Agricultural Drainage Management Systems Task Force

Dundee, Michigan -- April 17-19, 2012

Tuesday afternoon

Introductions: Tim Harrigan welcomed everyone to Michigan, and all participants introduced themselves. A full list of participants is on page 13.

Charlie Schafer gave an update from the Agricultural Drainage Management Coalition, including the current saturated buffer project and other industry topics of interest.

Agenda Overview

(Complete agenda page 11)

- Tuesday afternoon – presentations
- Wednesday morning – Phosphorus mini-symposium; Discussion
- Wednesday afternoon – Field Trip
- Thursday morning – NCERA 217 business meeting; Presentations; Discussion on next steps.

Xinhua Jia, Chair of the North Central Extension and Research Activity (NCERA) 217, briefly introduced the committee and its objectives for those not familiar with the committee. This is a multistate research committee sponsored by USDA National Institute for Food and Agriculture (NIFA), with the following objectives:

- Evaluate and demonstrate the impact of integrated drainage system design and agronomic management practices on reducing nitrate-N and soluble phosphorus loads from drained agricultural lands.
- Coordinate research on the water quality impact of manure application on drained agricultural land.
- Assess the need for further research in other aspects of environmental quality from drained agricultural lands, such as salinity, implications of emerging feedstock production for biofuels, and potential greenhouse gas production in drained agricultural lands.
- Develop Extension and outreach educational materials, develop strategies to facilitate communication between scientists and policy makers, and promote partnerships with stakeholders interested in drainage, soil and crop management, and environmental quality in agricultural landscapes.

This group has worked closely with the Ag Drainage Management Systems Task Force for many years, but this is the first meeting where the two agendas have completely overlapped.

Paul Sweeney discussed the NRCS Ag Water Management Team. The Team's Action Plan includes:

- Communication: Summit, presentations, State Technical Committees, outreach tools. All are available at http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage.
- Technology: Map of acres suitable for DWM, web-based application, and development of technical standards. (Map and others available at web site)
- Training and policy (state ag water management action plans), changes to programs, wildlife habitat.

Doug Toews discussed various standards that are in development or review. He also introduced Andrew Pursifell, NRCS engineer in Indiana, who is planning to study adoption of drainage water management as part of a leadership training. Andrew briefly described his project and invited input on barriers to adoption and other ideas that people have related to adoption. (It was pointed out that in Missouri the best adoption takes place where state cost-share of $300 adds to federal incentives.)

Norm Fausey described the many activities that ARS is doing related to drainage, beyond projects represented here. He shared information about the Soil Drainage Unit's work under two major CRIS projects, and invited collaboration. Asked to reflect on phosphorus, he noted that phosphorus is a separate issue from drainage, but is not clearly exacerbated by subsurface drainage. Yes, we have soluble phosphorus in the environment, and we're moving water out through drainage. Drainage moves another few inches of water out of the profile annually. He pointed out that the electrochemical bond between orthophosphate and the soil material is complex, including ligand exchange sites and other chemical properties.

Kelly Nelson presented drainage research in Missouri, focusing on agronomic aspects. They are stacking *integrated water management systems* with fungicide and insecticide applications and polymer-coated urea. Overall they have found a 20% increase in corn yield with drainage and 40% increase in yield with subirrigation. They are also studying air quality impacts of wet soils (ammonia volatilization and nitrous oxide). Water quality studies showed that managed drainage reduced annual water drained by 60%, and loss of TSS, ortho-P, and nitrate-N by more than that. Some pumped drainage is being introduced due to lack of an outlet. He also presented drainage in a perennial crop. Their 2012 drainage workshop was very successful, and produced interesting survey results and increases in knowledge.

Larry Goehring described Cornell University's research funded by a Conservation Innovation Grant on "Subsurface Drainage Water Management to Reduce Manure Contaminated Drain Discharge". Drainage sites have been installed near Lake Champlain, with measurements in a control structure, an uncontrolled tile, and outlet into the stream. The influence of manure application on phosphorus and *E. coli* is clear, with TP levels reaching 2.5 mg/L . The tile with the control had slightly less loss overall.

