

*F. Ngod*CONSOLIDATED HEARINGS BOARD

IN THE MATTER OF Sections 2 and 3 and 6 (3) of the Consolidated Hearings Act, 1981, S.O. 1981, c.20;

— and —

IN THE MATTER OF Section 12(2) of the Environmental Assessment Act, R.S.O. 1980, c.140;

— and —

IN THE MATTER OF Sections 30, 35 and 38 of the Environmental Protection Act, R.S.O. 1980, c.141, as amended;

— and —

IN THE MATTER OF Sections 24 and 61 (2) of the Ontario Water Resources Act, R.S.O. 1980, c.361, as amended;

— and —

IN THE MATTER OF Section 28 (3) of, and Regulation 164 under, the Conservation Authorities Act, R.S.O. 1980, c.85, as amended;

— and —

IN THE MATTER OF Section 40(12) of the Planning Act, S.O. 1983, c.1, as amended; in connection with site plan control of the sanitary landfill site;

— and —

IN THE MATTER OF Section 22(1) of the Planning Act, 1983 in connection with a referral to this Board by the Honourable Bernard Grandmaitre, Minister of Municipal Affairs, on a request by the Regional Municipality of Halton to amend the Official Plan for the Town of Milton to redesignate a parcel of land comprising Part Lots 3 and 4, Concession 2 N.S. in the Town of Milton from "Agriculture" and "Conservation and Hazard Lands" to permit the construction, operation and maintenance of a landfill site, Minister's File No. 24-OP-Q208-A01;

— and —

IN THE MATTER OF Section 34(11) of the Planning Act, 1983 in connection with an appeal to this Board by the Regional Municipality of Halton for an order directing an amendment to By-law 61-85 of the Town of Milton to rezone the lands situated at Lot 3 and part of Lot 4, Concession 2 N.S., in the Town of Milton from "Agriculture" to permit a regional sanitary landfill site and ancillary uses;

— and —

IN THE MATTER OF Section 15(1) of the Planning Act, R.S.O. 1980 ch.379 in connection with a referral by the Honourable Claude F. Bennett, Minister of Housing on a request by Tremaine Britannia Citizen's Group for consideration of part of the Official Plan for the Halton Planning Area with respect to Sections 1 to 5 inclusive, 7, 9 and 10 of Part III D3 Solid Waste Management, Minister's File No. OPC-0026;

— and —

IN THE MATTER OF Section 64 of the Ontario Municipal Board Act, R.S.O. 1980, c.347 as amended in connection with an application by the Regional Municipality of Halton for an order approving:

a) the acquisition of land for the construction, operation and maintenance of a sanitary landfill site to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton and to do so by one of two alternative methods as follows:

- (i) landfilling at the site referred to in Halton's Environmental Assessment as Site F in the City of Burlington;
- (ii) landfilling at the site commonly referred to in Halton's Environmental Assessment as Site D in the Town of Milton

at an estimated cost of \$12,775,000.00, and the borrowing of money by way of temporary advances not exceeding in the aggregate such estimated cost pending the sale of debentures, and

(b) the issuance of necessary debentures to a maximum of \$12,775,000.00 for a term not to exceed fifteen years;

— and —

IN THE MATTER OF Section 193(5) and Paragraph 84 of Section 210 of the Municipal Act, R.S.O. 1980, c.302, as amended;

— and —

IN THE MATTER OF Sections 6, 7 and 8 of the Expropriations Act, R.S.O. 1980, c.148;

— and —

IN THE MATTER OF an undertaking of the Regional Municipality of Halton to provide facilities for the purpose of receiving, dumping and disposing of waste as required by section 137 of the REGIONAL MUNICIPALITY OF HALTON ACT, R.S.O. 1980, c.436, as amended, by acquiring the land for, constructing, operating and maintaining a landfill to contain 7.96 million cubic metres of waste in the Regional Municipality of Halton.

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I N D E X

WITNESSES:

ROWE, Dr. Ronald Kerry, resumed:

CHARLESWORTH, Dr. David Leonard, resumed:

Cross-examination by Mr. Hodgson (cont'd) 21154

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20 Halton to amend the Official Plan for the Town of
21 Milton to redesignate a parcel of land comprising Part
22 Lots 3 and 4, Concession 2 N.S. in the Town of Milton
23 from "Agriculture" and "Conservation and Hazard Lands"
24 to permit the construction, operation and maintenance
25 of a landfill site, Minister's File No. 24-OP-0208-A01;

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1983 in connection with an appeal to this Board by the
Regional Municipality of Halton for an order directing
an amendment to By-law 61-85 of the Town of Milton to
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BEFORE: H. H. Lancaster, Q.C. - Chairman

Dr. D.J. Kingham - Member



Hearing conducted at The Oakville
Granary Commercial Centre, 105 Robinson
Street, Oakville, Ontario, on
Wednesday, February 10th, 1988.

