Minnesota Pollution Control Agency

January 8, 1997

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Robert S. Micheletti
Vice President - Operations
Rahr Malting Company
800 West First Avenue
Shakopee, Minnesota 55379

RE: FINAL ISSUANCE NPDES/SDS PERMIT MN 0031917
Rahr Malting Company - Shakopee, Minnesota

Dear Mr. Micheletti:

We are enclosing the final issued National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) water quality permit for your facility. This reissued permit supersedes the previous NPDES/SDS permit that was issued on August 4, 1992.

Discharge Monitoring Report forms to be used in reporting the required monitoring and analyses will be sent to you within 45 days of permit issuance. Please contact us if you have not received these report forms at least one week before your first required report submittal date.

Compliance with the terms and conditions of this permit is required as of the date of issuance.

If you have any questions concerning the final permit or related materials, please contact Bruce Henningsgaard at (612) 296-9289.

Sincerely,

Russell C. Felt

Russell C. Felt, Supervisor
Point Source Compliance Section
Water Quality Division

RCF:mbo
Enclosure: Final Issued Permit
cc: The Honorable Jeff Henderson, Mayor, City of Shakopee (w/final issued permit)
Ms. Rebecca Flood, Metropolitan Council-Environmental Services (w/final issued permit)
U.S. Environmental Protection Agency, Chicago (w/final issued permit)

STATE OF MINNESOTA

Minnesota Pollution Control Agency

WATER QUALITY DIVISION

National Pollutant Discharge Elimination System (NPDES) and State Disposal System (SDS) Permit MN 0031917

PERMITTEE: Rahr Malting Company

FACILITY NAME: Rahr Malting Company

RECEIVING WATERS: Minnesota River

CITY/TOWNSHIP: Shakopee **COUNTY: Scott**

ISSUANCE DATE: January 8, 1997 **EXPIRATION DATE: January 8, 2002**

The State of Minnesota, on behalf of its citizens through the Minnesota Pollution Control Agency (MPCA), authorizes the Permittee to construct, install and operate a disposal system at the facility named above, and to discharge from this facility to the receiving waters named above, in accordance with the requirements of this permit.

The goal of this permit is to protect water quality according to Minnesota and U.S. statutes and rules, including Minnesota Statutes chapters 115 and 116, Minnesota Rules chapters 7001, 7050 and 7060, and the U.S. Clean Water Act.

This permit is effective on the issuance date identified above, and supersedes the previous permit that was issued for this facility on August 4, 1992.

This permit expires at midnight on the expiration date identified above.

Signature: _____

Marvin E. Hora, Manager
Point Source Compliance Section
Water Quality Division

for

Peder A. Larson
Acting Commissioner
Minnesota Pollution Control Agency

If you have questions on this permit, including the specific permit requirements, permit reporting or permit compliance status, please contact:

Minnesota Pollution Control Agency
Water Quality Division, Point Source Compliance Section
520 Lafayette Road North
St. Paul, MN 55155-4194
Telephone: (612) 296-6300
Fax: (612) 297-8683
Telephone Device for Deaf (TTY): (612) 282-5332

Table Of Contents

Summary of Required Reports

21st day of each month	Monitoring report due
31st day of January	Annual $CBOD_5$ Load Reduction Monitoring report due

I. PERMITTED FACILITY DESCRIPTION

I.A.Written Description The principal activity at this facility is the conversion of barley to barley malt for use in brewing, distilling, and malting food industries. Approximately 2.5 million pounds of barley is converted into 2.1 million pounds of malt per day. The facility has an annual production capacity of approximately 23 million bushels of malt.

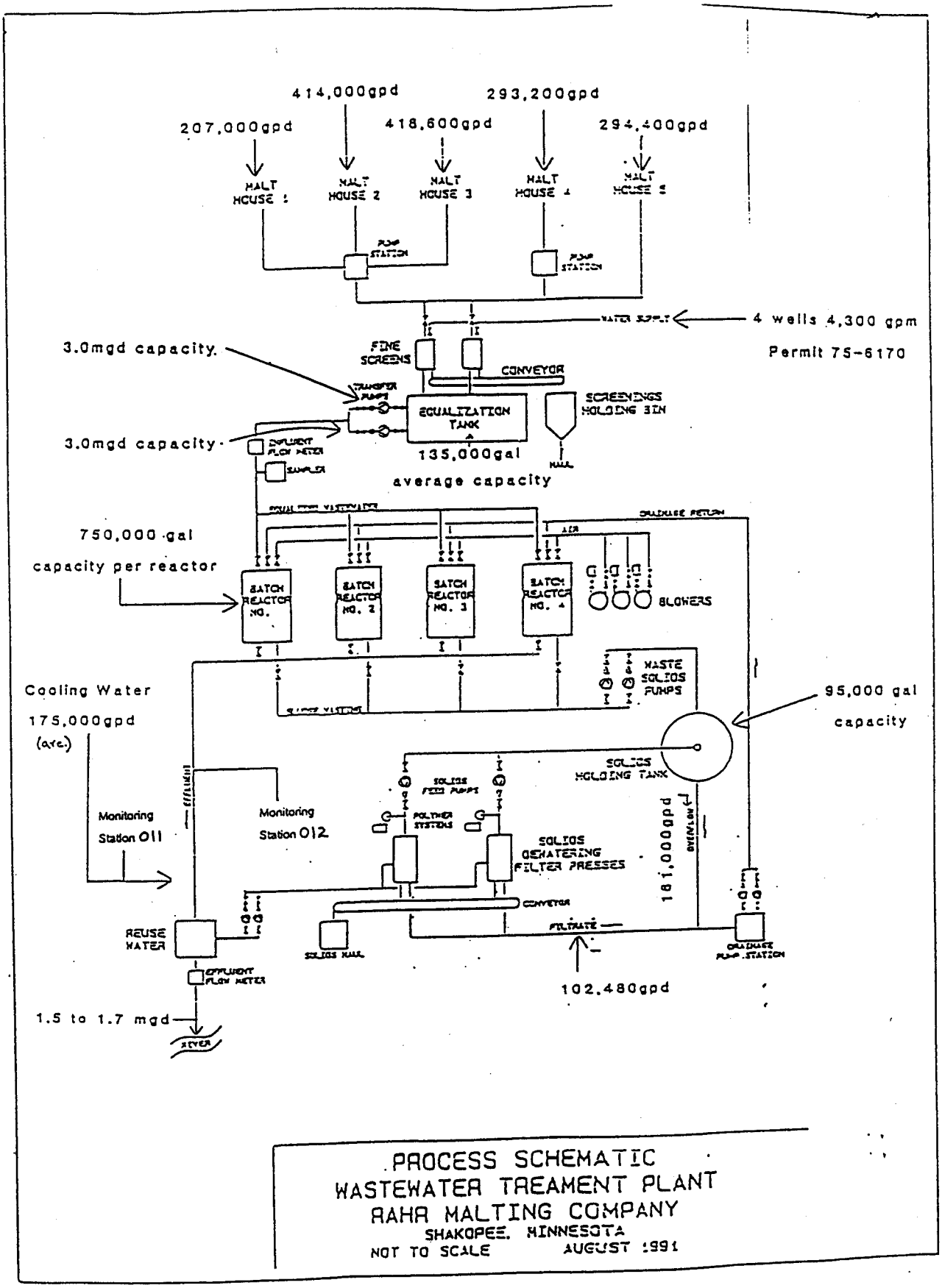
The noncontact cooling water discharge consists of untreated well water which is discharged to the Minnesota River (Class 2B) at an average rate of 1,500,000 gallons per day and a maximum rate of 3,500,000 gallons per day.

The proposed project is to construct and operate a wastewater treatment facility to treat all of the process wastewater generated by the plant. The plant will include two fine screens, an equalization tank, four sequencing batch reactors, a solids holding tank and two solids dewatering filter presses. The facility will be designed to treat an average flow of 1,500,000 gallons per day and a maximum flow of 2,500,000 gallons per day.

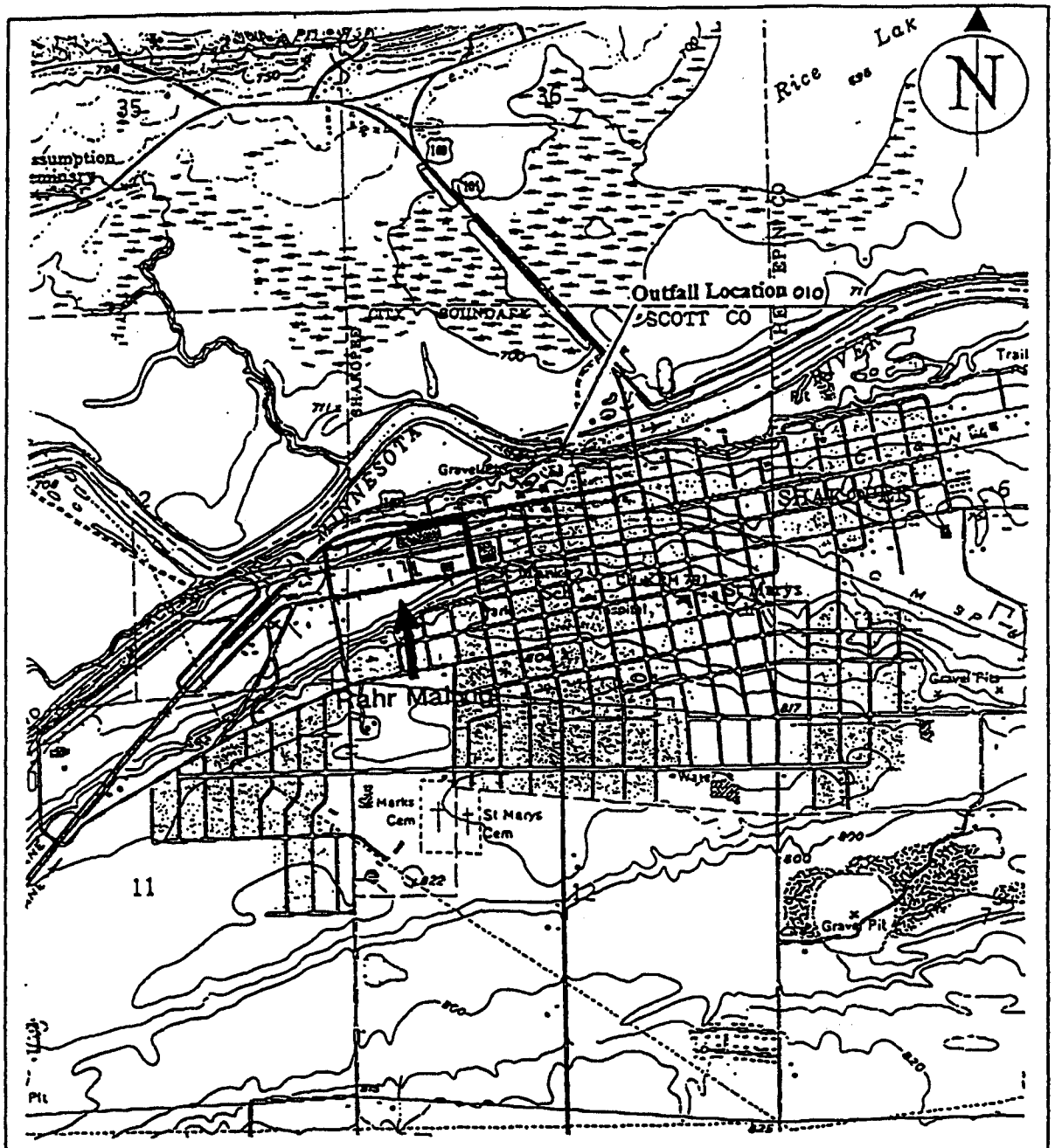
Both the noncontact cooling water and the treated process wastewater will discharge to the Minnesota River (Class 2B) through the same pipe. However, all sampling will be done prior to the mixing point. The noncontact cooling water discharge will be monitored at station 011. The process wastewater treatment facility effluent will be monitored at station 012. Sanitary wastes discharge to the municipal sanitary sewer.

The location of the facility and the designated monitoring stations is shown on the facility and watershed/basin maps below.