Chris Hay: There is huge interest in drainage in South Dakota, with lots of installation of new drainage; not so much drainage water management. They have held very successful drainage workshops together with Minnesota and North Dakota, with 250 people attending. They have developed a drain spacing calculator (http://climate.sdstate.edu/water/DrainSpacingCal.html), and it was noted that 3-inch tile is popular in the Red River Valley. He was asked about drainage coefficient used, but no work currently being done. They are looking at evapotranspiration of cover crops, since some are convinced that drainage not needed with cover crops.

R. Sri Ranjan presented a great deal of research related to **"**Better Water Management through Tile Drainage/Subirrigation Systems". Much interest in drainage in Manitoba, especially related to flooding. They are focusing on agronomic aspects for potatoes, and environmental impacts including soil salinity. They have controlled drainage with subirrigation, free drainage with overhead irrigation (highest yield and also highest nitrogen and phosphate export), and no drainage with and without irrigation. He presented the field monitoring, including groundwater, drainage flow (using sharp crested weirs with level logger), soil moisture, and salinity. (And I note had particularly wonderful photos.)

Bruce Shewfelt discussed activities in Southern Manitoba of Agri-Environment Services Branch of Agriculture and Agri-Food Canada related to agricultural drainage management systems. These include capacity building activities; the Hespler and CMCDC projects to study controlled drainage with various

irrigation systems, cover crops, and nutrient management. They are also studying Water Footprints on irrigated/tiled land in the Boyne River Valley, and he discussed the conclusions regarding controlled drainage contained within the "Red River Retention Authority Report" which discusses the international Red River Valley watershed. He brought up other potential areas of international cooperation such as training, education and case studies. He noted that the Agri-Environment Services Branch is planning to do a case study on a field-scale tile installation in Southern Manitoba, including adoption barriers.

Mark Sunohara described a paired watersheds study, where most fields in an intervention watershed had controlled drainage, and most fields in the "control watershed" did not. The non-statistically-significant results were that nitrate-N was reduced by 30% but Total P *increased* by 10%. (He speculated that the increase in P could be due to P mobilized, manure application, error, or in-stream inputs.) However, field scale studies consistently showed reductions of up to 80% in pollutant loads, and slight (3-4%) yield increases possibly a result of more uniform crop growth. They are also trying to identify barriers to DWM and inform future policy and program development. Why Is DWM not practiced broadly given environmental and economic benefits? They completed a survey on the research question: Why do farmers choose, or not choose, to adopt controlled tile drainage in the Eastern Ontario? They found that producers are aware of DWM, but don't adopt, and that agronomic benefits are a primary motivation. The uncertainty around agronomic benefits for different crops is a barrier, and producers would adopt in absence of incentives if yield improvements were consistent at significant levels. They also found that drainage contractors, who are a key source of information for producers, are not promoting the technology.

Eileen Kladivko discussed advances being made in cover crop adoption, and the Midwest Cover Crops Council (http:// www.mccc.msu.edu) which has achieved considerable success in the last 7 years. The goal is to facilitate widespread adoption of cover crops across the Midwest, for water and soil quality and economic productivity. She also discussed her research at Purdue including N cycling with oilseed radish cover crop, and using bicultures to reduce loss of sediment and P from oilseed radish cover crops. They are also looking at erosion and P loss in runoff and sediment.

Mohammed Youssef discussed the history of DRAINMOD-related models. The latest development is DRAINMOD –FOREST. Integrated forest ecosystem model. Also DRAINMOD-DSSAT, which provides a major improvement in crop yield.

Jane Frankenberger led a brief discussion of what was learned and items we should follow up on Thursday, and **Tim Harrigan** provided an overview of Wednesday's field trip.

Wednesday morning – Phosphorus Mini-Symposium

Jane Frankenberger opened the session with some background on the issue, and how it came to be discussed by this drainage group which usually focuses on nitrogen. Although some people have been raising concerns about phosphorus in tile drains for years, the levels are relatively small compared to nitrogen levels, and most models based on classical soil physics would not predict tile drainage to be an important transport pathway. In December 2011, NRCS asked a group of scientists to present

conservation recommendations for decreasing phosphorus loading to the Western Lake Erie Basin and Grand Lake St. Marys. One result was the realization of the potential importance of the tile drainage pathway, but a lack of consensus on how important it was in the watershed and in fact how it worked. Some interests have used this scientific uncertainty as a reason for doing nothing in response to the phosphorus. For examples of this, she presented excerpts from letters attached to the Ohio Agricultural Nutrients and Water Quality from March 2012.