VOLUME 89

APPEARANCES:

T.R. Lederer and H.D. Hodgson	for the Regional Municipality of Halton (Proponent)
J.R. Tidball	for the Ministry of the Environment
T. Vigod J.F. Castrilli	for the West Burlington Citizens Group
D. Estrin, F.E. Leitch and H. Dahme	for the Corporation of the Town of Milton
S.R. Garrod and A. Nurvo	for the Milton Area Citizens Coalition and several affected Milton area landowners
R.B. Tuer, Q.C. E.A. Cronk and F. Perrier	for National Sewer Pipe and Limited
L.F. Longo	for Azova Investments Limited
M.J. McQuaid, Q.C. and C.J. Tzekas	for the City of Burlington
C. Mansfield	for the Ministry of Natural Resources
P. Renaud	for Cumis



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APPEARANCES (Cont'd):

1	C. Stevenson	for Framgard Holdings,
2	P. Hancock	Fosseri Investments
3		Limited, Seriphos
4		Investments Limited and
5		Topic Investments
6		
7	J.H. Olah	for the Halton Region
8		Conservation Authority
9		
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Per: C.F. Nethercut, C.V.R.



Oakville, Ontario.

February 10, 1988.

--- Upon commencing at 9:30 a.m.

MR. LANCASTER: Good morning, please be seated.

DR. RONALD KERRY ROWE, resumed:

DR. DAVID LEONARD CHARLESWORTH, resumed:

CROSS-EXAMINATION BY MR. HODGSON (cont'd):

MR. HODGSON: We are going to return shortly to the overburden maps, but there is one topic I wanted to start with the witness this morning because it will form the foundation of what some of the evidence will turn out to be this morning.

Q. Dr. Charlesworth, could you pull out your copy of H-39A and turn up if you would the borehole logs under tab 2. The borehole log I am looking for in particular is borehole 1N-OW3 near the back of tab 2.

DR. KINGHAM: Are you looking at this one?

MR. HODGSON: 1N-OW3.

DR. CHARLESWORTH: A. You had asked me to do some calculations. Mr. Hodgson, I did some calculations and I hope it's what you wanted.

Q. If you have done the calculations,



1 give them to Mr. Sobanski and you can present them
2 later in evidence and I can ask some questions about
3 them, because you will want to talk about them now and
4 I am going to ask about them later and the evidence
5 will be split. Is that possible?

6 A. Okay.

7 MR. ESTRIN: How is he going to do that,
8 orally?

9 MR. HODGSON: He can do it any way he
10 wants. I just want to see the calculation before I
11 ask questions.

12 MR. ESTRIN: And I would like to see it
13 as well. So when he gives it to Mr. Sobanski, if he
14 could give it to me as well.

15 MR. HODGSON: He can give it to everyone
16 in the room. That is what we were looking for.

17 DR. CHARLESWORTH: I thought I was going
18 to go through it and clarify it so it is understandable
19 to people?

20 MR. HODGSON: I wonder if I could have
21 your assistance, Dr. Charlesworth. We have in Exhibit
22 H-39A, under a page titled No. 3, the Morrison Beatty
23 borehole logs, eight borehole logs and just so there is
24 no confusion later in the hearing, can you confirm that
25 the last four borehole logs entitled 4N-OW1, 4N-OW2,



1 4N-OW3 and 4N-OW4 all relate not to Site D but Site E?

2 DR. CHARLESWORTH: A. Yes, I believe
3 that that is the case.

4 Q. It says it was Site LF-4N, and
5 Site LF-4N was Site E...

6 A. Yes.

7 Q. ...in the study conducted...

8 A. Yes.

9 Q. ...by Gartner, Lee. It might be
10 useful if everyone wrote across 4N, Site E. It is
11 very easy when you are turning up these borehole logs
12 to get the 4N logs confused with the 1N logs and find
13 yourself studying the wrong borehole, or the right
14 information for the wrong borehole.

15 You will see as we are looking at 1N-OW3
16 that the borehole logs suggest that there is till down
17 to approximately sixteen and a half metres?

18 A. Yes.

19 Q. Then a unit of stratified drift
20 that appears to be, eyeballing it, and would we call
21 that a half a metre across?

22 A. Yes, something like that.

23 Q. Then another unit of till?

24 A. Yes.

25 Q. Then a unit of stratified drift?



1 A. Yes.

2 Q. Looking at borehole 1N-OW3 and
3 nothing else, could you simply advise the Board as to
4 how you as an experienced hydrogeologist who I am sure
5 has logged more than one core taken from more than one
6 borehole in Ontario -- is that correct?

7 A. Yes.

8 Q. What do the words "stratified
9 drift" mean to you?

10 A. Well, stratified drift is the
11 surficial cover as opposed to the bedrock and
12 stratified implies something other than till.

13 Q. Something other than till?

14 A. Yes.

15 Q. So what we have here is a unit of
16 shale, or two units of till and two units of something
17 other than till?

18 A. Yes.

19 Q. That is the extent of the
20 information conveyed to you by this borehole log?

21 A. Yes.

22 Q. Looking back at 1N-OW1, OW2, OW3
23 and 4, do you see the same identification of till,
24 shale and stratified drift in each of those boreholes?

25 A. I do.



1 Q. In fact, Dr. Charlesworth, what we
2 have here isn't really a description of what is found
3 by drilling in the ground, it is really an
4 interpretation, is it not?

5 A. What you have there is a minimal
6 amount of information really. It is a much simplified
7 version of the log, yes, and there is not a lot of
8 information on those sheets.