I.B. Flow Diagram



I.C. Topographic Map of Permitted Facility



Source: U.S.G.S. Quadrangle Map
Shakopee, Minnesota
SE/4 Minnetonka 15' Quadrangle

Topographic Site Map
Rahr Malting Company
Shakopee, Minnesota

Date
5/9/96

I.D. Designated Monitoring Stations

Station Number	Type of Station Monitored	Township/Range Location
011	Noncontact Cooling Water Discharge	SE¼, SE¼, NW¼, Section 1, T.115N., R.23W.
012	Wastewater Treatment Facility Effluent Discharge	SE¼, SW¼, NE¼, Section 1, T.115N., R.23W.

II. FACILITY-SPECIFIC REQUIREMENTS

II.A. Monitoring and Limits

II.A.1. Discharge Limits and Monitoring Station Number 011

The Permittee is authorized to discharge from outfall 010. This discharge shall be a mixture of noncontact cooling water and process wastewater treatment plant effluent, as described in Part I. Each effluent shall be monitored separately and prior to their combining. Station Number 011 shall be for monitoring noncontact cooling water.

The Permittee shall monitor Station Number 011 and comply with the limits as specified below:

Characteristics	Discharge Limitations		Minimum Sampling Frequency	Sample Type
	Monthly Average	Maximum		
Flow Rate (million gallons/day)	1.5	3.5	Weekly	Daily Average Flow Estimate
Temperature	----	30 degrees C.	Weekly	Instantaneous
pH (1)	----	----	Weekly	Grab

(1) The pH level shall be no less than 6.0 nor greater than 9.0 standard units; these upper and lower limits are not subject to averaging. The pH shall be measured at the time of sampling.

Floating solids or visible foam shall not be discharged in other than trace amounts.

Oil or other substances shall not be discharged in amounts that create a visible color film.

The Permittee shall install and maintain outlet protection measures at the discharge station to prevent erosion.

Samples for this station shall be taken at: Station Number 011.

II.A.2. Discharge Limits and Monitoring Station Number 012

a. The Permittee is authorized to discharge from outfall 010. This discharge shall be a mixture of process wastewater treatment plant effluent and noncontact cooling water, as described in Part I. Each effluent shall be monitored separately and prior to their combining. Station Number 012 shall be for monitoring process wastewater treatment plant effluent.

The Permittee shall monitor Station Number 012 and comply with the limits as specified below:

Characteristics	Mass Limits		Concentration Limits		Minimum Sampling Frequency	Sample Type
	Monthly Average	Maximum	Monthly Average	Maximum		
Flow Rate (million gallons/day)	1.5	2.5	----	----	Daily	Continuous
Total Suspended Solids (TSS)	171 kg/day	426 kg/day	30 mg/L	45 mg/L	3 X week	24 hr. comp.
5-Day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	68 kg/day	171 kg/day	12 mg/L	18 mg/L	3 X week	24 hr. comp.
Ammonia (N) May June July-September October November December-April	 51 Kg/day 68 Kg/day 11 Kg/day 28 Kg/day 40 Kg/day ----		 9 mg/l 12 mg/l 2 mg/l 5 mg/l 7 mg/l ----		3 X week	24 hr. comp.
Phosphorus	11 Kg/day	----	2 mg/l	----	3 X week	24 hr. comp.
pH (1)	----	----	----	----	3 X week	Grab
Dissolved Oxygen April-November December-March	6 mg/l (minimum) calendar week average (2) 7 mg/l (minimum) calendar week average (2)				Daily	Grab

(1) The pH level shall be no less than 6.0 nor greater than 9.0 standard units; these upper and lower limits are not subject to averaging. The pH shall be measured at the time of sampling.
(2) Applicable when river flow at Jordan USGS gauging station is less than 20,000 cfs.

Floating solids or visible foam shall not be discharged in other than trace amounts.

Oil or other substances shall not be discharged in amounts that create a visible color film.

The Permittee shall install and maintain outlet protection measures at the discharge station to prevent erosion.

Samples for this station shall be taken at: Station Number 012.

b. The Permittee is authorized to discharge $CBOD_5$ in accordance with the following effluent limitations in addition to those in Part II.A.2.a. One unit of trading credit is the equivalent of 1 pound per day of $CBOD_5$ discharged.

1. The Permittee shall comply with the cumulative $CBOD_5$ nonpoint load reduction specified in the table below or obtain $CBOD_5$ nonpoint load reduction equal to or greater than its actual $CBOD_5$ discharge. The actual $CBOD_5$ discharge shall be measured as the annual average or the highest monthly average when the river flow at the Jordan USGS gauging station is less than 500 cfs as a monthly mean during June through September, whichever is greater.

DATE	NONPOINT LOAD REDUCTION	CUMULATIVE
December 31, 1997	0 units	0 units
December 31, 1998	30 units	30 units
December 31, 1999	30 units	60 units
December 31, 2000	30 units	90 units
Permit Expiration Date	60 units*	150 units

* The Permittee has accepted a phosphorus limit of 2 mg/l instead of the 3 mg/l limit MPCA would otherwise propose at this time. Due to this, a 30 unit credit may be applied to the cumulative load reduction during the year 2001 and subsequent years provided the Permittee's phosphorus limit remains 2 mg/l or less. In addition, up to 10 units of the phosphorus credit may be used in either 1998, 1999, or 2000 for permit compliance purposes to satisfy any shortfall in the year's nonpoint source load reduction requirement. The Permittee has accepted a year-round $CBOD_5$ limit of 12 mg/l instead of the limit MPCA would otherwise propose at this time of 12 mg/l $CBOD_5$ from June through September and 25 mg/l $CBOD_5$ from October through May. Due to this, a 30-unit credit may be applied to the cumulative value for the year 2001 and subsequent years provided the Permittee's year-round $CBOD_5$ limit remains 12 mg/l or less.

2. The Permittee shall obtain 20 units of nonpoint load reduction prior to start-up of their wastewater treatment facility if start-up is after December 31, 1997;

3. The Permittee shall spend all of the $250,000.00 dedicated to $CBOD_5$ nonpoint source load reduction within 5 years of permit issuance to obtain $CBOD_5$ nonpoint source load reduction by implementing projects approved by the MPCA. If 150 units of actual nonpoint source load reduction are obtained for less than $250,000.00 during the five-year period, the time period for full expenditure of the $250,000.00 will be extended to ten years from the date of permit issuance.

4. The Permittee shall achieve the nonpoint source load reduction units specified above by undertaking projects subject to (1) land purchase or (2) easement(s) or other contractual obligation(s) in place for the duration of $CBOD_5$ discharge. Projects shall be Soil Erosion BMP's, Livestock Exclusion, Rotational Grazing With Livestock Exclusion, Critical Area Set Aside or Wetland Treatment Systems. The Permittee shall submit such proposed projects to the MPCA for review in accordance with the Point-Nonpoint Source Trading Summary dated January 8, 1997, and the Nonpoint Source Crediting Calculations dated January 8, 1997. The permit language shall control if any inconsistency arises from the referenced pollutant trading documents. The Commissioner is solely responsible for determining the amount of creditable $CBOD_5$ nonpoint source load reduction to be credited for projects. The Permittee shall obtain written approval for each project from the Commissioner.

5. If the Permittee has not obtained 150 nonpoint source load reduction units within the term of this permit because the Permittee's actual $CBOD_5$ discharge, in accordance with Part II.A.2.b.1, is less than 150 pounds per day and if the Permittee is authorized to continue to discharge 150 pounds per day $CBOD_5$, the Permittee shall obtain the remainder of the 150 nonpoint source load reduction units within 10 years of the issuance of this permit.

6. The Permittee may request the Commissioner to modify Part II.A.2.b.1. of this permit for schedule revisions in the event that the Permittee does not commence construction of its wastewater treatment facility by September 1, 1999.

II.B. Reporting

II.B.1. The Permittee shall submit an Annual $CBOD_5$ Nonpoint Load Reduction Monitoring Report each year that the Permittee discharges $CBOD_5$ (including years beyond the term of this Permit) by January 31 to the following address:

Point Source Compliance Section
Water Quality Division
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, Minnesota 55o8

The monitoring report shall verify compliance with the Permittee's effluent limitation for $CBOD_5$ nonpoint load reduction in accordance with Part II.A.2.

II.B.2 The Permittee shall provide monthly monitoring reports to the MPCA at the address on page 1. The Permittee shall provide this report even if no monitoring or discharges occurred during the previous month.

II.B.3. Reports shall be received or postmarked before the 22nd day of the month that follows the month in which the monitoring was done. (For example, the results from the May monitoring shall be received or postmarked before June 22 for delivery to the MPCA.)

II.B.4. Reports shall include complete monitoring results from all monitoring completed during the month before the report is submitted

II.C. Special Requirements

II.C.1. Separate Monitoring

The Permittee shall monitor both waste streams separately prior to their combining into one discharge. This is with the exception of temperature and dissolved oxygen. These two parameters may be monitored after the waste streams have been combined. The exact location for monitoring dissolved oxygen and temperature shall be included as a part of the plans and specifications required in Part II.D.

II.C.2. Solids and Sludge Plan

The Permittee shall provide a Plan for solids and/or sludge management and disposal to the MPCA, for review and approval. This Solids and Sludge Plan shall be prepared according to Part III.D.7 and incorporated into the plans and specifications required in Part II.D.1. Proposals to modify this Plan shall be approved by the MPCA at least 90 days before the proposed changes are implemented.

II.D. Construction

II.D.1. This permit only authorizes the construction of treatment works to achieve compliance with the permit requirements. The Permittee shall obtain written MPCA approval of the final design plans and specifications before this construction begins.

II.D.2. The Permittee shall perform the actions and conduct the activities authorized by this permit according to the design plans and specifications approved by the MPCA, and in compliance with the permit requirements.

II.E. Operator Certification

An operator with a class B certification shall directly supervise the disposal system, according to Minn. R. chs. 7048 and 9400. Information on operator certification is available from the MPCA at (612) 296-8868.

If the Permittee chooses to meet operator certification requirements through a contractual agreement, the Permittee shall provide a copy of the contract to the MPCA. Such a contract shall include:

a. The certified operator's name, business, and certificate number.
b. The contract period and renewal provisions.
c. The number of facility visits per month, and the time span of each visit.
d. The operator's responsibilities.
e. Provisions to notify the MPCA at least 30 days before the contract ends.

The Permittee shall notify the MPCA no later than 30 days after a change in operator certification or contract status.

III. STANDARD REQUIREMENTS

III.A. Definitions

"Act" means the federal Clean Water Act, as amended, 33 U.S. Code 1251 et seq.

"Annual Average" means the arithmetic mean of all samples collected during one calendar year expressed in pounds per day. The arithmetic mean concentration shall be flow-weighted, calculated by: a) multiplying each individual sample concentration times its respective individual flow; b) adding all such calculations for samples taken during the year; and c) dividing by the sum of the respective individual flows.

"Bypass" means, for National Pollutant Discharge Elimination System (NPDES) permits, an intentional diversion of a waste stream from a portion of the treatment works.

"Composite" sample type means:

a. A series of grab samples collected at least once per hour at equally spaced time intervals, and proportioned together relative to the flow volume of each grab sample; or

b. A combination of equal volume grab samples, each collected after a predetermined volume of flow has passed (such as 25-milliliter samples after each 1,000 gallons of flow).

c. For sludge, sediment, manure, soil or other solids, a set of grab samples combined from different locations so as to be representative of the whole monitored volume.

"Grab" sample type means an individual sample collected at one point in time.

"Instantaneous" sample type means a measurement, such as for flow or temperature, taken at the time of sampling for chemical characteristics.

"Maximum" means the greatest sample value recorded during the designated monitoring period.

"Monthly Average" means the arithmetic mean of all samples collected during one calendar month. For fecal coliform, the monthly average means the geometric mean of all samples collected during one calendar month. The arithmetic mean concentration shall be flow-weighted, calculated by: a) multiplying each individual sample concentration times its respective individual flow; b) adding all such calculations for samples taken during the month; and c) dividing by the sum of the respective individual flows.

