MANITOBA CLEAN ENVIRONMENT COMMISSION

HOG PRODUCTION INDUSTRY REVIEW

TRANSCRIPT OF PROCEEDINGS

PHOSPHOROUS PANEL

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Held at the Delta Hotel

Winnipeg, Manitoba

TUESDAY, MAY 29, 2007

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APPEARANCES:

Clean Environment Commission:

Mr. Terry Sargeant	Chairman
Mr. Edwin Yee	Member
Mr. Wayne Motheral	Member
Ms. Cathy Johnson	Commission Secretary
Mr. Doug Smith	Report Writer

Participants:

Ian Halket

Petra Loro

Mitch Timmerman

Dwight Williamson

Dave Green

Ken Mills

Don Flaten

Wole Akinremi

Marc Trudelle

Christine Rawluk

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UPON COMMENCING AT 10:05 A.M.

THE CHAIRMAN: Well, I think we may as well get going. We were also expecting Al Warkentin, but all of these rains have given him other concerns to deal with, so we may well not see him today.

Perhaps we can start with a round of introductions so that everybody knows everybody. I am Terry Sargeant, the chair of the Manitoba Clean Environment Commission, and the chair of the panel on the Hog Production Review.

MR. FLATEN: I will get this introduction out of the way. Don Flaten, nutrient management specialist, Department of Soil Science, University of Manitoba.

MS. RAWLUK: Christine Rawluk, Department of Soil Science, University of Manitoba, working with Don Flaten.

MR. AKINREMI: Wole Akinremi, associate professor of soil eco-dynamics, working on phosphorous in the Department of Soil Science.

MR. HALKET: Ian Halket. I'm with Red River College, civil engineering technology. I teach hydrology.

MR. TRUDELLE: Marc Trudelle, Manitoba Conservation, livestock section.

MR. GREEN: Dave Green. I'm a water quality specialist with Manitoba Water Stewardship Department.

MR. WILLIAMSON: I'm Dwight Williamson. I'm the director of the Water Science and Management Branch with the Manitoba Department of Water Stewardship.

MR. MILLS: Ken Mills with Energy Consultants International, advisors to the Commission.

MS. LORO: I'm Petra Loro, with Manitoba Agriculture, Food and Rural Initiatives. I'm a livestock environment specialist.

MR. TIMMERMAN: Mitchell Timmerman, nutrient management specialist, also with Manitoba Agriculture, Food and Rural Initiatives.

MR. MOTHERAL: Wayne Motheral, member of the Commission.

MR. YEE: Edwin Yee, member of the Manitoba Clean Environment Commission.

MR. SMITH: Doug Smith. I am working on contract for the Commission on this report.

MS. JOHNSON: I'm Cathy Johnson. I'm

secretary to the Commission.

THE CHAIRMAN: Well, thank you all for coming out this morning and giving us some of your time to help us resolve -- well, perhaps not resolve, but to understand a little better some of the issues that are surrounding phosphorous.

Just a couple of technical notes. As you've already been, or have experienced, we have to turn the mikes on and off when we're speaking. We are recording this. And we will produce a verbatim transcript in the next few days. This is for our own purpose only. In our hearings, when we produced the transcripts, we post them on our website within a few days. However, that will not be the case with this. This is strictly for our own internal use.

And in order to get the recording, we have to have the mikes on so that it goes through the system. So I would ask you just to bear with us when we remind you to turn them on and off. If we do not turn them off after a certain point, I think we can only have two or three on at once and then they stop turning on and it gets a little complicated.

We, on the panel, and I have said to

one or two people already this morning, most of us are lay people. We do not understand a lot of scientific issues. But there are a number of issues around phosphorous, some of them scientific. I am not sure how much of the science we need to go into, but we certainly need to have some understanding of the nature of phosphorous and how it works in an agricultural environment, because that is one of the main tasks that is been given to us by the Minister of Conservation. Specifically, one of the main Terms of Reference was to review the recently enacted Manure Management and Mortalities Regulation, which includes dealing with livestock manure on a phosphorous basis.

We realize that there are probably any number of opinions around the table. We do not expect to resolve any of these issues this morning. We do not expect -- most of the panel members -- Edwin does have a good background in science, but the rest of us do not. We do not expect to go out of here later this morning, or later on this afternoon, with a full scientific understanding of all of these issues. But if we can have some understanding of how it relates

particularly to our mandate, that will really be very helpful to us.

Cathy, a week or two ago, circulated a number of fairly general questions:
agronomic rates versus environmental rates of application,
rationale and methodology of calculation of the overall contribution of P from each source,
movement of P in water,
measurement of P,
calculation of total nutrient loads,
predicted future changes to the P regulation,
monitoring plans to determine if these regulations and management practices are doing what they hoped for.

Oh, actually, it was a couple or three weeks ago that Wayne sent some questions related to P:
the retention of P in soils,
retention according to various soil types,
different forms of P in soil, particulate, soluble, et cetera,
nature of P in soils,
effects on pH,
P in soils at different times of the year,

and the effects of winter and the fact that land in Manitoba freezes solid, what does that do to P movement? And those are just some overview questions.

I really have no idea how this is going to proceeded today or how we want this to proceed. But perhaps if we could get some -- perhaps just start off talking about where this regulation came from, and the thinking behind this regulation, and where it is hoped that this regulation will take us? Who might be able to do that? Well, I guess we may as well -- Marc, do you have something?

MR. TRUDELLE: Well, I can probably start some insight about the phosphorous reg and what I am used to seeing in the phosphorous reg. I circulated the document, I think. I have a copy here, an extra copy, with some graphs and tables that will probably be easier to follow. It is the same document, but with -- I added some extra information about that.

Well, my own knowledge about the phosphorous -- I will just take about maybe ten minutes to go through the document. My knowledge of the phosphorous started ten years ago. So in

Quebec, as you know, they had the phosphorous regulation in 1997. This regulation was based on, in fact, many studies. And they looked at different ways of evaluating or estimating the phosphorous, and what is best to get the picture of the phosphorous. And so they started by soil P test. And, finally, due to the fact that soil P test is usually formulated to look at planned response, so it is a question of agronomic way of spreading phosphorous, and looking at the soil P test and usually it is a fertility program.

In order to get a picture of the phosphorous problem as associated with water quality, they moved slowly to the DPS. What is the degree of P saturation? So the degree of P saturation is really related to the capacity of the soil to retain the phosphorous. So it is the easiest way of looking at the fact that for the same soil P test, you will have different capacity to retain phosphorous. So if you have a soil P test at a certain level, another soil P at the same level, the soil capacity will be different by different types of soils. So the principle behind it was to be more site specific.

The saturation concept is really based

on the extractable level of phosphorous on the total P sorption capacity. So there are many, many ways of looking at the way of estimating the DPS. Probably one of the easiest ways is to look at an alternative measurement and looking at different characteristics and looking at a way to evaluate the DPS, which is easy to do. So many studies try to relate the DPS to a different way of estimating this value.

If you go to the second page, you will see that the DPS started in Holland in 1992, and it was based on extractable oxalate P. It is minimal, so we have to be careful about the unit here. It is based on minimal. And the total sorption capacity, also defined as minimal, is related to aluminium and iron. It is quite complicated. And it is not a regular -- it is not a regular lab procedure.

So what Quebec did, if you go to the third page, you will see that they tried to relate an easy lab procedure to this DPS based on Holland and complicated, I will say, lab procedure. So on the third page you have the graph that related to the DPS, which is the minimal, this is the "Y" axis. In Holland, the threshold is 0.25. This is

the important number here. So at 0.25, based on the Holland equation, it is the threshold value that is used right now. So it is a way of looking at the -- if you exceed 0.25, you will start the processes of eutrophication.

Quebec tried to relate an easy way, an easy lab procedure. And they finally found that, P/Al, phosphorous on aluminium, Mehlich-III, which is a routine lab procedure, gave you a value of about 0.1. So there is a link between the Holland equation and the Quebec equation, making sure that we are looking at the same type of DPS, based on two different lab processes.

In order, also, to relate this value to water quality, if you go to the fourth page, you will see that the main relationship between this P/Al, Mehlich-III, which is the saturation of the soil, and they relate it to the water extractable value, which is the basic principle right now behind the phosphorous reg in Quebec. And it means that about 10-milligrams per litre of water extractable, this is the threshold that people do not want to exceed. If you go above 10-milligrams of P extractable per litre, you start the eutrophication processes.

They did a lot of studies in Quebec to relate it. And, finally, if you are below 10, you are below the 0.03-milligram, total P per litre, which is the limit that we do not want to exceed in water courses in Quebec.

MR. MOTHERAL: Question.

MR. TRUDELLE: Yes.

MR. MOTHERAL: Some of it is slipping over my head already. Milligrams and parts per million, first of all, I wanted to get -- what's the corresponding --

MR. TRUDELLE: It is ppm.

MR. MOTHERAL: It is the same thing?

MR. TRUDELLE: Yes, it's the same thing. Milligram per kilo is the same as ppm, yes.

MR. MOTHERAL: Okay, that's fine.

MR. TRUDELLE: And this is why we have to be careful about the unit because it is so voluble. And if you look at different studies, you will see that there are different numbers.

So the basic principle behind it is that you have the DPS, which is a Holland equation; and you have the Quebec DPS, which is based on water and aluminium; and you have the

water extractable that you do not want to exceed. This value, as in this 10 milligrams of water extractable, has been used extensively in other countries as well.

So what I did was I moved to different studies in Manitoba. And I looked at two different studies, which studies related the water extractable value to the Olsen P test, as well as the water extractable value to the DPS. So if you go to the -- well, maybe just after you have the "Conclusion" here. And so I will go to the number 3, "Conclusion". And if you look at the 9.7 milligrams of water extractable per litre, if you want to work on kilos, which is -- usually people are using litres or kilos. The 9.7-milligram of Pw per litre is about 8.43-milligrams of extractable P per kilo. And so this is the critical value. You have the mass or the volume, so depending on which value you are using.

I used the values from Manitoba, and I used two different studies. One is Kumaragamage, sorry about the name, that related the Olsen-P test to the water extractable phosphorous. And if you use the 8.43-milligram of Pw per kilo, the

critical Olsen-P test value would be about 40 milligrams per kilo. So it means that at this level, you are about at the threshold value for eutrophication based on water extractable value. This is for Manitoba soil.

Also, I looked at the Akinremi studies as well. Wole did a lot of studies about DPS and water extractable. And I also used the value, 8.43. And I related the DPS value to this 8.43. And my critical DPS value is about 0.9. So it is quite close to the value I used to work with, based on water extraction, as well. Quebec right now is 10 percent. So with a DPS of 10 percent and more, it is crop removal right now.

If you look at the other page, and you have another type of graph, as well, here. To make things simpler, water -- it is a Manitoba study here. It is November, December, 2005. I also related water extractable minimal per kilo. So in order to compare minimal per kilo with the 8.43, you have to divide 8.43 by 32. 32 is the weight of the phosphorous, how do you say that, compound?

MR. GREEN: Atomic weight.

MR. TRUDELLE: Atomic weight. Yes,

exactly, the atomic weight. So if you look at the graph, and you have six different graphs here, if you look at the 0.25, you will see that most of the time you are below a DPS of 10 percent. So there is a link between water extractable and DPS all the time.

So what I did was also, on the next page, you have what we call the agronomic way of looking at phosphorous. So at a certain level of phosphorous, if you exceed 20 ppm, usually you do not recommend much phosphorous. So depending on the crop, the 20 ppm is the agronomic threshold value, which is similar to other jurisdictions as well.

On the following page, you have the Quebec regulation here. Here you just have to be careful about the STP value. It is a kilo of P per hectare, and it is Mehlich-III. You almost have to divide by four in order to compare to the Olsen-P test.

MR. MOTHERAL: Can I have one more question here?

MR. TRUDELLE: Yes.

MR. MOTHERAL: And I hope I'm not the only one. But when I get confused, I need to stop

right away.

MR. TRUDELLE: No problem, yes.

MR. MOTHERAL: An agronomic value of 20 ppm is ideal, is that what I'm gathering from that?

MR. TRUDELLE: Yes.

MR. MOTHERAL: I always thought it was higher than that.

MR. TRUDELLE: No. When you exceed 20, 25, 30, crops don't respond. It is an economic response, so there is no benefit of spreading phosphorous.

MR. MOTHERAL: Then I must be getting some figures mixed up then.

THE CHAIRMAN: I thought in here, they say that above 60?

MR. FLATEN: That is an important distinction. What Marc said in his initial comments was true. At concentrations of soil test phosphorous, measured with the so-called Olsen method, which is the same method that shows up in the regulation, at levels beyond 15 to 20 parts per million, we would agronomically recommend very small quantities of phosphorous.

But we have records of responses, in a

comprehensive lit review from the Conservation Alberta, for example, at levels up to 60 parts per million in the prairies and, in fact, at higher in the Fraser Valley.

So I think what we're talking about is that at about 15 to 20 parts per million Olsen-P, the responses are small. And any agronomic recommendations are only for very, very small rates of phosphorous addition that would be less than crop removal. Like, there is no agronomic advantage to pushing your soil test phosphorous beyond that, if you are paying for fertilizer, for example.

Does that help to explain, Wayne?

MR. MOTHERAL: Yes. I am relating it to years ago when I used to get soil tests back from the University of Manitoba, of course. But I am not even sure what test was being run there. Was that an Olsen test?

MR. GREEN: Yes.

MR. MOTHERAL: Because I always understood that you needed probably 40 pounds of N, you know, at least, 40 pounds of N, or 50 pounds, to grow a reasonably good crop, is that right or not?

MR. FLATEN: The issue of nitrogen versus phosphorous needs to be sorted out, but also pounds per acre versus parts per million. All of these units that we use are designed to confuse people. Otherwise, anybody could do this, and we would lose our jobs, you know, right?

THE CHAIRMAN: Petra, did you have a comment?

MS. LORO: Yes. Just emphasizing something that Don said, the soil fertility guide the basis of that is the need to purchase additional fertilizer. So those recommendations are based on the agronomics and the economics for the producer. Do you need to go out and purchase more fertilizer, given a certain soil test value, in average conditions or most of the time?

But when we looked at the literature, the total body of literature for crop response, we would see that, in some instances, there was crop response. And definitely for some crops, up to higher soil test values. And the critical values seemed to be more in the range of 60 parts per million. What the soil fertility guide and these other recommendations were not based on was the need to land apply manure. So you may not need to

go out and purchase fertilizer, but the livestock producer still has manure that he needs to land apply. So the philosophy for the application rates is a bit different.

MR. MOTHERAL: Thank you. I'm sorry, it was the ppm and the pounds per acre, and that has clarified things. That is all I needed to know.

THE COURT: I am not sure if it is clarified yet.

MR. MOTHERAL: Well, part of it, yes, sorry.

MR. TRUDELLE: Okay. And thank you for the precision here.

So if you look at the Quebec reg right now, if you want to make certain comparisons with the data here, you almost have to divide by four. So it means that the threshold right now, and crop removal, is about at, well, I will say 55. So if you look at the 55, 65 and 75, it is based on crop yield. So for different crops, different yields, you will have different crop removal. So you have a line 55, 65, 75, it is about the crop removal. So it means that soil between about, I will say, 35 to 60, between 5 and 10 percent saturation DPS,

the limit is about crop removal right now in Quebec. So I think it is important to make sure that we understand the principle here.

Also, I printed a copy from a paper that shows you or gives you different values for different jurisdictions, as well, based on agronomic and environmental thresholds, as well, so you also have Mehlich different values, depending on each jurisdiction.

THE CHAIRMAN: Can I just interrupt? What is the Mehlich, or Mehlich-III, is that just a different --

MR. TRUDELLE: It is a different extraction. It is usually used in Quebec and under different conditions, acid conditions. So in Quebec, if you look at the eastern part of the Unites States, it is a regular extraction that is used.

THE CHAIRMAN: So it is an alternative to Olsen?

MR. TRUDELLE: Yes. Well, Olsen is good for calcium soils. If you have alkaline soils, this test is more appropriate for alkaline soils. Mehlich-III is more appropriate for acidic soils.

THE CHAIRMAN: And on this chart --

MR. TRUDELLE: Yes.

THE CHAIRMAN: -- we have the two columns, agronomic versus environmental.

MR. TRUDELLE: Yes.

THE CHAIRMAN: Can you just explain what the two -- the difference between the two or what the two are?

MR. TRUDELLE: Well, this is based on the same comment that we heard a few minutes ago. You have the agronomic concept, based on the fact that at a certain level you do not have any economic response. There is some room between agronomic and the environmental thresholds. So we know that for certain crops the response will be different. And even at 20 or 25, crops will still respond to phosphorous.

But at some point, if you exceed the environmental threshold, you are losing phosphorous. So the point here is, and I think this is the most important part of the phosphorous reg is to make sure that we exactly know the first level, which is the agronomic level, and the environmental level where there is a problem or when the problem will occur.

THE CHAIRMAN: And the environmental level, you said beyond that there is a loss of phosphorous. By that do you mean runoff?

MR. TRUDELLE: Runoff. Or, even in Quebec, it is runoff. I mean, they are receiving 250 centimetres of snow per year, so the spring runoff is very significant. But, also, they are losing phosphorous by leaching. So when there is rainfall, and there is a high DPS, so when the soil exceeds a certain DPS level, which is about 10 percent right now, you are losing phosphorous by leaching, so you have both processes together. And we want to make sure that we are able to really estimate the right value for the agronomic as well as the environmental threshold.

THE CHAIRMAN: So this might be an over-simplification, but the agronomic threshold, beyond that, there is really no economic value?

MR. TRUDELLE: Depending on the crop. Yeah, this is what Don said, it depends on the crop, but usually there is some room.

THE CHAIRMAN: And the environmental threshold, beyond that, there is concern for the environment?

MR. TRUDELLE: Yes. Yes.

THE CHAIRMAN: So that might be an over-simplification.

MR. TRUDELLE: Yes, this is exactly.

MR. MOTHERAL: I have a question.

MR. TRUDELLE: Yes.

THE CHAIRMAN: No, go ahead.

MR. MOTHERAL: I heard you say "leaching". Some is lost through leaching when you have that excess spring runoff and you have some that is leaching. What is the measurement of how much is lost in leaching?

MR. TRUDELLE: Yes. Well, you have the runoff processes, which is one part of the problem. You will measure it by runoff. And you have some studies that will make some estimates of the amount of soil. And you have the particulate phosphorous. And you have also the soluble phosphorous, so it is a complex mechanism.

On the other hand, you also have the leach -- well, kind of a leaching through the soil profile. And this is a different concept. Phosphorous is moving because of the soil. And the DPS is a way of looking at the capacity of the soil to retain the phosphorous. When you exceed this capacity, it is like a sponge. Phosphorous

will just leach through the soil profile. And right now, in some parts of Quebec where you have a very large concentration of livestock, soil tests are really high. They are losing phosphorous by runoff, as well as by leaching. And so you will measure phosphorous in the drainage system.