She stated that the goal of this mini-symposium is to reach consensus on the most important mechanisms for phosphorus transport to tile drains, and factors influencing transport. Speakers include Steve Davis, NRCS Watershed Specialist who has worked on this issue for many years and can provide a broad background as well as data collected by Dave Baker of Heidelberg University who was unable to participate due to illness; and four researchers who have done extensive research in the region at the plot, field, and small watershed scales:

- Kevin King, ARS Columbus, Ohio
- Doug Smith, ARS West Lafayette, Indiana
- Chin Tan, Agriculture and Agri-Food Canada
- T.Q. Zhang, Agriculture and Agri-Food Canada

She has asked two researchers with extensive experience in this field, Wayne Skaggs and Larry Geohring, to lead the discussion with their thoughts on key processes, and this will be followed by a discussion of processes, and finally how to move forward to improve science and policy.

Kevin King presented several data sets, including his small watershed study in the Upper Big Walnut Creek watershed, central Ohio. The drainage area is 389 ha; soils are Bennington silt loam (52.9%); Pewamo clay loam (46.2%). Land use is Agriculture (88.9%); Woodland (10.4%); Urban (0.4%). Cropping system is corn-soybean rotation; mostly rotational tillage and 78% of watershed drainage area systematically tile drained. He reported the following findings:

- Tile drainage accounts for approximately 46% of the watershed discharge, approximately 41% of the DRP, and 34 % of the TP measured at the watershed outlet.
- At the watershed outlet DRP (0.59 kg/ha/yr) accounts for 64% of the TP (0.92 kg/ha/yr) losses. At the tile outlets, DRP (0.3 kg/ha/yr) accounts for 77% of the TP (0.39 kg/ha/yr) losses.
- Median annual flow weighted DRP concentration at the watershed outlet was 0.127 mg/L compared to 0.132 mg/L for tile. Median annual flow weighted TP concentration at the watershed outlet was 0.187 mg/L compared to 0.175 mg/L for the tile.
- There are bimodal distributions of P concentrations in tile, with peaks in growing season and after harvest.

He has also set up edge-of-field monitoring at 16 sites in the Grand Lake St. Marys watershed, which will provide in-depth information on some fields with very high soil test phosphorus levels.

Doug Smith presented a comparison of surface and subsurface P losses in the St. Joseph River, Watershed, Indiana. He noted that relative to nitrate-N, P concentrations in tile drains are very small. But these small values are sufficient to induce eutrophication in Lake Erie. The amount of loss, 1 lb P/acre is agronomically insignificant, but 1 lb/acre is resulting in harmful algal blooms in Lake Erie. They have looked at alternatives to tile risers that minimize loss of productive land, allow farm traffic, require

minimal or easy maintenance, are approved for cost share, and effectively drain the landscape, developed a 10x10 foot blind inlet which reduced phosphorus. He presented data on four fields, all of which exceeded the phosphorus loss per acre of the Maumee as a whole. (Total phosphorus from surface runoff plus tiles ranged from 0.5 to 6 lbs P2O5, while Maumee during the same time was less than 1lb).

Chin Tan emphasized the important role of weather and climate. They have worked on a water balance for the tile drain plots and estimate the following average values in their southern Ontario plots:

- P (100%)=ET (55%) + Surface Runoff (8%) + Tile Drainage (30%) + Change in Water Storage (7%)

He described their wetland/reservoir subirrigation research, which found that for regular free drainage, from 3 to 5 % of the total soil P loss was in surface runoff water, while 95 to 97 % was in sub-surface tile drainage water. For the controlled drainage subirrigation system, from 29 to 35 % of the total soil P loss was in surface runoff water, while 65 to 71 % was in sub-surface tile drainage water. The CDS-reservoir system consistently increased corn and soybean yields relative to DR system, for example in the drought years of 2001 and 2002, corn yield was increased by 91 % and soybean yield was increased by 49 %.