"MPCA" means the Minnesota Pollution Control Agency, or Minnesota Pollution Control Agency staff as delegated by the Minnesota Pollution Control Agency.

"Permittee" means the entity identified as "permittee" on page 1 of this permit.

"Upset" means an exceptional incident in which the permit discharge limits are unintentionally and temporarily exceeded due to factors beyond the reasonable control of the Permittee.

"Weekly Average" means the arithmetic mean of all samples collected during one calendar week. For fecal coliform, the weekly average means the geometric mean of all samples collected during one calendar week. The arithmetic mean concentration shall be flow-weighted, calculated by: a) multiplying each individual sample concentration times its respective individual flow; b) adding all such calculations for samples taken during the week; and c) dividing by the sum of the respective individual flows.

III.B. Monitoring

III.B.1. Samples and measurements required by this permit shall be representative of the monitored activity.

III.B.2. Sample preservation and analysis procedures shall be those approved under 40 Code of Federal Regulations (CFR) Part 136. A laboratory appropriately certified by the Minnesota Department of Health shall conduct the laboratory analyses, according to Minn. R. 4740.2040. Information on laboratory certification is available from the Minnesota Department of Health at (612)623-5243. Dissolved oxygen, pH, temperature and total residual chlorine analyses shall be conducted as soon as practicable after sample collection, and no later than one hour after collection; these analyses do not need to be done by a certified laboratory.

III.B.3. The monitoring and analytical instruments used to monitor for permit compliance, including pH and flow measurement devices, shall be regularly calibrated and maintained so as to ensure accuracy. The Permittee shall maintain written records of all calibration and maintenance.

III.B.4. The Permittee shall maintain the following records for each sample and measurement:

a. The exact place, date and time of the sample or measurement;
b. The date of analysis;
c. The individuals who performed the sample collection, measurement, analysis, or calculation;

d. The analytical techniques, procedures and methods used; and
e. The analytical results.

III.B.5. If a characteristic is monitored at any of the monitoring stations designated in Part II.A more frequently than this permit requires, the Permittee shall include the results and monitoring frequency on the report to the MPCA for that monitoring period.

III.C. Reporting

III.C.1. Monitoring results shall be reported in the units specified by this permit (see Part II.A), on a Discharge Monitoring Report (DMR) form or other report form provided by the MPCA.

III.C.2. The Permittee or the duly authorized representative of the Permittee shall sign the reports and documents submitted to the MPCA by the Permittee.

III.C.3. A person who knowingly makes a false statement on a report, or tampers with a monitoring device or method, is subject to criminal and civil penalties.

III.C.4. The reports required by this permit are available for public review at the MPCA St. Paul office, except for information determined to be confidential according to 40 CFR Parts 2 and 122.7, and Minn. Stat. ch. 116.075, subd. 2. Effluent data are not considered confidential. A request for confidentiality shall be submitted according to Minn. R. 7000.1300.

III.C.5. The Permittee shall keep the records required by this permit for at least three years, including any calculations, original recordings from automatic monitoring instruments, and laboratory sheets. The Permittee shall keep the records of sludge use and disposal activities for five years. The Permittee shall extend these record retention periods upon request of the MPCA, and/or during the course of an unresolved enforcement action.

III.C.6. The Permittee shall provide to the MPCA any information requested to determine permit compliance.

III.D. Operation and Maintenance

III.D.1. If the Permittee determines that emergency operational assistance is needed, the Permittee shall notify the Minnesota Department of Public Safety Duty Officer at 1(800)422-0798 or (612) 649-5451. The Permittee shall provide the pertinent information regarding the emergency. If there is a life threatening situation, the Permittee shall first call 911, or contact other local public safety services.

III.D.2. Maintenance of the treatment works that may degrade water quality shall be scheduled during non-critical water quality periods.

III.D.3. The Permittee shall properly operate and maintain the systems used to achieve permit compliance. Proper operation and maintenance includes effective performance, adequate funding, adequate staffing and training, and adequate process and laboratory controls, including appropriate quality assurance procedures.

III.D.4. The Permittee shall construct, operate and maintain adequate backup and support systems to achieve permit compliance, such as alternative power sources, auxiliary treatment works and sufficient storage volume for untreated wastes.

III.D.5. The Permittee shall prevent routing pollutants from the facility to a municipal sanitary sewage treatment system, except according to pretreatment standards specified by the MPCA and the municipal authority. The Permittee shall prevent routing pollutants from the facility to a municipal sanitary sewage treatment system

such that the pollutants interfere with, pass through inadequately treated, or are otherwise incompatible with, the treatment system.

III.D.6. The Permittee shall obtain the prior approval of the MPCA before increasing the use of a chemical additive identified in Part I, or using a chemical additive not identified in Part I. "Chemical additive" includes processing reagents, water treatment products, cooling water additives, freeze conditioning agents, chemical dust suppressants, detergents and solvent cleaners used for equipment and maintenance cleaning, among other materials. The Permittee shall request approval from the MPCA in writing, at least 30 days before the proposed increased use or new use of a chemical additive. This written request shall include at least the following information for the proposed additive:

a. Material Safety Data Sheet, and complete product use and instruction label.
b. Commercial name, and chemical name of all ingredients.
c. Aquatic toxicity, and human health or mammalian toxicity data.
d. Environmental fate information, including, and not limited to, persistence, half-life, intermediate breakdown products, and bioaccumulation data.
e. Whether the material is a suspected carcinogen, mutagen or teratogen.
f. The proposed method, concentration, and average and maximum rates of use.
g. If applicable, the number of cycles before wastewater bleedoff.
h. If applicable, the ratio of makeup flow to discharge flow.

This permit may be modified to restrict the use or discharge of a chemical additive.

III.D.7 The Permittee shall dispose of or utilize solids, sediments, sludges, filter backwash, screenings, oil, grease and other substances so that pollutants do not enter surface waters or ground waters of the state. The MPCA may require the Permittee to provide, for review and approval, a plan for such disposal or utilization. A site used for sludge disposal or utilization shall be authorized by an MPCA permit or letter of approval before disposal or utilization begins at the site.

III.D.8. The Permittee shall comply with all applicable water quality, air quality, solid waste and hazardous waste statutes and rules in operation and maintenance of the facility.

III.E. Upsets

III.E.1. If the Permittee wishes to establish an affirmative defense to MPCA enforcement action due to an upset, the Permittee shall demonstrate the following:

a. The specific cause of the upset.
b. That the upset was unintentional.
c. That the upset resulted from factors beyond the control of the Permittee, and did not result from operational error, improperly designed or inadequate treatment systems, lack of preventive maintenance, or increases in production that exceed the treatment capacity of the facility.
d. That the facility was being properly operated at the time of the upset.
e. That the Permittee notified the Minnesota Department of Public Safety Duty Officer at 1(800)422-0748 or (612)649-5451, no later than 24 hours after the upset started.
f. And, that the Permittee took all reasonable steps to minimize harm to human health, public drinking water supplies, and the environment resulting from the upset.

III.E.2. The Permittee shall provide a written report of any upset, in compliance with Part III.F.2.

III.F. Noncompliance

III.F.1 Within 24 hours of becoming aware of a permit violation that may endanger human health, public drinking water supplies or the environment, the Permittee shall notify the Minnesota Department of Public Safety Duty Officer at 1(800)422-0798 or (612)649-5451. The Permittee shall provide the following information to the Duty Officer:

a. The name and telephone number of person reporting violation.
b. The Permittee name and permit number.
c. The city or township, and county.
d. The receiving waters of any discharge.
e. The time and duration of the violation.
f. The volume of wastewater involved.
g. If treatment has been provided.
h. The pollutants likely to be present.
i. The cause of the violation.
j. If there are drinking water supplies or recreational areas (such as swimming beaches) that may be impacted.
k. If a fish kill has occurred.
l. If immediate assistance is needed.
m. If news media have been notified.

The Permittee shall provide a written description of the violation to the MPCA, within five days of discovery of the violation.

III.F.2. The Permittee shall include with the next monitoring report a written description of bypasses, upsets and/or permit violations that occurred during the reporting period. This description shall include at least the following:

a. A description of the discharge or other violation, including volume, duration, wastewater characteristics (monitoring results), and receiving waters.

b. The cause of the bypass, upset or violation, and the steps taken to reduce, eliminate and prevent its recurrence.

c. The exact dates and times of the bypass, upset or violation and, if it is still occurring, how long it will be before it ends.

d. And, those steps the Permittee has taken to minimize adverse impacts to human health, public drinking water supplies, and the environment due to the bypass, upset or violation.

III.F.4. If the treatment works fails or is impaired, the Permittee shall halt or limit production or wastewater releases or both, as needed to maintain permit compliance, until the treatment works is restored or alternative treatment is provided. It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce production or other permitted activities in order to comply with this permit.

III.F.5. Noncompliance with the requirements of this permit is cause for enforcement action, including permit termination, permit revocation and reissuance, permit modification, monetary penalties, and/or imprisonment.

III.G. Inspection

The Permittee shall allow the MPCA to:

1. Enter the facility.
2. Review and copy the records required by this permit.
3. Inspect the systems, equipment, practices or operations regulated or required by this permit.
4. Sample or monitor to determine compliance.

III.H. Permit Modification

III.H.1. The following changes may require a permit modification and shall be reported to the MPCA for approval before the proposed change is implemented:

a. Proposed changes in the facility as described in Part I, including the proposed increased use or new use of a chemical additive.

b. Proposed new wastewater discharge point, not identified in Part I, from the facility. The Permittee shall provide a complete application to the MPCA in writing, at least 180 days before the planned starting date of construction for a new discharge, to modify or reissue this permit to authorize the discharge.

c. Proposed facility modifications, additions, and/or expansions that increase the amount of pollutants in untreated or treated wastewater, or change the sludge use and disposal practices.

d. Changes in the characteristics, concentrations or frequency of the wastewater flow. Such changes may include: new significant industrial discharges to a sanitary sewage treatment system; significant changes in existing industrial discharges to a sanitary system; significant rerouting of wastewater for reuse or for land disposal; or significant changes in the levels of indicator characteristics.

e. Facility closure that could result in a potential long-term water quality concern, such as the ongoing discharge of wastewater.

f. Transfer of the permit to a new facility owner. A permit transfer application shall be provided to the MPCA at least 90 days before a scheduled change in ownership or control.

III.H.2. After notice and opportunity for a hearing, the MPCA may modify, suspend or revoke this permit, in whole or in part, for causes including, and not limited to, the following:

a. A violation of permit requirements.
b. A failure to pay applicable permit fees.
c. Obtaining this permit by misrepresentation, or a failure to disclose fully all relevant information.
d. A change in a condition that causes a change in discharge.
e. The establishment of toxic effluent standards or prohibitions more protective than the limits in this permit.
f. The provisions of Minn. R. 7001.0170.

III.I. Permit Reissuance

III.I.1. To obtain permit authorization beyond the permit expiration date identified on page 1, the Permittee shall provide a complete application for reissuance of this permit to the MPCA. This application shall be submitted at least 180 days before the permit expiration date identified on page 1.

III.I.2. If the Permittee has provided a timely application for permit reissuance, the Permittee may continue to conduct the activities authorized by this permit, in compliance with the requirements of this permit, until the MPCA takes final action on the application, unless the MPCA determines that any of the following are true:

a. The Permittee is not in substantial compliance with the requirements of this permit, nor with a stipulation agreement or compliance schedule designed to bring the Permittee into compliance with this permit.

b. The MPCA, as a result of an action or failure to act of the Permittee, has been unable to take final action on the application on or before the permit expiration date identified on page 1.

c. The Permittee has submitted an application with major deficiencies or has failed to properly supplement the application in a timely manner after being informed of deficiencies.

III.J. Liability

III.J.1. This permit does not:

a. Preclude the institution of legal or administrative proceedings, nor relieve the Permittee from responsibilities, liabilities, or penalties, for violation of effluent and water quality limits, or other federal regulations or state rules, not included in this permit.

b. Convey a property right nor exclusive privilege, nor does it authorize injury to persons or property, nor the invasion of personal rights, nor the infringement of federal, state or local laws or regulations.