9 Q. It is a kind of interpretation,
10 isn't it?

11 A. Yes. I don't know what the
12 objective was or how much effort went into that
13 interpretation, but yes, there is an interpretation
14 involved there.

15 Q. Could we refer to your Exhibit
16 M-438, and I would ask you to turn up the borehole log
17 in your Appendix A for the same hole, 1N-OW3?

18 A. Yes.

19 Q. And would you mind getting out
20 your cross-section RG from this same exhibit, you have
21 it mounted and perhaps you could put it up for the
22 Board to look at.

23 Now, Dr. Charlesworth, looking at your
24 cross-section RG, can you confirm that the unit that
25 you have plotted on your cross-section as the upper



1 granular unit in borehole (MB)OW-3, which is 1N-OW3...

2 A. Yes.

3 Q. ...the information you have plotted
4 in the lower granular unit is the information that is
5 given on the original borehole log by Morrison Beatty
6 at approximately sixteen and a half metres?

7 A. I am just checking, but I am sure
8 -- yes, yes, that is the case.

9 Q. Do you see anything on the
10 original Morrison Beatty log to suggest there is any
11 upper granular unit in borehole (MB)OW-3?

12 A. There is very little information
13 on this log.

14 Q. There is nothing to suggest there
15 is any "stratified drift", i.e. non-till at the level
16 you have drawn in the upper granular unit?

17 A. On the log that is presented, that
18 is correct.

19 Q. But you have drawn that on your
20 cross-section RG and you have a unit or have an
21 interpretation that there may be some of the upper
22 granular unit at this borehole?

23 A. As I indicated in my evidence-in-
24 chief, we had the advantage of the detailed logs which
25 were not available to Trow at the time they did their



1 interpretation. It is my understanding that only this
2 simplified log was available to Trow and the detailed
3 log had not been available to them. Maybe Mr. Hodgson
4 can clarify that point, but that is my understanding.

5 Q. Could we just look at, and forget
6 about the original Morrison Beatty log, but look at the
7 log you have been kind enough to include in your
8 report, M-438, and just so that we can see and
9 illustrate for the Board how it is you have used this
10 information. I don't mean to suggest by these
11 questions any criticism of you, but I would like you to
12 indicate for the Board how you identified a possible
13 extension of the upper granular unit in (MB)OW-3 from
14 the detailed borehole log which is contained in your
15 report?

16 A. Certainly. We examined the log and
17 within the unit which on the simplified log in the
18 Morrison Beatty report is mapped as till, we noticed --
19 obviously there is some degree of variation and there
20 was far more detail available to us there and, among
21 other things, we noticed that between 9.78 metres and
22 9.91 metres there was something described other than
23 till and within that till they have identified:

24 "SAND, fine with minor silt and minor
25 gravel, brown, wet,"



1 and that seemed to be an elevation, and as you will
2 note when you look on our borehole, we have question
3 marks beside it, but it is a possible location of the
4 upper granular unit.

5 Q. What throws some doubt is the
6 combination, it's 13 centimetres thick plus it has silt
7 in it.

8 A. You say it throws doubt, but what
9 it does, the evidence of that particular horizon we are
10 referring to throws doubt, Mr. Chairman, on the gross
11 simplification which is presented in the log, the copy
12 of which Trow reproduced, which is all I understand
13 they had to work with.

14 Q. Could we look at the same borehole
15 log in the original Morrison Beatty log, which suggests
16 there was some stratified drift approximately 16 to
17 16.1/2 metres deep?

18 A. Yes.

19 Q. Could you indicate for the Board
20 what data you use from the more detailed borehole logs
21 to interpret the lower granular unit in (MB)OW-3?

22 A. Yes. On the second page of the
23 log from 16.31 to 16.86 metres, you will note it says:
24 "SAND with some gravel, brown,
25 wet."



1 and we noted the elevation it occurred at and thought
2 yes, that may be significant and we suggested that it's
3 possibly the lower granular unit.

4 Q. Morrison Beatty in their original
5 log indicate stratified drift approximately between the
6 21st and the 24th metre, and you have interpreted that
7 as some more granular material sort of sitting on top
8 of the bedrock?

9 A. As a possibility, yes, and that is
10 how we interpreted it in that....

11 Q. You would agree that this more
12 detailed borehole log is of far more use to you as a
13 hydrogeologist than the more abstract one that appeared
14 in H-39A.

15 A. Certainly.

16 Q. You would also agree with me,
17 would you not, that this is a borehole or a core that
18 was taken and logged in July, either July or early
19 August of 1984?

20 A. Yes.

21 Q. In fact, if we look at the four
22 borehole logs for Morrison Beatty contained in your
23 Appendix A, all of them are from that period of time,
24 approximately July and August of 1984?

25 A. I can look, but I am sure that



1 that is correct. Yes.

2 Q. Would you agree with me, Dr.
3 Charlesworth, that a borehole log to be useful should
4 be compared, that is the core should be logged, both in
5 the field and shortly after the log is brought back to
6 the laboratory -- I am sorry, the core is brought back
7 to the laboratory?

8 A. That is the ideal way of doing it,
9 yes.

10 Q. There is some deterioration in the
11 materials if they are permitted, for example, to dry
12 out?

13 A. Yes, it makes your logging more
14 difficult, yes.

15 Q. Have you any evidence you can
16 provide this Board as to when the detailed borehole
17 logs which are contained in your Exhibit M-438 were in
18 fact prepared?

