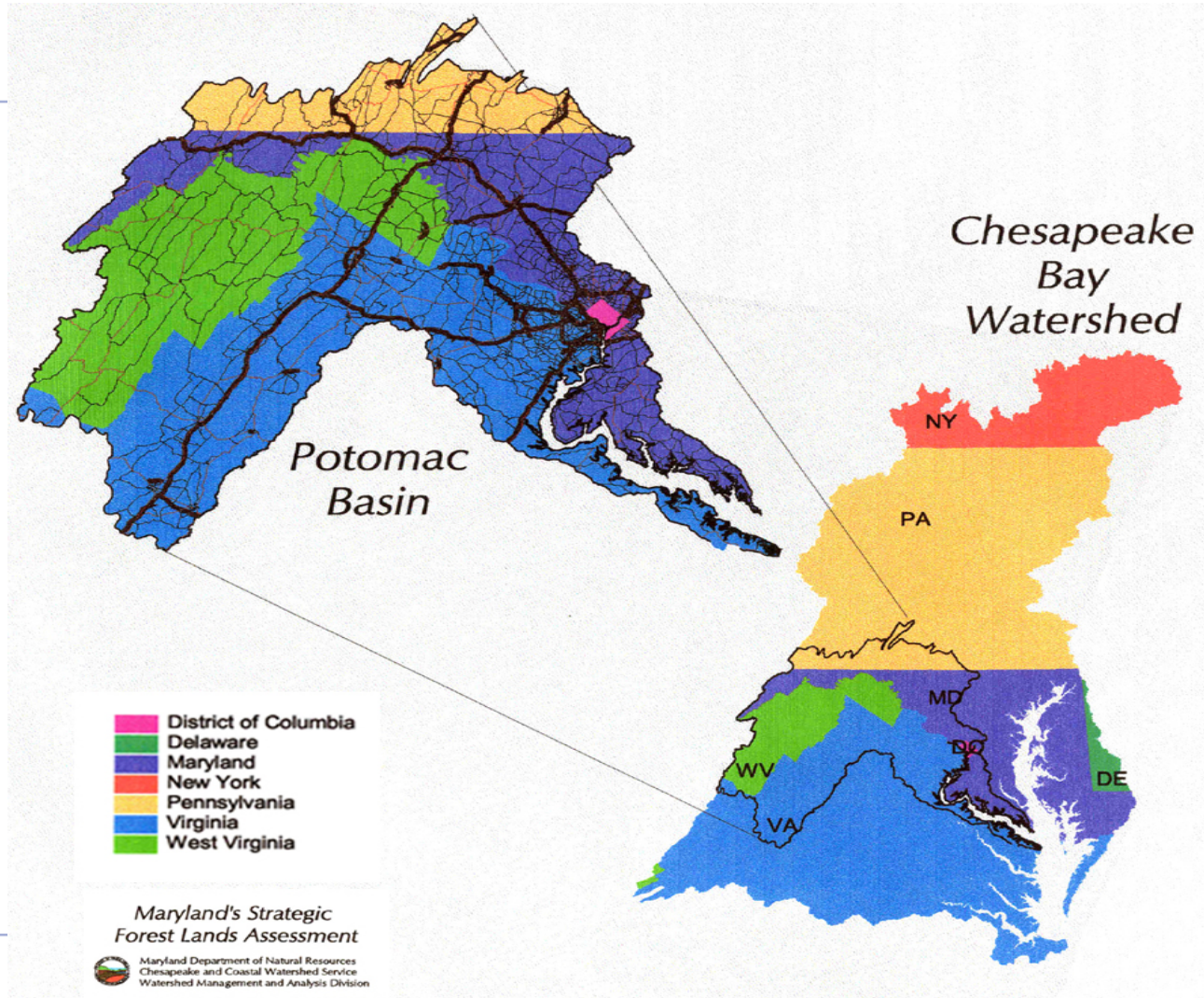
***NutrientNet* was created to build a nutrient trading market place which:**

- Provides standardized calculation of reductions;
- Provides estimates of cost and effectiveness of potential trades;
- Allows potential market participants to identify each other;
- Provides a central place to list volumes and types of trades.





# *NutrientNet* in the Chesapeake Bay





# *NutrientNet* in the Chesapeake Bay

## **Estimation tool based on location:**

- Using data from the Chesapeake Bay Watershed model, *NutrientNet* links the user-specified field location with segment data
- Linked data includes
  - Edge of Stream coefficient
  - Delivery Factor
  - Deposition
  - BMP efficiency





# *NutrientNet* in the Chesapeake Bay

## **Baseline estimation for non-point sources:**

- Calculations based on CBWM and Nutrient Management Yardstick
- Baseline loading is equal to the total nitrogen inputs less the nitrogen that is removed through plant uptake and volatilization.