III.J.2. In issuing this permit, the state and the MPCA assume no responsibility for damage to persons, property, or the environment caused by the activities of the Permittee, including those activities authorized, directed, or undertaken to comply with this permit. To the extent the state and the MPCA may be liable for the activities of its employees, that liability is explicitly limited to that provided in the Tort Claims Act, Minn. Stat. ch. 3.736.

III.K. Incorporation by Reference

The Permittee shall comply with the provisions of 40 CFR Parts 122.41 and 122.42(a), Minn. R. 7001.0150, subp. 3, and 7001.1090, subp. 1 and 2, which are incorporated into this permit by reference, and are enforceable parts of this permit.

III.L. Severability

The provisions of this permit are severable. If a provision of this permit, or the application of a provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of the permit shall not be affected.

III.M. Bypasses

III.M.1. Bypasses are prohibited under this permit.

III.M.2. If an emergency bypass occurs, the Permittee shall notify the Minnesota Department of Public Safety Duty Officer at 1(800)422-0798 or (612)649-5451, no later than one hour after the bypass starts. The Permittee shall monitor the bypass for those characteristics for which regular monitoring is required by this permit (see Part II.A); the bypass shall be monitored at least twice as frequently as the minimum sampling frequency in Part II.A.

III.M.3. The Permittee shall notify the MPCA at 1(800)657-3864 or (612)296-8711 when the bypass ends, and provide all available information on the volume, duration and monitoring results of the bypass.

III.M.4. The Permittee shall provide a written report of any bypass, in compliance with Part III.F.2.

Point-Nonpoint Source Trading Summary

Finalized For Rahr Malting Permit On January 8, 1997

Executive Summary

The Minnesota Pollution Control Agency (MPCA) welcomes the opportunity to resolve the issue associated with Rahr Malting Company's proposed discharge to the Minnesota River in an innovative manner that provides flexibility to the Permittee while ensuring a degree of water quality protection that is equal to or better than that which would have resulted from a more traditional approach. The substitution of upstream nonpoint source pollutant loading reductions for at-plant Biochemical Oxygen Demand discharge loading addresses the problem of dissolved oxygen sag in the lower reach, while providing additional water quality benefits both upstream and downstream of the Total Maximum Daily Load zone. The agreement described above meets the basic guidelines for pollutant reduction trading developed by the Water Quality Division as well as the U.S. Environmental Protection Agency's (EPA) Draft Framework for Watershed Based Trading. The funds provided by Rahr Malting appear to be sufficient to obtain the specified reductions in nonpoint source pollutant loading, provided that best management practices (BMPs) are selected and sited using the methodology prescribed in the Nonpoint Source Trade Crediting Calculations document, and care is taken not to overcompensate landowners for implementing BMPs.

Introduction

Rahr Malting Company has proposed to combine at-plant limits on phosphorus and Carbonaceous Biochemical Oxygen Demand as determined by the five day test ($CBOD_5$) with point-nonpoint source pollutant reduction trades. These two approaches are targeted to provide adequate treatment of the waste loads to remain within the requirements of the 1985 (amended 1987) Waste Load Allocation for the lower Minnesota River. The Rahr wastewater currently is being treated at the Metropolitan Council Environmental Services Blue Lake wastewater treatment plant (Blue Lake). Rahr wishes to control future wastewater treatment operation costs while providing a beneficial reuse of the sludge associated with only the malting process (not domestic waste) by treating the process wastewater in a separate system and discharging the effluent into the lower Minnesota River.

Background

The EPA and the Minnesota Pollution Control Agency established a Total Maximum Daily Load (TMDL) for Biochemical Oxygen Demand (BOD) at the Minnesota River below river mile 25. The TMDL was established in 1988 for the seven-day, ten-year low flow (7Q10) and is set at 53,400 pounds per day of CBOD ultimate. Many factors contribute to the oxygen demand of the river in this reach. The following is a list of significant contributors to the demand:
a) metropolitan wastewater treatment plants (WWTP) loading; b) upstream loading from the River; c) loading from tributaries to the Minnesota River below river mile 25; d) sediment

oxygen demand; and e) nitrogenous oxygen demand. Two of these are of direct relevance to the Rahr request for a discharge permit:

- The first is the loading of oxygen demand generated upstream of river mile 25. This loading comes from other municipal WWTP discharges and nonpoint sources of nutrients which generate biological productivity and sediment uptake of oxygen.

- The second is the metropolitan wastewater treatment plants (WWTP) of Blue Lake and Seneca which discharge into the TMDL reach of the Minnesota River. These plants are not operating at their capacity. It may take years for the WWTPs to reach design loads. MPCA staff estimates conservatively a ten-year window exists before the total loading allocated to Blue Lake WWTP will be utilized at the current rate of growth after Rahr's discharge is removed. Until this time, the BOD loading from the proposed Rahr treatment facility would fall well within the amount authorized by the TMDL.

Complicating the use of the TMDL is how the BOD has traditionally been allocated to point source and nonpoint discharges upstream. A wastewater treatment plant discharge has an organic load which is assumed to be treated by the assimilation process which exists in nature. The treatment plant's impact studied to determine discharge limits have concentrated on the local reach. However, investigations indicate that during low flow periods, the River is overloaded with a BOD load from upstream which impacts the lower reach. The river is most vulnerable to BOD loading during low flows.

To address this, a paper by Erwin Van Nieuwenhuyse, Ph.D., formerly of the MPCA, documented the association of nutrients, specifically phosphorus, with chlorophyll concentrations in rivers world wide. This provides the foundation for river eutrophication similar to lake eutrophication data linking phosphorus and chlorophyll. The paper also focused specifically on the relationship between chlorophyll and BOD in the Minnesota River finding a strong correlation. This concept of nutrient load to chlorophyll to BOD is significant to all BOD related loading studies. The nutrient loading from discharges and nonpoint sources convert into a BOD load as the biology takes in the nutrient, then grows and then dies, extending the length downstream of a source's BOD impact.

This is important when considering BOD loading demands in a river. ***All*** sources of nutrients upstream are uptaken by algae and other plant growth, and then can exert a BOD demand in the lower reach as the algae dies and decays. Hence, nature is constantly converting nutrients into organic material and organic material back into available nutrients while exerting an oxygen demand.

The impact of the nutrient conversion to organic material and then algae to a BOD load is increased when the river slows down and deposits of organic material are allowed to build up in one location, as is the case of the Minnesota River in the metropolitan area. If the river flows sufficiently to maintain a flushing process, the BOD load is minimized. However, during lower flows, the organic loading builds up in a section of the river and exceeds the assimilation

capability in that reach. The foundation of trading then is a reduction of a persistent nutrient loading upstream, such as phosphorus, which accomplish reductions in oxygen demand in the lower reach of the Minnesota River.

MPCA has used Dr. Van Nieuwenhuyse's paper for a basis to evaluate the projected relationship between phosphorus and BOD for the Minnesota River. MPCA staff estimates that one pound of phosphorus is equal to eight pounds of BOD at the city of Jordan. The relationship between phosphorus and BOD is variable dependent on the nutrient needs of the biological life forms, flows, turbidity impacts on photosynthetic activity and the bio-availability of phosphorus. In upstream reaches where phosphorus is considered the limiting growth factor, one pound of phosphorus could generate 17 pounds of BOD based on average stream value correlations. In contrast, as the river proceeds through the metropolitan area, phosphorus is so abundant that significant reductions will be necessary before the nutrient again becomes the most limiting factor in algae growth.

Nitrogen exerts an oxygen demand in a similar manner. Based on stoichiometry, each pound of total Kjeldahl nitrogen (organic nitrogen plus ammonia) requires 4.6 pounds of oxygen to be assimilated. Because nitrogen can be lost to the atmosphere as nitrogen gas, it is less persistent in the river system. Also, the oxygen demand from nitrogen is generally exerted more rapidly than the phosphorus-related oxygen demand from a given nutrient source.

The travel time of the river also must be considered. Algal cells produced in the metropolitan area travel downstream before exerting the oxygen demand in the Mississippi River, where as the algal cells produced upstream exert their oxygen demand on the metropolitan reach. Therefore, reductions in phosphorus in the Minnesota River upstream of Jordan have a higher BOD to Phosphorus ratio, and at the same time, will help to minimize the overabundance of phosphorus in the reaches below the metropolitan WWTPs.

Concept of Point - Nonpoint Source Trading

Point-nonpoint source (P-NPS) pollutant trading refers to the substitution of nonpoint source pollutant load reductions for point source pollutant load discharge requirements by a discharger permitted under the National Pollutant Discharge Elimination System (NPDES). To meet the TMDL goals, Rahr Malting will treat its effluent discharge beyond what the MPCA would propose and participate in P-NPS trading. MPCA will require that such trades result in pollutant reductions that are:

- Equivalent to the point source discharge in their water quality impact. Equivalence refers to the physical substitution of nonpoint reductions traded for point source loads, taking into account all relevant factors, for example, differences in time, place and chemical form of point and nonpoint source loadings and the sensitivity of the receiving water. In this trade it has been determined that sufficient safety factors for nonpoint BMP's are in place to meet this definition.

- Additional to NPS reductions that would be likely to occur in the absence of a trade. Additionality requires that nonpoint source load reductions that are credited to a point source in a P-NPS trade would not have occurred otherwise, in the absence of P-NPS trading. For example, in this trade feedlot corrections or conservation tillage are not allowable trade credits because there is a regulatory program for feedlots and a cultural trend of adoption of conservation tillage already existing.
- Accountable so that the NPS measures proposed in the trade will be implemented and maintained to achieve their intended result on water quality. Accountability refers to the need to ensure that a P-NPS trade satisfies the above criteria of equivalence and additionality, and that terms of the trade agreement are being lived up to. Only the nonpoint source BMP's verifiable by field inspections or other physical measures have been selected.

A framework for P-NPS trading has been developed for the Rahr Malting permit. In order to implement P-NPS trades, the following definition of what constitutes a trade has been developed.

Trade: A trade is a direct reduction in NPS load which is applied against Rahr Malting's point source load. Trading parameters have been identified for phosphorus, nitrogen, BOD and sediment. In order to address the relative persistence of these compounds in the river system and the spatial variability of BMP sites, NPS load reductions are converted to pollutant reductions using the following conversion ratios:

Table 1

Trade Parameter	Measured Value	Metro Reach BMP $CBOD_5$ Credit	Upstream BMP $CBOD_5$ Credit
Phosphorus	1 pound	8 units	8 units
$CBOD_5$	1 pound	1 unit	Determined by Table 2
Nitrogen	1 pound	4 units	1 unit
Sediment	1 ton	0.5 units	0.5 units

Exertion of oxygen demand within the river system from NPS BOD loading is highly variable, depending on the location of the NPS loading, the river flow, and the velocity. Within the TMDL zone, 1 pound of $CBOD_5$ will be credited at 1 unit. A "BOD trading zone," which extends upstream from the TMDL to river mile 107, or equivalent tributary distances, has been established based on the exertion of BOD oxygen demand during the 7-day 10-year low flow (7Q10). Upstream of the "BOD trading zone," minimal trading credit will be given for $CBOD_5$ reductions since most of this oxygen demand will have already been exerted prior to the TMDL zone. A trade credit of one percent of the pounds removed is credited. Table 2 determines the calculated percent remaining BOD credits.

To satisfy the criterion of equivalence in the case of Rahr Malting, then, it will be necessary to identify types and quantities of BMPs that can be expected to achieve the necessary NPS reduction to remain within the Waste Load Allocation.

Table 2.