19 A. No, I don't have that information.

20 Q. I take it, Dr. Charlesworth, you
21 indicated the first day you gave evidence that when you
22 began to work on this whole project, among the things
23 you set out to do was to prepare some cross-sections
24 and in fact we saw some of your preliminary cross-
25 sections, and I think they were put into evidence as



1 Exhibit M-158?

2 A. Yes, that is probably the number,
3 I'm not sure.

4 Q. Do you remember the cross-sections
5 Mr. Estrin put to Mr. Sobanski?

6 A. He put in some preliminary cross-
7 sections.

8 Q. Geocon prepared those cross-
9 sections?

10 A. That is correct.

11 Q. I take it when you were preparing
12 those cross-sections, you had available to you these
13 detailed borehole logs?

14 A. Yes.

15 Q. Were they available to you as soon
16 as you started work on this project?

17 A. It's getting so hard to remember,
18 but I think they were, yes. They were certainly
19 available to us at an early stage in the project.

20 Q. In Appendix B of your exhibit, we
21 find three borehole logs for cores that were again
22 taken, I gather, from the dates -- we don't seem to
23 have a date of coring, but we have the completion date,
24 and do you know whether the completion date at the top
25 of these borehole logs prepared by Comcor was the date



1 they were drilled or the date they were logged?

2 A. It is my assumption that that is
3 the date when the borehole itself was completed.
4 However, that is only an assumption.

5 Q. Were these borehole logs also
6 available to you when you prepared your preliminary
7 cross-sections in the spring of 1987?

8 A. Yes.

9 Q. Do you know on whose behalf these
10 particular cores were taken?

11 A. Yes. I think this was for a
12 citizens group.

13 Q. When you started your work, you
14 had available to you these cores?

15 A. Yes.

16 Q. I notice on the front of M-438, it
17 says report to David Estrin, barristers and solicitors
18 for the Town of Milton. Did Mr. Estrin provide you
19 with the detailed borehole logs contained in Appendices
20 A and B?

21 A. They came to us either directly or
22 indirectly through his office, yes.

23 Q. Now, Dr. Charlesworth, you will
24 recall that approximately four days before Mr. Sobanski
25 and Mr. Beechinor began to give evidence in June of



1 1987 that you and your colleague Janet, and I don't
2 know her last name---

3 A. Haines.

4 Q. Janet Haines. Miss Haines and Mr.
5 Estrin attended a meeting in the office of Osler,
6 Hoskin & Harcourt, a meeting arranged at the request of
7 Mr. Estrin?

8 A. Yes, I recall that.

9 Q. You met with Mr. Lederer and
10 myself and Mr. Sobanski and Mr. Beechinor?

11 A. Yes, sir, that is correct.

12 Q. At that meeting you were kind
13 enough to present to Mr. Sobanski the preliminary
14 cross-sections and, in fact, I think they were
15 preliminary, preliminary cross-sections which you had
16 been preparing at that point?

17 A. That is correct.

18 Q. When you presented Mr. Sobanski
19 with those preliminary, preliminary cross-sections, you
20 were also kind enough to make available to him the
21 borehole logs contained in Appendices A and B to your
22 Exhibit M-438. Do you recall that?

23 A. I think we did, and it is some
24 time now and I don't have total recall.

25 Q. Dr. Charlesworth, I want to show



1 you if I could, a letter, and this is a letter dated
2 the 25th of October, 1984, and I don't have a copy --

3 MR. ESTRIN: May I see it first?

4 MR. HODGSON: I don't think you are
5 entitled to see it.

6 MR. ESTRIN: I am entitled to see it,
7 at least at the same time he shows it to this witness.
8 What's going on in this hearing?

9 MR. HODGSON: I don't think the rules
10 require me to show every exhibit to Mr. Estrin before I
11 show it to the witness. This happens to be a letter
12 written by Mr. Roy Main, Town Administrator for the
13 Town of Milton to Mr. Perlin at the Region of Halton.

14 MR. ESTRIN: May I see it?

15 MR. LANCASTER: I think he should be
16 able to see it.

17 MR. HODGSON: I think I should be able
18 to present it to the witness and I don't think that Mr.
19 Estrin is entitled...

20 MR. LANCASTER: Present it to the
21 witness and the witness will say nothing until Mr.
22 Estrin has seen it.

23 MR. HODGSON: I will show it to Mr.
24 Estrin.

25 MR. ESTRIN: All right. Go ahead.



1 MR. HODGSON: Q. Mr. Charlesworth --
2 Dr. Charlesworth, this is a letter from Mr. Roy Main,
3 and have you met Mr. Main?

4 DR. CHARLESWORTH: A. I don't think I
5 have, no.

6 Q. Can you confirm that Mr. Main is
7 the Town Administrator for the Town of Milton?

8 A. To my understanding, yes, to my
9 understanding he is. I am trying to remember if he
10 did attend the meeting.

11 Q. Nothing turns on that,
12 Dr. Charlesworth. This is a letter from Mr. Main to Mr.
13 Perlin, the chief administrative officer for the Region
14 of Halton, dated the 25th of October, 1984 and it says:

15 "Further to your recent letter and our
16 discussions, this letter is to confirm
17 that I will release the Bore Hole Logs
18 as prepared by Morrison, Beatty
19 immediately after release of such
20 information to the O.W.M.C."