<b>Nitrogen In</b>	<b>Nitrogen Out</b>
Fertilizer	Plant Uptake
Deposition	Volatilization
Irrigation	
Excreted Manure	
Fixation	





# *NutrientNet* in the Chesapeake Bay

## **Load reductions:**

The baseline loading can be reduced by implementing one of the available BMP options:

- Cover crop
- Land conversion
- Conservation Tillage
- Filter strip
- Stream protection w/ fencing
- Stream protection w/o fencing
- Roof runoff control
- Manure management system





# *NutrientNet* in the Chesapeake Bay

## **Baseline and reduction estimates for point sources**

- Baseline loadings based on actual data from MDE and CBP
- Baseline loading depends on location in watershed
- Point Sources have three upgrade options to reduce their current load:
  - 8 mg/l
  - 5 mg/l
  - 3 mg/l







# *NutrientNet* in the Chesapeake Bay

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## Tradable credits

- Baseline loading – Mitigation = Reductions
- Conversion of reductions to credits depends on the rules of the program, e.g.:
  - *Trading ratio*
  - *Cost share*





# *NutrientNet* in the Chesapeake Bay

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## Price of credits

- For non-point sources, NN estimates cost of BMP: the minimum price at which to sell generated credits
- For point sources, NN estimates cost per credit for upgrade
- Credit supply and demand will decide at which price the buyers and sellers will meet



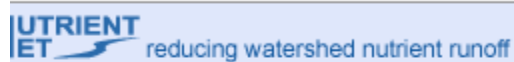


# Walkthrough of *NutrientNet*

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The next slides will take you through  
*NutrientNet*





WELCOME to **NutrientNet** - first on-line market for improving water quality through nutrient trading

project of the World Resources Institute



My NutrientNet

» About NutrientNet

» Markets

» Support

User name:

Password:

Login

Sign-up

Introduction  
FAQs  
References  
Contacts

Nutrient trading  
Potomac river / market  
Kalamazoo river / market

Getting started  
Glossary  
Forgot password?

Get started in 5 easy steps: (why sign up?)



» What is NutrientNet? Quick guide:

- Water quality & current problems
- Nutrient run-off sources
- Existing policies & regulations
- NutrientNet approach

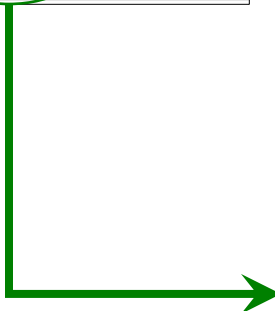


# Signing Up for *NutrientNet*

» My NutrientNet

User name:

Password:



» My NutrientNet » About Project » Markets » Support

Home > My NutrientNet > Sign up

**About NutrientNet**  
**Markets**  
**Support**

## Create a new account

Use this form to sign up and start using NutrientNet.

---

**Login information :** \* required fields

User name :  \*  
Password:  \*  
Confirm password:  \*

**Market information :**

Market:  \*  
Role:  Point source  
 Farmer

---

**Personal information:** \* required fields

E-mail:  \*      Address:   
First name:  \*      City:   
Last name:  \*      State:   
Occupation:       Zip code:   
Phone:       Country:

---

**Security code:** \* required fields

Code:  \*      Enter this number: 4 3 5 7 7 2  
(this is to prevent automatic registrations - use the number on the right for the code)

Done





# *NutrientNet* as a Farmer

First we will review *NutrientNet* from a Farmer's perspective:

**Market information :**

---

Market:

Role:  Point source  
 Farmer

---



NutrientNet - My NutrientNet - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media Print Mail Stop

Address http://www.nutrientnet.org/nn.cfm?p=nag\_home Go Search Go 16 Links

World Resources Institute WRI Main Site...

**NUTRIENT NET** reducing watershed nutrient runoff

>> My NutrientNet >> About Project >> Markets >> Support

Home > My NutrientNet

**My NutrientNet**

- My profile
- My market / history
- Sell credits
- My bids
- My offers
- Logout

## My NutrientNet Home

Use this form to add or modify your farming sites.

**Alyssa Denzer** - farmer  
 > [edit my profile](#)

**Market:** Potomac river basin    **Nutrient:** Nitrogen

1

No.	Farming site	Type	Details	Delete
1.	<a href="#">Pasture #1</a>	Pasture		

**Notes:**  
 1. To view or modify farming site details click on its name or Details icon.  
 2. To delete a site click on Delete icon.