River Mile	CBOD5 Percent Remainin	Miles Shakopee
25	100%	0
26	96%	1
27	93%	2
28	91%	3
29	89%	4
30	86%	5
31	84%	6
32	82%	7
33	80%	8
34	77%	9
35	75%	10
36	73%	11
37	71%	12
38	70%	13
39	68%	14
40	66%	15
41	64%	16
42	62%	17
43	61%	18
44	59%	19
45	58%	20
46	56%	21
47	55%	22
48	53%	23
49	52%	24
50	50%	25
51	49%	26
52	48%	27
53	46%	28
54	45%	29
55	44%	30
56	43%	31
57	42%	32
58	41%	33
59	40%	34
60	38%	35
61	37%	36
62	36%	37
63	35%	38
64	35%	39
65	34%	40
66	33%	41
67	32%	42
68	31%	43
69	30%	44

River Mile	CBOD5 Percent Remaining	Miles Shakopee
70	29%	45
71	29%	46
72	28%	47
73	27%	48
74	26%	49
75	26%	50
76	25%	51
77	24%	52
78	24%	53
79	23%	54
80	22%	55
81	22%	56
82	21%	57
83	21%	58
84	20%	59
85	20%	60
86	19%	61
87	19%	62
88	18%	63
89	18%	64
90	17%	65
91	17%	66
92	16%	67
93	16%	68
94	15%	69
95	15%	70
96	15%	71
97	14%	72
98	14%	73
99	13%	74
100	13%	75
101	13%	76
102	12%	77
103	12%	78
104	12%	79
105	11%	80
106	11%	81
107	11%	82
>107	1%	>82

Minimization of Associated Risks

The use of nonpoint source BMPs to trade for a controlled point source discharge does pose some risk. The effectiveness of BMPs in reducing NPS loading depends on the type of BMP selected, its location on the landscape, and the quality of its design and maintenance. It also depends on weather. BMPs are effective during normal storm events and may not operate during drought or extreme storms. Risks associated with BMP implementation will be reduced by conservative estimates of pollutant credit units. Specific examples include:

- The phosphorus to BOD crediting ratio will be 1:8 for the life of the BMP site. This is based on current estimates of the ratio at the city of Jordan, MN. The ratio increases upstream of Jordan, and the ecoregion mean estimates are closer to 1:17. As the Minnesota River is cleaned up, the actual ratio should move toward the ecoregion values.

- In calculating phosphorus loading from soil erosion, conservative estimates of the soil phosphorus content are used. In the event that site-specific soil sampling justifies a higher phosphorus content, a safety factor of 0.75 will be used in the crediting calculations.

- The maximum credit for nitrogen is 1:4 in the TMDL zone. The actual oxygen demand associated with the nitrogen loading is 4.6 pounds of oxygen per pound of TKN.

- Calculation of nitrogen will assume a "field loss factor" of 50 percent to account for ammonia volatilization and nitrogen assimilation prior to transport into the surface water.

- A delivery ratio (DR) of 100 percent for NPS in the riparian zone will be used. However, a DR of 20 percent will be used for lands within a one-quarter mile of the stream and a DR of ten percent will be used for areas further away. These DRs are highly conservative on sites being targeted in this process.

- Land locked areas and watershed divides within larger BMP sites will be factored out of the pollutant credit calculations.

To ensure the appropriate use of these ranges by Rahr, site visits by MPCA staff are to be coupled with communications with the Soil and Water Conservation District staff during the selection process. These factors are multiplicative in the equations used. The conservative nature of the numbers for phosphorus per ton and delivery ratios will result in underestimating the phosphorus reduced by at least a factor of two on "typical" sites. It is, therefore, important to have many sites in the trade so that "typical" conditions are the normal occurrence.

To make a final selection of BMPs, it is necessary to go beyond the question of equivalence to address the criteria of additionally and accountability. Which combination of BMPs would result in pollutant reductions that probably would not have occurred in the absence of trading? Which BMPs most lend themselves to accountability? That is, for which ones would installation,

effectiveness and maintenance be easiest to confirm? What type of BMP could be implemented through the fewest possible number of enforceable contracts with landowners?
Any currently regulated practice cannot be used in the trade as the permitting program would require the change anyway. Some BMPs, such as reduced tillage, are being widely adopted because they make economic sense, and further adoption is likely with or without payments from a trade. Trading eligible BMPs that have been identified to date include:

1. **Soil Erosion BMPs**, including sheet, rill and ephemeral gully erosion, gully erosion, stream, river, and ditch bank erosion.
2. **Livestock Exclusion,** separating livestock from waterways for protection against bank erosion and direct manure impacts.
3. **Rotational Grazing With Livestock Exclusion,** to enhance forages for pollutant reductions from filtering processes and plant nutrient uptake.
4. **Critical Area Set Aside,** of highly erodible land.
5. **Wetland Treatment Systems**, for nutrient removal.

As trading practices become adopted on a more widespread basis, it is likely that additional BMP categories will be identified. These additional BMP categories can be added to the list during permit reissuance or a permit modification.

There are many alternative ways of achieving the required NPS load reduction. To evaluate the effectiveness and cost of some of the most promising BMPs, the MPCA has used a newly developed system of BMP crediting that estimates the reductions in NPS loading that can be expected to result from the implementation of BMPs.

Soil Erosion BMPs

Sources of sediment, nitrogen, phosphorus and BOD occur naturally throughout the basin. The transport of these pollutants to the river is accelerated by intensive land use management such as roads, drainage, construction activities and agricultural practices. In addition, some land use activities provide increased sources of nutrients for vegetative needs such as cropping or lawns. The BMP Soil Erosion crediting system is based on established programs. The first is soil erosion protection. The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) has been successful in defining soil movement from sheet and rill formations with the use of an equation which is based on soil type, field slope, length of slope, vegetation, and management practices. The Universal Soil Loss Equation, as it is called, is used to predict the erosion tons generated at the field in tons per acre per year. For large gullies or bank erosion, soil loss is estimated by calculating the area which has been eroded divided by the number of years during which the process took place. Once the volume has been established by either of these methods, a conservative value of nutrient content of the soil is calculated. Then a coefficient is used to conservatively estimate how much of the field or bank erosion is transported to the nearest surface water.

Livestock Exclusion

The increased density of animals for agricultural production can also increase the NPS loading associated with storm runoff. The elimination of direct deposits of manure in the riparian zone and bank erosion from animal traffic can be credited. The riparian zone typically has higher delivery ratios associated with it due to its proximity to the water body. The estimated time, number of animals and manure produced is necessary to credit the existing scenario changes in delivery when the animals are no longer allowed access. Likewise, the current bank erosion recession rates are used to estimate future protection provided by stabilizing the current bank and preventing future access.

Rotational Grazing With Livestock Exclusion

Pastured areas not currently classified as feedlots may still contribute significant loads of nutrients, $CBOD_5$ and sediment. The MPCA has a feedlot permitting process for sites where animals are concentrated to such an extent that natural vegetation is destroyed. However, most existing animal grazing systems which maintain vegetation can greatly reduce the delivery of manure to the water. Livestock exclusion when combined with rotational grazing and the use of buffers or easements can be practiced to lower the amount of nutrient impacts on the water body. To estimate this process, the number of animals, the manure content and the time spent in relation to the water is all estimated for the before conditions. This is then compared with the post conditions where the time spent in close relation to the water is eliminated. Delivery of manure volumes from each "paddock" can then be compared with each scenario to predict whole farm reductions of manure delivered to the water. In addition, the management scenarios need to estimate the time the animals occupy each paddock or area of the pasture to rotate the animals sufficiently to prevent a "feedlot" situation and improve the quality of the vegetative stand. The water quality benefit comes from combinations of: a) improved rotation management providing a better forage, improved nutrient uptake as the plant is in a growth phase and added soil cover; b) the use of vegetative filter strips which separate livestock from the water and filter sediment and associated nutrients in runoff; and c) the dispersion of manure throughout the pasture providing more opportunities for nutrient uptake due to proximity of the upper end of the pasture and the water body.

Critical Area Set Aside

Critical area set aside refers to the conversion of land use practices in areas which are excessively vulnerable to soil erosion. Traditional soil conservation sites have been steep sloped bluffs or hills, where removal of vegetation or plowing of soil had greatly accelerated the erosion rate. Combining this concept with criteria that is concerned with the proximity to a hydraulic system that delivers the eroded soil to the river will allow small changes in vegetative management, or bio-engineering to provide large protective savings in river load. The targeting of riparian corridors, steep slopes directly connected to the river, and restoring previously drained isolated wetlands, all fit into this category.

Wetland Treatment Systems

The construction of wetland treatment systems specifically for water quality enhancement defines the wetland treatment system nonpoint source trading BMPs. Wetlands are a valuable watershed management tool in any basin. Wetlands help stabilized hydraulic peaks, provide necessary habitat for the many species critical to the food chain and settle sediments out of the runoff. However, not all wetlands remove nutrient loading from the watershed. Some wetlands act as sinks for phosphorus much of the year only to pulse the mass of nutrients stored out during stressful times such as after drought periods or snow melt. The constructed wetland treatment system is designed to control the way the nutrients are captured and stored or converted so that the mass of nutrients are not available to be released downstream. By maximizing optimum depths, surface area and detention time, criteria nitrogen is volatilized off to the atmosphere, while the phosphorus is captured and buried. This type of wetland may limit some types of habitat use, but is targeted specifically for chemical and sediment treatment.

Structure of the Trade Agreement

The Rahr Malting Company will achieve $CBOD_5$ nonpoint source load reduction by setting up a fund dedicated to projects that encourage adoption of nonpoint source reduction practices. The trust fund will have a board of citizens made up of people concerned with water quality conservation from grass roots organizations, state offices and Rahr representatives who will oversee the selection of BMP sites for trading. MPCA approval is required for all selected sites and the use of the pollutant reduction estimates. All pollutant reduction estimation will follow the formulas in the document entitled: Nonpoint Source Trade Crediting Calculations. The trust fund will be established with $200,000 up front and be augmented by $50,000 over the permit life. Additional members may be added to the board if other contributors wish to add to the trust fund.

Rahr Malting Company's NPDES permit contains the following:

1. A permit limit which authorizes a maximum monthly average discharge up to a 150 pounds per day of $CBOD_5$.

2. The Permittee has accepted a phosphorus limit of 2 mg/l instead of the 3 mg/l limit MPCA would otherwise propose at this time. Due to this, a 30 unit credit may be applied to the cumulative load reduction during the year 2001 and subsequent years provided the Permittee's phosphorus limit remains 2 mg/l or less. In addition, up to 10 units of the phosphorus credit may be used in either 1998, 1999 or 2000 for permit compliance purposes to satisfy any shortfall in that year's nonpoint source load reduction requirement. The Permittee has accepted a year round $CBOD_5$ limit of 12 mg/l instead of the limit MPCA would otherwise propose at this time of 12 mg/l $CBOD_5$ from June through September and 25 mg/l $CBOD_5$ from October through May. Due to this, a 30 unit credit may be applied to the cumulative value for the year 2001 and subsequent years provided the Permittee's year round $CBOD_5$ limit remains 12 mg/l or less.

Other Trade Values Exist

A trade of nonpoint controls to mitigate for point source BOD discharges has several other valuable contributions to the environment. This trade was set up considering primarily the NPS contribution to the reduction goals of BOD in the metropolitan area of the Minnesota River. In addition, NPS reductions from the Minnesota River are an essential part of the emerging strategy to improve the water quality of Lake Pepin on the Mississippi River. Both upstream and downstream improvements in non-metro counties will contribute to the achievement of important water quality goals, and are valuable side benefits of the trade. Basin planning allows for the right blend of conservation adoption and economic growth. This trade has a high potential to make that blend happen.

In addition, the Rahr trade is a pioneering agreement which could help Minnesota break new ground in environmental protection. It provides a flexible means of compliance for the Permittee, and allows industrial expansion to proceed while ensuring a degree of water quality protection that is equal to or better than that which could have resulted from a more traditional approach. Lessons learned from this experience could lead to significant improvements in water quality protection programs.

Nonpoint Source Trade Crediting Calculations

Finalized For Rahr Malting Permit On January 8, 1997

Introduction

The use of Best Management Practices (BMPs) to reduce nonpoint source pollution is included as an effluent limitation in the Rahr Malting Company's and National Pollutant Discharge Elimination System (NPDES) permit.

Rahr Malting has proposed to construct a new wastewater treatment facility (currently, Rahr's process water is treated at the Blue Lake facility). The proposed Rahr discharge is just upstream of river mile 25. In 1988, the MPCA and the US Environmental Protection Agency (EPA) established at a total maximum daily load (TMDL) for the Minnesota River below river mile 25. Allocation of load to point and nonpoint sources under the TMDL does not allow a re-allocation of load for Rahr's proposed discharge. As a result, Rahr Malting has proposed to combine at-plant effluent limits along with nonpoint source reductions to compensate for the load which will result from the proposed discharge.