Since all of the fields are almost drained right now in Quebec, it is quite easy to have a measure of the soluble phosphorous that will be lost by looking at the drainage outlet. So you will be able to measure the concentration of phosphorous in the water just by looking at the drainage system outlet. And so there is an easy way to do it.

In some fields in Quebec it is flat land. So the St. Lawrence lowland is very flat. It is a zero to two percent flat land. The clay soil is almost the same as here. And they will probably, some time -- the leaching will be, probably, the most important phenomenon right now. And if the soil is flat, and you are able to control erosion, you will lose phosphorous by leaching through the soil profile. And so it is both those mechanisms at the same time that will

play, depending on the conditions and the DPS, as well.

MR. MOTHERAL: You see, my question was: How do you measure the leaching? Is it through the ground there?

MR. TRUDELLE: It is through the soil profile. And as I said, it is easy to measure if you have a drainage system. If you do not have a drainage system, it is a little bit more complex. But when you have a drainage system, it is very easy to measure.

MR. MOTHERAL: Well, there is not that many --

MS. RAWLUK: Tidal.

MR. MOTHERAL: Yes, you mean tidal, we won't have that in Manitoba.

MR. TRUDELLE: Yes. And the processes are still occurring, but we do not probably know how.

MR. MOTHERAL: Okay. I think I am satisfied there.

MR. TRUDELLE: So you have here the distinction between agronomic threshold and environmental threshold.

I gave you also another article which

is trying to relate this level of Mehlich-III and different threshold values. Usually, the values for the environmental threshold, it is usually low, I will say. And when you are exceeding 100 on 120 Mehlich-III milligrams of P, it becomes to be a problem, usually speaking.

So my next page, my last page, and it is not recommendations, so I probably didn't use the right words. It is probably more of a summary or proposal. It is not really a recommendation. It was not the right word there.

So I designed a table, which is about the Quebec reg right now, so in terms of Olsen-P. So in order to understand what will be the Olsen-P value associated with a certain DPS and the maximum annual application of phosphorous, I tried to transfer the Quebec reg to the Olsen-P test. And you will just see that between 0 and 30 it is nitrogen. Between 30 and 60, depending on your DPS, in Quebec it is two or one time crop removal. And if it exceeds 60, right now, it is 1.5 to 1 time crop removal depending on the DPS. And for very, very high soil test Mehlich-III, such as 120 or 130 ppm of Olsen, it is below crop removal.

Is it working? Well, they did also

large studies on all of their -- they used 276 field trials to look at the reg and if crops are going or not. And, usually speaking, if you look at the agronomic concept, people are able to grow crops based on this regulation here. And they are also trying to look at the environmental impact.

They also made last week -- I just received an article about the reg. And after 10 years, they made an evaluation of the reg. And, finally, what they found is for poor soil, so if you are below 22 Olsen-P test, if you are using the nitrogen concept here, soils are increasing right now in Quebec, so this is what they are looking for. If it is poor soil, then they want to increase the soil P tests.

For soil between 22 and 40, it is after 10 years, they didn't see any change in the soil P test. And so they are keeping the soil P test at about 22 to 40, just to make sure that there is no increase. And if you are looking at soil between 40 and 65, now it is slowly decreasing. So they want to bring the soil P test at about between 22 and 40. And for soils that are higher than 65, they decrease it by almost 30 ppm in 10 years.

So the purposes of the reg is just to make sure that at low levels you increase your soil P test. At above, or optimum level, you do not want to increase it. And when it is very high, you want to decrease the soil P test, based on the reg right now here. And one of the conclusions is that farmers are getting better yields and they are spending less money on commercial fertilizers. So this was after 10 years.

THE CHAIRMAN: Just a question, Marc. Should we pursuing a similar goal in Manitoba or is that what we are doing? Is that the intent of the --

MR. TRUDELLE: Well, I think we have to talk about that, I guess, today. Yes, it is part of the reg. In fact, the reg has been adopted, but it is not enforced right now. I mean, we still have until November 10, 2008, to enforce the reg. And so I think we have time to look at different options just in making sure that we are going in the right direction here.

MR. YEE: Marc, I have a couple of questions.

MR. TRUDELLE: Yes.

MR. YEE: Is there good correlation between the various test protocols for calculating soil P?

MR. TRUDELLE: Well, it takes time. And you need a lot of lab tests to make sure. But when it is done, it is well done and it works well. So you have to be very careful about the way that you are doing it. But I think that Wole did a good job about that.

And so I think we have -- for me, I think, in Manitoba right now we have good data on that. And I do not feel that we are in the dark right now. We still have some good information on studies. And I am probably able to use all of the information. We probably need to emphasize a little bit more the direct link between DPS and water extractable, but I think it has been done mostly right now.

MR. YEE: And the other question that I had was that in your table 6-3 that you show the comparison between the agronomic and the environmental thresholds.

MR. TRUDELLE: Yes.

MR. YEE: Is it because of the test protocol or is it due to soil conditions? Why is

there such a variation between the different States?

MR. TRUDELLE: Well, maybe an easy answer for that is, yes, you have science behind it and you have also political and social issues. So this table probably reflects both concepts right now.

MR. YEE: Okay, thank you.

MS. LORO: I would just like to come back to the first question about the correlation. My recollection, and I am going to rely on Don and Wole, was that between the different soil test extractants, that the correlation wasn't strong enough for us to convert from one to the other, which is why we moved away from that and focused on Olsen's P, and that the relationship was less strong as you went into manured soils.

MR. AKINREMI: No. For soil tests, while we had two studies, we had one where we did not consider manure soils. And they were very good. I mean, the correlation, we have correlations between all tests. And then we did another study in which we included manured soils. And then the correlations, the correlations -- I think that the correlations are pretty solid for

soil tests in Manitoba. I think that they are reliable.

MS. LORO: For converting between the two?

MR. AKINREMI: Yes.

MS. LORO: And what was the conversion between the Mehlich-III and the Olsens?

MR. FLATEN: I think we need to -- I'm sorry. I think we need to distinguish between correlations that look good from a science point of view and correlations that would look good from a regulatory point of view. There is, I think, pretty good agreement among the soil test methods. Like we have talked about today the Olsen method, which is the one the reg is based on, and we have talked about Mehlich-III. Those are quite highly correlated. And I forget what the exact figures are, but there might be something like 80 to 90 percent of the variation, and one can be explained by the other.

But from a regulatory point of view, there are still these outliers in that relationship. And I think that that was the reason why the Phosphorous Expert Committee wanted to go with a single, you know, specified method of

measurement for regulatory purposes. So I think it is important to distinguish that there are some good general relationships.

And then these relationships start to break down more when we start looking at the extractable phosphorous with, let's say, Mehlich or Olsen extract, compared to the phosphorous in a water extract. The water extracts do not correlate as well with the soil test, as the soil test methods do among themselves, the conventional tests.

And then, thirdly, you have to eventually talk about: Well, what's the correlation between these soil tests and what you measure in water that is running off of that into some Manitoba river or stream or lake? And so when we're talking about correlations, let's just be cautious and say that, yeah, there is some good correlations between the agronomic soil tests in a lot of situations. But they start to break down a little bit more as soon as you start looking at water extractable phosphorous in a lab. And then you have to make that next step to look at the water, the concentrations of phosphorous in water in real watersheds.

And so we are just going to -- I think that is that just, sort of, sets the stage for this discussion. We have to be cautious. But there are two very good studies that Wole's team has done to show the relationships among all of these different ways of measuring. And it is an enormously valuable pair of papers that we can easily share with the Commission, you know, if anybody is interested. And they are both published.

MR. YEE: Yes, I appreciate that clarification. Because that is the biggest problem I'm having right now is to try to correlate how we test for P in soils versus, you know, this limit that we have established for water quality to protect the environment from eutrophication. And so I have been just trying to get my head around that.

MR. FLATEN: Yes, it is a good question.

MR. TRUDELLE: So for the point 3 and point 4, I think it is not probably part right now of the discussions, so I will probably come back later in the day about that. And also if you want some copies, I made some copies of all of these

studies here so I can share these copies here with you and so on.

THE CHAIRMAN: Thank you, Marc. Yes, I mean, I think you've got -- I think we should come back later on to your last page.

MR. TRUDELLE: Yes.

THE CHAIRMAN: And 3 and 4. I mean, in number 4, in particular.

MR. TRUDELLE: Yes, that's okay.

THE CHAIRMAN: There is good provocative suggestions there.

MR. TRUDELLE: Yes.

THE CHAIRMAN: And so what was the driving purpose behind this regulation? Was it agricultural or economic -- or I mean environmental?

MR. TRUDELLE: You mean for Quebec?

THE CHAIRMAN: No. No, for the Manitoba regulation, the Manitoba Manure and Mortalities regulation?

MR. FLATEN: Would you allow me to speak to the development of the Manitoba regulation because that predates -- that is before Marc.

THE CHAIRMAN: Yes, sure.

MR. FLATEN: Is that all right?

MR. TRUDELLE: Yes.

THE CHAIRMAN: Yes, absolutely. I mean, just let me make an overriding comment, okay? This may look a little or today may be a little haphazard and a little unstructured, but we have a whole bunch of questions that keep coming up among us. And we thought, well, if we sat down and wrote to different ones of you, or e-mailed and got back responses and then sent it back, this could take forever, and we would miss a lot of the nuances. So that's why we asked that all of you come here today.

And we will be firing out questions. They may seem disjointed and haphazard, but I think it will help us. Particularly, you know, if we throw out a question, then we can get an immediate sort of debate or a response from different parties, rather than trying to do it through e-mails or correspondence. So that is a bit of an override about today.

Now, you wanted to talk about the regulation. Petra and Dwight have comments. Do you want those comments before Don?

MR. WILLIAMSON: Perhaps Petra and I,

we are going to be saying the same things. But I was just going to, if you wish, provide just a bit of context. And it is probably best to come from Conservation. But as Don mentioned, Marc wasn't working for Conservation at that time.

MR. TRUDELLE: Yes.

MR. WILLIAMSON: In terms of the evolution of the existing regulation. And then, Don, would that be appropriate, then, for you to take over from there in terms of the Phosphorous Expert Committee?

MR. FLATEN: Yes. I am just trying to work backwards from the future to the past.

THE CHAIRMAN: Sure.

MR. MOTHERAL: That's because he is talking to backward people.

MR. WILLIAMSON: So essentially --

THE CHAIRMAN: You may have to sing for your lunch.

MR. WILLIAMSON: So essentially in Manitoba, the first Livestock Manure Mortalities Management Regulation was enacted in 1998. And that was intended to deal with environmental issues related to the livestock sector, in general, and application of livestock manure to

lands. That is a regulation under the Manitoba Environment Act.

And in the first number of series of that regulation, manure, or the application of manure, was based only upon its nitrogen content. It was recognized, in 1998, that phosphorous was also an issue, but a decision was taken that insufficient information was available at that time to make specific recommendations or regulatory clauses in that regulation to deal with phosphorous.

In late 2002, the issue of phosphorous continued to be raised. And there was a need to more fully consider how best to deal with that issue, in terms of its application also to agricultural lands. So in late 2002, the Manitoba Government struck the Manitoba Phosphorous Expert Committee to look at the entire issue of phosphorous as it relates to animal manure and its application to lands. And their charge was to come back to government with a recommendation on the best way to deal with phosphorous.

Arising from the report of the Manitoba Phosphorous Expert Committee, then, in early November of 2006, last November, the

Manitoba Manure Mortalities Management Regulation was once again revised now to include thresholds and principles around management of animal manure on the basis of both nitrogen and phosphorous. And so that was -- that is sort of the evolution of it, in a nutshell.

THE CHAIRMAN: Thanks, Dwight. Petra, did you have, sort of, more background comment before Don gives us a bit of an overview?

MS. LORO: No. That was what I wanted to say. Thanks, Dwight.

The only other thing is we were quite concerned about the fact that when we were applying manure continuously, year after year, based on nitrogen, that we were seeing phosphorous buildup in the soils.

THE CHAIRMAN: Thank you.

MR. FLATEN: This is going to be sort of like a sermon. But, I mean, I guess considering the amount of issues of faith and belief that will pervade this discussion, it is probably appropriate to quote gospel and verse.

But I think you've all got -- I have seen some of these loitering around. If you take a look at page 25, you will see the third

commandment from the Phosphorous Expert Committee. We didn't come up with 10. We only came up with three. But it starts off saying that:

> "The preceding recommendations..."

that we came out with, including the soil test P thresholds and special management areas,

> "...are only a first step towards improved environmental sustainability and are focused primarily on reducing excessive phosphorous loading onto agricultural land and adjacent water bodies from manure. They are based on the best available scientific information and judgment, but little scientific data related to this issue exists for Manitoba."

And I think it is very, very important that what we did, at the time, was try to bring forward what we considered to be the best available information to bear on this issue. And we deliberately chose a fairly high threshold because we didn't feel we had enough scientific evidence to lower that threshold, at least scientific data related to this issue from Manitoba.

And so I think Marc's proposal helps challenge us to come back to this. Like, this recommendation was actually formulated by the Phosphorous Expert Committee two years ago. And I think, you know, we have learned some more in the last two years. And I think it is an important issue to debate and discuss, but I think we should go back and talk about the basis for the recommendations of two years ago. And they are really the regulation that came in in November in 2006.

There is two streams of information. First of all, there is scientific evidence pointing towards a threshold of approximately 120 parts per million Olsen in a few soils of the world, okay? And some of that data has been published by Andrew Sharpley, the guy that put that table together.

THE CHAIRMAN: Yes.

MR. FLATEN: That was quoted in Marc's work there. So that was one stream of work. But that is -- but that is at the upper end of the literature. Ours could easily be -- our environmental thresholds could easily be lower than that, but there was not evidence that is

relevant to Manitoba being -- it was not available to us, anyways.

The other thing is that we were considering the policies and regulations of our nearby neighbours. And if you consider what the Minnesota Pollution Control Agency goes with, it is basically a 60 and 120 parts per million Olsen-P threshold, based on the distance away from streams and ditches. 60 parts per million threshold near streams and ditches and 120 parts per million away.

So from both a science and a policy standpoint, we thought that the starting point, that is a number less than infinity, we should be no higher than that 60 to 120 parts per million threshold. And if we could make that first step towards something less than infinity, that would at least prevent the extreme concentrations that have accumulated in areas like southern Alberta, where they are accumulating 2,000 or 3,000 parts per million soil test P. We for sure did not want to get that high.

THE CHAIRMAN: Why is Alberta's rate that high? Is it from excessive manure application or is it just natural?

MR. FLATEN: Yes. No, it is from excessive manure application.

But one of the greatest disappointments I have had, as a result of the enormous investment of effort that we put into the Phosphorous Expert Committee, is that nobody is taking recommendation 3 seriously. We, actually, have not invested, in this province, very much effort at all in checking to see whether these environmental thresholds are, indeed, appropriate for our watersheds.

And so I think that, you know, in terms of the basis for these, yeah, it was kind of flimsy. It was kind of at the upper end of the thresholds that are in the world literature. And it was kind of, sort of, similar to what Minnesota had in place. But it was the best we thought we could do as the initial step.

It is very important that we engage in this debate and discuss the concepts that Marc has proposed as part of that third commandment type of exercise. We do have to look at what we have got here, what we need to get in terms of additional information, and where we should be going with these environmental thresholds.

But these thresholds were not picked because of divine inspiration that we knew exactly what they should be, and came down from a mountaintop with them carved in stone. They were our best estimate based on, like I say, maybe the upper end.

But, you know, if we find information that is concrete enough to justify moving to a lower threshold personally, you know, I think we should move in that direction. And I think one of the directions that will have to come up for debate later in the day is whether we have that evidence yet.

But I think it is very important to answer the question that you posed at the beginning of this roundtable: Where did the current regulations come from? And that is, more or less, kind of, sort of, where they came from, I think. Would you agree, Petra?

MS. LORO: Yes. I think that your reference to the 120 being at the upper end I would agree with. But where we came in at the 60, and how we managed it, was pretty consistent with about midline of what other jurisdictions were doing. And if they were doing anything with

phosphorous, which isn't the case with Saskatchewan, and hasn't been the case with Alberta yet.

But when we looked at Ontario, and we looked at Minnesota, and we looked not just at their regulation, which may say one thing, but how it was administered. And so we brought those people here and said: Well, exactly how are you administering that?

And you would find out that things were -- we were not far off at all. We are very transparent in how ours is prescribed. It is very obvious. Whereas, in Ontario, it was hidden in their software. You would have to know how the calculations were done, and that sort of thing.

I think we are fairly middle of the road. There are lower thresholds than 60 parts per million, and there are higher. And there are some jurisdictions where there are none. I think where we may be unique, or we were at the time, was at the 180 end.

There were not other jurisdictions willing to come forward and say: No more manure. If you hit this soil test, no more manure. You have to go to a different field.

I think we were unique at the time. I don't know if that is changed since then to do that, because it is quite a hardship for producers who have reached that level, who might not have additional land, in terms of what their options are.

And I think we considered more than just the soil science through this committee and their processes. And we looked at technologies available to livestock producers in order to comply. And our confidence was that by making the thresholds more rigorous, more demanding, that we would actually see an improvement in Lake Winnipeg, which was the ultimate goal, I think, was to protect water. And we did not have data that connected the soil test values to our water quality values. We have both, but we're not able to measure -- to make that connection between those two bodies of literature.

MR. FLATEN: I think Dave was there, too, another witness.

MR. MOTHERAL: Then what I'm hearing is -- like, the question was asked, environment was certainly the driver of this whole -- this whole operation or this whole thing. But when it

became -- when the regulations came out, it became environment and economics, was that what I am hearing there?

MS. LORO: I think that when you look at the way the regulation has a period of time of phasing in, even though they are not necessarily the phase-in dates of 2008, but the fact that producers can continue to apply manure, based on nitrogen, if they are below the 60 parts per million. And then above 60 to 120, it is twice the crop's removal of phosphorous. And that buys some time, for sure, for producers to explore technologies. Because their ultimate goal will be to continue to apply manure based on nitrogen, and so they need to bring down the phosphorous concentration of their manure. That is a very complicated issue in terms of feeding strategies, phytase, technologies that are available. If they can't do that, they need technologies for manure management. How low can the spreading equipment go, that sort of thing, and then the whole area of treatment technologies.

And so there is definitely a huge economic component to this. The thresholds are focused primarily on soil science, but it was not

done in isolation. It was looked at more broadly by the committee than that.