**Follow 4 easy steps to start trading:**

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Internet

- My market history
- Sell credits
- My bids
- My offers
- Logout

- About NutrientNet
- Markets
- Support

Selected Best Management Practices

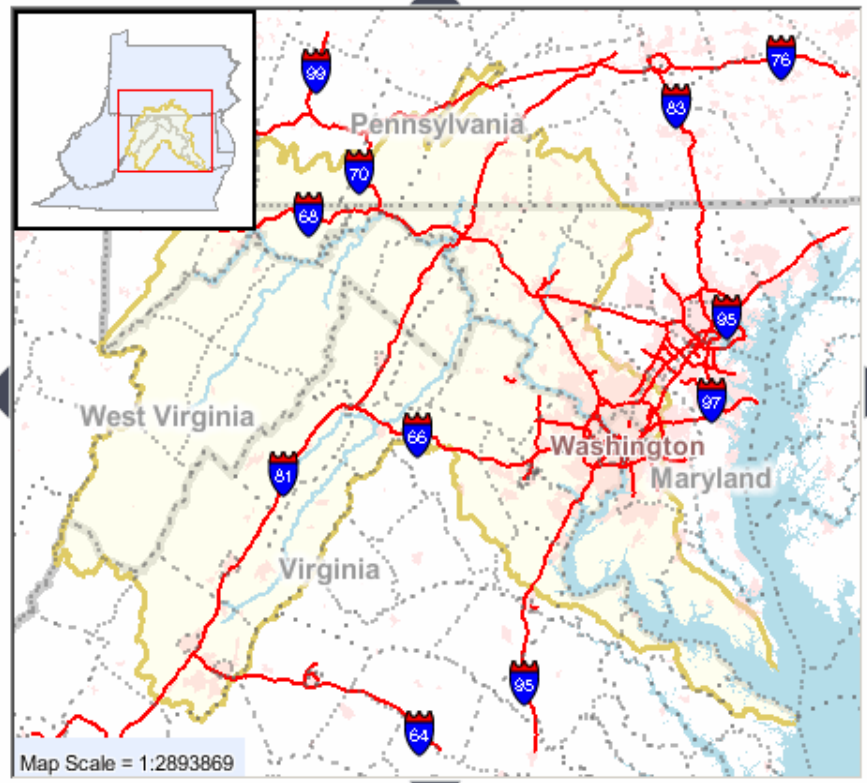
Summary	Location	Field details
---------	----------	---------------

Zoom to a ZIP Code Area  Reference Map  Aerial Photos

**Help**  
Use the map tools or ZIP code list to find your area.

**Farm Field Tools**  
Click the **start** button below to draw a new farm field boundary. Once the field is defined, click the **submit** button to proceed.

**start**  
**submit**



- STEPS:**
- 1. Zoom in**  
Click on the map to zoom in to your location area, or select a zip code from the scroll down menu.
  - 2. Define your field**  
After zooming in, press the start button, and click the boundary corners of your field. If you make a mistake or want to start drawing again, just press the start button again.
  - 3. Save location**  
Once done click Submit button to continue.
- You may also...**
- Switch between Aerial photos and Reference map modes by selecting appropriate radio box (in upper right corner).
  - Click on Zoom out icon to zoom out one level.



- Send credits
- My bids
- My offers
- Logout
- About NutrientNet**
- Markets**
- Support**