Trading Framework

The trading concept is philosophically simple, yet the number of variables make the details of a trade complex. The focus of the Rahr trade is the reduction of oxygen demand in the TMDL zone of the river. In order to implement the point-nonpoint source (P-NPS) trades, the following definition of what constitutes a trade has been developed.

Trade: A "trade" is a direct reduction in NPS load which is applied against Rahr Malting's point source load. Trading parameters have been identified for phosphorus, nitrogen, five day carbonaceous biochemical oxygen demand ($CBOD_5$), and sediment. In order to address the relative persistence of these compounds in the river system and the spatial variability of BMP sites, NPS load reductions are converted to pollutant "units".

Trade Calculation

The "gold standard" for the Rahr trades is the presence of $CBOD_5$ load in the lower Minnesota River, where 1 pound per day (lb./day) of $CBOD_5$ in the TMDL zone equals 1 unit. Phosphorus, nitrogen, $CBOD_5$, and sediment from nonpoint sources all have varying degrees of persistence in the river system and mechanisms for exerting oxygen demand. The conversion of load reductions to trading units takes into account the relative persistence of the compound and the spatial variability of BMP sites. The pollutant equivalency credits are summarized in the table below and the $CBOD_5$ Percent Table.

Pollutant Equivalency Credits

Trade Parameter	Measured Value/Day	Metro Reach BMP $CBOD_5$ Credit	Upstream BMP $CBOD_5$ Credit
Phosphorus	1 pound	8 units	8 units
$CBOD_5$	1 pound	1 unit	see discussion below
Nitrogen	1 pound	4 units	1 unit
Sediment	1 ton	0.5 units	0.5 units

Phosphorus

The phosphorus to $CBOD_5$ crediting ratio will be 1:8 for the life of the BMP site. This is based on current estimates of the ratio at the City of Jordan, MN. The linkage connecting total phosphorus to $CBOD_5$ is algal growth and death cycles. The ratio increases upstream of Jordan, and the ecoregion mean estimates a value closer to 1:17. As the Minnesota River is cleaned up and light penetrates further into the water column, the actual ratio should move toward the ecoregion values.

$CBOD_5$

Exertion of oxygen demand within the river system from NPS $CBOD_5$ loading is highly variable depending on the location of the NPS loading, the river flow, and velocity. Within the TMDL zone, 1 pound of Carbonaceous Biochemical Oxygen Demand as determined by the five day test ($CBOD_5$) will be credited at 1 unit. A "$CBOD_5$ trading zone" which extends upstream from the TMDL to river mile 107, or equivalent tributary distances, has been established based on the exertion of $CBOD_5$ oxygen demand during the 7-day 10-year low flow (7Q10). Upstream of the "$CBOD_5$ trading zone" one percent of the reduction will be credited for $CBOD_5$ reductions since most of this oxygen demand will have already been exerted prior to the TMDL zone during low flow periods. The $CBOD_5$ Percent Credit Table determines the calculated percent remaining $CBOD_5$ credits for the basin site locations.

$CBOD_5$ Percent Credit Table

River Mile	$CBOD_5$ Percent Remainin	Miles From Shakopee
25	100%	0
26	96%	1
27	93%	2
28	91%	3
29	89%	4
30	86%	5
31	84%	6
32	82%	7
33	80%	8
34	77%	9
35	75%	10
36	73%	11
37	71%	12
38	70%	13
39	68%	14
40	66%	15
41	64%	16
42	62%	17
43	61%	18
44	59%	19
45	58%	20
46	56%	21
47	55%	22
48	53%	23
49	52%	24
50	50%	25
51	49%	26
52	48%	27
53	46%	28
54	45%	29
55	44%	30
56	43%	31
57	42%	32
58	41%	33
59	40%	34
60	38%	35
61	37%	36
62	36%	37
63	35%	38
64	35%	39
65	34%	40
66	33%	41
67	32%	42
68	31%	43
69	30%	44

River Mile	$CBOD_5$ Percent Remaining	Miles From Shakopee
70	29%	45
71	29%	46
72	28%	47
73	27%	48
74	26%	49
75	26%	50
76	25%	51
77	24%	52
78	24%	53
79	23%	54
80	22%	55
81	22%	56
82	21%	57
83	21%	58
84	20%	59
85	20%	60
86	19%	61
87	19%	62
88	18%	63
89	18%	64
90	17%	65
91	17%	66
92	16%	67
93	16%	68
94	15%	69
95	15%	70
96	15%	71
97	14%	72
98	14%	73
99	13%	74
100	13%	75
101	13%	76
102	12%	77
103	12%	78
104	12%	79
105	11%	80
106	11%	81
107	11%	82
>107	1%	>82

Nitrogen

The protection of drinking water, the Gulf of Mexico hypoxia issue, nitrogen's eutrophication links, and direct demand of ammonia on oxygen are all considered to benefit from nitrogen trading. Nitrogen is assimilated, where it creates eutrophic conditions in a more complex interaction than phosphorus. The maximum credit ratio for nitrogen is 1:4 in the TMDL zone. The actual oxygen demand associated with the nitrogen loading is 4.6 pounds of oxygen per pound of Total Kjeldahl Nitrogen (TKN). Calculation of load reductions from livestock management BMPs will include a 50% "field loss factor" to account for atmospheric nitrogen losses prior to transport into the water column.

Sediment

Only minor crediting values are directly assigned to sediment. Control of sediment losses from BMP sites will result in reductions in turbidity and oxygen demand associated with sediments.

NPDES Permit Loads

The Rahr Malting permit will allow the discharge of up to 150 lb./day of $CBOD_5$ just upstream of the TMDL zone. This $CBOD_5$ is assumed to be carried intact into the TMDL zone, requiring that 150 units, or 54,750 units per year (units/year) to be addressed through point-nonpoint source trading.

As part of the NPDES permit, Rahr has agreed to an effluent phosphorus limit of 2 mg/l instead of the 3 mg/l limit MPCA would otherwise propose at this time. Due to this, a 30 unit credit may be applied to the cumulative load reduction during the year 2001 and subsequent years provided the Permittee's phosphorus limit remains 2 mg/l or less. In addition, up to 10 units of the phosphorus credit may be used in either 1998, 1999 or 2000 for permit compliance purposes to satisfy any shortfall in that year's nonpoint source load reduction requirement. As basin wide NPDES phosphorus reductions are implemented by the MPCA, the relative benefits of the Rahr phosphorus limit will decrease. Therefore, it is likely that the trading credit for the effluent phosphorus limit will be terminated in a future permit cycle.

The Permittee has accepted a year round $CBOD_5$ limit of 12 mg/l instead of the limit MPCA would otherwise propose at this time of 12 mg/l $CBOD_5$ from June through September and 25 mg/l $CBOD_5$ from October through May. Due to this, a 30 unit credit may be applied to the cumulative value for the year 2001 and subsequent years provided the Permittee's year round $CBOD_5$ limit remains 12 mg/l or less.

The trading credit units required for Rahr Malting are summarized in the table below.

Trading Units Required

Trading Criteria	Daily Equivalent	Annual Equivalent
NPDES Permitted Discharge Load	150 units	54,750 units/year
Direct NPS Trading	90 - 150 units	32,850 - 54,750 units/year
Effluent Phosphorus Credit (as needed)	30 units	10,950 units/year
Effluent $CBOD_5$ Credit (as needed)	30 units	10,950 units/year

Assumptions

The P-NPS trade proposal assumes many physical process restraints. The following is a list of conditions which selection of BMPs are based on:

1. The Best Management Practice (BMP) must occur upstream of the Rahr discharge point in the Minnesota River basin.

2. The Phosphorus unit value is based on phosphorus conversion to chlorophyll and the chlorophyll death and decay resulting in a $CBOD_5$ load on the river.

3. Phosphorus will be treated as a conservative and persistent compound. The phosphorus entering the watershed at any location will cycle down stream and exert a load on the lower reach of the Minnesota River at some future date.

4. The Midwest Plan Service publication, which provides the manure estimates, reflects the current professional estimates of manure content for the parameters of $CBOD_5$, phosphorus and nitrogen.

5. The Universal Soil Loss Equation (USLE) and later the Revised Soil Loss Equation (RSLE) reflect the current professional expertise for projecting soil erosion rates from sheet, rill and ephemeral gullies. Local Natural Resource Conservation Service (NRCS) and Soil and Water Conservation Service (SWCD) will determine the equation coefficients for sites in their respective areas.

6. Delivery ratios of sediment and phosphorus contents of soils are based on conservative professional estimates unless justification of higher rates can be provided.

7. As with any estimation process using average or conservative numbers, the use of several sites increases the probability that the averages or conservative estimates are reflective of the sites in the whole base. When using several sites the variance of a specific site below the estimated average value is accounted for by the excess of a different site in the population. The system developed has a overall safety factor of

approximately two worked in to the conservative estimating process. Therefore, the administration for rigorous inspection and enforcement of BMP sites will be avoided and replaced by initial inspections and periodic checks.

8. The choices of average or conservative values is constantly improving as the knowledge base on the nonpoint sciences improve and the number of research sites increase. As documentation increases and modifications to the following calculations are justified this document may be updated to remain current. Previously approved trades will remain credited at the values previously agreed to; modifications will only apply to trade sites yet to be approved by the MPCA through permit modification.

9. The phosphorus to $CBOD_5$ trading ratio will be 1:8 for the life of the BMP site. This is based on current estimates of the ratio at the city of Jordan. The ratio increases above the Minnesota River at Jordan, the ecoregion mean estimates a value closer to a 1:17 ratio for phosphorus to $CBOD_5$ correlation. As the Minnesota River is cleaned up the ratio will move toward the ecoregion values. This trend provides a portion of the conservative estimation that is desirable in trading versus command and control regulation.

10. Nitrogen will be considered as a trade parameter. The protection of drinking water, the Gulf of Mexico hypoxia issue, nitrogen's eutrophication links and ammonia's direct demand on oxygen are all considered valuable objectives for this allowance. Nitrogen is assimilated, however, it creates eutrophic conditions in a more complex interaction cycle than phosphorus. Therefore, trading credits for nitrogen will be given after factoring in a 50 percent decay rate prior to loading the surface water and the nutrient will not be treated as a persistent or given constant rate in the pollutant crediting units.

11. The term "surface water entry points" will be defined as streams, rivers, wetlands, ditches and surface tile intakes which are connected to the main stem of the Minnesota River. The connection may be at some point down stream. Watersheds entering lakes have a greater assimilative capacity and therefore must be justified prior to use in this agreement.

12. Land locked areas, and watershed divides within a larger BMP implementation site will be factored out of all pollutant reduction calculations by estimating only contributing acres associated with the Minnesota River.

BMP Calculation Procedures

Four general categories of BMPs have been identified for P-NPS trading:

1. **Soil Erosion BMPs**, including sheet, rill and ephemeral gully erosion, gully erosion, stream, river, and ditch bank erosion.

2. **Livestock Exclusion,** separating livestock from waterways for protection against bank erosion and direct manure impacts.
3. **Rotational Grazing With Livestock Exclusion,** to enhance forages for pollutant reductions from filtering processes and plant nutrient uptake.
4. **Critical Area Set Aside,** of highly erodible land.
5. **Wetland Treatment Systems**, for nutrient removal.

As trading practices become adopted on a more widespread basis, it is likely that additional BMP categories will be identified. These additional BMP categories can be added to the list during permit reissuance or a permit modification.

The variety of BMPs which can be implemented all contain aspects of their establishment or performance which require special considerations by the operator. Some the changes will be new to the operator and technical assistance will be required as part of the BMP set up (i.e., rotational grazing of livestock may bring forage questions to bear and technical assistance through the establishment period will be provided). All BMPs with vegetative components will require an establishment criteria to ensure a dense stand. In addition some BMPs which treat sediment by filtering or settling require on going maintenance:

- to ensure sheet flow conditions are maintained in upland flow areas,
- to remove sediment build ups which obstruct the operation of the BMP,
- to reestablish a structure or plant life after major storm events or fire,
- to remove harmful infestations (such as, carp from treatment wetlands, destructive insects in vegetation and beavers from bioengineering sites)

At the time of the site crediting and approval the responsibilities and technical assistance proposed to address the above issues for the site will be considered.