MR. TIMMERMAN: I would also like to remind the group, briefly, that there are other provisions in the regulation, stemming from recommendations from the Phosphorous Expert Committee, that address other aspects of the issues beyond the soil test thresholds. That might be the crux of the matter today.

But there are the restrictions on manure application in the Red River Valley Special Management Area that is to address the movement in phosphorous or what's commonly referred to as transport. So there are other aspects to the approach to this. And that one, I think, is an important one. And because we know that winter application of manure is impossible to defend on the issue of economics, which is a reality, especially for the producers in question, because they will be small ones. So the committee did address more than just the loading the bucket issue. The transport issue was factored in, as much could be, with the science available at the time.

THE CHAIRMAN: Well, it also addressed

the setbacks?

MR. FLATEN: Special management areas was our language.

THE CHAIRMAN: Yes. But even the setbacks from waterways and edges of lakes and things like that.

The question came up earlier, before we gathered here this morning: All of this rain that we have had for the last few days, has that had any effect on transport in the Red River Valley, for example? Would that have had any affect?

MR. GREEN: Probably.

MR. TIMMERMAN: And I do not want to sound tongue-in-cheek, but I will say it anyway, the first thing I thought about, actually, was the lack of separated sewers in the city as I saw the water rushing down the driveway.

But I think that timing is key on that one. A couple of years ago we had a major rain before the frost was out of the ground. It was in March. It was pretty strange for that to happen. But I would say that that would be the kind of scenario where we would be most concerned about losses, at that time of year, with the frost still

on the ground.

THE CHAIRMAN: Dwight, did you have something?

MR. WILLIAMSON: I was just going to respond by saying: Yes, when we pour more water onto the landscape, and given the relationships that we know between phosphorous and the soil, and water loss from other environments, we can reasonably expect there to be more phosphorous coming off with more water moving across that landscape.

But, of course, as Mitch mentioned, it is not the only outcome, and the only transport mechanism, of phosphorous and nitrogen to Lake Winnipeg during high rainfall events. But it is reasonable to expect that it would be one.

MR. FLATEN: Yes, just to put it into context, and Ian is very familiar with this because he worked on it on a literature review to look at this as well. But snow -- and it is also published in the Lake Winnipeg Stewardship Board Report. But there is a little figure that shows the phosphorous loading from the Red River at Selkirk into Lake Winnipeg. And the vast majority of runoff in the prairies occurs during snow melt,

averaging 80 to 85 percent.

So although, by the time we start going outside again from our winter hibernation, these rainfall events look like they are really, really important, the majority of the damage, in terms of nutrient loading, has already occurred by the time the summer rains come along. It doesn't mean that they are inconsequential. But on average, probably 80 to 85 percent of the runoff and I suspect a nearly equal proportion of phosphorous loading, occurs during snow melt in the Canadian prairie watershed, which is the watershed we live in. So it doesn't mean that this isn't important, but the spring runoff snow melt is a lot more important.

MR. MOTHERAL: I will make a comment on that one, too, and you can shoot me down on this one. Would not the crop development, at this stage of the -- when this rainfall has come, there is root development and phosphorous. I mean, that is important to root development. Would a lot of that phosphorous already be taken up by the plant, rather than runoff? I mean, rather than a rain before a crop was planted?

MR. AKINREMI: I don't think that

there is much development, at this stage, within this province, though. I mean, before you have crop development, you are looking at probably June to July, yes, at this stage.

MR. YEE: These peak events during the snow melt, and the loading of the phosphorous, can we attribute it to something in particular? Like, I am thinking, and I realize that the small operations can still spread in the wintertime. Are they the major contributor, as a result of this, or is it just residual P that is being washed into the waterways as a result of the snow melt?

MR. FLATEN: Yes. It is all of those things. And we're doing some, what I consider to be interesting experiments looking at the variety of sources. Ian tipped us off on the concentrations of phosphorous in snow itself. Snow and precipitation load 600 tonnes of phosphorous directly into Lake Winnipeg every year. That is more than what Winnipeg dumps in its waste water system. So right off the bat the snow has quite a bit of phosphorous in it. It picks up additional phosphorous from the vegetative residues. That phosphorous may or may

not be intercepted by the soil as it goes into the soil and runs across the soil. Maybe some of that vegetative phosphorous will be reattached to the soil and recycled.

And so there is all sorts of processes and all sorts of sources. And it is one of the factors that I think contributes to our uncertainty is that we do not know as much about that as we would like to. But in the final analysis, we're confident that soil test phosphorous concentrations are still a very, very important factor. It is showing up again and again.

There is a paper that will be published imminently from Alberta Agriculture showing remarkably consistent and strong relationships between phosphorous measured in runoff water in watersheds there and the soil test phosphorous within those small watersheds. We have got evidence of that from 14 regional watersheds in Manitoba at a larger scale. We have got runoff experiments in the laboratory.

We're not going to be able to ignore the contribution that comes from high concentrations of soil test phosphorous. It is a

very important player, but it is probably not the only one.

THE CHAIRMAN: Don, what sort of -- or, Ian, since Ian was the one you said tipped you off, what's the source of the phosphorous in the snow, the source or sources, of the phosphorous in the snow?

MR. HALKET: Well, that is a good question. This originally was triggered by Rod McGinn out in Brandon, who had some of his students go out and measure snowfall. And what he found was that starting with the snowfall in the early fall, it was very rich in phosphorous, compared to the snowfalls in the middle of winter. And then, of course, in the spring, or subsequently in the spring, the phosphorous content of the snow increased again.

Now, what he suggested was that there was a lot of dust, probably in the fall, in the atmosphere. And that phosphorous may be a freezing nuclei or a condensation -- a preferential condensation nuclei for condensation in the atmosphere, and that that is -- that that was the source of it. And then slowly, as the prairies sealed with the snow cover, that dust

source diminished. And then, of course, opened up in the melt season again when the snow cover was lost. And, therefore, that is was his -- that was their premise, his students and him. But I haven't seen any other work on that.

THE CHAIRMAN: So this was in fresh snow, fresh snow that had fallen, not snow that had sat on the ground that had absorbed stuff?

MR. HALKET: No.

THE CHAIRMAN: So is there phosphorous in rainfall, as well, then?

MR. HALKET: Yes.

THE CHAIRMAN: A significant amount?

MR. HALKET: Well --

THE CHAIRMAN: And where would that phosphorous come from? Would these dust particles, or whatever, would it come from a variety of sources or would that be natural?

MR. HALKET: Well, I think there is a lot of wind erosion on the prairies.

THE CHAIRMAN: Yes.

MR. FLATEN: And on the planet.

MR. HALKET: And on the planet, yes. I mean, we just happen to be east of the whole fetch of the prairies when the wind is coming from

west and from the north. So I imagine that there is a lot of dust moving through our atmosphere that --

MR. YEE: Yes, there is, actually. Because air section has -- well, we looked at data for other reasons. But there is a fair amount of data in Manitoba, in particular, that shows we have relatively high dust levels, so I will just mention that.

MR. HALKET: Yes. It would be an interesting thing to do is to start measuring the amount of phosphorous in precipitation, both rain and snow, and to start documenting that.

THE CHAIRMAN: Well, we can blame our neighbours. It gives us an easy out.

MR. HALKET: Well, I think when you come back to the hydrology, or when you start looking at this issue, one of the ways, and I guess this is my training, is I like to look at it from a mass balance type of perspective.

THE CHAIRMAN: What does that mean?

MR. HALKET: And mass balance is: Here is the inputs of phosphorous into the system. Here is the outputs of phosphorous into the system or out from the system. And then if they do not

add up, then you've got some storage mechanism going on there.

And I, sort of, looking at this issue, believe that there is a huge input of phosphorous into the system, and not so much in terms of the output that we measure, if we look at what's going out in Lake Winnipeg. And, therefore, I would suggest that there is a lot in storage in the watershed.

And our hydrology, where we get, say, a 10 year flood, spring snow melt flood that inundates all of the land, a 10 to 20 year flood of that level, I suspect that that takes that storage that has been contained over five or seven or eight years, or whatever, within the watershed and then whooshes it out of the system.

And I am not so sure that our records, in terms of water quality records and gauging records, can actually show that. Because at the outlets, I think, I do believe, that the records or the water quality is done once every two to three weeks or every week. Dwight would help me with this.

But I am not so sure -- and even in the '97 flood, when I look at the records, during

the whole '97 flood, there was one water quality sample collected for that large peak event that was over a month. And so we only have one water quality sample to base our mass loading to the lake on. So I would suspect that when we have -- or what I would like to see is that when we have large flood events that we actually measure the water quality daily at the outlets so that we can actually see what is the loading to the lake when these huge inundations take place. And they take place probably every ten years, every five years. And we go over bank and we flood, basically, the whole valley, and I suspect that that is when the phosphorous comes out to the lake.

THE CHAIRMAN: Dwight?

MR. MOTHERAL: I was just going to make a comment first on that. Like, I thought we had heard, during our hearings, that we had information on water samples during floods. Because did we not come to the conclusion, or that there was a conclusion made, that because of the excess of water, because of the quantity of water, that it was all diluted, that it was diluted so much that there was not any valid tests because of the overabundance of water?

MR. YEE: That was some of the local water studies that were done by some of the conservation districts, yes.

MR. MOTHERAL: Okay.

THE CHAIRMAN: Dwight?

MR. WILLIAMSON: Perhaps just a couple comments. First, I would agree with Ian in his observations. I would support those. And it is generally very consistent with our knowledge.

As a general rule, in terms of monitoring streams in Manitoba, they are monitored on a regular frequency of a monthly interval. We are in the process of changing some of the way we do that monitoring to make sure that, as Ian has mentioned, we are able to pick up loadings from short-term episodic type events. And that was one of the recommendations in the last report of the Lake Winnipeg Stewardship Board.

Prior to that, we have been doing some of that work. During the large floods in southern Manitoba during the summer of 2005, we did collect a considerable number of samples from small streams throughout, generally, the other Red River Valley, and north to Lake Winnipeg, during that period of time.

In terms of the 1997 flood, we were, in fact, during that time, collecting samples sometimes on a daily basis, sometimes every two to three days. So we have a very good understanding during the peak of that flood what was being transported into Lake Winnipeg. So on very large floods like that, we do have additional data.

But I would support Ian's observation from his review of the data set that the -- if storage is occurring in the system, there is loss of storage or movement out of the system during these large -- these large events. In the 1997 flood, when we looked at and when we calculated loadings during the peak, that was the greatest load in our set of records of phosphorous, at least, delivered to Lake Winnipeg.

Interestingly, though, in -- also in 1997, there was also a major rainstorm event that occurred partway through the summer in July and August. So once the peak had receded, in which we had an all-time delivery of phosphorous load to Lake Winnipeg, the system was beginning to dry out and then was inundated with a very large rainfall event again.

And in the second event, we also saw a

very high load of phosphorous again being delivered into Lake Winnipeg. And it was not quite as high as what was delivered during the peak but, clearly, it was an event that was moving significant quantities of phosphorous off the landscape again.

THE CHAIRMAN: And so what would be the sources of that stored phosphorous that got spread by the '97 flood, by this major rainfall, other wet year events, what would be the sources of that? Would it be livestock manure? Would it be dust bringing phosphorous from elsewhere? Would it be natural? Would it be all of the above?

MR. HALKET: All of the above.

THE CHAIRMAN: And is one more than the other or is it possible to tell?

MR. HALKET: Well, I think it is possible, if you look at what is coming into the watershed, certainly if you want to characterize it as big grain fertilizer is probably the number one. I was looking at this the other day. I was just putting it together on an Excel spreadsheet quickly. And then I was doing work with animal units and hogs in Manitoba.

And, you know, I can bring it up. But, basically, it went -- and the order -- I don't have it in front of me here, but the order was big grain was the number one producer, if I took the fertilizer and reduced it to phosphorous. And big grain was number one. Cattle was number two. Hogs was number three.

I couldn't get a handle on migratory birds and some of the other natural stuff that is happening. For example, erosion is another natural source of P. And I didn't get a handle on snow, either, like, in terms of how much is coming out or for precipitation how much is coming out of the atmosphere.

But there is certainly -- I think that there is certainly room for someone to look at a mass balance. When I say that, is we are measuring -- Dwight's department is measuring, very adequately, the amount that we're losing out of the system in terms of water. If we can measure what's coming in, then we can start to look at storage, and the changes, and try to get a handle on how to -- and see if our management policies are working to handle that storage and how it is getting out of the watershed.

THE CHAIRMAN: Is it possible to measure the inputs of what's coming in?

MR. HALKET: Yes, I believe it is.

MR. FLATEN: I think we're getting way off track here. The key point that drives phosphorous loss from most prairie watersheds is the concentration of phosphorous in the soil. Now, that soil test phosphorous represents a balance between a variety of inputs and a variety of outputs. And so, for example, if I am a grain and oil seed producer, a farmer, and I ship 35 pounds of phosphate per acre every year to some dumb city slicker who doesn't know how to grow his or her own food, I have got to replace that phosphorous somehow. So I have got to buy fertilizer or, you know, put on manure to replace that.

If my soil test phosphorous level doesn't change in the process, if I am just putting on as much as I am removing, that doesn't necessarily change the risk of phosphorous loss by very much off of that parcel of land because the water is running over the land and it is reacting with the amount of available phosphorous that might show up in that water downstream.

And so I think it is very important, when we're talking about some of these concepts, like mass balances, and other sorts of things, they are sort of like one layer of detail beyond the most important factor, which is the level of available phosphorous, let's say measured with a soil test, in the soil. And is that level of soil test phosphorous staying the same or going down or going up? And that is what is going to regulate the risk. And behind that are all of the different factors that might be governing that rise or decline in soil test phosphorous concentrations.

I think it is very important to keep focused on the prominent importance of soil test P. And these Alberta studies, as I said, they are not yet published. They are just in the galley proof stage, accepted for publication. Almost 90 percent of the variability in phosphorous concentration from one small watershed to another watershed, in various locations in Alberta, was explained by the soil test phosphorous concentration.

So I think that there is a lot of different areas that we could explore behind that.

But the key issue is to manage soil test phosphorous and account for all of the natural sources and the human management factors that are adding phosphorous and taking it away. But soil test P is a very, very important issue.

THE CHAIRMAN: We are bringing it back, then, to our more immediate concern, hog production. Has the pretty rapid expansion of the hog industry in Manitoba over the last 12 or 14 years, has that had a significant or measurable effect on the amount of phosphorous, both in soil and in, ultimately, the waterways?

MR. FLATEN: I am not aware of any data that is been collected to document trends in soil test phosphorous in Manitoba. Ironically, in Alberta, they have done these studies. But I am not aware of any equivalent studies in Manitoba to document trends in soil test phosphorous.

MR. AKINREMI: I think some have been done. I think some have been done, Don. I think that Lavis Lavinski and he did a soil survey of soils in Manitoba. And he found -- he found that -- I think that that was done by the Manitoba Livestock Initiative.

And I think, generally, if I remember

his data, on average, for manured soils, he was comparing manured soils to nominal soils, the manured soils are about twice the value of nominal soils. And that's -- even in our own study, which is now a published paper, when we sample soils, which we used in the paper that we published, when we sampled -- when we took soil samples, and we looked at the manure soils and the nominal soil samples, on average, the manured soils are twice the soil test P compared to nominal soils.

I mean, it is just a matter of input and output. If you put more in there, the soil is going to measure more. And so some studies have been done.

THE CHAIRMAN: Marc?

MR. TRUDELLE: Well, for the Manitoba context, it is probably difficult for me to answer that. But if I look at the experience that I have thus far, I think the mass balance at the farm level is very important. And, in fact, the whole farm budget is a way of looking at the amount of phosphorous that will be generated by the farm, and the ability of the soil, or the farm, to spread this phosphorous.

And if you are able to have a mass

balance that is quite at equilibrium, the soil P test won't increase. And so a way of being able to manage the soil P test is to be able to manage at the full farm budget, as well. And so when you are buying feed, when you are exporting crops, when you are buying livestock, all of these farms, they have the ability to manage their phosphorous, as long as they have the tools to estimate the value of phosphorous that will be imported and exported. And so it is quite easy to do. And it just requires some basic data for the farm to do it. And it does not take time. And just by looking at the whole farm budget, which is a mass balance on the farm, you can easily detect the area that will need some improvement or areas that you will have to export manure.

So if you look at the southeast and you have a mass balance for the farm, you will easily find that some farms will need other strategies, maybe a feeding strategy, or maybe technology to import or export the phosphorous. And other farms will be able to comply to the regulations without any problems, even if they are in an area with problems.

So I think it really -- this is what

we call, in Quebec, the farm pro forma approach. It is really a site specific evaluation for each farm. And even if you are in the southeast area, which is a concentrated area, some farms will be able to comply without spending too much money. Other farms will need more improvement. But by looking at the balance, on the farm basis, you can easily see what are the problems and where you have to spend money or time to improve the situation.

And so I think it is just a universal basic principle formula. Whether it's in Denmark or France or Quebec or Manitoba or Alberta, or wherever you are, I mean, the basic principle is just to look at what is the balance on the farm basis. And then you will introduce the concepts or the equipment that you will need to improve the situation.

THE CHAIRMAN: Ian?

MR. HALKET: Is there any information on how much the soil P test decreases after inundation by a flood in a soil?

MS. LORO: I don't think that there is anything that specific. But there is definitely data that shows that you saturate a soil and you

increase the solubility of P. So that's the first thing that that is to mind when Dwight said, you know, we had a huge flood. It was -- the soil was saturated for a prolonged period. Some of the phosphorous would have gone into a soluble state and not necessarily have been transported at that time. And the next rainfall, then, may have flushed that out, as a result of being saturated during the first flood period. I mean, that is just speculation.

MR. HALKET: My students and I studied this on Sturgeon Creek. We isolated the watershed a couple of years ago. And we actually had that huge flood. But I think it was about a 1 in 250 year rainfall event. It was a humpty-back camel sort of thing that occurred just after the snowfall event. And that snowfall event inundated everything, because it was a round of 1 to 10 year event. And so we measured twice a day the water quality at four different stations on Sturgeon Creek. And there was a huge loading coming out that was of phosphorous.

About a month later, there was this 1 to 250 year event that occurred. And the loading, again, was huge. It was even more than the snow

melt flood. But not as much as you would think from a 10 year to a 250 year event, which surprised me. But it was still in the order of about two-thirds more, in terms of the loading coming off of Sturgeon Creek.

So the point here, I think, is that we have soil P tests. But we have got to look at the soil P, in terms of how many times is it going to be inundated by waters and how much of that is being released from that? And there has got to be some sort of risk analysis or risk benefits analysis done on that side of it, compared to the environmental and economic side.

THE CHAIRMAN: Petra?

MS. LORO: One of the greatest challenges to the Phosphorous Expert Committee was looking at hydrology in Manitoba and looking at it in the context of phosphorous, because there has been so much work done internationally on phosphorous.