Selected Best Management Practices

Summary	Location	Field details
---------	----------	---------------

Reference Map 
  Aerial Photos

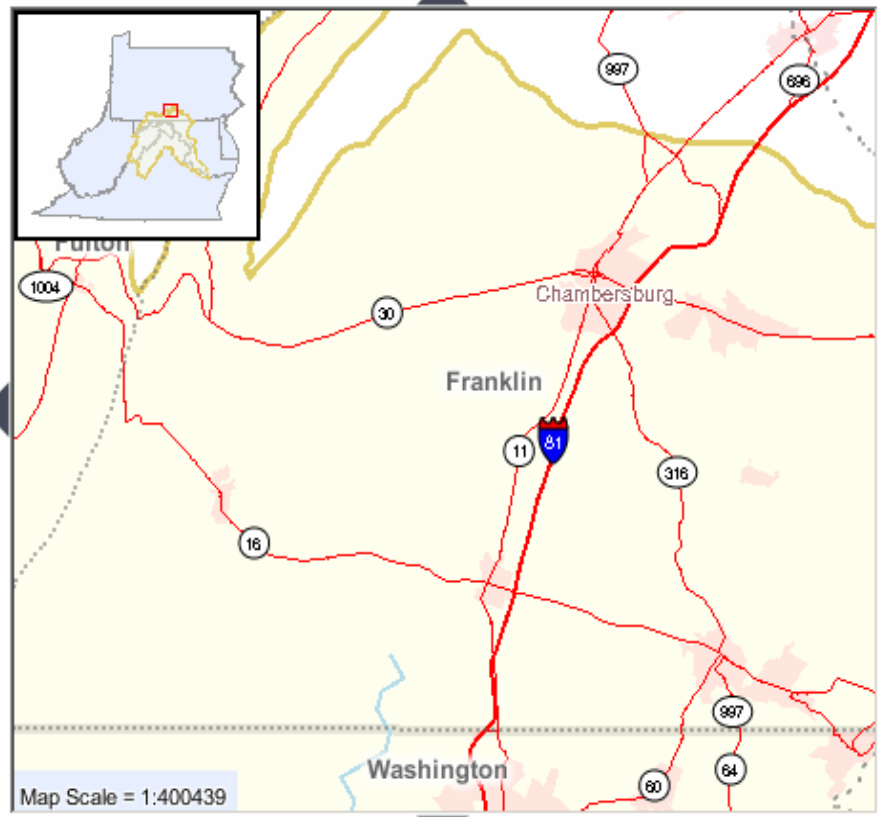
17252 (PA)

**Help**

Use the map tools or ZIP code list to find your area.

**Farm Field Tools**

Click the **start** button below to draw a new farm field boundary. Once the field is defined, click the **submit** button to proceed.



location area, or select a zip code from the scroll down menu.

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- Switch between Aerial photos and Reference map modes by selecting appropriate radio box (in upper right corner).
  - Click on Zoom out icon to zoom out one level.

NutrientNet - My NutrientNet - Field. Location - Microsoft Internet Explorer

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Back Forward Stop Home Search Favorites Media Print

Address [http://accessinitiative.org/nn/nn2/nn.cfm?p=nag\\_field\\_location&FFID=-1&g=1](http://accessinitiative.org/nn/nn2/nn.cfm?p=nag_field_location&FFID=-1&g=1) Go Links »

My bids  
My offers  
Logout

**About NutrientNet**  
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Selected Best Management Practices

Summary Location Field details

Zoom to a ZIP Code Area

Reference Map Aerial Photos

Map Scale = 1:5652

**Help**  
Use the map tools or ZIP code list to find your area.

**Farm Field Tools**  
Click the **start** button below to draw a new farm field boundary. Once the field is defined, click the **submit** button to proceed.