21 Now, OWMC was the Ontario Waste
22 Management Corporation?

23 A. Correct.

24 Q. From that sentence, Dr.
25 Charlesworth, will you agree with me that we know two



1 things; No. 1, Mr. Perlin already knows that Mr. Main
2 has borehole information that he would like to obtain
3 on Site D?

4 A. Yes, that is certainly indicated
5 by the wording of the letter.

6 Q. The other thing indicated from the
7 wording of the letter, is it not, is that Morrison
8 Beatty are working for the Town of Milton and have
9 prepared these borehole logs for the Town of Milton and
10 the Town of Milton has those borehole logs in their
11 care and control?

12 A. Yes, that is certainly implied by
13 that.

14 MR. HODGSON: I don't think we need to
15 make this an exhibit but I am in your hands.

16 MS. CRONK: I would like it made an
17 exhibit as it has been put to the witness.

18 MR. LANCASTER: H-493.

19 --- EXHIBIT NO.H-493: Letter from Mr. Main of the
20 Town of Milton to Mr. Perlin
21 of the Region of Halton re.
boreholes.

22 MR. HODGSON: Q. That letter was
23 dated October, 1984. Do you have a copy of M-155,
24 Exhibit M-155, page 115?

25 DR. CHARLESWORTH: A. Yes.

Q. After page 115, do you see four



1 borehole logs, 1N-OW1, 1N-OW2, 1N-OW3 and 1N-OW4?

2 A. I do.

3 Q. Are those the same borehole logs
4 Mr. Sobanski had in his Exhibit H-39A?

5 A. Yes.

6 Q. Let's look at the letter dated
7 November 9, 1984.

8 "This letter confirms our meeting today
9 at 10:00 a.m....."

10 This is a letter from Brian Beatty to a
11 hydrogeologist I believe at Gartner, Lee?

12 A. That is correct, a hydrogeologist
13 who was with Gartner, Lee at the time.

14 Q. Gartner, Lee were the
15 hydrogeologists working for the Ontario Waste
16 Management Corporation to study, among other things,
17 the hydrogeological regime at Site D?

18 A. Yes.

19 Q. On behalf of OWMC?

20 MR. ESTRIN: Just a minute, please.

21 MR. HODGSON: This is the exhibit you
22 put into evidence.

23 MR. ESTRIN: It's a technical appendix.

24 MR. HODGSON: You put this into
25 evidence.



1 MR. ESTRIN: I understand that. There
2 are two.

3 MR. HODGSON: Do you have another copy
4 of that?

5 MR. ESTRIN: There are two documents
6 which are somewhat similar.

7 MR. HODGSON: "This letter confirms our
8 meeting today at 10:00 a.m. to discuss
9 our work on OWMC sites Pl-1N and LF-4N."
10 We already know he was working for the
11 Town of Milton.

12 "We have enclosed preliminary copies of
13 the borehole logs at the four locations
14 we tested at each site. Maps showing
15 the test locations and private well
16 locations are also included.

17 The well logs are abbreviated, since
18 detailed examination of the borehole
19 samples has not been completed. They
20 show the significant stratigraphic units
21 only."

22 We know in November of 1984 Mr. Beatty
23 made available to the Ontario Waste Management
24 Corporation these abstracted borehole logs we examined
25 earlier?



1 A. Yes.

2 Q. This report was published in
3 September of 1985, and that's on the inside page, and
4 would you agree with me that it would at least appear,
5 since we don't find the more detailed borehole logs in
6 the OWMC report, that as at the date of publication,
7 Gartner, Lee didn't have those more detailed borehole
8 logs. That would be a fair interpretation, would it
9 not?

10 A. If you are asking me to
11 speculate....

12 Q. I am not asking you to speculate,
13 Dr. Charlesworth, I am asking you as an experienced
14 hydrogeologist, if you had the choice between studying
15 and publishing the detailed borehole logs from 1N-OW1,
16 2, 3 and 4 and the abstracted borehole logs, 1N-OW1, 2,
17 3 and 4, which would you use?

18 A. I would use and publish the
19 detailed ones.

20 Q. Do you think that is a fair
21 interpretation of what Gartner, Lee would do?

22 A. I would hope that they would do
23 that.

24 Q. Fine. Now then, Dr.
25 Charlesworth, I would also like to show you another



1 letter and this is a letter dated the 30th of July,
2 1986 and this is from Mr. Harry Dahme, an associate of
3 Mr. Estrin in Mr. Estrin's office, and have you met
4 Harry Dahme?

5 A. Yes.

6 Q. I wonder if we could read this
7 letter together and we don't need to read the whole
8 thing. This was a letter from Mr. Dahme to Mr. Estrin -
9 - I'm sorry, from Mr. Dahme -- I'm sure he writes you
10 memos but not letters. This is Mr. Dahme to Mr.
11 Lederer, my colleague:

12 "We wish to confirm our request that you
13 provide to us the borehole logs produced
14 as a result of the Region of Halton's
15 recent drilling program at Site D.