And then the building of phosphorous indexes as a way of managing phosphorous on the farm. And we found those indexes generally did not work very well in the Red River Valley because of the hydrology there. It just did not capture

the major events.

That and the other fact that most of the phosphorous going to Lake Winnipeg was coming from the Red River Valley, from your data. And we thought: Well, we need to look at the Red River Valley. And it really doesn't follow the same patterns of other jurisdictions where we would be able to just use some of their data or some of their conclusions and help us.

So what we did was we said: Well, what do we think is hang in the Red River Valley? And we do have data on the spring snow melt. That is our big event. So there were a few things that we did. Not just the ban on winter spreading, but we also recommended that if you are going to fall apply manure, that you inject it in the Red River Valley. Because the literature will show that if you even cover that manure, there is less risk of transport the following spring.

Winter application, then, is obvious. I think the presentation we had from Water Stewardship was we made a general assumption that every acre in the Red River Valley went underwater one year in two. So the risk of inundation was huge in that area. So winter spreading in that

area, you can just assume that that is going to flush right off the surface. And so we wanted to also bury the manure from the fall application. And we set those thresholds.

So there is sort of a three tiered approach in the Red River Valley, because of the transport in that area, as well as the water quality data that shows us that that is the time when the phosphorous is moving. The water and the phosphorous together are moving into Lake Winnipeg. So we focused quite a bit in that area to try and manage the situation based on what we know. We did not just look at the soil test thresholds. But that is a part, and a very big part, of the recommendations, but it applies province wide.

We looked at winter application of manure. And we looked at fall application, as well, in terms of that is a necessity for the industry. And we would like to see that manure buried so that there is at least a soil cover before the next spring snow melt event.

THE CHAIRMAN: How much of a hardship on farmers would it be if all manure were required to be incorporated?

MS. LORO: We looked at that as well. And in some instances, it is not the recommendation that we would want to make based on phosphorous transport. We really want the forages in place. Incorporation on bare soils is in their best interests.

So in the liquid manure systems, which is the predominant one in the hog industry, injection is ideal for a number of reasons. It conserves their nitrogen. It gives them a better N to P ratio. It brings down their application rates. It is a better fertilizer if it is injected, but it is also environmentally better.

So for a lot of the big industry that has expanded in the last 10 to 15 years, they are injecting their manure, except on forages. And we did not want to see all of the forages plowed up so that the manure could be incorporated, and so we built that into the recommendations again. We do not -- the vast majority of the phosphorous in soil is probably in particulate form. It is bound in there in these highly fertilized soils. So we do not want to see the soil moving off the field as well. We are worried about that soluble P.

But if erosion was our primary

transport mechanism, we would be more worried about the particulate P. And so we do not want to do anything that makes that more of a problem. So in the case of bare soils, incorporation is ideal. And, you know, there is going to be some years, you know, obviously --

MR. FLATEN: Burying the fertilizer.

MS. LORO: Yes, burying the manure. It is the best fertilizer that way and it is the best environmentally.

THE CHAIRMAN: Are there any concerns about spreading manure on forage, and are they significant?

MS. LORO: There is agronomic concerns, depending on the time of year you do it and the weather conditions. And there is probably concerns, if it is in a grazing system, about how soon afterwards you allow other animals to graze in that system.

Environmental concerns on forages, it is surface applied. So if it were a forage in the heavy clay soil, if it were in an area that was already saturated that it is going to pond on the top, I don't think you would have less of an issue with injection because you just wouldn't be able

to inject into a saturated soil. And you might get surface transport, surface runoff. But you get a lot of slowing of movement with the grass that is there.

And so that is -- I don't know if you can answer that question, Don? I mean, I think the advantage is to keep the forages there and to surface apply the manure. And you definitely get a fertilizer response from the manure. And so you increase the productivity of that soil. You increase yield. If you harvest that crop, you then increase the quantity of nutrients that you truck off as harvested crop material. So it can work to be a better system environmentally, if done well.

MR. TIMMERMAN: And especially on the lower agriculture capability land, that's where forages have more of a fit. They still create problems. Because if manure has to be broadcast to avoid ripping up the stand, then to supply nitrogen to crop requirements, more phosphorous will have to go on. And so there is a land based issue there.

But in terms of using manure for a suitable land use, annual dropping versus

perennial, the quality of the land certainly comes into play. So, as you can see, there is no simple answer because of the complexity of cropping systems.

MR. FLATEN: Yes, I was just going to echo Petra's and Mitch's comments, but also mention that the University of Manitoba is collaborating with Manitoba Agriculture and Agriculture and Ag Food Canada, and a variety of other collaborators, on a major study on liquid hog manure application on forages down at La Broquerie. And probably it has surfaced every once in a while when people talk about the La Broquerie project or something like that.

And we are monitoring greenhouse gas emissions associated with that practice, pathogen transmission, nutrient accumulations and balances, and a whole bunch of other things looking at ground water risk and all of these other sorts of things.

And if you ever want to get a presentation from our group, or come out to the site and take a look at it or something like that, you are certainly welcome to do that. But I think it is one of the most intensive and

multi-disciplinary studies to look at exactly that issue. But if there is something specific you want to talk about with respect to what the Commission or the panel feels is a threat from liquid hog manure on forages, you know, we could respond to that.

But like Petra mentioned, we did not want to create undue pressure on removal of forages and converting fragile land from perennial forage into cultivated agricultural land and having it blow or washed away. And so that is why we do not want to mandate injection or incorporation in all cases.

THE CHAIRMAN: For my part, I think that the responses today are quite sufficient. And I think we may well want to talk to you or that group a bit more about that project.

MR. YEE: In terms of application to forage land, was there any consideration by the expert panel when you were considering things in terms of topography and potential runoff from forage lands?

MS. LORO: In terms of slope factors?

MR. YEE: Slope factors, yes.

MS. LORO: Yes, slope was not built

into these recommendations. Although, the injection, the requirement to inject in the fall, and then not to have to do that on forage lands came in the Red River Valley where slope was not considered. But, again, the next phase, if you wanted further regulation, would be to look at the area outside of the Red River Valley and the transport processes there.

We did not emphasize that because we relied on the water quality data that said: Your biggest problem is in the Red River Valley. So we had to rationalize how much we could do and how many recommendations, and also coming up with something that producers could understand and hopefully follow.

And you would probably come up with a different set of recommendations for sloping land than you would for the Red River Valley, and that sort of thing. But we really focused on the Red River Valley just because the loads were coming from the Red River.

MR. HALKET: When you say the Red River Valley, you're -- do you mean right the way to the Pembina hills, to the Manitoba Escarpment, which makes part of the Assiniboine area?

MS. LORO: It's part of the Special Management Area. It's defined. The boundaries are defined in the recommendations. So it is the Red River Valley Special Management Area.

MR. HALKET: Okay.

MS. LORO: And so the boundaries are different.

MR. HALKET: Thank you.

MR. TIMMERMAN: And they are based on the criteria of nearly level land, fine textured soils and enhanced surface drainage. Essentially, the criteria to produce the map, the best available data on those three.

MR. MOTHERAL: I don't know if this is the time to bring up a question. But we heard -- the question came up or comment came up in several of our hearings. Because it is the hog industry that we are working with, that we have to come up with our report. Supposing there was no hogs in Manitoba? And, I don't know, I am maybe going to get a comment from everybody on this, so you've heard this question before. If there is no hogs in Manitoba, would that make any difference to our phosphorous loading? I just want to hear somebody comment on that.

MR. HALKET: I suspect it would.
MR. MOTHERAL: And any reasons?
MR. HALKET: Well, I think the volume -- I can't get this on. I think that there is a lot of hogs in Manitoba. And is it 2.98 million?
MR. WILLIAMSON: Eight million.
THE CHAIRMAN: At any one time, there is about three million.
MR. HALKET: Three million, 2.98 or 2.89. I can't remember what it is, but they produce a lot of poop. And there is a lot of phosphorous in that poop. And, yeah, if you took them out of the -- if you took hogs out of that equation, there would be a lot less phosphorous coming into the system, no question.
MR. MOTHERAL: Okay, just a minute, maybe I didn't get this right. If there is no hog manure, then that land will be fertilized with commercial fertilizer. This is the point I am getting at. There will still be phosphorous going on to the soil. I think that is more clarification.
MR. FLATEN: The other question is what represents "a lot less"? Because I think

that, although, once again, the hog industry is a significant source of phosphorous that is applied to land, it is not the largest source.

As Ian mentioned in his initial comments, the single largest source of phosphorous application onto agricultural land is in the form of phosphorous fertilizer. And the total amount of phosphorous applied as hog manure is substantially less than the amount that is applied as synthetic fertilizer. But it is a lot -- there is a lot more incentive in the system, in the agricultural system, as a whole to apply only as much phosphorous fertilizer as what you are removing. And so your soil test phosphorous doesn't usually build too rapidly with a synthetic fertilizer based system. Whereas with manure application, you know, especially if it is applied on a nitrogen basis, it will rise.

But I think we have to pause and think: How much of the total amount of phosphorous, how much of the total land base, is associated with the hog industry? And I have taken a lot of flack over the last six months for coming up with a ballpark estimate that it is probably one percent or two percent. I firmly

believe it is in that range. In terms of the total phosphorous loading to Lake Winnipeg, we are dealing with one or two percent from the hog industry.

That does not mean that the hog industry doesn't have its share of phosphorous loading that it has to deal with. But the fact is that if we regulated the hog industry to death, and did nothing with our other sources of phosphorous, then the improvement in Lake Winnipeg's water quality, and the water quality of other water bodies in Manitoba, would be minimal. It is a small, but a significant source, just like a lot of the other sources.

And we have to take a very broad range of initiatives with all of our sources. It doesn't diminish the importance of taking care of the hog industry's phosphorous. But if people in the City of Winnipeg think that if we bludgeon the hog industry to death on this, then we will have Lake Winnipeg cleaned up, that is misguided. I think you have to be thinking about the magnitude of the contribution relative to other sources. And all sources are important. All sources are small. And there is no one bogeyman that we have

to bang on the head in order to solve our problems.

THE CHAIRMAN: Marc?

MR. TRUDELLE: Maybe one comment about the hog industry. I think what is different from the hog industry, comparing to other livestock, is the fact that it is very concentrated. So one of the biggest problems, or the biggest issues, I think, is concentration. And even if you have one or two, or whatever, percent, if you are really concentrated, and the problem in other jurisdictions has always been -- it has been always the fact that they are really concentrated. And so it is a concentration problem. So I think that we have to probably be careful about the fact that, well, yes, the impact is probably low, but it is concentrated.

So what makes the issue more difficult is the fact that we need to work in a small area where the pressure is really high on the land. So we have to find a way of making sure that some phosphorous is exported from these areas and the problem will be solved. We do not want to get rid of the nitrogen. We want to get rid of the phosphorous.

So I think we do not have -- and if you look at Quebec, as well, if you spread the manure all over the place, all of the hog manure, it is at equilibrium. The problem is that they have three areas which are really concentrated. So the problem is it is not to spread the manure. It is just to make sure that these areas are able to export a certain amount of phosphorous from the area.

THE CHAIRMAN: Dwight?

MR. WILLIAMSON: I just wanted to add perhaps a couple comments, and maybe to underpin the response with a bit of science. We have talked earlier this morning about storage of phosphorous and soils and the mechanisms that move that phosphorous out of storage into streams. There is a large body of credible science that demonstrates, and others with more expertise can speak to this issue in this panel, but as soil phosphorous levels increase, there is a greater loss -- when you pour water onto that landscape, there is a greater loss than coming off to downstream areas.

And some of the studies, as well, show a threshold, that is there is a change in the

inflection point between that relationship. And so once you reach a certain point, you are losing more phosphorous than otherwise. So in any situation, then, where soil phosphorous levels are being built up over a period of time, and that landscape is being subjected to an event where water is moving off, then there would be more phosphorous moving out of those areas with a higher soil test P than in other areas. So in any sector, any sector operating on a Manitoba landscape, that builds phosphorous in the soil to greater and greater levels, there will be more and more phosphorous coming off from those areas.

MR. FLATEN: Yes, that is a very important comment.

MR. HALKET: Coming back to the original question about how much phosphorous the hog industry is producing. I just went to the Manitoba Yearbook the other day. And I will come back to this statistic now that I have it in front of me. But the amount of fertilizer in tonnes that was applied to Manitoban lands in 2005 was 189,500. Now, that is got a nice big chemical name to it. But if you break it down in terms of just phosphorous equivalent, it is about 40,000

tonnes of phosphorous that was applied in terms of fertilizer.

Manure. I can take cattle, and I can put it in terms of animal units and how much P is in their poop, et cetera, and I get about, just roughly, just trying to put numbers on this, 27,000. So we're talking 40,000 in terms of grain. 27,000 tonnes in 2005 from cattle. And around 15,000 tonnes from hogs.

Now, if I do the human population in Manitoba, because they are also -- and Winnipeg has sometimes been referred to as the biggest hog operation in Manitoba.

MR. FLATEN: Define livestock?

MR. HALKET: Sorry, livestock, then.

MR. TIMMERMAN: Pardon me, confined animal feeding operations.

MR. HALKET: Yes. And, actually, if I don't do Winnipeg, if I just do the whole of Manitoba and take it as 1.5 million people in 2005, I get the P equivalent there of around 6,000, so one-fourth of the hogs.

MR. FLATEN: How many hog operations discharge directly into Winnipeg rivers and streams?

MR. HALKET: Well, you know, the thing is that the human population has sewage treatment.

MR. FLATEN: Phosphorous removal?

MR. HALKET: Well, it is not phosphorous removal. But within that sewage treatment, you do take some of the phosphorous out.

MR. FLATEN: Not very much.

MR. HALKET: That is true. But, at the same time, if you look at the hydrology of Manitoba, I would suggest, also, that when you apply the phosphorous on the land, that if there is a huge storage complex there, and granted you are taking some out in terms of crop removal, but there is always a residue. And if that residue is accruing in a five to ten year period, I imagine that there is a lot of phosphorous moving out through the river systems, too.

The other piece is the one to two percent that hogs are responsible for in terms of the P, the overall P in Manitoba rivers. Actually, it's phosphorous. I keep calling it P as an abbreviation. Don got me calling it that years ago. But that calculation I don't agree with. And part of it is based on what was a

report that was given out of Conservation a few years ago.

But one of the things that I look at, just initially right off the bat, is that in Winnipeg we have 650,000 people. And we're putting out about five percent of the P load to the Red River from that report that was done by Conservation. And I look at how many hogs are in Manitoba, and I say: Wow! They probably poop three or four times the amount that humans do. And that is being land applied, so some of it is being taken off. But even if I do the calculation of, say, 20 percent of it getting into the rivers, or something like that, it is still a larger number than one or two percent.

MR. TIMMERMAN: 20 percent, where do you get that number from?

MR. HALKET: I am just taking 20 percent, saying 80 percent is removed by crops from the --

But, anyway, coming back, Don, that calculation was based on -- the calculation that you are basing it on, sorry, okay, is, I am not sure, a good calculation in terms of how much P is being produced by different sectors of the

economy: The hogs, the municipal works, agriculture, that was given in that report. And I forgot what the report was titled, but it was by Armstrong.

MR. WILLIAMSON: Lorne Armstrong.

MR. HALKET: Lorne Armstrong, okay.

MR. WILLIAMSON: Yes.

MR. HALKET: And the reason I say that is because those numbers were based on export coefficients from different land uses. And I think that they used four different types of land use to come up with this proportioning.

And if I look at those -- if I look at that -- in hydrology we use a method called the rational method, which is sort of the same hydrologic conditions. And what it does is it proportions, or it identifies, different lands and uses export coefficients in terms of water. How much water is going to run off this particular type of land?

And in hydrology, the caveat on that type of analysis is to use it for very small watersheds. Watersheds that are probably in the order of less than 25 square kilometres. So this calculation that you're basing the one percent on

was done on export coefficients that were used for the whole of the Red River and the Assiniboine River Valleys, which far, far surpass that sort of caveat.

Looking at that calculation, Bourne and Nicole also did separate calculations on the Red River portion of the Red River Valley and on the Assiniboine drainage portion of the Red River Valley. They got good numbers in the downstream. And when I say "good numbers", I mean that their numbers actually added up to what the results that they were looking for.

But on the Assiniboine portion, and this includes the Red River Valley portion, from Portage La Prairie to Winnipeg, they were out by an order or 10 orders of magnitude, I think, or an order of magnitude in that calculation. And that shows, to me -- and if you go back and read this report, that shows to me that there is a huge amount of error involved in that calculation in terms of using export coefficients to try and figure out how much phosphorous is coming off or nitrogen is coming off the land in a runoff episode.

I think -- and I also look at the

character of the Red River Valley in terms of its drainage, its hydrological drainage. And I would suspect that the natural areas -- when they did this calculation, what they had was it was sort of -- if I could describe it this way, it was an additive calculation. You have an answer of the total loading that is coming out of the system. And then you have -- you have how much is coming from agricultural land. How much is coming from end-of -pipe situations that are coming into the system. And then you have the remainder.

And so what you do is you use your export calculation or export coefficients to calculate how much is coming off agricultural land. You have your end of your pipe. And then you have your answer, which is what is being measured on the streams.

If they do not add up to that number, then that must be natural sources. And there is no way on checking on that calculation. The remainder just automatically must be coming out of the natural system. And looking at those calculations, I, sort of, do not agree with it. And, therefore, to base Don's numbers -- because Don takes that calculation a little further to

calculate that one percent --

MR. FLATEN: One important correction, I didn't use those export coefficients.

THE CHAIRMAN: Mike.

MR. FLATEN: I didn't use those export coefficients at all in my calculation.

MR. HALKET: No. But those export coefficients are used to ratio the amounts.

MR. FLATEN: I didn't use them at all in that calculation. But I know what you are getting at. Like, the Bourne and Armstrong estimates are very important part of this discussion, what I call the blame game, apportioning the loading to various industries. But, as I have said more times than Dwight wants to hear, the blame game ultimately doesn't take us anywhere.

We have to go back to the dynamics of: Is the proportion of phosphorous loading, whatever it is from the hog industry, increasing or not? And if it is increasing, because of increased loading in excessive removal, like Dwight and Marc have mentioned, that is the action that I think we need to focus on in terms of the CEC panel, the CEC as a whole, or even our academic affairs at

the University of Manitoba.

I was just trying to respond -- like, these are just really rough back of the envelope, not even as sophisticated as what you are talking about. And it is just that all of these sources -- and I think Dwight will even agree with this one, all of our sources are small, but they are all significant. Because in aggregate, in total, we end up with a lot of phosphorous at the end of the day.