TQ Zhang described phosphorous loss in tile drains from agricultural lands, in comparisons with surface runoff. They found phosphorus export in surface runoff, matrix, macropore and drain flow. Most previous research and nonpoint source control efforts have emphasized P losses by surface erosion and runoff because of the relative immobility of P in soils. P leaching and losses of P via subsurface runoff have rarely been considered important pathways for the movement of agricultural P to surface waters. They consistently find concentrations similar in surface runoff and subsurface drainage, resulting in much higher losses in subsurface drainage because of greater flow. Continuous sod increases soil P loss in tile drainage. He noted that he has looked at published papers over the last 25 years and found 1600 related to P loss, of which < 10% related to subsurface flow, and < 1% compared surface and sub-surface flow.

Steve Davis, Ohio NRCS, presented a fascinating look at "Lake Erie – Our Great Lake". Lake Erie has a $1 billion sport fishery, producing more fish than all other Great Lakes combined. Toxic algae bloom of 2011 was the largest recorded. Major recent studies and reports have provided a great deal of information and some strategies for moving forward:

- Ohio Lake Erie Phosphorus Task Force
- Lake Erie Millennium Network Synthesis Team
- Agricultural Nutrients and Water Quality (March 2012)

When he talks to agricultural groups, they point to lawns, lawn points to municipal waste water and they in turn point to agriculture. The average annual export from Maumee watershed is 1.1 pounds of P per acre as measured by Heidelberg University. "We're not doing a bad job, but there are so many acres that it becomes a large problem". Since 1995, dissolved P has increased, and that has mirrored the algae growth. The timing of the storms seems particularly important. Winter broadcasting of fertilizer, when followed by a rain event, means large runoff. The farther away from application you have the rain

event you will have smaller concentrations. P moves in a few major events in a year. 65% of soybeans are grown using no-till, but only 19% of corn.

Discussion of P in tile drainage

Since P in drain tiles was quite unexpected for many people, the discussion began with ***reflections by distinguished researchers.***

Wayne Skaggs pointed out that we all have a different definition of "normal". In North Carolina, less that 0.03 kg/ha was typically found coming from tile drains, with levels at least 10 times higher in surface runoff. But clearly the soils in the Lake Erie watershed are very different, emphasizing different processes. High P losses in tile drains seem to be caused by "surface-like processes" rather than subsurface processes. Water moving through soil cracks and root-holes is not the same as matrix flow. (When you see muddy coming out of tile you've got surface flow.) He also discussed what we know about flow paths when the field is ponded. In that case, most water moves over the surface above the tile (Kirkham equation) and drainage rate greatly increases. He noted that more than half of flow comes from within plus or minus one drain depth (width) from tile. This process would make macropores flow as well. One process-based way to address this would be to bed over tiles, so that surface water never ponds in those areas. This mounding would reduce the short-circuiting directly to tiles. He also noted that in North Carolina, controlled drainage did reduce P loss, because there the drainage includes surface flow, which had more time to sorb to sediment in controlled systems.

Larry Goehring reflected on phosphorus transport mechanisms, and the need to think more about the phosphorus exchange (adsorption and desorption) at the surface. In heavy clay soils with macropores, the drainable porosity is nearly the same as the macropores, and drainage is especially this portion of the flow. He discussed the unstable wetting front which is typical, including in the Michigan state soil. He also showed images available
at http://nmsp.cals.cornell.edu/publications/factsheets/factsheet12.pdf
and http://nmsp.cals.cornell.edu/publications/factsheets/factsheet13.pdf.

Discussion

We looked in depth at three studies:

- Kevin King: Tile drainage was the flow path for 41% of DRP, 34% of TP in a small watershed.
- Doug Smith: Tile drainage was the flow path for 2-100% of TP in several fields (most 30% to 50%).
- Chin Tan and TQ Zhang: Tile drainage was the flow path for 97% of the phosphorus in small plots.

Are these sites representative? If not, why not? Millions of dollars have been spent to determine these. What else should be monitored?

- Group members felt that it is important to separate true no-till, defined as 3-6 years of no stirring of the soil, from rotational tillage where just soybeans are no-tilled. For clarification, one field monitored by Doug Smith has 20 years continuous no-till. Another is rotational tillage.