16 We have difficulty in understanding
17 your confusion as to our request. The
18 information was requested at this time
19 in order to permit the Town of Milton to
20 evaluate the results of the drilling
21 program prior to the forthcoming
22 hearing, thereby avoiding any
23 unnecessary expense of public funds in
24 relation to the forthcoming hearing and
25 also avoiding any unnecessary request



1 for an adjournment of the hearing in
2 order to evaluate the information
3 received.

4 We wish to point out that the Town
5 of Milton was requested to make
6 suggestions as to the drilling program
7 at Site D and that consultants retained
8 by the Town of Milton assisted the
9 Region of Halton with respect to the
10 appropriate drilling program. The Region
11 have apparently instructed its
12 consultants to proceed in accordance
13 with those requests, and we are
14 therefore surprised at your reluctance
15 to make the results of the drilling
16 program available in a timely manner.

17 We understand that the borehole
18 drilling information was made available
19 to the Region of Halton this month."

20 and the cores were barely resting in the laboratory:

21 "And accordingly...."

22 MR. ESTRIN: Please don't give
23 evidence.

24 MR. HODGSON: "And we would accordingly
25 request that that information be made



1 available to us as soon as possible."

2 Now the next sentence isn't relevant
3 because it had to do with some unrelated information
4 Mr. Estrin's office was also seeking, so let's skip one
5 sentence and read:

6 "The environmental assessment process is
7 a process whereby all of the impacts on
8 the environment of an undertaking are to
9 be identified and assessed. In the
10 process of conducting an environmental
11 assessment, it is fundamental that there
12 be informed public participation."

13 Do you agree with that, Dr.

14 Charlesworth?

15 "In the process of conducting an
16 environmental assessment it is
17 fundamental there be informed public
18 participation?"

19 MR. ESTRIN: Mr. Chairman, I think we
20 can all agree with that, but I don't know why we are
21 wasting the Board's time having Dr. Charlesworth agree
22 with it, because it is not his area.

23 MR HODGSON: Q. Dr. Charlesworth, have
24 you been engaged by other clients to assist in the
25 preparation of an environmental assessment for a solid



1 waste management project?

2 DR. CHARLESWORTH: A. Yes.

3 Q. You have actively participated in
4 the environmental assessment process?

5 A. Yes. I would agree that it is --
6 I would agree with that statement, Mr. Chairman. I
7 also have to observe at this point that the process we
8 are going through right at this minute highlights in my
9 mind, and I know it is a concern shared by other
10 consultants, the real problem we have in going through
11 whatever was said last week, it is an adversarial
12 process and the rules played by the lawyers and the
13 rules the scientists play by or would like to play by
14 are somewhat different, as I am sure you appreciate.

15 To my mind, this highlights the concern
16 that I am sure most of the technical witnesses who have
17 appeared before you share.

18 Q. "Not only does that participation
19 assist in informing the participants of
20 the undertaking, but it also assists the
21 proponent in finding the range of
22 impacts and the degree of impact of the
23 undertaking. In order to be effective,
24 public participation must be informed,
25 and in order to be informed, there must



1 be a timely release of information in
2 order to assist the participants in
3 assessing the information and responding
4 accordingly.

5 The Town of Milton is a participant
6 in the undertaking and, accordingly,
7 requests the timely release of
8 information in order to assist it in
9 participating in an informed and
10 effective manner. The timely release of
11 information is required by the
12 Environmental Assessment Act and
13 accordingly...."

14 This is Mr. Estrin's office's
15 interpretation of the Environmental Assessment Act and
16 I am not asking you to agree:

17 ".... accordingly we are surprised at
18 the tenor of your letter which suggests
19 that the contents of the letter will
20 only be made available in an adversarial
21 manner."

22 And there is no need to discuss the tenor of anyone
23 else's letter, but let's explore....

24 MS. CRONK: Could I ask Mr. Hodgson to
25 provide copies of that too, to provide copies and to



1 provide the date of the letter.

2 MR. HODGSON: The date was July 30,
3 1986.

4 MR. LANCASTER: We will mark that
5 H-494.

6 --- EXHIBIT NO.H-494: Memorandum dated July 30,
7 1986 prepared by Mr.Estrin's
office.

8 MR. HODGSON: Can I hold onto it?

9 MR. LANCASTER: Yes.

10 MR. HODGSON: Q. Dr. Charlesworth,
11 would you agree with me that if the timely release of
12 information -- first of all, do you agree that the
13 timely release of information is important to the
14 public discussion process which is part of the
15 environmental assessment process?

16 MR. ESTRIN: Don't answer the question.
17 I would like to rise and ask Mr. Hodgson to sit down at
18 this point, because I would like to make some
19 submissions to the Board with regard to this matter.

20 I have sat here for a few minutes to try
21 and understand where Mr. Hodgson seems to be going and
22 it's not clear from what he said, but it is clear from
23 the tone and manner of his questions that he is aiming
24 at asking -- casting some negative indications on
25 perhaps the Town with respect to the fact that the Town



1 had detailed borehole logs and apparently they weren't
2 made available to his client in what he might consider
3 to be a timely way. If that is indeed what he is
4 getting at, I will stand back and use my own voice
5 because this is ringing. If that is what he is
6 getting at, I think what has to be understood here, and
7 Dr. Charlesworth is not in a position to provide this
8 information, and Mr. Hodgson is well aware of it, and
9 that is at the same time, and the Board has some idea
10 of what has happened, but perhaps it is not very clear.