And if we can set the blame game aside and focus on the really important thing, which is: Is that share increasing or decreasing? And what are the reasons for it increasing or decreasing? Then I think we have some potential to move the issue in a constructive direction. If all that we do with our various rough estimates try to apportion the blame to somebody else or to somebody else, I don't think we're going do make much progress.

But like Dwight and Marc have said, the focus, I think, that is really important for your panel is: Is that share increasing because of increases in soil test phosphorous concentrations?

And I know the debate -- I know the debate over the export coefficients, but that was not the issue.

MR. HALKET: Well, I don't believe that it is a blame game. I think that it is a game of trying to come to an understanding of where the phosphorous is coming from in this province, and then how it is moving. Once you've got a handle on how much you have, then you can look at how much -- at how it is moving through the system.

And so I am not in any way trying to run a blame game here. All I am doing is criticizing some of the figures that are being thrown around, especially the one percent from the hog industry that you are that you were talking about earlier, Don. And I just do not agree with the way that calculation or the calculation is based.

But moving on, moving on, it seems to me that this -- that part of the phosphorous -- everyone is contributing to phosphorous in this. Or I should say all of the industries, agricultural, the municipalities, and other industries in Manitoba are contributing to

phosphorous. And I think that we have to have an understanding of where it is coming from. We have to not only just isolate the hog industry in this. I think we have to -- I think you have to know how much the hog industry is relative to others? And is it a problem from that point of view or isn't it? And that is why I come back to: Let's have a look at the numbers and let's try to do a mass balance on this.

THE CHAIRMAN: Petra?

MS. LORO: Yes, I think our department would be very supportive of accurate numbers for which pieces of agriculture contribute how much. But we can't wait while those numbers are generated before we look into management.

And the focus is on the hog industry because it is one of our industries that continues to expand. And so we want that expansion to be sustainable. And what we have found is that with the regulation, largely of the hog industry, with the previous manure regulation, is that if you look at our proportion of producers in the different sectors, probably the highest proportion of producers that are actually soil testing at all come from the hog sector, because they are

required to submit Manure Management Plans, probably come from the large barns, or the large operations, because those are the ones that are required to submit.

And so they have been soil testing. They were developed with basic land requirements for nitrogen. They are doing, I would say, an above average job on management because there has been so much focus on manure. And this focus will, or will not, inhibit their development overall.

And so I think what we have to look at is: Do we need to do better in terms of the management? We have concentrated the barns in a couple of R.M.s. That could potentially cause us problems, especially if that expansion were to continue. And the problems are likely to come from phosphorous, because we have had this strong focus on nitrogen.

At the same time, we have a problem in Lake Winnipeg. And we do not want the hog sector to be blamed for that. And so it is in our best interests to get them managing the manure on the basis of phosphorous to eliminate that or it, again, is going to inhibit their development and

their ability to do business.

So from our perspective, from a nitrogen perspective, under the previous regulation, they are doing a very good job. And our regulation, when you look at it in the context of other regulations in North America, I would say is very good because of the way it is administered at Conservation. The plans are actually submitted to the government and reviewed. And in most jurisdictions, it is just either on the shelf or that there is an assumption that you may be audited. It doesn't actually come into government.

So there has been a lot of interaction with this industry to get them managing their manure and managing it well, in terms of storages, and also in terms of land application. But we have to move to a phosphorous based system or a nitrogen and phosphorous based system, which is what we have done.

We would like to see more accurate numbers for each of the sectors, but I don't know if that is possible, so that -- Because there is a very strong feeling, within the general public, that the problem in Lake Winnipeg comes from the

pigs in this province. And I think that that is completely unfair. The problem in Lake Winnipeg is due to all of us on the landscape.

So I agree with you, better numbers are going to be better for everyone. But, at the same time, we have to move forward because this is one of our sectors that continues to expand. It might not be expanding right now. But in the past 15 years it has been, and into the foreseeable future.

And so it is a two-sided coin. They are doing quite well. They are soil testing more than if you looked at the proportion of grain farmers that are soil testing.

But we really do need to make phosphorous a part of that whole management scheme in a way that they can comply with. Because the only way that we are going to see any difference on the landscape is if the producers buy into the system.

THE CHAIRMAN: Thank you. The food has been set up here for lunch. And I would -- rather than trying to talk with our mouths full, I would suggest: Let's take a break for about a half an hour, grab some lunch and munch it down,

and then we can reconvene in about a half an hour. Sound good?

(PROCEEDINGS RECESSED AT 12:15 P.M. AND RECONVENED AT 1:00 P.M.)

THE CHAIRMAN: Okay, we are back now at 1:00 o'clock. We are well fed with Manitoba produced food. Some of it, I'm sure. And I think Ian and Don, did you resolve your --

MR. FLATEN: Not completely, but we agreed to be nice.

THE CHAIRMAN: We are glad. We would hate to have war break out in this little room.

MR. FLATEN: We are going to take this outside after.

THE CHAIRMAN: I think talking with my co-panelists, I think we still have a number of questions that we want to ask of you folks this afternoon. I think there is one sort of overriding element aspect, is that where do we go forward from this? Is there or are there specific things that we could be recommending in our report, perhaps things that some of you would like to see and you might be able to convince us that that is where we should be going in that regard.

So, keeping that in mind as an overall

discussion and perhaps we can come back to that later on in the afternoon about what still needs to be done or might be done. Yes, Mark.

MR. TRUDELLE: I think to answer your question, if I go back to my recommendation or proposal, what I would like to see in Manitoba is, based on the fact that I think we need to estimate on the farm basis, the whole farm budget of the farm, we need to have some information on the efficiency of operation. There are some tools that are available right now, so it can be easily done on the farm, and actually I am starting with Puratone Corporation, so we are doing their 50 farms and we are doing the whole farm budget for their 50 farms. So I think there is a way of being more efficient by looking at different strategy and the purposes of these plans, and I think I would like to see the plan not only to get extension, right now it is part of the reg, and you have to present a plan to Manitoba Conservation if you want to get more time, that is okay. But I think it would be better if we go and if we are pro-active and look with a plan to, and seek to start a process of looking at the efficiency. So the plan should be used as a tool,

not only a planning tool, laterally tool, and it should be a distant plan. The plan is not only to comply with the reg, that it is one purpose, but I think the plan should be better used and it should be better used by looking at the farm at the beginning. And it should be a starting process to get a real picture of the farm.

So the plan for me, a plan is a way of going forward and looking at different options as well. So when you talk about strategy, feeding strategy, treatment system and so on, it is part of a plan and it gives the farmer a way to get some improvement over time. I think we need time. But in order to get time we need to get the picture. We don't have the picture right now. I think it is important to get a picture of the farm. It gives us time, and this is what I would like to see in the future. It should be a tool and a shared responsibility. I think it is not only Manitoba Conservation's responsibility as well. I don't want to be the only one in Manitoba working on that. I think it should be a shared responsibility, and it should be Water Stewardship as well. We should work together, otherwise this regulation, we won't be able to (inaudible). I

think the bottom line is to get the farmer efficient as possible and to comply with the reg. When you are really efficient, I think most of them will be able to comply with the reg without a problem, as long as we have the picture and we know where we are going.

So, this is the first, my first comment. My second comment is probably related to intensively developed areas. These areas are probably intensively developed, and I think it comes back to the fact that apart from the one person loading, I don't want to spend time on numbers, what I wanted to see is to work within these area and making sure that we have a good picture of the situation, and it should be based on the RM basis, and not on Stats Canada as well. We are five years behind with Stats Canada. So we don't even have the right information right now. So I think we should probably put some emphasis on these areas. And by looking exactly at the number of livestock and where phosphorous comes from, and after that it should be supported by a kind of management strategy for these particular areas.

And for a phosphorous reg as well, if you look at other jurisdictions, you always need a

financial support to be able to comply with the reg. There is no doubt about that, farmers will need support. And I was just reading yesterday about the Quebec budget and they will spend $40 million for the agro environmental plan. So it is a lot of money to the farmer, and I don't know here much money we need, but we need money to make sure that the farmer will be able to comply. But I think it is feasible as long as we are -- and I think I will do the same -- I think it is a question of, it is a team, we should work as a team, otherwise it won't work. And if we have to fight between different organizations to get the phosphorous reg in place, I think we will lose our time and it is not well spent.

THE CHAIRMAN: Thank you. Not for me to bring politics into it, but I'm not sure that budget is not going to survive very long in Quebec.

MR. TRUDELLE: I think so.

THE CHAIRMAN: I'm sure you understand the politics there much better than we do. I believe everything that I read in the Globe and Mail. Anybody else? Wayne, you had something?

MR. MOTHERAL: Yes. We've heard this

through our hearings too about the terminology, the BMP, beneficial financial plans, or management plans, and how many farmers and hog operators are in these plans and are finding the value of them. How this, of course, needs to be monitored in the future and how can you, how do you see this happening? How many years is this going to take to find out, you know, how the environment is benefiting from these plans?

MR. TRUDELLE: I will answer your question easily. Yesterday I got the plan, five year plan, so they are monitoring from 1988 to 2003. So they are monitoring, I can give you a copy of the -- it is part of the report. You have the BMP implementation and you have a follow-up for different livestock sectors, and so you can easily see that from 1988 to 2003, they are using phytase. I think the level of phytase was very low in 1988, and it now has reached 90 per cent. They are using nutrient management plans, they are using the plan. So they have a questionnaire here and they have a survey. I can give you a copy. It has been translated in English as well, so it will be easy for you. So each farm has a plan. And they have to -- it is a survey. And this is

why I talk about survey, and by a survey you are able to make adjustments all the way. And you know exactly how a farmer is going with their BMP. So it is one way of having, in five years from now, the amount of farmers that are using a plan, that are injecting manure, that are using phytase. So it is a way to be able, from the public point of view as well, they are knowing that now it is increasing and they are using these BMPs.

So I think it is an easy tool, it is easy to implement, it just takes -- it is a question of willingness. So we need to be willing to do some -- to ask farmers some information. There is nothing wrong about that. It is just the way that if they feel they will be able to use it, and they will be, and these tools will be used for their own benefit, they will participate. And I think it is probably proactive. And for the phosphorous reg, I think we should be proactive, otherwise it won't work. Tools are existing. It can be adapted to the Manitoba conditions, of course. But the principle is to get the information to know the picture and be able to -- I mean someone has to probably take the management of these tools, so it can be a shared

responsibility again, or one organization, I don't know, but someone has to probably, should be responsible for getting this information and they will publish a report after four or five years.

So we know that the phosphorous reg started in 2006. Maybe in 2011 we need something to make sure that we will be able to evaluate the progress associated to that. So tools are available, and the expertise is available and people are doing it in our jurisdiction. So it is just a way of transferring this type of information and this type of processes here.

MR. MOTHERAL: Who is responsible for this in Manitoba?

MR. FLATEN: Before we leave that idea, just suggesting that, Mark, would you explain the process by which the pork industry in Quebec developed these objectives and developed a strategy, and then worked, like you said, in a team work kind of fashion with a group of other people to move their industry forward? I don't know whether all of you have heard about this story, about how the pork industry has advanced towards these environmental objectives. I think that would be worthwhile.

MR. TRUDELLE: In fact, the pork industry started this processes before the pause, so they were expecting some problem, and they were expecting some problem, so they started to evaluate their BMPs and they started this processes by working with Quebec Agriculture and Quebec Conservation. So it is a joint project. It has been supported by Agriculture Canada as well. So even here, if we don't have money, I think Ag Canada supported this program, I think by 50 percent, there is a way of getting money from AG Canada when you want to do these types of surveys. And it is a team effort. It has been shared by different departments, and everyone now is using this information to make sure that the industry is going in the right direction, and now I think last year, they signed an agreement between Quebec Agriculture, Quebec Conservation and the Quebec Farmer Association. It is a three year agreement to work together and to reach -- because they have to reach equilibrium in 2010, they have three years. So they signed to work together and they have three years to comply with the reg. They are working together. I think this is the bottom line here, otherwise if we just try

to figure out how to work in our own organization it will be very, very difficult. But the basic principle here is to put everyone together and start to work together.

THE CHAIRMAN: Petra.

MS. LORO: I'm going to interpret your question a little differently. I think what we are missing, it is fairly easy to measure uptakes of BMP if there is an intensive program. We know what we are financial and we can do the statistics on that and say what is new happening out there. As well, with the changes that come as a result of this new regulation with Conservation, the plans that you see, the number of plans that come in will be a good indication of the number of people that are participating at that time relative to the number that should. But what we don't have with any of the BMPs is a measure of their success, and that is in terms of improving water quality. So if a producer is asked to change his practice, what improvement might that give us in terms of water quality or if a group of producers like the pig producers all change their practice, is there a measurable improvement in terms of water quality? And I think that is the data that

we are missing and maybe need help in terms of establishing some way of collecting that data so that we can connect BMPs to water quality. I think uptake is relative easy to measure, but the value of the BMP itself in terms of improving water quality, I don't think that we have any data on that for any of our BMPs. We have a bit out of webs and things like that, but nothing large scale across the province. Maybe we should start thinking about that when we ask producers in large scale to start changing their practices.

MR. MOTHERAL: And what part can this Commission be a part of that? Is there a need for more analysis of best management or beneficial management practices in the future? There must have been a plan with this, there must have been a long term plan with this.

MS. LORO: I think there is a huge need if we look at the threshholds as an example of a better management practice than the current system with nitrogen, of being able to further evaluate that and further refine it. And the only way that you can do that is say when we switch to this type of management system, what improvement are we having for water quality, and is it enough?

And if it is not enough, how might we then go back and change it. So we have put something in place. I think we need some kind of monitoring and measurement and research to continue so we can establish if it is enough or if we need to change and come back and modify it. I think there is probably a lot of research that can be done on BMPs, we want to make sure that the practices we recommend not only solve one problem, but they also don't create another problem.

MR. AKINREMI: In my mind, to be able to do that, we can do that on say the Buck Creek and so on and do that experiment, but in my mind to be able to do this on a large scale is to do modeling, and it has been done in the United States. To use a lake scale, you can look at this on the synergistic effect. But to my mind, it is going to be difficult to carry out studies and very, very expensive to carry out studies to validate the BMPs. And the other problem is just from my own gut feeling, a problem with BMP, that, I mean we can do one, we can do and do it in a small scale, and see that it works, but in the large scale nobody is really sure that it will work, it will work, nobody is very sure. That is

when we do these things. I think it goes from, it is almost like a leap of faith going from you do this and then what happens when they measure the water at Lake Winnipeg down the line? Nobody is really sure how that is, by how much per cent and so on. That is the problem of doing this experimentally.

MR. WILLIAMSON: Let me make three points here. And, first of all, I would agree with everything that has just been said with regard to BMPs and all of the work that is required there. We have in place a new regulatory framework now in Manitoba that for the first time, for the livestock sector, last November, includes phosphorous, and that is because of the huge amount of consultation that went into it leading up to that. There is a different approach and a different dot process now going into how to manage livestock manure in the Manitoba environment. And that is going to be -- we need a lot of information over the next period, as Don mentioned I think very early this morning, that the approach was the first approach going from having nothing in place, essentially nothing for phosphorous, to a regulatory framework for phosphorous. We need a

lot more information to refine that. One of the points that I wanted to make, though, is that BMPs and some of the approaches that Mark talked about, are really tools to get to a certain end point. And until you know what that end point is, you don't know how much is enough. And so we also need to -- so, in addition to putting in tools to get us some place, we also need to know where we want to ultimately be, because otherwise it is unlikely that we will overshoot, but more likely that we will give up too soon. But there is economic and social and environmental risks on either side of that.

So we need to know where we are going. So there is an immediate need over the next period of a few years to refine the research that went into and directed the approach that we have now, or probably lots of ideas, and some that came out already today on what needs to be done. But the other thing that I don't think is in dispute, that even if we don't know anything else, we know this, and we've talked about this already to some degree this morning, if we build up phosphorous in the soil there is more that is going to come off into the landscape. And for the long term, and here I

will refer to a recommendation from the Lake Winnipeg Stewardship Board, and so this is recommendations 32.1. So what they have said is that for planning individual livestock operations the province should ensure that operators have sufficient land available for new and expanding operations, I'm paraphrasing a bit, to phosphorous rates with renewal rates over the long term. So there is still some questions there at what soil test do you P balance. Nevertheless, if phosphorous builds up in the soil over the long term, there is either a greater risk or an actual likelihood that more is coming off. So the long term, so that may be a useful target for the long term, and then what do we need to do over the next period of time to get ourselves there.

MR. MOTHERAL: This question that I'm asking now is in relation to what has been done in the hog industry over the last few years, or last two or three years, that is with the phosphorous regulations and they have to work under a regulatory framework. Is this comparable to any other industries that are phosphorous polluters? What have they done in the past number of years, is there anything done in other industries? We

heard this from our travels around the province that the hog industry was targeted at one particular time and that industry we have been told has done a lot in the last number of years to reduce their, or to mitigate that so called pollution. What have other industries done? Is that a fair question?

MR. WILLIAMSON: Well, let me try and start with that. And I think Don especially and others in the room will have heard me talk about this before. Over the last number of years, as we started to move forward on our nutrient management strategy, we have been working with very large number of sectors and we touched on this this morning, we have a large number of relatively small contributors, so we have got a very large number of 1, 2, 5, 6 per centers, so we are trying to deal with all of those at the same time. I would say that I would have trouble seeing any one sector ahead of the other, and they are all very difficult to work with. But they have, they have many things in common and one of the things that they are looking for is fairness. They want to make sure that their one or two per cent or their six per cent, if they have to deal with that, they

need to look across the roadway or across the boundary and see that someone else's contribution is also being dealt with in about the same period of time and in about the same way.

So we have a lot of contributors at about the same stage right now, all on the verge of being regulated with time lines still in the future, but that they know what they are facing in a few years. So we have got a lot of sectors all at the same point. But it is not clear to me that there is any one sector that is really out in front. And everybody is watching every other sector because of the challenges that we face, the fairness issue, and the fact that everyone knows that they are not the only contributor, and we know that in order to make gains on the issue, we need to deal with them all.

THE CHAIRMAN: Just on your point, Dwight, we certainly heard a lot about fairness and particularly from the hog farmers, their constant bete noir, the one that got them the most was the city and cottagers. They said, you know, if we are doing this, we are expected to do all of this, why isn't the city cleaning up and why can't cottagers clean up? It is a fairly big point in

the fairness issue. Mark, did you have a point on the same thing in response to --

MR. TRUDELLE: The only example that I have right now in mind is when the reg started in Quebec in 1997 there was one sector that has been singled out before that and it was the pulp and paper industry, and at that time when the reg started for the livestock industry in Quebec, people were always looking at the pulp and paper industry and saying they are doing the job, they are doing a good job. In fact, it is not easy, but the bottom line is they need some regulation and they need some money as well. So there are always two options associated with the reg, and it is probably a question of fairness as well, but it is always how much money do we have to put on the reg in making sure that people will be able to comply, and it should be fair. What is the definition of fairness? I don't know. But it was just that people were comparing it by industry, but it was easier for the pulp and paper industry. You have single sources, you can follow 10 or 15 industries, and you are able to make sure that industry will cope with the reg. When you have, such as Quebec, 25,000 farmers, it is a little bit

more complicated. But the point is people were just looking at what the industry is doing and the fact is you probably need financial support to make sure that people will be able to comply.