start  
submit

**STEPS:**

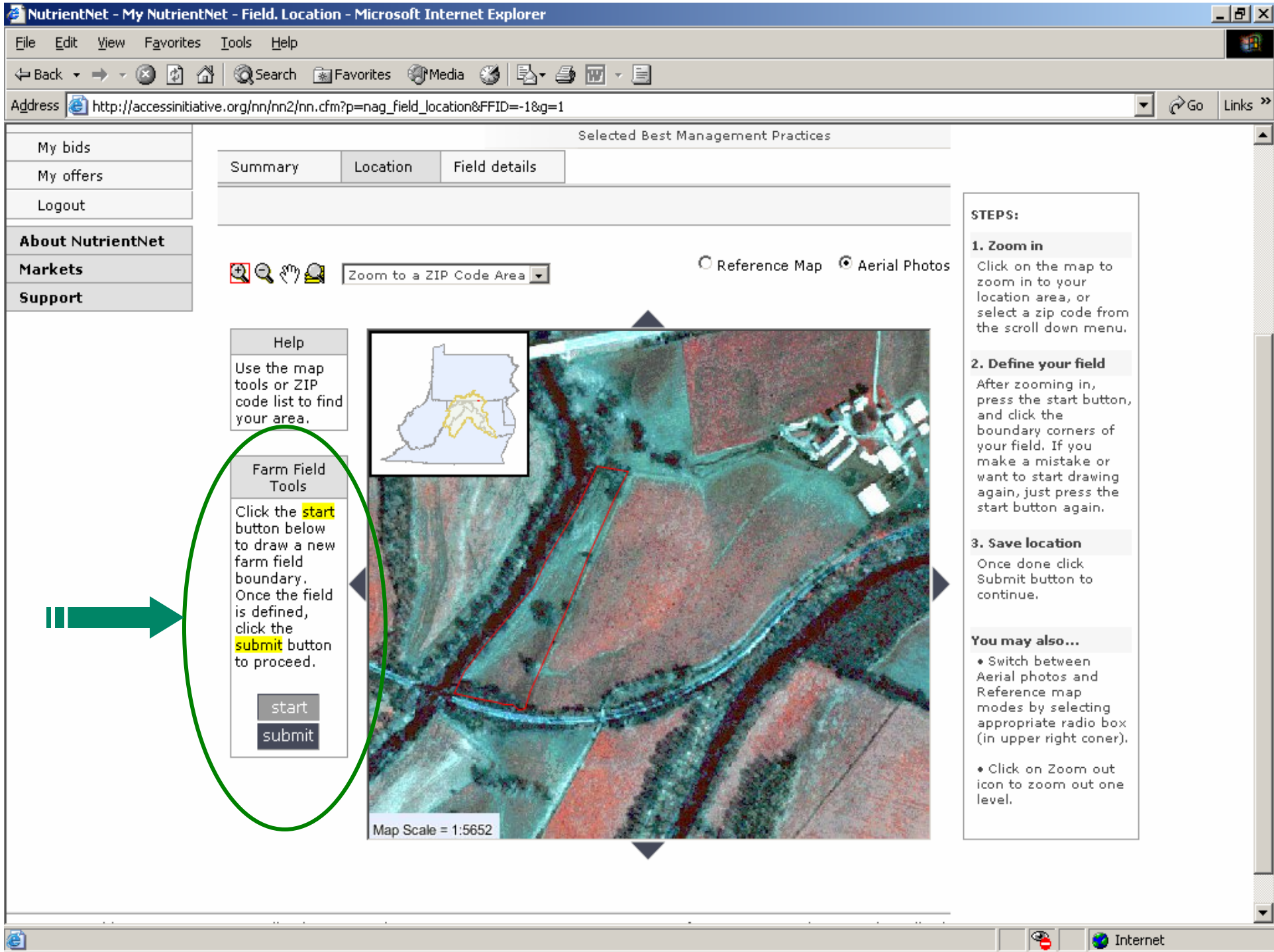
**1. Zoom in**  
Click on the map to zoom in to your location area, or select a zip code from the scroll down menu.

**2. Define your field**  
After zooming in, press the start button, and click the boundary corners of your field. If you make a mistake or want to start drawing again, just press the start button again.

**3. Save location**  
Once done click Submit button to continue.

**You may also...**

- Switch between Aerial photos and Reference map modes by selecting appropriate radio box (in upper right corner).
- Click on Zoom out icon to zoom out one level.



NutrientNet - My NutrientNet - Pasture. Details - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address [http://www.nutrientnet.org/nn.cfm?p=nag\\_pasture\\_details&ID=1004&g=1&](http://www.nutrientnet.org/nn.cfm?p=nag_pasture_details&ID=1004&g=1&) Go Search Go 0 Links >>

World Resources Institute WRI Main Site...

**NUTRIENT NET** reducing watershed nutrient runoff

>> My NutrientNet >> About Project >> Markets >> Support

Home > My NutrientNet > Pasture. Details

### My NutrientNet

- My profile
- My market / history
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## Pasture details

1 FIND LOCATION 2 ENTER SITE DETAILS 3 SELECT MITIGATIONS 4 TRADE CREDITS

Use this form to view and update your pasture details.

Selected Best Management Practices

Summary Location Pasture details

Pasture location was successfully added. Save Reset

**Pasture:** ?

Site name: Pasture #1

Pasture size (ac): 8.00

Type: permanent pasture

**Livestock:** ?

	Animal type:	Count:	Days grazed:
#1:	Milk cows	500	150
<input checked="" type="checkbox"/> #2:	Beef (fattened)	250	150
<input type="checkbox"/> #3:	Milk cows		
<input type="checkbox"/> #4:	Milk cows		
<input type="checkbox"/> #5:	Milk cows		
<input type="checkbox"/> #6:	Milk cows		

**Pasture Size** will default from the field outline drawn on the prior screen, although the value can be changed.

- My NutrientNet
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## LPA details

- 1 FIND LOCATION
- 2 ENTER SITE DETAILS
- 3 SELECT MITIGATIONS
- 4 TRADE CREDITS

Use this form to view and update your livestock production area details.