11 At the same time the Region of Halton
12 was engaged in the site selection process for a
13 municipal waste disposal site, the Ontario Waste
14 Management Corporation was also examining sites which
15 coincided with two regional sites, Sites D and E;
16 regional sites were also being identified by the OWMC
17 under their own particular nomenclature as P1-IN, and
18 who knows what else, but as sites they were also
19 investigating.

20 The Town of Milton had to deal
21 accordingly with two different proponents engaged in
22 two different projects for different purposes, but
23 which happened to coincide to a large extent in two of
24 the same geographic area. In other words, the Town of
25 Milton was concerned about what the OWMC was up to for



1 a toxic waste disposal site, as much as it was
2 concerned about the Region's activities.

3 In the context of the concern with
4 respect to the Ontario Waste Management Corporation
5 issue, the firm of Morrison Beatty was retained by the
6 Town of Milton to investigate the two sites and indeed
7 that is confirmed by the fact that the borehole logs
8 that have been referred to by Morrison Beatty refer to
9 the OWMC numbering system and I don't think any clarity
10 is needed in that regard.

11 Therefore, certain information was
12 prepared for the Town of Milton with respect to the
13 hydrogeology or preliminary basis of those sites and
14 some information was obtained by Morrison Beatty. What
15 has to be remembered here is that as of the time when
16 these logs were made available to the Region of Halton
17 as well as to the Ontario Waste Management Corporation,
18 there was very much an objective by the OWMC to locate
19 a site in Milton. That direct threat was abated to some
20 extent at a later date when OWMC identified a preferred
21 site in the Niagara area. However, as Mr. Leitch or I
22 made clear, certainly right at the outset of this
23 hearing, the OWMC process is far from complete and, as
24 the Board is well aware, certainly opponents of the
25 preferred OWMC site, the Region of Niagara and many of



1 the municipalities in the Niagara region may well be
2 arguing when that hearing commences, as it will perhaps
3 later this year or early next at the latest, that
4 OWMC's previously identified sites in the Town of
5 Milton are as good as or better than the site in West
6 Lincoln and therefore the Town of Milton continues to
7 have a real concern with respect to where the OWMC
8 process is going in respect of these sites in the Town
9 of Milton.

10 To the extent that information was
11 released at all to OWMC and to the Region in respect of
12 the Town of Milton's investigations in preparing for
13 that issue, as I think a commendation of the Town of
14 Milton, subsequently more detailed information was
15 released but I think what you have to understand, and I
16 have attempted to make it understandable, is that the
17 Town of Milton's release of information and the way in
18 which it was released had much to do with its real
19 concern and a continuing concern with respect to the
20 OWMC matter and the detailed logs were made available
21 to the Region at an early date relative to this matter
22 and meaning by that, as Mr. Hodgson suggested in June
23 before his hydrogeologists testified, they had the
24 opportunity of looking at them and I think they
25 indicated, as you know in evidence and in cross-



1 examination, that they had no substantial disagreement
2 with that information. So, I think that just helps to
3 set the stage for the background of these questions. I
4 am not sure how Dr. Charlesworth can assist the Board
5 in answering questions, and Mr. Hodgson is certainly
6 entitled to make an argument and I think it would be
7 fair if he wants to make some kind of argument about
8 how this information came about and the timing of how
9 it came about, but I don't think it is appropriate that
10 Dr. Charlesworth be asked questions about matters he
11 knows really nothing about for the purpose of
12 developing that argument as Mr. Hodgson is quite free
13 to make that submission if he wants to make a
14 submission. Thank you.

15 MR. LANCASTER: Mr. Hodgson?

16 MR. HODGSON: Mr. Chairman, if I could
17 just clarify for the record on the two or three
18 purposes I have for bringing this information to the
19 attention of the Board. The first is that we have to
20 be grateful to Dr. Charlesworth for providing us with
21 his cross-sections, which are better than the cross-
22 sections which Trow has, it has more information. Dr.
23 Charlesworth has been critical of Trow in his evidence,
24 or impliedly critical of Trow in his evidence for
25 basically not providing enough information on, for



1 example, the granular units and I want to bring out in
2 the course of the evidence this morning that some of
3 the information that was in fact available on granular
4 units was held back from the Region until the last
5 moment. That was the reason for bringing to the
6 Board's attention the fact that these detailed borehole
7 logs, which are useful, very useful, weren't available
8 to Mr. Sobanski until two or three days before he went
9 into the witness box.

10 The second reason I wanted to bring this
11 information to the attention of the Board, and I have
12 one more piece of information I want to bring before
13 the Board, but later on this morning or early this
14 afternoon I want to test with Dr. Charlesworth,
15 Dr. Charlesworth's statement, not only his implied
16 criticism that not enough information has been put
17 forward, but his direct statement to this Board that
18 you don't have enough information to approve Site D. I
19 want to bring this information, the information I have
20 been bringing to the Board's attention to the Board's
21 attention because it would appear that a party to these
22 proceedings, which has continuously cored four holes on
23 Site D and doesn't bring that information forward for a
24 very long time, one of the interpretations for that
25 conduct is not any malice on the part of Milton, but



1 one interpretation is that they have enough information
2 and they don't need our information and if that is the
3 position the Town of Milton took, they then seem to
4 have changed and are taking a slightly different
5 approach, which is we don't have enough information,
6 but they had the important information and they chose
7 to hold it back for a long, long time.