- If we are only considering problem in Lake Erie, then yes the sites are sufficient. However, for the entire Midwest, then they are not representative enough. Need more sites with soils that do not contain many macropores (no cracking)
- We should separate morainal soils (which includes much of the Indiana portion of Lake Erie basin) from the lake bed soils which are heavier and include shrink/swell clays.
- Terminology: Need to be careful about calling water from surface inlets "subsurface drainage" – Refer to it as "surface processes" or " Surface Induced subsurface flow"

How can models be improved to include phosphorus transport through macropores to tiles?

Add macropores/preferential flow to models

- Need a better idea of mechanisms that cause P travel through soil
- There are some models that include preferential flow for herbicides, etc. that could be looked at, but are not the same as it would be for P.
- Challenge: shrinking and swelling of soil.
- Challenge: reaction of P with Ca and Fe

Surface processes bring P into the drain, but if the drain is controlled, the P has a chance to go back out through matrix. Modeling this process will be a real challenge

What else should be looked at?

- Can't prevent P from escaping so need to get solutions to prevent P from reaching the lakes---is there a short term step?
- Can't stop the cracking of soils. What has happened to water recycling?
- Clearly state that tile riser is different from pure subsurface. Surface-induced subsurface flow. Other suggestion: Direct entry.

Follow-up from this discussion: Two groups were formed with volunteers and conveners as noted.

- **Modeling**: Initial focus: Proposal to develop macropore/preferential flow components for major models used in planning and assessment. It was noted that some models already have this capability, especially for dealing with pesticides. *Volunteers:* Mohammed Youssef (convener), Xinhua Jia, Sri Ranjan, Hamid Farihani, Kevin King, Doug Smith, Jane Frankenberger.
- **Education:** Initial focus: publication focusing on helping farmers understand how phosphorus gets off the farm. Could have one beyond Lake Erie that covers tile drains and phosphorus. *Volunteers:* Jane Frankenberger (convener), Larry Geohring, Bill Kuenstler, Natalie Rector, Carrie Vollmer-Sanders, Paul Sweeney, Xinhua Jia, Eileen Kladivko, Doug Smith, Steve Davis.

End-of-pipe solutions: No specific volunteers, but this needs to be researched and findings disseminated.

Wednesday afternoon Field Trip

The group traveled to two sites:

- Stop 1: Livestock Reservoir Wetland Sub-irrigation System—Bakerlad's Dairy, Clayton, MI. (Handout: http://www.lenaweeconservationdistrict.org/centerforexcellence/LRWSIS%20report.pdf)
- Stop 2: Two-stage ditch, Hillsdale, MI. **Jon Witter** from Ohio State University presented background information on two-stage ditches and how this one was designed and is performing.

Thursday morning

NCERA217 Business Meeting

Notes from this business meeting were taken by Tim Harrigan, NCERA-217 Secretary, and will be distributed separately to NCERA-217 members. Chris Hay, South Dakota State University was elected incoming Secretary, and will become Chair in 2013. Tim Harrigan will become Chair after the meeting, and Xinhua Jia is Past-Chair.

Discussion of next meeting (Spring 2013), which will likely be held together with ADMS Task Force as this one was. The date should be the last week in March. Location options suggested include Purdue (could visit bioreactor, two-stage ditch); South Dakota (lots of activity; Chris Hay will be organizing); and North Carolina. Further discussion will take place by email.

Presentations

Xinhua Jia described her extensive agricultural water management research in North Dakota. At Fairmount, they are looking at the feasibility of subsurface irrigation. They have collected ET measurements in corn and soybeans, and are completing DRAINMOD simulations. She pointed out that a complicated field makes DRAINMOD very complicated... Salinity is also a concern, with TDS reaching nearly 10,000 mg/L. They also have a SARE (Sustainable Agriculture Research and Extension) project at North Moorhead, MN. She also discussed future Upper Red River Basin projects

Roxanne Johnson presented "Red River Valley Water Quality Assessment: Tile Drainage in Saline Soils". Very little water quality research has been done, so preliminary studies of tile drain outlets and comparable untiled areas. Found high levels of sulfate and nitrate-N (average 30 mg/L). Other parameters were in normal range.