Selected Best Management Practices

- Summary
- Location
- LPA details

LPA location was successfully added. Save Reset

**LPA:** ?

Site name:

Animal confinement area (ac):

Confinement area type:

**Any of the following in place?** ?

Livestock waste management system

Poultry waste management system

**Livestock:** ?

	Animal type:	Count:
<input type="checkbox"/> #1:	Milk cows	1000
<input type="checkbox"/> #2:	Milk cows	
<input type="checkbox"/> #3:	Milk cows	
<input type="checkbox"/> #4:	Milk cows	
<input type="checkbox"/> #5:	Milk cows	
<input type="checkbox"/> #6:	Milk cows	

**Cropland available for spreading manure:** ?

	Crop type :	Acres:	Yield:
<input checked="" type="checkbox"/> #1:	Alfalfa for hay	100.00	3.30
<input type="checkbox"/> #2:	Alfalfa for hay		
<input type="checkbox"/> #3:	Alfalfa for hay		
<input type="checkbox"/> #4:	Alfalfa for hay		

Note: yield in bushels/ac, except for Alfalfa for hay - tons/ac

**Pasture:**

Do you use pasture to spread manure:  (check for yes)

Pasture area (ac):

**Animal Confinement Area** will default from the field outline drawn on the prior screen, although the value can be changed.

- My NutrientNet
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- My offers
- Logout

### Field details

1 FIND LOCATION 2 ENTER SITE DETAILS 3 SELECT MITIGATIONS 4 TRADE CREDITS

Use this form to view and update your farming field details.

Selected Best Management Practices

Summary	Location	Field details	Cover crop
---------	----------	---------------	------------

Save Reset

**Field:**

Site name:

Field area (ac):

Current crop:

Average yield (bu/ac):  (average - 75.00) ?

Do you use conservation tillage:  check for yes ?

**Fertilizer:**

Commercial fertilizer:

Application rate (lbs/ac):  (average - 772.73; as recommended by NMP) ?

Manure/Sludge applied?  (check for yes)

Manure/Sludge type:

Application rate (tons/ac):  (as recommended by NMP)

**Irrigation:**

Do you irrigate your field?  (check for yes)

Water applied (inches):

Nitrogen content (ppm):

**Field Area** will default from the field outline drawn on the prior screen, although the value can be changed.

My NutrientNet

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About NutrientNet

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## Selected BMPs



Use this form to select best management practices/mitigations.

Selected Best Management Practices

Summary Location Field details

Update BMPs Go to Summary

Field name: Field #1

Field area: 175.00 acres

Nitrogen out: 11,662 lbs

Nitrogen in: 15,785 lbs

Nitrogen baseline loading: 3,000 lbs

### Selected best management practices

- Cover crop What are these?
- Land conversion
- Conservation tillage
- Filter strip

STEPS:

**1. Select BMP**  
Click on a checkbox next to the best management practice title to select/deselect appropriate BMP for this field.

**2. View BMP effects**  
Once done with BMP selection click the update BMPs button to fill out BMP details.

**You may also...**  
» Go to the summary by clicking on the Go to Summary button.

**My NutrientNet**

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**About NutrientNet**

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**Support**

## Grass filter strip



Use this form to view and update your farming field grass filter strip details.

Selected Best Management Practices

Summary    Location    Field details    **Filter strip: grass**

Save    Reset

**BMP details:**

Strip width:  ?

Strip length (ft):

Project duration (yrs):

Interest rate (%):

**Costs:**

Maintainance (\$/ac/yr):

Opportunity cost (\$/ac/yr):  ?

Land rent (\$/ac/yr):

**Cost sharing:**

Do you participate in cost sharing?  check for yes

Contract length (yr):  ?

Sign-up bonus (\$/ac):

Establishment subsidy (\$/ac):

Land rent subsidy (\$/ac/yr):

**STEPS:**

**1. Enter BMP details**

If you are not sure about a certain value, leave a default one.

**2. Save values**

Once done click Save button to continue.

**You may also...**

» Click Reset button to restore values you started with.

» Click on question mark icon for more information about a certain field (where available).

Home > My NutrientNet > Field. Summary

**My NutrientNet**

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**About NutrientNet**

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## Field summary



Use this form to evaluate best management practices effects and place generated credits for sale.