Soil Erosion BMPs

The following steps outline a general process for calculating estimates of pollutant reductions from soil erosion BMPs.

Step 1: Calculate reduction in soil erosion. Based on the erosion mechanism, different methods of estimating the erosion rate apply.

Sheet, Rill and Ephemeral Gully Erosion:

A. Estimate the site erosion rate prior to and after installing the BMP using the USLE or RSLE. (Determination of which process used will reflect the equation used by the local NRCS or SWCD). Result will be in tons/acre/year (SED_p and SED_a).

B. Using the Delivery Ratio Table below enter the sheet and rill erosion category to calculate the percentage delivered for the prior and after values. Sediment reduction in tons equals the difference between these values times the acres that the practice was applied over. SEDRDC = (SED_p* DR) - (SED_a* DR)

C. To determine the nutrient mass reduced, take the sediment tons per acre prior and after (from B; SED_p* DR & SED_a* DR) and enter the Enrichment Table. Nutrient enrichment estimates represent the nutrient attachment potential of different soil types combined with the settling characteristics of the different particles. For example in a sandy clay, sand holds less phosphorus and settles out sooner than clay, so as a mixed soil is transported, the sands drop out and the clay fractions can continue. Thus, the portion delivered represents more of the clays and less of the sands instead of the original sand clay mix. To estimate the enrichment take the nutrient content results (either nitrogen or phosphorus) for the "prior estimate" and subtract the "after estimate" value from the table. (P_p, P_a, N_p and N_a), PRDC = P_p -P_a and NRDC = N_p- N_a

Delivery Ratios

Area	Gully Erosion Channelized to Water	Gully Erosion Nonchannelized to Water	Sheet, Rill Erosion	Stream Bank Erosio
Riparian	100%	NA	100% When Justified	100%
Within 1/4 Mile of Stream	100%	20%	20%	NA
Greater than 1/4 Mile from Stream	50%	10%	10%	NA

Sediment Delivery Rate T/AC/YR	Phosphorus Enrichment Estimate				Nitrogen Enrichment Estimate			
	units lbs/ac				units lbs/ac			
	Clay	Silt	Sand	Peat	Clay	Silt	Sand	Peat
0.01	0.05	0.04	0.03	0.06	0.09	0.08	0.07	0.12
0.02	0.08	0.07	0.06	0.10	0.16	0.14	0.12	0.21
0.03	0.11	0.10	0.08	0.15	0.22	0.19	0.16	0.29
0.04	0.14	0.12	0.10	0.18	0.28	0.24	0.21	0.37
0.05	0.17	0.15	0.12	0.22	0.33	0.29	0.25	0.44
0.06	0.19	0.17	0.14	0.25	0.39	0.34	0.29	0.51
0.07	0.22	0.19	0.16	0.29	0.44	0.38	0.32	0.57
0.08	0.24	0.21	0.18	0.32	0.49	0.42	0.36	0.64
0.09	0.27	0.23	0.20	0.35	0.54	0.47	0.40	0.70
0.1	0.29	0.25	0.22	0.38	0.58	0.51	0.43	0.76
0.2	0.51	0.44	0.38	0.66	1.0	0.9	0.8	1.3
0.3	0.70	0.61	0.52	0.92	1.4	1.2	1.0	1.8
0.4	0.88	0.77	0.65	1.15	1.8	1.5	1.3	2.3
0.5	1.1	0.9	0.8	1.4	2.1	1.8	1.6	2.8
0.6	1.2	1.1	0.9	1.6	2.4	2.1	1.8	3.2
0.7	1.4	1.2	1.0	1.8	2.8	2.4	2.0	3.6
0.8	1.5	1.3	1.1	2.0	3.1	2.7	2.3	4.0
0.9	1.7	1.5	1.2	2.2	3.4	2.9	2.5	4.4
1	1.8	1.6	1.4	2.4	3.7	3.2	2.7	4.8
2	3.2	2.8	2.4	4.2	6.4	5.6	4.7	8.4
3	4.4	3.9	3.3	5.8	8.9	7.7	6.5	11.6
4	5.6	4.8	4.1	7.3	11.1	9.7	8.2	14.5
5	6.7	5.8	4.9	8.7	13.3	11.6	9.8	17.4
6	7.7	6.7	5.7	10.1	15.4	13.4	11.4	20.1
7	8.7	7.6	6.4	11.4	17.4	15.2	12.9	22.8
8	9.7	8.4	7.2	12.7	19.4	16.9	14.3	25.3
9	10.7	9.3	7.9	13.9	21.3	18.5	15.8	27.8
10	11.6	10.1	8.6	15.1	23.2	20.2	17.1	30.3
11	12.5	10.9	9.3	16.3	25.0	21.8	18.5	32.7
12	13.4	11.7	9.9	17.5	26.8	23.3	19.8	35.0
13	14.3	12.4	10.6	18.7	28.6	24.9	21.2	37.3
14	15.2	13.2	11.2	19.8	30.4	26.4	22.4	39.6
15	16.0	14.0	11.9	20.9	32.1	27.9	23.7	41.9
16	16.9	14.7	12.5	22.0	33.8	29.4	25.0	44.1
17	17.7	15.4	13.1	23.1	35.5	30.8	26.2	46.3
18	18.6	16.1	13.7	24.2	37.1	32.3	27.4	48.4
19	19.4	16.9	14.3	25.3	38.8	33.7	28.7	50.6
20	20.2	17.6	14.9	26.3	40.4	35.1	29.9	52.7
21	21.0	18.3	15.5	27.4	42.0	36.5	31.0	54.8
22	21.8	19.0	16.1	28.4	43.6	37.9	32.2	56.9
23	22.6	19.6	16.7	29.5	45.2	39.3	33.4	58.9
24	23.4	20.3	17.3	30.5	46.7	40.6	34.5	61.0
25	24.1	21.0	17.8	31.5	48.3	42.0	35.7	63.0
26	24.9	21.7	18.4	32.5	49.8	43.3	36.8	65.0
27	25.7	22.3	19.0	33.5	51.4	44.7	38.0	67.0
28	26.4	23.0	19.5	34.5	52.9	46.0	39.1	69.0
29	27.2	23.6	20.1	35.5	54.4	47.3	40.2	70.9
30	27.9	24.3	20.7	36.4	55.9	48.6	41.3	72.9

Stream Bank and Gully Erosion:

A. Using the existing contours, estimate the volume of soil removed by gully erosion and/or stream bank erosion. (VOL)

B. Using the land operator as a reference determine the amount of time in years it has taken to produce the gully and/or stream bank erosion. (VOL/YRs)

C. Using the soil density values shown below, convert the volume per year estimate to tons/year. (SED)

Soil Textural Class	Dry Density Tons/ft^3	Dry Density lbs./ ft^3
Sands, loamy sands	0.055	110
Sandy loam	0.0525	105
Fine sandy loam	0.05	100
Loams, sandy clay loams, sandy clay	0.045	90
Silt Loam	0.0425	85
Silty clay loam, silty clay	0.04	80
Clay loam	0.0375	75
Clay	0.035	70
Organic	0.011	22

Step 2: Determine amount of sediment delivered to the river system. Using the Delivery Ratio table above, select the appropriate delivery ratio (DR). Multiply the soil erosion rate (SED in tons/year) by the delivery ratio to determine the amount of soil reaching the river. Result will be in tons/year delivered. DEL = SED * DR

Step 3: Determine NPS pollutant values associated with sediment. Using the default values in the table below, calculate the amount of phosphorus and nitrogen delivered to the river system. (PDEL, NDEL), PDEL = DEL * Adjustment Coefficient for P,
NDEL = DEL * Adjustment Coefficient for N,

Soil Type	Phosphorus Adjustment Correction Factor	Nitrogen Adjustment Correction Factor
Sand	0.85 lb./ton	1.7 lb./ton
Silt	1.00 lb./ton	2.00 lb./ton
Clay	1.15 lb./ton	2.30 lb./ton
Peat	1.50 lb./ton	3.00 lb./ton

The values listed above are conservative estimates. At certain BMP sites, soils may have enriched nutrient content due to past application of fertilizers. Higher nutrient levels can be justified through site-specific soil sampling. However, to account for uncertainties associated with the sampling process, site specific values shall be multiplied by a safety factor of 75% to calculate the amount of nutrients actually delivered.

$CBOD_5$ content of sediments is expected to vary widely with the amount of organic matter present. Transport, organic matter present, and time of year all present variation of estimated values. Unless other wise justified and preapproved the crediting estimation of the $CBOD_5$ content and turbidity impacts reduced will be 0.5 lbs per ton of soil as stated in the trading credit table.

Step 4: Calculate Trading Credits. Using the unit conversion ratios from the trading credit table, calculate the credit units that will result from the estimated reductions in phosphorus, nitrogen, $CBOD_5$, and sediment.

Livestock Exclusion

The following steps outline a general process for calculating estimates of pollutant reductions from livestock exclusion.

Livestock exclusion: Livestock exclusion for the purpose of this discussion means a management contract such as fencing and alternative water supply which provides a separation distance protecting the water and bank/shoreline.

Step 1: Determine the number of head and size of animals. This information can be obtained from the livestock manager. In Minnesota, the maximum grazing density for cattle that can be supported without supplemental feeding is 1 animal per acre (head/ac) over a 5-month grazing season for cattle. Other animal pasture operations must determine the land's capacity and document the assumptions. The animal count will be determined by the typical weight categories given in the Midwest Plan Service's

Livestock Waste Facilities Handbook (MWPS-18). Keep separate counts for each animal category presented. (HEAD)

Step 2: Determine the manure load generated by the herd. The Midwest Plan Service's Livestock Waste Facilities Handbook (MWPS-18) lists standard production rates for nitrogen, phosphorus, and $CBOD_5$. (MBOD, MP, MN)
MBOD = HEAD * MWPS-18 $CBOD_5$
MP = HEAD * MWPS-18 P
MN = HEAD * MWPS-18 N
MTBOD = $CBOD_5$ from all the animal categories presented
MTP = Phosphorus from all the animal categories presented
MTN = Nitrogen from all the animal categories presented

Step 3: Determine the field layout currently and after rotational grazing with livestock exclusion has been implemented. Generally, the pasture area can be divided into a riparian zone and an upland area. For large pastures, the upland area may be divided based on the delivery ratio as shown below:

Area	Delivery Ratio
Riparian	100%
Upland (within 1/4 mile of stream)	20%

Step 4: Determine the amount of nitrogen, phosphorus, and $CBOD_5$ delivered in each portion of the pasture before and after implementation of the BMP. Deposition of manure in pasture areas is assumed to be directly proportional to the amount of time spent by the animals in each area. Research into the amount of time unrestricted cattle will spend in the riparian zone is limited and is strongly influenced by regional climatic and forage factors. After a review of existing research data, the MPCA has proposed the following time distribution for beef cattle having unrestricted access in the riparian zone:

Month	Time in Riparian Zone
May	25%
June	25%
July 0-15	25%
July 15-30	36%
August	36%
September	25%
Average	*28%*

Time not spent in the riparian zone is assumed to be spread equally throughout the upland pasture area.

Example time distribution (TD) are shown below:

Example Time Distributions

	Livestock Management	
Pasture Area	Before BMP	After BMP
Riparian	28%	0%
Upland (within 1/4 mile)	72%	100%

The amount of nitrogen, phosphorus, and $CBOD_5$ deposited in each portion of the pasture can be calculated based on the amount of time spent in each pasture area. Field or Paddock account variables should be kept separate based on proximity to receiving water.

Step 5: Determine amount of nitrogen, phosphorus, and $CBOD_5$ delivered to the river system.

In general, the amount of nitrogen, phosphorus, and $CBOD_5$ delivered can be calculated from the amount deposited in each pasture area multiplied by that area's delivery ratio. However, several special conditions apply:

Herd Size: As mentioned in Step 1, the maximum grazing density for beef cattle is 1 head/ac without supplemental feeding. If a substantial portion of the pasture will fall under a conservation easement, the herd size should be reduced in the calculations to reflect the decreased carrying capacity after BMP implementation.