MR. MOTHERAL: I have to apologize, I didn't really mean to bring that into the sectors again, you know, who is doing what, I didn't mean that. I just meant what other industries are doing, because we have been told, I am only bringing this up because of the hearings we have, and as the chairman said, we heard it from other people, what are other industries doing, because there has been a lot done in the hog industry in the last number of years.

MR. WILLIAMSON: Mr. Chairman, perhaps I can be a bit more specific in my response. With regard to the City of Winnipeg, they have been issued licenses under the Environment Act which required them to, through a phased approach, put in full nutrient removal, including both phosphorous and nitrogen, at the west end facility by the end of 2006. The next phase would be at the south end facility, at the end of 2011, and finally complete nutrient removal as well at the north end facility by 2014. So those are licenses

already issued. We do know that they have missed the first deadline, and that discussions are now occurring on the timelines for the west end facility in that first package of work. At the present time we don't know whether or not the end date of 2014 is in jeopardy, or whether it is simply startup to move to full nutrient control at the west end or not. Anyway, those are already in place. We have, and this is through conservation, and our input to that process, letters of intention and at least one meeting has been held with the City of Portage la Prairie. The licence that was issued to them, just as we were breaking for lunch, was a conditional licence, and when it was initially issued in 2002 or so, they had three years to complete a study on their portion of the Assiniboine River. There was a clause in the licence that required us to re-open the licence to look at nutrient limits. The time frame has expired. The study has been completed. We have issued notice to Portage that we are coming back now to revisit the issue of nutrient removal. Our best available information at this time is that Portage as well will be required to remove both nitrogen and for certain phosphorous.

The discussions are at about the same stage in the City of Brandon. The City of Brandon is looking at consolidating wastewater treatment for a number of its industrial sector. And they have, they already know what targets they will need to meet to plan for that. We have quite a good agreement with North Dakota and Minnesota through the IJCs, the International Joint Commissions, International Red River Board. They have agreed to join with us and to reduce their collective contribution into Manitoba by 10 per cent within five years. So we are part of the way into that five year period. I don't know whether actual reductions have been made yet. My knowledge of those two jurisdictions is that Minnesota has been putting in place considerable measures on the landscape to achieve that. I think less so in North Dakota. Nevertheless, there is lots happening in lots of other sectors and still lots more to be done.

THE CHAIRMAN: Petra.

MS. LORO: I think within agriculture the livestock industry is more regulated in terms of nutrients than the rest of agriculture. All of the new storage going in or

modification to the storage has been permitted, there is a zero discharge tolerance for agriculture. There is no straight pipes from our storage going to water courses. And there has been the regulation for manure management plans which I think up until now has largely focused on the pig industry, that has been the emphasis in terms of administration of the regulation. So within agriculture the pig industry is feeling that they have been targeted, that is one thing. And then when they speak in terms of fairness, even though they use the example of the City of Winnipeg to the livestock producer, the economics are completely different with the City of Winnipeg being able to spread the cost over the tax base. I live in south Winnipeg and I have had increases to my water bill that are negligible by comparison to the small producer in the Red River Valley who is prohibited from winter application. His manure structure to give him overwinter capacity will cost him $40 million, so that 40 million capital investment could take that farm out of production altogether.

The economics of the industry right now for small producers, that kind of money isn't

readily available unless someone comes up with financial incentive programs. So often when the industry talks about fairness, you have to look at who pays and whether you can spread that cost over population for a tax basis versus the individual who would have to pay for this out of the family farm. So there is a couple of different perspectives, but I know the industry has felt targeted within agriculture and as well when you look at all of the sectors.

MR. YEE: As a follow-up question, we heard this in the hearing process, we often posed the question if there are further changes in the regulations regarding manure management, how would that affect you, and we heard from, some say no it wouldn't, we would comply anyway, but for the most part they said it was significant in terms of their economic viability. I'm wondering if MAFRI or agriculture, have they done any studies or can they support this, the effect regulations has been having on the small operating farms in Manitoba?

MS. LORO: We are looking at this in terms of the needs of incentive programs right now, particularly for small farms. That is where our real difficulty lies, is the economies of

scale and the fact that we could put small farms out of business. We knew this as a committee when we made the recommendation on banning winter spreading in the management area. We counted the number of farms for each commodity group that were there and approximately how much storage would be required, and we also cautioned the government if you bring this in, it is a recommendation from us, but if you choose to bring this in as a regulation, that some financial assistance would be needed. That is on the ban on winter spreading.

In terms of the land application, we looked at it in a number of ways, and at how land locked you are, multi-year application rates. Some of these barns, their application costs for the season might be in the range of $50,000 to apply manure. It is not an inexpensive part of their manure management system as part of an annual cost. So we wanted to keep those costs down as much as possible while still obtaining the objectives of the regulation by better phosphorous management, so we put in some flexibility in terms of a multi-year application rate, as long as you don't you have to have more land to rotate and

things like that. If you are land locked, we have to get more creative. I think there is potential on the feeding side, but there is significant barriers, that you heard about, the Federal Feeds Act and how phosphorous additions to feed is regulated, and that might be a problem in terms of how much they could reduce their phosphorous in feed. They may only be allowed to do it to a certain point. But feeding definitely has a huge amount of potential, and probably the worst case scenario is treatment, because of the cost, and then we are into hundreds of thousands of dollars for treatment for an operation or a group of operations that could pool together. Until we get experience with the regulation, because it hasn't come into force yet, we won't really know what the real impact is. I think we can estimate fairly well in the Red River Valley, and we are hoping that we can help producers, so we don't put them out of business.

MR. YEE: As a follow-up, have they acknowledged the issue of the phosphorous requirements in the feed? It is AG Canada that regulates that.

MS. LORO: The FIA.

MR. YEE: The impact of phosphorous and because of the phosphorous reg, it would be helpful if they re-evaluated that requirement.

MS. LORO: And I'm sure they are aware of it. And I think our minister is being advised on that so that when there is a meeting of the ministers that can be raised. But I think, this is a progression in terms of the whole evolution of this. We get this feedback from industry of we think that we can do certain things with phytase and it should be no problem, and then we get feed back from industry that there is a problem. And I think that has to be explored at this point in terms of what needs to be done, if anything. But I have had that mentioned to me in the last couple of weeks, repeated a number of times. And that is one example.

MR. TIMMERMAN: And to build on that, in terms of what MAFRI staff have done to talk about the impact of operations, we have also been able to go through the exercise in estimating the number of operations that would be affected by the major provisions of the new regulation, and it is a considerable number. If we add up the total number across species, speaking beyond the pig

industry, the total impact of the new regulatory requirements is considerable on the industry as a whole.

MR. TRUDELLE: Concerning probably the feed, in fact, yes, there is a Fed regulation right now that as a minimum amount of phosphorous, but I will say that when the reg started ten years ago in Quebec, people were very high in terms of phosphorous. And even with the reg right now, they are able to achieve better efficiency. So I think, yes, there is a reg, there is a fed problem, but at the same time I think there is room to be more efficient, and this is probably the interesting part of starting a plan right now is you are able to look at your level of phosphorous and look with your nutritionist, and if there is some way of improving the efficiency of the barn, it has just started the processes. I think it is true, but at the same time we still have probably the responsibility to go forward and look at ways of improving, even if we know that we need the Federal Government to be more, the feds should listen to that, but it will take time. I think we should probably go and start the processes, even if we know there is some reg at

some point. Regs will be changed in time, and this is why people started to look at this, at this issue even today, and I think we should not just look at the reg and say, well, there is a reg, but I think there is some room to be more efficient.

MR. SMITH: I would like to ask a question that follows up on something that Dwight said. It comes off the phosphorous report. It says long term planning for newer or expanding livestock operation should ensure the availability of a crop land base with the region that will allow application, within the region that will allow application of manure phosphorous at no more than can be removed by a crop in one year. I guess the question I'm asking is to what -- how could -- given the current regulations regarding siting and approval of operations, can you do this, or how does this sort of recommendation or this idea of having operations have a land base that will allow removal at one year, fit with the current process of approval of new livestock operations?

MR. WILLIAMSON: I think others around this table will also be able to respond to this.

But specifically what we are doing in Water Stewardship to move forward on that is that we, within the province, we have an internal mechanism which allows us to review and provide comments and advice on new operations as they are starting up. One of the -- and so our department is reviewing new operations. We are looking at and using similar measures as Conservation and Agriculture, to estimate how much phosphorous and nitrogen will be generated from that operation and, therefore, how much land they may ultimately need to ensure some level of balance between input and removal. And so we are recommending then at startup that they have access to that land base. And so these are new recommendations, and so we've built a process in to inform the system about what will be required, at least over the long term in terms of that land base. So there may be much more that can be done in that, in the future, but that is our approach right now. So at least the decision making processes at the present time are being informed of what ultimately the land base requirements, whether that is in five, ten, even 20 or 25 years out.

THE CHAIRMAN: Can I just expand on

Doug's question? Perhaps I don't fully understand this allowing up to five years of crop removal application, what does that mean? Does that mean if I'm allowed one time so I can put five times, or if I'm allowed 2 times I can put 10 times on? Is there no concern about that building the phosphorous level in the soil too high?

MS. LORO: The multi-year application rate, it could be up to five times, provided you don't exceed the nitrogen requirements of the crop. So if your nitrogen application rate resulted in four times the amount of phosphorous being applied than would be removed by the crop, that would be allowed, but you wouldn't be able to go back to that field and reapply nitrogen fertilizer in the subsequent years. So rather than applying, if your nitrogen application rate was 8,000 gallons per acre and your phosphorous was 2,000, rather than trying to go in at 2,000 pounds per acre, we would allow the 8 but you wouldn't be able to go back to that field in the next five years. The build-up of phosphorous in that field would not be different than if you went in two, two, you went down and the subsequent crops draw down the phosphorous in the subsequent

years.

THE CHAIRMAN: So there is no danger of that phosphorous escaping in those subsequent years because you have overloaded it in the first year, or am I misunderstanding the concept?

MS. LORO: Providing the other management practices are used, you have, I'm going to assume injection of manure and so you have a covering, so there is not an unreasonable increased risk of that converting to soluble P and then all being leached off or transported through runoff. The assumption is it would go into the soil cycle and be available to the next crop. You may get some losses, but the cropping system is never going to be a no loss system. So it was to allow some flexibility with different types of manure. So cattle manure as well, for multi-year application rates. You still need the same land base, you would still need this one time crop removal land base, because in the other three years you have to have other parcels of land to go to. So your overall land base doesn't change. It is a phosphorous land base, but your management of each individual parcel might be on a nitrogen basis.

THE CHAIRMAN: All right. Mark.

MR. TRUDELLE: Maybe I have just a comment about the five time crop removal rate. I have two concerns with that. The first one is five times -- it is okay if you have a soil P that is low, when you have a high soil P there is a problem with that, you are increasing the soil P that is higher. My second concern that is more important than that, if you have a certain land base and you are spreading five time crop removal, it means if you have four different pieces of land and you are using two pieces of land and you are spreading five times crop removal, if you are doing the same thing on the other two pieces of land in the year after, it means that for the next three years you don't have access to your land, you have to go outside. You have a five years time where the land won't be used. So you will have to move manure, instead of moving one part of manure, you will remove all of the manure for two, four, maybe five. So from a management point of view I think it is not helping the farmer, and I will prefer to have a five time crop removal by using liquid separation, you keep the nitrogen and you just get out of the phosphorous. So you will

probably be able to keep your five times with nitrogen, without the phosphorous, otherwise you will just increase your rich, especially on rich soil P, you will lose your field for the next two or three years. I don't know, I did some scenario with that on one farm and it didn't work well.

MS. LORO: This recommendation was fairly well thought out by the committee and goes beyond just liquid pig manure. Liquid pig manure is high in nitrogen, so it is highly unlikely unless you have a very dilute terms of the five times application rate. You are going to likely be (inaudible) by the nitrogen application rate, some of it allows them for economic reasons and for reasons of spreading equipment technologies that are currently being used, to continue with their nitrogen rate of application provided they don't go back to that field the next year and continuously overapply phosphorous. They have to rotate in order to draw down. So this was done for economics for the industry. The other reason was for the cattle industry, because their manure are very low in nitrogen, they tend to put on at very high rates often during the year that they establish forages. So they incorporate fairly

high rates of manure and establish their forages there and they don't have to go back to that field until sometime later in their cycle. They wanted it based on their forage and based on the nutrient to be able to rotate their fields. So there is a couple of different reasons, the number 5 was chosen based on looking at other jurisdictions on what they were allowing in making it fairly consistent. Understanding in the long term there wouldn't be an overall increase in soil test P, and also that the nitrogen requirements of the crop were never exceeded in any one application.

MR. MOTHERAL: Correct me if I'm wrong, the five times application needs a letter of approval, does it not, from the department? Where did I read that?

THE CHAIRMAN: I think if you want to apply if it is over 180 parts per million --

MR. MOTHERAL: Sorry. I would hope in that case like that, that there would be other factors looked into.

THE CHAIRMAN: It would be part of the manure management.

MS. LORO: It would be looked at within the manure management plan.

MR. MOTHERAL: All of that would be looked at.

MS. LORO: It would have to be approved.

MR. TIMMERMAN: Because application rates are all reported, it would all have to be explained to Conservation.

MR. FLATEN: Just to clarify though, what it means is that you would be applying on the nitrogen based manure application rate just like all farmers were doing prior to November 8, 2006. So I mean this one and five kind of thing sounds like it is a huge increase in the amount of manure that would be put on, but it is really not. You would be applying the manure, the nitrogen based rate, but you would have to take years off. So it is still an incremental downward loading over that five year cycle as opposed to a continuing -- allowing the nitrogen based application to continue. But the reasons are primarily economic in that the practical technology, as Petra mentioned, is not readily at hand in applying manure at 2,000 gallons per acre. And the economics, it costs people thousand of dollars an hour to hire these manure managing companies and

to put it on at that low rate and spend an extra week applying manure on the farm is going to be extremely costly. It is an indication of the cost and technical requirements, and it results in a lowering of the application in the five year period, and it is no greater amount of manure applied in that five year period.

THE CHAIRMAN: We heard one farmer in Whitemouth told us, and his operation was closer to Beausejour, he told us he paid 35,000 for the spreading and it was three days work. And a bigger operation, I'm sure you suggested would be 50,000 up, so --

MR. FLATEN: Just to make a comment on the cost of these adaptations strategies, I'm not an economist, but I did grow up on the farm, and farmers take in a lot of money in Manitoba, 3.6 or $7 billion a year, but they are very good at spending it. I don't know if you saw the Winnipeg Free Press, after taking in $3.6 billion, they have $25 million left. So when we are talking about estimated costs of adapting to the phosphorous regulation being 20 to $30 million a year for the pork industry alone, in a kind of year like 2006, it means $1,500 per farm in

Manitoba. And these farmers compete in international marketplaces where they don't have control over prices. The economics even though they are not the overriding issues that you had protecting the environment, to introduce expensive BMPs into a system that is already struggling to survive economically is a big challenge that I'm certain you heard about before, but especially in light of today's news. I think that we are talking a few million here and a few million there, it really does count up.

MR. HALKET: When you say that the spreading of the manure on the fields when you bury it or put it underneath the soil, is there any hard information on the mobility of that P in terms of is it better off underneath the soil, or is it the same mobility when it is on the surface? Are there studies along those lines that have been conducted?

MS. LORO: I know Jane Elliot did some work looking --

MR. FLATEN: There is tonnes of -- there is lots and lots of papers showing that incorporating and injecting the manure substantially improves the chance that the

phosphorous stays in the soil and lessens the chance of it running off, yes, very well documented.

MS. LORO: I'm not sure in the context of your question about flooding --

MR. HALKET: When I look at the Red River Valley, when the Red River, for example, goes over bank, it floods very shallowly, huge areas. And I'm wondering if the mobility of that phosphorous that is buried or injected into the soil, if there are any studies under those conditions?

MS. LORO: There have been studies in relation to soils in saturated conditions and when you saturate a soil we can't get away from it in the Red River Valley that the soils saturate, the studies say when you have saturated a soil you have phosphorous in that soil. But I think when you balance the literature in terms of which management practices when we have manure to apply to the soils, which management practices should we be promoting, we felt injection and incorporation, and the ban on winter spreading were the right practices to recommend and that we would get more benefit doing that than worrying about the

injected manure and its soilability during the flooding period. You have to balance those out, for sure. In the Red River Valley you are getting huge transport in the spring from overland flow, it goes underwater and anything surface applied is going with it, hence the recommendation to incorporate or inject in the fall and to ban winter spreading there altogether.

MR. HALKET: When you talk about five times the amount being applied to the soil, or five times the P removal from a crop, I look again at the Red River and its hydrology and I say, you know, every one out of every two or three years it is going to be overbank and it is going to be -- the waters are then going to be removing that phosphorous anyway, if you are going to look at a regulation that says you are allowed to go five times over.

MS. LORO: The regulation doesn't actually say that you are never allowed to exceed the nitrogen requirements of the crop, but you can exceed the phosphorous requirements. With pig manure it is very unlikely that you are going to be applying phosphorous at five times the removal rate when you apply the nitrogen requirements of

the crop. So that is not a target rate. We are not targeting, saying I'm going to calculate how much manure I'm going to apply so the crop will remove 30 pounds of PP, I multiply that by five and I can back calculate how much manure I can put on, that is not how it is done. You would never be able to exceed the nitrogen requirements. Prior to November it is the way manure has been applied all along, so what the five times does, it allows you a multi-year application rate and it is probably more applicable in terms of its magnitude in terms of the cattle industry and cattle manure, which are low in nitrogen and so the application rates based on nitrogen are much higher and they are putting on more phosphorous, and the majority of that was during the establishment, they don't want to bury their forage, it is during the establishment of the forage that they would plant into it and establish that.