Selected Best Management Practices

Summary	Location	Field details	Filter strip: grass
---------	----------	---------------	---------------------

**Field name:** Field #1 [200]

Field area: 175 acres  
 Nitrogen out: 11,662 lbs  
 Nitrogen in: 15,785 lbs

Nitrogen baseline loading: 3,000 lbs

**Selected best management practices**

- Cover crop What are these?
- Land conversion
- Conservation tillage
- Filter strip Grass

**Trade generated credits**

Amount:  Starting price:

**Credits & costs**

Selected BMP	Credits	Credit cost	Annual BMP cost	Cost per pound of reduction
Filter strip: grass	369	\$0.20	\$73.77	\$0.04

**Loading data**

Loading	Reductions	Loading (lbs/yr)
Baseline	--	3,000
After upgrade	58%	1,260

**STEPS:**

**1. Evaluate BMPs**

Review BMPs impact on nutrient run-off, generated reductions/credits and cost data.

**2. Sell credits**

Click Sell button to place market order to sell credits generated by BMPs. Note that you may adjust credit amount and starting price. (Available only if BMPs generate any credits).

**You may also...**

- » Click on appropriate tab to review/update farming field Location, Details and BMP data.
- » Switch between Basic/Detailed BMP summary view modes.

During the trading exercise, as you evaluate different BMPs, you may want to record these figures to facilitate comparisons between the options.





**My NutrientNet**

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## Sell credits

Use this form to review and confirm your offer to sell credits details.

**Offer details :**

Credit amount:	<input type="text" value="369"/>	Market:	Potomac river basin
Starting price:	<input type="text" value="0.20"/>	Nutrient:	Nitrogen
Offer closes:	<input type="text" value="8/13/2004"/> <input type="text" value="8 AM"/> <input type="text" value="ET"/>		
Reserve:	<input type="text"/> (blank for none)		
Buy now price:	<input type="text"/> (blank for none)		

**Notes:**

1. **Starting price** - minimum price you want the bidding to start at.
2. **Reserve price** - minimum price you want to sell the credits for.
3. **Buy now price** - price you agree to sell credits for right away, without waiting for the offer to expire.
4. **Offer closes** - date and time when offer expires.

**My NutrientNet**

- My profile
- My market / history
- Sell credits
- My bids
- My offers**
- Logout

## My offers

Your sell offers with up-to-date details are listed below.

--

### My current offers

	Credits	Price	Buy now	Bids	Time left	Reserve
<a href="#">details</a>	77	\$9.84	-	-	14h 49m	-
<a href="#">details</a>	369	\$0.20	-	-	14h 49m	-
<a href="#">details</a>	3,325	\$7.37	-	1	14h 49m	-
<a href="#">details</a>	719	\$1.88	-	-	14h 49m	-
<a href="#">details</a>	396	\$0.70	\$3.25	-	14h 49m	-

### My closed offers

Ended with	Credits	Final price	Buy now	Bids	Ended
No records found.					



# *NutrientNet* as a Point Source

Now let's take a look at the NutrientNet site from a Point Source's perspective, as defined by the user profile:

**Market information :**

---

Market:

Role:  Point source  
 Farmer

---



Home > My NutrientNet

**My NutrientNet**

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- My market / history
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**About NutrientNet**

**Markets**

**Support**

## My NutrientNet Home

Use this form to add or modify your point sources.

**Alyssa Denzer** - point source  
» [edit my profile](#)

**Market:** Potomac river basin    **Nutrient:** Nitrogen

Add point source



No. Point source      Details    Delete

No point sources found.

### Follow 4 easy steps to start trading:



#### YOUR OPTIONS:

**1. Add point source**

Click Add point source button.

**2. Review/edit PS**

In case you already have point sources in your account, click the point source name to review or edit its data.

**2. Delete point source**

In case you already have point sources in your account, click on appropriate trash can icon to delete the point source.

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Site details



Use this form to view and update your point source site details.

Summary Site details Upgrade details

Save Reset

Select your facility:

Water treatment plant: PA - Hyndman Borough

Facility data:

Design flow (mgd): 0.1040

Nitrogen concentration (mg/l): 11.11

Regulations:

Loading limit (mg/l): 4.00

Notes:

- Select a facility from the drop down box. Facility design flow and concentration will be updated automatically.
- Set loading limit concentration for your facility.

STEPS:

1. Enter site details

If you are not sure about a certain value, leave a default one.

2. Save values

Once done click Save button to continue.

You may also...

» Click Reset button to restore values you started with.

PA - Hyndman Borough  
MD - Seneca Creek  
MD - Taneytown  
MD - Thurmont  
MD - Westminster  
MD - Winebrenner  
PA - Antrim Township  
PA - Chambersburg Borough  
PA - Franklin County Authority-Greencastle  
PA - Gettysburg Municipal Authority  
PA - Hyndman Borough  
PA - Littlestown Borough

**My NutrientNet**

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## Upgrade details



Use this form to view and update your point source site upgrade details.