Umesh Adhikari and Tim Harrigan presented their work on Pathogen removal efficiency of constructed wetlands subjected to pulsed pathogen loading. They concluded that pulsed pathogen loaded constructed wetlands can significantly reduce pathogens, but cannot eliminate them. They also found that bacterial removal in constructed wetlands is better than virus removal, subsurface flow wetlands were superior to surface flow wetlands in both bacteria and bacteriophage removal, and that pathogen removal performance of constructed wetlands in summer is similar to or better than in winter

Kyle Brooks and **Jane Frankenberger** discussed the new Krohne electromagnetic flow meters recently installed, which can capture forwards or backwards flow which can be an issue in very flat areas with

poor outlets. The meters seem to be capturing a wide range of tile flows well. Kyle discussed the meter installation, and programs he wrote to process the data automatically.

Siddharth "Sid" Verma discussed innovative bioreactors that include steel turnings to remove phosphorus. Found that it was very effective, as long as steel turnings were after the woodchips. If the steel turnings were first, followed by the woodchips, some of the P removed by the steel turnings was replaced by flow through the woodchips. Future research required to see how long they would last, and if the steel turnings would start to release P at some point. This presentation elicited lively discussion, since the need to reduce phosphorus from drain tiles is clear. The work is preliminary so far. He also presented the temporal variability of loads, showing that the top 5 events produce most of the phosphorus loads.

Discussion – Next Steps

Doug Toews, who will be retiring June 1, looked back on what the ADMS Task Force has accomplished in its ten years of existence. He noted that we are considered superstars in terms of what can go right in a Partnership Management Team group. It has been useful to make sure that research fits the needs of the implementers, and the NRCS Ag Water Management Team that Paul Sweeney is leading will continue to interact closely with the Task Force. There will be another national water management engineer in the future, and in the meantime, ***Paul Sweeney*** will be the primary NRCS contact for ADMS. For future directions, he suggested going beyond water management structures, and taking up the concept of integrated water management. Reusing water wherever possible, like the livestock system we saw yesterday, will be important. A role for this group might be to look more broadly at integrated water management, including rainfed agriculture, to optimize the use of our water resources in agriculture. He is moving to the central coast of California, where the state is requiring irrigators to have zero discharge which should lead to many interesting challenges.

What issues should we address next?

What work is going on related to **manure**? Phosphorus discussion relates to this.

- Discovery Farms starting in ND. Two sites have livestock, third site is tile drainage site.
- Integrated water management and livestock wetland reservoir systems yesterday. Tim Harrigan has additional work on wetland treatment. Also integrating manure with cover crops.
- Water recycling is a huge issue in Manitoba. Moratorium on expansion of livestock systems.
- Pat Dumoulin reminded the group to keep in mind that manure varies between species. United Soybean Board - National Board and Illinois -have designated livestock as a number one priority. Good source for funding.
- Can we integrate treatment with management in the field to make a good thing better?

Idea of **soil health** has exploded. Need to go from anecdotal information to research measurements. There are many farmers that have excellent practices. This group aimed at drainage. Don't want to convert to soil health people. Can we work with people who work on that?

- Work on systems for monitoring (in Canada) might provide more tools for lower-cost research.

- Systems monitored are too short so far. Need 10 years. Tan/Zhang have some long-term data on cover crops.
- What impact does soil health have on infiltration and runoff? Need to measure total water balance to make sure we get at that. (Tan/Zhang setup is good for this.)

Future meetings:

It was decided to hold an ADMS meeting in the Fall, then hold the spring 2013 meeting in conjunction with the NCERA217 meeting like this year. Possible locations for the Fall 2012 meeting:

- Arkansas, because of all the drainage work. Possibly Memphis (convenient location) or Little Rock (NRCS National Water Management Center)
- Iowa. Could visit saturated buffers and bioreactors.

- At future meetings, presenters should provide handouts of their presentation, or maybe post on web site when possible.

Additional Thoughts and Future Activities

- Research should meet the needs of the implementers.
- We have interactions with other groups focusing on other interests like cover crops.
- Also should interact with SERA17, focusing on phosphorus. Mostly soils people are there, and it would be helpful to have hydrologists.
- Suggestion: If someone is going to or is a part of another group, could have a liaison. Bring back a report. Find out key scientists, bring them into our meetings.
- How about forming international task team by integrating ecosystem approach? We could identify field sites representing typical areas.
- International benefits of this project. We share the soil, we share the water.