MR. TIMMERMAN: This is the first iteration or first shift from nitrogen to phosphorous in agriculture period, and the livestock industry that faces the most challenges in trying to comply, and the expert committee had to recognize that in coming forth with

recommendations that would be reasonably flexible while still moving towards the long term objectives, knowing we will make change again down the road, knowing how it works out. We had to have something that we could sell with the producers, especially with the cattle industry, if we didn't build some flexibility in, we wouldn't be making any progress in moving from nitrogen to phosphorous. On the point about fall application of manure, I will call upon Don to reach into the recesses of his brain or anyone else from the expert committee that could confirm that Jane Elliot has done work in Saskatchewan in looking at manure, fall application versus spring, and certainly we would favour a spring application that is closer to crop utilization and after spring snow melt to fall, which would then be in the middle, and at the worst end of the range would be winter application. So, again that moves to my point of moving industry to the right direction and logistics have to come into play, we can't insist on the industry applying its fertilizer in the spring, fall prices tend to go substantially lower than spring prices.

MS. JOHNSON: I want to go back to the

spread fields. We have heard in our travels, calculating them differently and agriculture has a whole different opinion. So how do we arrive at that?

MR. WILLIAMSON: What I can say is and my colleagues from Conservation and Agriculture I hope would respond as well. This is a new internal process that we are implementing, and the calculation itself, we are I believe at exactly the same point now. Certainly when we started this process there were differences. The differences are really technical. And as far as I know, we've either worked out all of the technical details or virtually are there. So we should see, at least moving forward, be able to do the arithmetic in the same way.

MS. LORO: It has been a learning curve for a lot of people whose expertise hasn't been manure management and definitely on the other side water quality bringing those two together. The calculations, we should all be doing the same thing. You may get technical differences of opinion on the productivity of a parcel of land. So all of the manure application rates are calculated based on crop yields potential, so you

have a target crop yield and there may be differences of opinion there, particularly when you get to more marginal lands. And how you are assessing those lands, whether you have had a site visit versus looking at a map that may or may not be outdated, and whether that land has been improved or not. So your assessment might lead you to conclude it is not very productive, but in fact it is, those things get ironed out in the process. I see one area where you come out with different opinions would be on crop yield potential and that is the first number that is used in the calculation. So if I think my crop is going to remove a lot of phosphorous and somebody else disagrees, they are going to come out with a different application rate.

It is different with phosphorous than the nitrogen side of things. In the past producers may have seen large differences between agriculture in the southeast on grasses saying we think that you can remove 120 pounds of N and somebody else saying that land is marginal, we think it is 60 pounds. And those are differences of opinion that have to be resolved in the process. That may be -- I'm guessing as to why

you have heard that, but the calculations themselves, there are various ways of doing them but they all come back to roughly the same thing.

MR. TRUDELLE: I think for the calculation, moving from nitrogen to phosphorous, you have to include new concept, and the way that conservation has being looking at phosphorous right now is trying to estimate the output of phosphorous per different type of livestock. So avoiding the -- trying to avoid the volume by concentration which is quite difficult to estimate for different livestock, you need accurate soil analysis and accurate volume. By using the output of phosphorous per head, it is easier and quicker to get a good estimate of the phosphorous generated by the operation. So I think right now we are probably using the same value, so it should not be an issue in the long run I guess.

THE CHAIRMAN: So, one thing we heard a bit, and I think in part we read between lines, that a lot of the anticipated growth in the industry in Manitoba in the next few years would not be a lot more farms and more hogs, but growing more hogs or pigs to finish in Manitoba. And perhaps a significantly larger number of pigs

growing to finish size, which, of course, means more and perhaps significantly more hog manure. What does that do to this whole equation? Or is it just a matter of management within the regulation?

MS. LORO: Well, they project more finishing barns so they can close the loop within Manitoba because we export, and so if the border is ever shut we don't want to be left with a lot of piglets and no home. They want to close that production loop. Some of our best manure data is from feeder operations because we have so many of them, we have lots of data to work with, and also right now, it is the feeder barns that have had the best uptake for phytase use. And so with respect to that, it is not, it is definitely not a negative, it might be a positive in terms of manure management. These barns are well on their way in terms of phosphorous management. They have got some tools at their disposal. They are already using phytase in their feeding systems. My hope is that they will be able to bring that manure more into balance so when we do a calculation, whether it is the nitrogen rate or phosphorous rate, the land base is about the same

so they can manage the manure the way it fits best into their system. So to have those barns be feeder barns is not a negative for the province, it is a positive in terms of closing the production loop. And we had most of our data for them, most of the manure data, and then those barns are using phytase, a large number of them.

MR. TIMMERMAN: I would also add it doesn't matter what kind of operation it is, it is just a matter it is new and it is subject to the new rules and has to be more sophisticated in its management if it is going to apply. Pretty sober education as to what they face in the way of phosphorous management.

THE CHAIRMAN: Petra, did you say that a feeder operation with using manure balance practices phytase, phytase et cetera, it would be a wash as far as land needed to spread the manure? I think that is the big concern. Particularly if a lot of weanling barns in heavily concentrated areas like Hanover, La Broquiere, if they were to switch to feeder with an increase in the amount of manure, is there enough land in that area?

MS. LORO: No, I think you have to target your expansion into less dense areas. We

might not be shipping to the states but we might be shipping them out of the RMs for finishing. Currently if you do a phosphorous calculation versus a nitrogen for land base, they might find in the short term the land base is about double. It really depends on the system and how you do that calculation right now. I would think the industry is going to work very hard to reduce the concentration of phosphorous in their manure through the adoption of various technologies. I mean phytase is a hopeful one, and I don't know if they can reduce what is in their feed further. That needs to be explored. So they don't double their land base with a phosphorous base, so they are closer to the land base that is calculated for nitrogen. The big thing is to bring that manure into a better balance. And that is a lot of, there is a lot more confidence within the industry right now for the use of phytase within the feeder barns as opposed to the sow barns and the nursery barns. So all of those areas need to be explored.

THE CHAIRMAN: Dwight?

MR. WILLIAMSON: From our perspective, in response to your question, I would just like to underscore something that Petra did mention, and

it is consistent with an earlier question that I think was asked this morning about contribution in this particular section. I think the fundamental issue -- and so it doesn't matter what the source is, which of the sectors the source is arising from, as long as over the long term soil test phosphorous is not being built up in the soil in such a way that, if it is built up, there is a greater risk that it is going to be lost to the environment. So the fundamental long term sustainability issue is whether a balance can be maintained between removal and application. And again, that sort of equalizes it. It doesn't matter what the source is, what component is expanding in any one sector, but the fundamental is that you need to manage this balance issue.

MR. FLATEN: Just a comment about the strategies for ensuring that the expansion of the industry is sustainable, and it certainly relates to some things that we have already heard today, yes, soil test P is an important driver, a balance is the driver of whether or not you are raising or lowering your soil test P concentrations. But the tools that can be used by producers, by hog producers to maintain soil test P at an

environmentally acceptable level are varied. There is a wide variety of tools that will fit in better with some operations than others, whether it is a farrowing operation, finishing operation, what stage of life they are working with, what are the local circumstances in terms of availability of crop lands, the types of crops that are grown; there is a whole range. I think what we want to think of when we look at BMPs it is like a box of tools, and I hope that your Commission and your panel doesn't arrive at a sickle tool that is absolutely the only one that you want to focus on, that all farmers will use a pair of pliers and we don't care about cresent wrenches or anything else. Farmers need a wide range of tools and we have to make sure there is no policy impediments to those tools being available. We talked briefly -- Mark talked about how we have to reduce oversupplementation of phosphorous in the feed and Petra mentioned phytase as a means of cutting down on phosphorous in the feed. There is also some new low phytate, high available phosphorous feed barleys in development. There is a whole range on the feeding side, whole range of tools in terms of barn management and treatment. We want to make

sure all of those tools are available and in fact the industry is encouraged to adopt them.

What we are missing and this is why I asked Mark to highlight them in his comments earlier, what we are missing in my opinion in Manitoba is a coordinated team oriented approach that goes beyond the regulations to helping set targets for the industry to adapt. Not just regulations, but also recommendations where we just try to ensure that all of these tools are in place. It involves researchers, Provincial and Federal government people, absolutely critical to this process is the industry. And this I would think what I call adaptation strategy is a well thought out, overall policy, that we don't just see a government introducing regulations, we see a government that is sincerely concerned about water quality and nutrient concentrations and has a comprehensive approach to make sure that the tools are there for the farmers to adapt and comply, and it goes beyond the regulatory package. One of the challenges is to think of how can we coordinate those activities so they are most effective and most efficient and have the public and private sectors in that partnership. And I think that is

really one of the biggest challenges that we need to address here in Manitoba, is to encourage more collaboration among the different groups that have a vested interest in water quality and the livestock industry both.

THE CHAIRMAN: Would it be -- I heard what you said, Don, about not picking on just one or two specific tools, would it be fair to say that a common end point or goal would be, I think Dwight just a moment ago stated, but a number of others have talked much the same thing over the course of the day, that the end goal should be a balance, if I can really simplify it.

MR. FLATEN: That is one of the critical principles, yes.

THE CHAIRMAN: How they get there, there should be an number of different tools available to achieve the balances, as long as they achieve the balance is that a fair way to put it?

MR. FLATEN: In the long term you have to reach balance. For example, with the current threshholds you have to reach 120 parts per million. And as soon as you get started as a producer in cutting down your phosphorous loading, the easier it is going to be on your operation if

it encounters that threshhold. So it doesn't matter whether the threshhold were 16, 30, 20 Olsen P, at the threshold life is the same for anybody who reaches that threshold, they have to balance. This is where Mark's efforts to introduce the balance where the Lake Winnipeg Stewardship Board's recommendations, all of section 32 -- who was quoting from the gospel of the Lake Winnipeg Stewardship Board?

THE CHAIRMAN: Mike was.

MR. FLATEN: The information balances and on farm balances, and it is what the phosphorous expert committee was recommending, we have to consider the balance of scales. These are the universal themes that need to be addressed. Like I say, no matter what threshold the government sets, as soon as that threshold is encountered it is the same, so it inputs and outputs so it doesn't go higher.

THE CHAIRMAN: If we at the end of our day in this review, if we can contribute to making a better public policy on this, that is -- we would be proud of our work. I mean how we get there, what we say to get there, I'm -- we are not sure yet. Anything you want to offer in that

regard, we would certainly appreciate.

MR. FLATEN: I would like to make a comment that a lot of today's discussion has been on the regulations. And I think there has been some discussion about financial assistance, but recommendations are a very important part. Research and extension activities are a very important part of this as well, and they probably deserve additional investment. The other comment I would say is that we have been focused a lot on nutrient management.

There is a whole other element to this phosphorous loss issue that hasn't received much attention because we don't know much about it, and that is water management. I think Ian alluded to it several times. What we don't understand very much about is what water management BMPs should be used to compliment phosphorous from farms in Manitoba, once again, regardless of what type of production, whether it is pork production or grains and oil seed production or whatever, and that is another reason why I think that within the Lake Winnipeg Stewardship Board and other organizations we have been advocating for more investment in field scale hydrological research

expertise so we know more about how the water management practices that we are employing on our farms might be affecting water quality as well. So I think if you combine sort of a water management strategy with a nutrient management strategy, that combination has a chance to succeed in improving water quality, but we have to work at both of those issues overall.

THE CHAIRMAN: Without taking us too far afield, what might be some of the water management practices that we should be looking at, or the province should be looking at, whether it is us or --

MR. FLATEN: Well, some of the water management issues are embedded in the special management areas and setbacks that were discussed and in fact included in the first round of phosphorous regulations. We don't really know in our system how effective a set back might be in reducing the forms of phosphorous that we traditionally find moving off of our fields in Manitoba, so you will see that the setbacks, for example, are not very wide in the current recommendations. Some people would say they should be way, way wider, and in fact the

specification for those setbacks, that might be wider in areas where they have got documentation that a wider setback will work.

Within our phosphorous expert committee we couldn't see evidence for that, and subsequent to the expert committee completing their work, we now have a study out of Manitoba on vegetative buffer strips and the overall effectiveness is only 4 per cent in terms of reducing phosphorous loading. And if you follow those buffer strips, you will find that an individual buffer strip doesn't work very well for snow melt runoff, but it does the job it is supposed to do as soon as the rainfall runoff comes. That only accounts for 15 per cent of our runoff, so that is why it is limited. Those are the issues in, the special management issues in the current regulation that are affected by this lack of knowledge in transport processes and water management in particular. So it is another huge gap in our knowledge that is affecting our ability to come up with science based policies.

MS. LORO: I just want to comment on those buffers. We did have evidence to show the effectiveness of buffers being questionable,

especially in the Red River Valley that was completely under water in the spring. Those were difficult to establish. With the exception of the one metre buffer recommendations where we did have evidence that in some cases the farmers were tilling into it and planting into it and fertilizing it. With the one metre buffer we got the equipment out of the ditch and so I think it serves its purpose in that way. As a regular vegetative buffer to intercept overland flow and filter nutrients, that wasn't its intent, because we struggled with that in terms of the hydrology and data that we had available. But it does work in terms of getting equipment out of the ditch.

THE CHAIRMAN: I'm glad you gave that explanation, because that was one of my questions, why only one metre? It didn't seem to make much sense, but from that perspective it makes a lot of sense. Dwight.

MR. WILLIAMSON: I, of course, don't mean to be argumentive on this point, but in a sort of system of very small percentages, 4 per cent is important, and so it is, and I think with a lot of work and some of what is, some of the work that Don has alluded to in terms of further

research, some of the buffer strips under test yielded much better than that. Others in fact contributed nutrients to systems. So we need to look at that overall. It was a positive benefit overall, relatively small at 4 per cent. But still we can probably do better on that to improve the efficacy of those that were yielding better results than that, and to at least come to zero to those that were contributing nutrients. So we still have a lot of work involved, but nevertheless in terms of small percentages, that is an important one.

MR. FLATEN: More research is required, isn't that what professors say?

THE CHAIRMAN: I'm sure that 4 per cent less phosphorous in Lake Winnipeg would make a significant difference.

MR. YEE: Don, just following up recommendation number 3, everyone wants more research and we have heard a few things, in particular right now we have been discussing and we talked about the 60 PPM and the 120 being sort of a starting point in terms of soil P, and where we are going with that. To help us out as a Commission, because I think that is part of our

mandate, to look at the effectiveness of the regulatory controls in terms of protecting the environment regarding nutrient loading, what are the particular areas that you could suggest that data is required, what sort of data do we really need? What should we be looking at and focusing on to look at the effectiveness of these regulations?

MR. FLATEN: Well, before we can even look -- maybe we could look at the data first, but it is going to come down to personnel. So I might as well jump to that point. We don't have a -- we don't have a team of field scale hydrologists that can really help us measure flow and concentration relationships with response to BMPs here in Manitoba. We don't have a team of scientists that can assure us that the flow rated mean concentration, something that you are going to be familiar with, is indeed affected significantly by this BMP. We don't have the expertise and availability of researchers to monitor the effect of let's say a manure management practice on flow as well as concentration. Manure, we have almost -- we have painted manure as being a devil today, but manure is a tremendous source of

organic matter and improved soil quality, and the infiltration of water into the soil and in many cases will actually decrease runoff.

We have to consider that our manure management practices and crop management practices may have an effect on water qualities as well as the concentrations of nutrients in the water. We need that type of expertise, and for the last two and a half years it has been the recommendation of the Lake Winnipeg Stewardship Board that we get that expertise to facilitate that type of work. We have to take that type of work that Wole and I are doing in laboratory simulations and take it to the watershed and validate the models that Wole was referring to, and make sure that when we input a process into a model, that it fits the prairie watershed scenario.

We have almost no BMPs being evaluated systematically and scientifically as a whole. For example, an example, it is not related to manure management, we have two little spots of land, 20 acres each in the twin watershed study in the South Tobacco Creek in zero till and conventional till. One records a conventional treatment and it is confounded as all heck, but that is in Western

Canada. That is how much we have invested in water quality research. It is an indication of how little we actually care I'm afraid about water quality, when you take a look at the level of investment in the BMPs. When looking at BMP, and alternative drainage systems so that manure fields don't contribute as much water, that would be wonderful, or the water is not as contaminated, looking at the relationships between soil test P and phosphorous in runoff field conditions, all of these sorts of things are very important. But to compliment that lacking, in my opinion, I'm wandering into Dwight's territory here, all that data is not going to help you if you don't have ecologically relevant locally important water quality objectives. There has to be complimentary research in the waterways themselves or the water bodies like Lake Winnipeg to know, okay, we do have to go down to 40PPM and Olsen PPM, not only because we demonstrated that we can from the water ecological standpoint that our aquatic studies demonstrate that we have to get down to that level. (inaudible) We need watershed studies and nutrient management and in water management, combined with an area that I don't know very much

about, which is aquatic ecology, making sure that we have a good idea what our objectives should be. Then when those things are in place, we should be in a much more informed position to look at proposals such as Mark's and decide, you know what, here is the evidence from Manitoba that is pretty compelling. We have to ratchet these down, let's get at it. Unless we have that investment, I think we are going to be sharing a lot of opinions about work done elsewhere, and I will bring out one paragraph or one page from one paper, and Mark will bring up another and Dwight another and we will argue, and campaigning opinions, but we wouldn't have the data locally to settle the argument.

THE CHAIRMAN: And most of that stuff is being done elsewhere than Manitoba or elsewhere in the Canadian prairies?

MR. FLATEN: Exactly. You take a look at how comprehensive the evidence was in Quebec, not just a regulatory initiative, but a lot of excellent research combined with a good strategic plan developed by the industry. It wasn't just one thing, it is a very comprehensive approach, and I think your panel has an opportunity to go

beyond the regulations alone and into something that is likely to be more effective.

MR. MOTHERAL: You bring up the twin watersheds, of course, that is in the Deerwood Conservation District. It is an excellent -- they have done a lot of good work in the past number of years and they have an excellent location to conduct these sorts of things. Could there be a recommendation at all that we enhance those kind of projects, that there needs to be more done in that area -- I keep looking over here, I don't know -- I'm meaning this seriously. You say there is lack of research on local areas and that is something I know I talked to a couple of people in that department in the Deerwood area, that do have some things going there, and they need to do more.

MR. FLATEN: Before I turn it over to Dwight, I will make some comments from the Provincial point of view. I just want to say that for the last probably three or four years I have been hammering away at everyone that I possibly can about the need to expand our base of work on watershed management BMPs beyond the Deerwood area, partly because although the Deerwood project is in a highly erosive area, it is on an

escarpment and it is a high risk area for erosion and flooding and stuff like that, it is actually pretty typical for landscapes in Manitoba. So I have been a long standing advocate in making sure that we have a cluster of BMPs being developed for the low lands, the Red River Valley, as well as the uplands area and the Manitoba parkland area as well. Maybe I will turn it over to Dwight and he may know more about the initiatives to expand that type of work in the province.