Nitrogen: After manure deposition in the pasture, some nitrogen will be lost to the atmosphere through ammonia volatilization. The amount lost is weather-dependent. In order to account for in-field losses of nitrogen prior to transport, nitrogen loadings should be multiplied by a "field loss factor" of 50%.

Filter Strip: Filter strip credit will be allowed for management areas where flow characteristics and vegetation are such that filtering out of solids is enhanced. The minimum width of the easement for application of a filter strip function is 25 feet for stem grass vegetation, and 50 feet for woody vegetation. Filter strips are assumed to remove 30% of particulate pollutants and 0% of soluble pollutants. The relative distribution of soluble/particulate fractions is assumed to be 50%/50% for manure-based nitrogen, phosphorus, and $CBOD_5$.

Step 6: Calculate Trading Credits. Using the unit conversion ratios from the trading credit table, calculate the credit units that will result from the estimated reductions in phosphorus, nitrogen, $CBOD_5$, and sediment.

Rotational Grazing With Livestock Exclusion

The following steps outline a general process for calculating estimates of pollutant reductions from rotational grazing when added to livestock exclusion.

Step 1: Determine the number of head and size of animals. This information can be obtained from the livestock manager. In Minnesota, the maximum grazing density for cattle that can be supported without supplemental feeding is 1 animal per acre (head/ac) over a 5-month grazing season for cattle. Other animal pasture operations must determine the land's capacity and document the assumptions. The animal count will be determined by the typical weight categories given in the Midwest Plan Service's Livestock Waste Facilities Handbook (MWPS-18). Keep separate counts for each animal category presented. (HEAD)

Step 2: Determine the manure load generated by the herd. The Midwest Plan Service's Livestock Waste Facilities Handbook (MWPS-18) lists standard production rates for nitrogen, phosphorus, and $CBOD_5$. (MBOD, MP, MN)
MBOD = HEAD * MWPS-18 $CBOD_5$
MP = HEAD * MWPS-18 P
MN = HEAD * MWPS-18 N
MTBOD = $CBOD_5$ from all the animal categories presented
MTP = Phosphorus from all the animal categories presented
MTN = Nitrogen from all the animal categories presented

Step 3: Determine the field layout currently and after rotational grazing with livestock exclusion has been implemented. Generally, the pasture area can be divided into a riparian zone and an upland area. For large pastures, the upland area may be divided based on the delivery ratio as shown below:

Area	Delivery Ratio
Riparian	100%
Upland (within 1/4 mile of stream)	20%
Upland (greater than 1/4 mile from stream)	10%

Step 4: Determine the amount of nitrogen, phosphorus, and $CBOD_5$ delivered in each portion of the pasture before and after implementation of the BMP. Deposition of manure in pasture areas is assumed to be directly proportional to the amount of time spent by the animals in each area. Research into the amount of time unrestricted cattle will spend in the riparian zone is limited and is strongly influenced by regional climatic and forage factors. After a review of existing research data, the MPCA has proposed the following time distribution for beef cattle having unrestricted access in the riparian zone:

Month	Time in Riparian Zone
May	25%
June	25%
July 0-15	25%
July 15-30	36%
August	36%
September	25%
Average	*28%*

Time not spent in the riparian zone is assumed to be spread equally throughout the upland pasture area.

Example time distribution (TD) are shown below:

Example Time Distributions

	Livestock Management	
Pasture Area	Before BMP	After BMP
Riparian	28%	0%
Upland (within 1/4 mile	36%	50%
Upland (greater than 1/4 mile)	36%	50%

The amount of nitrogen, phosphorus, and $CBOD_5$ deposited in each portion of the pasture can be calculated based on the amount of time spent in each pasture area. Field or Paddock account variables should be kept separate based on proximity to receiving water.

Step 5: Determine amount of nitrogen, phosphorus, and $CBOD_5$ delivered to the river system.

In general, the amount of nitrogen, phosphorus, and $CBOD_5$ delivered can be calculated from the amount deposited in each pasture area multiplied by that area's delivery ratio. However, several special conditions apply:

Herd Size: As mentioned in Step 1, the maximum grazing density for beef cattle is 1 head/ac without supplemental feeding. If a substantial portion of the pasture

will fall under a conservation easement, the herd size should be reduced in the calculations to reflect the decreased carrying capacity after BMP implementation.

Nitrogen: After manure deposition in the pasture, some nitrogen will be lost to the atmosphere through ammonia volatilization. The amount lost is weather-dependent. In order to account for in-field losses of nitrogen prior to transport, nitrogen loadings should be multiplied by a "field loss factor" of 50%.

Filter Strip: Filter strip credit will be allowed for management areas where flow characteristics and vegetation are such that filtering out of solids is enhanced. The minimum width of the easement for application of a filter strip function is 25 feet for stem grass vegetation, and 50 feet for woody vegetation. Filter strips are assumed to remove 30% of particulate pollutants and 0% of soluble pollutants. The relative distribution of soluble/particulate fractions is assumed to be 50%/50% for manure-based nitrogen, phosphorus, and $CBOD_5$.

Step 6: Calculate Trading Credits. Using the unit conversion ratios from the trading credit table, calculate the credit units that will result from the estimated reductions in phosphorus, nitrogen, $CBOD_5$, and sediment.

Critical Area Set-Aside

Many areas in the Minnesota River floodplain are still in row crop production. An example of scour erosion rates on cropland fields within the floodplain is 75 tons/ac/year, and that establishing a good permanent vegetative cover would reduce this to 3 tons/ac/year (Scott County SWCD), if a woody vegetative cover is placed with some structural BMPs in the channel the scour situation can be altered to one of deposition. Placing these areas under conservation easement and/or adding bio-engineering would result in substantial NPS reductions.

River Flood Scoured Areas

Step 1: Determine portion of field subject to scour excavation. This information can be obtained through the land owner or by direct observation of field conditions. The erosion volumes also must be estimated by averaging the previous events in a tons/acre unit base. (AREA, VOL)

Step 2: Using the dry density table, provide above, calculate the weight of the soil eroded by multiplying the dry density and the volume. (Tons/acre)

Step 3: Determine frequency of flooding. This can be determined from the landowner or through flood insurance maps. (FREQ)

Step 4: Determine average annual sediment loading. This is determined by multiplying the scour area by the averaged volume and dividing the by the flooding frequency.

SED = tons/acre/yr = AREA * VOL / FREQ

Step 5: Determine NPS pollutant values associated with sediment. . Assuming 100 percent delivery and using the default values in the table below, calculate the amount of phosphorus and nitrogen delivered to the river system.

Soil Type	Phosphorus Content	Nitrogen Content
Sand	0.85 lb./ton	1.70 lb./ton
Silt	1.00 lb./ton	2.00 lb./ton
Clay	1.15 lb./ton	2.30 lb./ton
Peat	1.50 lb./ton	3.00 lb./ton

The values listed above are conservative estimates. At certain BMP sites, soils may have enriched nutrient content due to past application of chemical fertilizers. Higher nutrient levels can be justified through site-specific soil sampling. However, to account for uncertainties associated with the sampling process, site specific values shall be multiplied by a safety factor of 75% to calculate the amount of nutrients actually delivered.

$CBOD_5$ content of sediments is expected to vary widely with the amount of organic matter present. Calculation of the $CBOD_5$ content will be done based on site-specific sampling using the 75% safety factor.

Step 5: Calculate Trading Credits. Using the unit conversion ratios from the trading credit table, calculate the credit units that will result from the estimated reductions in phosphorus, nitrogen, $CBOD_5$, and sediment.

Bluffs and Restored Wetlands

These types of critical area set asides will follow the Sheet, Rill and Ephemeral Gully Erosion system calculations as stated above. Consideration of the following two aspects of this category should be provided in addition to the estimation equations:

- Restored wetland contributing area will depend on determination that the wetland remains hydraulically unconnected with the watershed previously drained to. However, treatment credit can be justified by following the conditions of the treatment wetland systems section.

- Steep bluffs or hill slopes need may need several practices to obtain stability of the soils during their installation and through out the trade life.

Wetland Treatment Systems

The construction of wetland treatment systems specifically for water quality enhancement defines the wetland treatment system nonpoint source trading BMPs. Wetlands are a valuable watershed management tool in any basin. Wetlands help stabilized hydraulic peaks, provide necessary habitat for the many species critical to the food chain and settle sediments out of the runoff. However, not all wetlands remove nutrient loading from the watershed. Some wetlands act as sinks for phosphorus much of the year only to pulse the mass of nutrients stored out during stressful times such as after drought periods or snow melt. The constructed wetland treatment system is designed to control the way the nutrients are captured and stored or converted so that the mass of nutrients are not available to be released downstream. By maximizing optimum depths, surface area and detention time criteria nitrogen is volatilized off to the atmosphere while the phosphorus is captured and buried. This type of wetland may limit some types of habitat use but is targeted specifically for chemical and sediment treatment.

The science of nutrient treatment by wetlands is relatively new to the design processes in colder climates. Mixed results have often been obtained. Excellent results have been obtained by a system on the Des Plaines River near Chicago, Illinois. The basic concepts designed for with this constructed wetland provide controlled depths ranges to prevent resuspension of sediments, prevention of short circuiting of flows and adequate detention times which all provide for the loading rates for settling characteristics. When following these basic guidelines the performance equation for predicting phosphorus is:

$$\ln\left[\frac{C_o}{C_i}\right] = \frac{-k}{q}$$

where:

C_o = outlet mean annual phosphorus concentration in mg/l
C_i = inlet mean annual phosphorus concentration in mg/l
k = 1st order rate constant set at
12.1 meters depth per year for non-research projects
23.7 meters depth per year when research is provided (for first three research projects); or
Average of Research Results, upon completion of first three research projects
q = loading rate in meters of depth per year

Sediment reduction credits will be based on the annual average water concentration of sediment for the treated stream reduced by 75 percent. The volume treated will be estimated by design flows based on the average year's cycle as determined by flow data (if available) at the location.

Nitrogen reduction credits will be allowed based on the specific site information provided in the final site design. The crediting reduction rate will be determined by the streams content of nitrogen, flow and detention design aspects of the treatment wetland and a conservative factor of 25 percent less than comparable site designs at other locations. The literature sites from the other locations will be used only if it can be verified that the site has relatively the same design characteristics and flow and loading constraints. As the information on this process is developing a formula for projection of the credits will be developed and approved by the Permittee representatives and the MPCA staff.

Wetland Research will be targeted at assessing the performance of wetland treatment sites in Minnesota. The research can be provide by another partner or non-trade participant. Constructed wetland treatment systems will use the following guidelines for planning considerations, as adapted from Robert Pitt, November 2, 1993:

1. Treatment systems can have poor water quality and water contact recreation and consumptive fishing should be discouraged.

2. Keep the wetland shape simple to encourage good water circulation. The length should be about three to five times the width for maximum detention efficiency and the inlets and outlets need to be widely spaced to minimize short-circuiting. Lower length to width ratios will be allowed if justification can be provided based on the design flows, vegetation establishment and/or energy of the unchannelized water in the wetland.

3. Protect the inlet and outlet areas from scour erosion.

4. Minimum and maximum depths of the wetland need to be considered. The depth should not be such that anoxic layers readily develop. Nor should the bounce of the wetland be too high.

5. Maximum flows to be treated will be designed for by providing adequate detention times and emergency spillway or flow bypasses. These design aspects can be met in many varying alternatives. However, the main planning consideration driving a treatment wetland is the capture and long term storage of the sediment and nutrients. The approved system will strongly address these issues in the site design.

6. A routine maintenance schedule will be developed, which will address:
    - the sediment accumulation
    - provisions for unforeseen circumstances (such as carp resuspending the sediments)
    - the inspection and replacement of structures
    - establishment and maintenance of the vegetation.

The trading credits for a wetland treatment system will be divided among site participants as follows:

Wetland costs for installation will be totaled. All parties (i.e., Rahr, LGUs, state and federal offices, private organizations, etc.) contributing to the installation costs and estimation of maintenance costs will determine the percent credits. Operation and research costs provided by third parties will not be calculated in the crediting process.