AGENDA -- Joint meeting of the
Agricultural Drainage Management Systems Task Force and
North Central Extension and Research Activity 217
(Drainage Design and Management Practices to Improve Water Quality)
Dundee, MI, April 17-19

Tuesday, April 17

Xinhua Jia, Chair of NCERA 217, Moderator

Time	Topic	Speaker(s)
Pre 1 pm	*Registration (Tim Harrigan). Speakers load presentation*	
1 pm	***Welcome***. Overview and goals of meeting, and of ADMS Task Force and NCERA-217; Introductions of all participants	Xinhua Jia; Tim Harrigan; Jane Frankenberger;
1:30	NRCS Ag Water Management Team and related NRCS activities	Paul Sweeney, Doug Toews; Andrew Pursifull
2:00	ARS, Soil Drainage Research Unit station report	Norm Fausey
2:15	Missouri report	Kelly Nelson
2:30	South Dakota State Report	Chris Hay
2:45	**Break**	
3:15	Update on controlled drainage research in NY	Larry Goehring
3:30	Hespler Controlled Drainage Subirrigation Project	R. Sri Ranjan
3:45	Manitoba Drainage Water Management Activities	Bruce Shewfelt
3:55	Watershed Evaluation of Beneficial Management Practices	Mark Sunohara
4:10	New cover crop research in Indiana	Eileen Kladivko
4:25	North Carolina report	Mohammed Youssef
4:40	Discussion – Summarize key points, and identify items for follow-up Thursday morning	All
4:50	*Prepare for tomorrow*	Tim Harrigan
5 pm	Adjourn	

Wednesday, April 18

Morning: Phosphorus in Tile Drainage Mini-Symposium (Jane Frankenberger, Moderator)
Afternoon: Field Trip (Tim Harrigan, Organizer)

Time	Topic	Speaker(s)
8:15	Phosphorus Mini-Symposium: Introduction and goals	Jane Frankenberger
8:30	Significance of Tile Drainage as a Conduit for Phosphorus Transport: an UBWC watershed case study	Kevin King
8:50	A comparison of surface and sub-surface phosphorus losses in the St. Joseph River watershed.	Doug Smith
9:10	Effect of water management on phosphorus transport through surface and sub-surface drainage in corn and soybean rotation	Chin Tan
9:40	Lake Erie: A national treasure threatened by harmful algal blooms. Phosphorus impacts and control efforts.	Steve Davis
10:00	**Break**	

10:30	Comparisons of soil phosphorus loss in tile drainage with surface runoff	Q.T. Zhang
10:50	Short reflections on phosphorus transport mechanisms	Distinguished researchers
11:10	Group discussion – can we reach consensus on most important mechanisms for phosphorus transport to tile drains, and factors influencing transport?	All
noon	Adjourn – Lunch and prepare for field trip	
1 pm	**Board bus for field trip** Stop 1: Livestock Reservoir Wetland Sub-irrigation System—Bakerlad's Dairy, Clayton, MI Stop 2: Two-stage ditch, Hillsdale, MI	Tim Harrigan

Thursday, April 19

Time	Topic	Speaker(s)
8:00	NCERA 217 business meeting – Elect officers, plan next year; review of objectives and annual report requirements	Xinhua Jia
8:30	Wetland research	Tim Harrigan
8:45	North Dakota station report	Xinhua Jia
9:00	North Dakota station report - 2	Roxanne Johnson
9:30	Monitoring tile drains: New electromagnetic sensors	Jane Frankenberger& Kyle Brooks
9:45	Break	
10:00	Synergism in nitrate and phosphate removal in bioreactors and Temporal patterns of nitrate and phosphate export from tile drained watersheds in the Lake Erie basin	Siddhartha Verma
10:15	Moving agricultural drainage management forward: Key research, education, and action steps	Discussion by all
Noon	Adjourn. Safe travels.	

	ADMS and NCERA-217 Meeting Participants - April 17-19, 2012	
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