MR. WILLIAMSON: Thanks. I'm not quite sure where to start. But perhaps by saying that in some of the issues that Don has just raised, he is completely right and we don't have a defence for that. I would say too, though, that direct investment into BMP research is not a good measure by itself how much we care. There are other measures that go into that. That could be one, but it not ought to be the total measure. But I agree, nevertheless, that as we move forward to build and to fill the tool box analogy that was raised earlier, these are very germane issues that require answers to. I think, though, that in some cases a critical argument, and I would make a credible argument that we don't need to replicate

all of the research all across the landscape to come to a common, to come to consensus on the benefit of one particular best management or beneficial management approach relative to another. There is some testing that needs to be done, but we don't have to replicate all of that in the various forms of our landscape, but more, of course, is much better than not enough.

I would say as well, just a couple of things, we are looking at providing more investment in this area directly into BMPs and those discussions are still underway, even internally within the province, of what the magnitude of that is going to be and the direction, but there will be some of that. And I will say as well that we are jointly, with agriculture and our two Federal counterparts, Environment Canada and Prairie Farm Rehabilitation Administration looking at a project in two areas of Manitoba, moving forward at the same time, one in the four watersheds in the little Saskatchewan River area, as one representative type of Manitoba landscape. And another being the LaSalle drainage area where we are looking at precisely implementing beneficial management practices and

doing research on it to understand on a scaled up basis, if you scale that up to those watersheds, then what does it mean? And so those discussions are underway, and I would say I think the target is to start work on that project this year, but I can say that there are still some significant differences of opinion yet on what that project ought to be, and how we might go about implementing it. But anyways, we are developing that and thinking through that process, implementing BMPs on a small scale and then being able to see what happens when we scale that up to a watershed, and those are the two watersheds that we are looking at. So there is some things underway.

MR. MOTHERAL: Hopefully one of those is phosphorous movement in soils.

MR. WILLIAMSON: Seems to be, and I will look to my soil science counterparts that those, that is a different body of research, it is a matter of dumping water on to different soils with different soil test P levels and measuring what is coming out at the other end that is not quite the same thing as this, but there is a need for that, and that will verify or generate

contrary findings to what we already know, that the higher the soil test P is, the more phosphorous comes off, is there an inflection point and where is it for our soils in Manitoba, and that will help refine the thresholds that we already have.

THE CHAIRMAN: They brought in some fresh coffee and drinks. Why don't we take a short break, grab a coffee and drink and we will consult amongst ourselves and just see what more questions we might have for you this afternoon. There may not be too much more today, although I'm sure we will have any number of them over the next few weeks or months. Let's do that, come back in ten minutes.

(RECESS TAKEN)

THE CHAIRMAN: Why don't we get back at it? I don't think we are going to be that much longer today. It appears that we've -- we are getting close to having beaten this to death at least for today. I think there is still one or two perhaps minor questions among us around the panel, but not a lot more right now. Edwin or Wayne, did you have --

MR. YEE: I had a little conversation with Ian and Mark. We are challenged with a report, and we are looking at the sustainability of hog production in Manitoba, so I'm trying to get my head around this whole business of how do we look at it, at hog production in a sustainable manner. Have we reached it or not reached it? Do we have the data? What data is missing? What do we need today to address this issue of sustainability of hog production in Manitoba? So I throw that out to anyone around the table, if you can comment on that.

MR. MOTHERAL: And if I may ask, and base it on this is a phosphorous committee meeting today, and based on that, what can we as a panel recommend to the government, any research based on phosphorous? I mean that is what we are here today for. There is a lot of other issues in the whole sustainability part of it, but that is just my comment.

MR. YEE: Thank you for clarifying that.

MR. TRUDELLE: I think one of the most important parts of this phosphorous reg is associated to, and especially to the pig industry,

is associated to the capacity of the land to receive a certain amount of phosphorous. So when I think about balance, I'm thinking about a mass balance from a farm to farm approach, but I'm also thinking about a mass balance for a RM as well as for a watershed. I think it is important to move from farm to farm to a watershed in order to have a picture of the capacity of the land to receive phosphorous. And when I think about the capacity, I think about manure, phosphorous from manure, as well as commercial fertilizer. So it is part of the whole picture and we should look at the sources, the agriculture sources, and look at the capacity of the land to receive phosphorous. And the issue after that will be, well, are we accepting that we are going two, three or five times. It has become a political decision. But before that, before looking at what will be the issue for the amount of phosphorous, I think we should look at the basic principle behind it, and looking at the mass balance.

After that we will have a picture, and the decision will come based on the economy and based on the social issue, and we know there are some areas that are concentrated, and they are

probably right now exceeding two or three times crop removal. Maybe it will become an issue of technology or some other option. Before looking at different options, I think we should look first at the mass balance of the area, and after that we will work and be able to take the right decision.

So, instead of buying technology for every farm in La Broquiere, there are other tools. I think we have a box with different tools and we should use all of these tools together. At first we need the information and we need a way of estimating on the watershed basis or RM basis, what is the capacity, what is the capacity of the land, and there is a limit somewhere anyway, so we have to make sure we know the limit. And after that we will work to increase it or expand it, based on the fact that we know that there is certain options that will be easily installed on the farm or established on the farm.

MR. MOTHERAL: Would some of that information be like what Don was saying, they have got a project going in La Broquiere?

MR. FLATEN: Not on the balance of what Mark is talking about. Our project at La Broquiere would help illustrate the challenges

that lie ahead with respect to imbalance, because right now our project at La Broquiere, we are applying manure on a nitrogen basis and removing very little phosphorous, and so we are able to track the rise in phosphorous. But that project is not actually testing phosphorous balance per se.

I think what Mark is talking about is right on target with respect to needing to evaluate balances at a variety of different scales, and that is right in line with what a group of us here that preexisted Mark have been thinking along the same lines, that anything -- the most important focus in terms of something constructive is to start lining up information on our balance.

But with respect to the limits, I mean crop production in Manitoba, you know, removes a lot of phosphorous every year and we export that in grains and oilseeds. They are exported around the world. So we are a long ways away from having a phosphorous surplus in the province due to livestock manure. I keep on reiterating it, but 85 per cent of the phosphorous that we apply is in the form of synthetic fertilizers, and until we

displace every kilogram of that out of the province in a sense, we always have room to grow our livestock industry.

Not every acre of land or farm is going to be suitable for manure application. That is sort of a ridiculous concept. We have so much more synthetic fertilizer phosphorous being used in this province. We are a long way away from having a really difficult province wide balance problem. What we have is a problem of distribution, exactly what Mark mentioned earlier. We have some phosphorous surplus areas with respect to manure and a whole bunch of the province that is buying phosphorous fertilizer imported from Ontario, Florida and Togo, West Africa, instead of Steinbach or La Broquiere.

MR. HALKET: But surely there is an upward number or a threshold that the land base has based on the crop, the crop uptake, and how you disperse that is maybe political in terms of, okay, you have commercial fertilizer here and you have livestock manure here. But surely there is a number, there is a threshold, that this is what the land can take, this is how much livestock can be here based on this proportioning of fertilizer

to manure. And if we play with those ratios, then maybe we can get a different picture. I don't see any numbers out there that sort of suggest that, and from what I hear Mark telling me, Quebec can do this, and they can look at a particular watershed and they can say, hey, this is --

MR. FLATEN: Recommendation 32, Dwight. That is exactly what the Lake Winnipeg Stewardship Board has been on record of recommending for the last two and a half years is that we have that capacity to do that. Is anybody listening? Check.

MR. MOTHERAL: So you want me to highlight 32?

MR. FLATEN: Almost nothing we've discussed today hasn't been discussed at considerable length before. I was just going through my gospel of the Lake Winnipeg Stewardship Board, just highlighting the recommendations that are directly pertinent to what we have discussed. And the initial interim recommendations that came out two and a half years ago haven't been changed that much for the December 2006 recommendation. It is just a matter of following through I think on a lot of these concepts. But Mark's concept of

having a balance and knowing what your limits are on a municipality by municipality basis, it doesn't matter if there is a province-wide deficit in phosphorous or whatever. If the RM of Hanover and the RM of La Broquiere have a surplus, they have to deal with that, if we are going to address this issue of rising phosphorous in the soil.

MR. WILLIAMSON: I was actually not looking for the recommendation from the Lake Winnipeg Stewardship Board, but there was one figure in our report, figure 13, and so I'm transcribing this off of the graphs. The numbers are terribly rounded.

MR. FLATEN: 100,000 tonnes of PDO 5, which is the phosphate in the form which is measured in fertilizer, which is about 45,000 tonnes of P expressed on what we call an elemental basis. That is the crop removal. And if we take a look at the total amount of phosphorous produced by the livestock industry, in terms of recoverable nutrients, this is old data, obsolete from Stats Canada, but something like 9,000 tonnes being mechanically applied on to agricultural land in the province. So with 45,000 tonnes of removal, and according to this, like 9,000 tonnes being

added, there is quite a bit of ceiling there province wide. But the distribution is not even, for a whole bunch of the social reasons that you have heard ad nauseam as well. So that is why this recommendation to address this issue on a municipality by municipality basis is so important, because that is where a lot of the land use planning is based and that is the scale at which I think we have to manage our livestock density. Would you agree, Mark?

MR. TRUDELLE: Yes, yes.

MR. FLATEN: I think I'm saying what you said.

MR. WILLIAMS: Don has made a better point on what I was going to make on the data. But I think this gets to maybe the number that Ian was looking for. It is this value of on an annual basis, province wide, that we deal with in terms of phosphorous. And it doesn't matter then what proportion is made up of livestock manure versus synthetic, as long as, if there is an addition in one component, there is a subtraction in the other so that this is ultimately what you are dealing with.

And then we have the other issues

which Don did express. It is this regional imbalance thing, that we have more of one and not enough of the other in one area, and in another part of the province we are actually importing from Togo, West Africa, which doesn't make a lot of sense.

MR. AKINREMI: Just based on my experience in the last few years, this is talking personally, most of my research dollars has actually come from the hog industry. And that is where most of the information that we have now has been generated. We have very little support from the government in terms of RD and so on. And there are quite some things that we have done and some things that we have to do. For example, we know, Mark has quoted, we know that acid soils had to have a good way of measuring what we call the degree of phosphorous saturation. And we don't have one for Manitoba, it is just because it is not easy to do, and we started to look at that and we find it is not that easy. If it were that easy, a lot of people would have done it, because we have a unique set of soils. That type of research, working on that and refining that, will be something that I think the farmers would

benefit from eventually.

The other concept that has been developed say for the fertilizer industry is the concept of say the phosphorous buffering capacity. If I add say 800 gallons by acre of manure containing this phosphorous, by how much do I expect my soil test P to increase? We don't have to do it for all soils, you can do it for typical soils in Manitoba, I think this would help producers so they sort of know what the value of their soil test is right now and they have an idea of how much do I have to apply, how far do I have to go in order to be below this threshold.

So those are some of the specific studies, specific experiments that I think will benefit the industry, more chemistry in that area doing some more specific things, that would be good if there could be money for that.

MR. TRUDELLE: Maybe I haven't just been following all of the talk. I was just thinking about Manitoba in terms of research and organization. And I think it will probably be important to look at the fact that we probably also need an organization that is probably independent, and I'm looking at something that

Quebec has right now is a non-profit organization, that is responsible of all of the research. So it is not only the Pork Council that is giving the money or the cattle industry, it is kind of a global amount of money that is given to one organization, and this organization is doing research with different people, and it is open to other jurisdictions as well.

So I think it probably will be important to look at other jurisdictions as well when you are doing some research. And we can probably, as Dwight already told, we don't have to recreate or try to do again what has been done elsewhere. There is probably a matching processes that can be easily implemented and it will be faster here for the phosphorous reg. So instead of waiting ten years to get a phosphorous reg, it will be faster and easier here when the tools are known, and when you are able to have some research, I will say independent research, I don't know how to say that, but it is kind of an organization that is not directly linked to the industry and money is given to different researchers. But there is always a committee and it is a multi-disciplinary committee looking at

the research. So you have peer review at the same time. So it will probably avoid a lot of problems, and people will have confidence in the fact that research is done on a global perspective, and with different people involved as well. So it is not only conservation research or water stewardship research, but it is a research that has been supported and followed up by different people.

THE CHAIRMAN: This might be going off a little bit in a different direction, a question that I have; how much of a concern is the leaching of phosphorous into groundwater from overapplication on marginal soils or out of earthen manure structures, storage structures, is that a major concern?

MR. AKINREMI: In the short term it may not be, it depends on the soil. In the short term it may not be, but in the long term it may be.

For example, what you find is that most of the soils that are sandy are the soils that will not runoff. If the water doesn't go one way on the overland, it will go vertically. The other issue is the concept of degree of

phosphorous saturation. Those soils, for example, the sandy soils right now, they have very little capacity to hold phosphorous. So for now, we may not be seeing anything, but if you continue to load those soils, we have quite a bit of vertical movement. If you continue to load them with time, I think you are going to see leaching.

The other thing in terms of leaching that has come up in terms of literature, what we don't have here is where you have drainage, you find that water is not the only thing that moves, you have the (inaudible) that moves and it carries quite a bit of phosphorous. They are finding when water moves through cracks or when water moves through the soil, not only will the water carry what it dissolved but it will carry particles with it, and so you have collateral movement. I don't think that is much of a problem here, but some soils, if phosphorous is in there, it is going to move with water.

MR. WILLIAMS: Just a couple of points on this. First of all, unlike nitrate and nitrite, a component of nitrogen, which have human health concerns related to drinking water and therefore leaching of those parts, or those

nitrogen components into groundwater, can have an adverse impact on groundwater and its use by humans for drinking water. Unlike that there is no such concern for phosphorous and its impact on human health when it makes its way into groundwater. The main issue with phosphorous is in surface waters and its relationship to the promotion of algal blooms. There is a linkage, though, in that there is a component of ground waters in Manitoba that do discharge to surface water streams. So, for example, there is a considerable that is simply not known. But we do know that at the base flow in many of our streams in southern Manitoba, that is the base flow that would be there during periods of prolonged drought, is actually being contributed from groundwater.

In the Assiniboine River, for example, through the Assiniboine Delta aquifer, the contribution from the aquifer to the Assiniboine River is something like 200 cubic feet per second. So if you move phosphorous from surface soils into groundwater and that discharges into a surface stream, it is not a major concern in the groundwater, but it is when it comes out

contributing to stream flow and there it has an impact on promotion of algal blooms.

MR. FLATEN: Just to reiterate that, there is well documented cases in Britain, Netherlands, Quebec, Delaware, other parts of the world, where if you overload a soil with phosphorous, the phosphorous indeed can't be held by the soil and it starts to leach through. And if you just have natural drainage in that area, you might not notice much of a problem for a long, long time. But if you put tile drains in, so that once that phosphorous has gone down a few feet it has a direct outlet, that is when you can notice a very substantial deterioration in surface water quality, and a significant portion of phosphorous loading to surface waters in those regions that I just mentioned has been traced back to not tile drainage on its own, but tile drainage combined with excessive concentrations of phosphorous in the surface soil itself; that is a deadly combination.

If it is natural drainage out of that groundwater, it probably would take a long, long time before that problem actually shows up, and once it shows you up you are going to have to live

with it for a very long time as well. An example of that, I think one of the best in Western Canada is under the County of Lethbridge there is what is called a batter seed drain which has quite a bit of ground water from feedlot alley, these areas where 2,000 to 3,000 part per million soil test phosphorous is astonomically high compared to what we have here in Manitoba, and the concentration of phosphorous in the groundwater discharge is something like .3 parts per million, which is ten times the threshold for nutrification.

So I think if -- that was one of the reasons why we wanted to get these initial phosphorous thresholds so that we wouldn't have the same situation that they have got in Lethbridge already, and it is partly related to groundwater, as well as surface water, but it takes a long time before you see it. So it is not within the electorial cycle of a four year period, for example.

THE CHAIRMAN: Any other questions? Comments? Parting shots?

MR. MOTHERAL: This is not a parting shot. It is a comment. And we have been working in our report, probably will today, is we are

working on phosphorous, which is the buzz word today. Now if this had been known four years ago, the RM of Hanover maybe wouldn't be in the situation they are, because they came up with a development plan, and Doug Caver, the administrator, told us that they came up with a plan that they won an environmental award over, and now since the phosphorous regulations have came in, they are looked upon as demons now, and they have to handle the problem.

I say phosphorous is the issue today, what is the issue tomorrow? When we come up with some recommendations, there is going to be another issue. It is just me. It is a parting comment. There could be a flavour of the day coming up in five years' time that is completely different than phosphorous.

MR. FLATEN: I would like to make a comment on how far you can go with recommendations and common sense, and give you an example of a potential problem with copper and zinc loading associated with manure that was nipped in the bud before it ever became a problem. Some researchers at the University of Manitoba were working with a large pork producer in the province to look at the

characteristics of manure, looking at nitrogen and phosphorous, salts and metals, and they identified an area of concern there. They thought that after something like 15 years of application some of these nursery barns, where they supplement with high concentrations of copper and zinc, could be reaching levels of loading that were similar to what the regulatory thresholds were for application of municipal biosolids, for example. As soon as that was flagged in the early drafts of this report, this pork producer got its people together; the veterinarian, together with the nutritionist, with the land application manager and all of these other people, and they said, you know, do we really need to be supplementing with this? We have to watch the balance here of copper and zinc, because if we are in it for the long haul -- and their team got together and they reduced the supplementation, by 60 per cent and the excretion by 75 per cent. They immediately had got rid of the problem, it never saw the desk of a regulator. It was just the right thing to do.

And these people did not want us to publicize this. I thought this was an outstanding

example of what we really call stewardship. But they didn't want to draw attention to themselves or anything like that. They just wanted to get the job done and fix things before it became a problem.

So there are other aspects of manure management, salts and metals, and some of those are covered in some of that Manitoba Conservation Sustainability Study that Access put together. But to the credit of the industry, I think it has been able to deal with most of those problems, potential problems before they have occurred.

THE CHAIRMAN: So that flavour of the month won't come to pass.

Well, I would like to thank you all very much for coming out here today and giving us some of your time. I know speaking for myself this has been a very good session. There is a lot of stuff, we have heard lots over the last few months in our hearings, we have read lots over the last few months in preparation for the hearings and after the hearings, and I still didn't have a complete understanding of a number of the issues. I probably still don't have a complete understanding, but I certainly have a better

understanding than when I walked in this morning, so for that alone I am quite grateful.

I suspect that we will be talking or writing to any number of you again over the next few weeks and months. So thank you for your time today, and your time in past sessions, and perhaps we will be calling upon you again. Thank you very much.

(Concluded at 3:15 p.m.)

CERTIFICATE

CECELIA REID and LISA REID, duly appointed Official Examiners in the Province of Manitoba, do hereby certify the foregoing pages are a true and correct transcript of my Stenotype notes as taken by me at the time and place hereinbefore stated.

Cecelia Reid

Lisa Reid