- Summary
- Site details
- Upgrade details

Save Reset

**Facility upgrade details:**

Water treatment plant: Hyndman Borough

Would you like to upgrade  check for yes

Upgrade to: 5 mg/L

**Cost to upgrade facility:**

Capital cost (\$): 245014

Annual O&M (\$): 5719

**Economics:**

Amortization period (yr): 20

Interest rate (%): 1.60

**Loading data**

Loading	Concentration	Loading (lbs/yr)	
Current	11.11 mg/l	3,518	
Limit	4.00 mg/l	1,266	
After upgrade	5.00 mg/l	1,583	

**STEPS:**

**1. Evaluate options**

Evaluate available nutrient treatment upgrade options.

**2. Select upgrade**

Choose nutrient treatment upgrade from the drop box.

**3. Review cost data**

Check the upgrade cost data and modify if necessary.

**4. Save to continue**

Click save button to continue.

**You may also...**

» Click on reset button to restore default values.



Home > My NutrientNet > Site. Summary

<b>My NutrientNet</b>
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<b>Markets</b>
<b>Support</b>

## Site summary



Use this form to view your point source site summary.

Summary	Site details	Upgrade details
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**Facility:** PA - Hyndman Borough

Upgraded:	yes	Total annual cost:	\$20,131
Upgraded to:	5 mg/L	Generated credits:	-200
Reductions:	1,935 lbs	Credit cost:	--

**STEPS:**

- 1. Review data**  
Review cost and upgrade results.
- 2. Sell credits**  
Review credit amount and starting price date, click Sell button to continue.

**You may also...**

» Click on appropriate tab to review/update point source details or upgrade options.



**Negative credit balance**

Currently you need **200** credits to comply with the loading limit.  
 You may buy needed credits on the market. [Click here](#) to go to your [market](#).  
 Or you may upgrade your facility. [Click here](#) to [upgrade](#).

### Loading data

Loading	Concentration	Loading (lbs/yr)	
Baseline	11.11 mg/l	3,518	<div style="width: 100%; background-color: blue; height: 10px;"></div>
Limit	4.00 mg/l	1,266	<div style="width: 36%; background-color: blue; height: 10px;"></div>
After upgrade	5.00 mg/l	1,583	<div style="width: 50%; background-color: blue; height: 10px;"></div>



# Viewing the Market

- After establishing that the Point Source will need to buy credits, the next step is to view the **Market**
- *My Market* displays credits for sale and current bids

## Negative credit balance

Currently you need **200** credits to comply with the loading limit.

You may buy needed credits on the market. [Click here](#) to go to your [market](#).

Or you may upgrade your facility. [Click here](#) to [upgrade](#).





Home > Marketplace

**My NutrientNet**

- My profile
- My market / history
- Sell credits
- My bids
- My offers
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## Nitrogen market: Potomac river basin

Welcome to the Nitrogen marketplace. Offers to sell credits are listed below.

	Credits	Price	Buy now	Bids	Time left	Reserve
<a href="#">Bid</a>	77	\$9.84		-	15h 13m	-
<a href="#">Bid</a>	369	\$0.20		-	15h 13m	-
<a href="#">Bid</a>	3,325	\$7.37		-	15h 13m	-
<a href="#">Bid</a>	719	\$1.88		-	15h 13m	-
<a href="#">Bid / Buy now</a>	396	\$0.70	<b>\$3.25</b>	-	15h 13m	-

**My Market** is accessed either via the link shown on the previous slide, or via clicking **My Market** on the sidebar to the left.

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## Buy credits

Use this form to place a bid for an offer.

### Offer information :

Credit amount: 3325  
Seller: adenzer [e-mail seller](#) Nutrient: Nitrogen  
Starting price: \$7.37 Market: Potomac river basin  
Highest bidder: Bids so far: 0  
Current price: \$7.37  
Offer closes: 08/13/04 8:08 In: 14h 55m

**Your maximum bid:**  Enter **\$7.37** or more.

NutrientNet automatically bids on your behalf up to your maximum bid. [Learn about bidding](#)

Place bid

Home > My NutrientNet > My bids

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## My bids

Your bids with up-to-date details are listed below.

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### Auctions I'm bidding on

High bidder	Credits	Price	Buy now	Bids	Time left	Reserve
<a href="#">Me !</a>	3,325	\$7.37	-	1	14h 51m	-

### Auctions I've won

Ended with	Credits	Final price	Buy now	Bids	Ended
No records found.					

### Auctions I haven't won

Ended with	Credits	Final price	Buy now	Bids	Ended
No records found.					