8 The other thing I want to bring to the
9 Board's attention, and I need to do this by putting
10 into evidence a letter -- you will recall when I read
11 Mr. Estrin's letter, and what exhibit number was Mr.
12 Estrin's letter?

13 MR. LANCASTER: Mr. Dahme's letter? You
14 have it, and it's 494.

15 MR. HODGSON: I didn't write it on, Mr.
16 Chairman. When I read H-494, it had a passage to the
17 effect:

18 "We wish to point out that the Town of
19 Milton was requested to make suggestions
20 as to the drilling program at Site D and
21 that consultants retained by the Town of
22 Milton assisted the Region of Halton
23 with respect to an appropriate drilling
24 program."

25 I have another letter which I wanted to



1 put to the witness, and this is a letter from Mr. David
2 Smith of the Region of Halton to Mr. Roy Main, Town
3 Administrator of the Town of Milton, a letter dated the
4 7th of January, 1986 and it reads:

5 "Further to our telephone conversation
6 of 1986 01 08,"

7 and it's not clear how you could have a conversation on
8 the 8th of January and write a letter dated the 7th,
9 but that aside:

10 "The purpose of this letter is to
11 confirm your statement that the Town of
12 Milton will not be providing any
13 comments to Halton staff regarding the
14 additional hydrogeological work
15 recommended at Site D."

16 So what had happened -- if I may
17 continue, but what had happened....

18 MR. ESTRIN: What we are doing is Mr.
19 Hodgson is re-opening his case and that is what is
20 happening. If he wants to now open his case for the
21 purpose of criticising the process on the part of the
22 Town of Milton, then he should call his witness, Mr.
23 Smith, and let him tell the Board what it is about the
24 conversation that concerns them and I will have the
25 chance of asking Mr. Smith about it and we can see



1 where this conversation fits into other information the
2 Town of Milton had provided at an earlier date or at a
3 later date or whenever. It is simply unfair and not
4 proper, and I think the Board can well understand that,
5 for Mr. Hodgson to purport to start cross-examining and
6 insinuating documents about process issues in respect
7 of information, whether it is hydrogeological or
8 anything else with a witness who clearly knows nothing
9 about the process. Dr. Charlesworth didn't start
10 working on this until 1987, but here is a letter of
11 January, 1986. If Mr. Hodgson wants to, I am quite
12 prepared to consider agreeing to him re-opening his
13 case and he can call Mr. Perlin or he can call anyone
14 else from the Region of Halton and he can call Mr.
15 Lederer, who apparently wrote Mr. Dahme a letter and he
16 has not given the Board a copy of that letter to which
17 he has filed a reply. I would like to cross-examine
18 Mr. Lederer about his letter, because obviously there
19 is some interchange that led to that one. I could
20 start telling the Board that for the last two years I
21 have been requesting from the Region of Halton their
22 detailed borehole logs and we have never got them. Do
23 you hear that, Mr. Hodgson? For the last two years,
24 and this Exhibit H-494, you weren't kind enough to
25 provide the Board a copy of Mr. Lederer's letter that



1 prompted this response, but this letter, for example,
2 refers to a request which has not been fulfilled to the
3 Region to provide the detailed borehole logs that his
4 clients have done. We have not seen them and we want
5 it and that is what this is about, we want a chance to
6 look at the same kind of details that he is now saying
7 he has and his clients have had an opportunity to
8 consider. All they have ever provided is typewritten
9 clean nice neat borehole logs. I can tell you that my
10 experience in this kind of matter goes back many years
11 and Mr. Hodgson is well aware of it and the fact is
12 that what is taken in the field can differ quite
13 markedly on occasion from what you see in a nice typed
14 version of a log published in somebody's report. That
15 is why we requested and that is what this letter refers
16 to as:

17 "We wish to confirm our request that you
18 provide to us the borehole logs produced
19 as a result of the Region of Halton's
20 recent drilling program."

21 And we have never got them.

22 MR. HODGSON: Those borehole logs are in
23 evidence in Exhibit H-39.

24 MR. LANCASTER: This whole question
25 seems to be between Milton and the Region and I don't



1 know what help we can get from this..

2 MR. HODGSON: It's more important than
3 that because while I can only cross-examine this
4 witness on his suggestion to you that there is not
5 enough written information to approve this site, the
6 context within which that cross-examination should take
7 place is the context that while the drilling programs
8 were going on, the Town of Milton was being consulted
9 as to whether it had advice as to what kind of
10 information should be gathered. Milton wasn't giving
11 its advice, notwithstanding that it was being asked.

12 MR. LANCASTER: How can the witness
13 comment on that?

14 MR. HODGSON: I don't think he can
15 comment on that, but he can understand the context
16 within which he now comes forward and says we don't
17 have enough information.

18 MR. LANCASTER: That's a matter of
19 argument and not a matter for the Board to determine.

20 MR. McQUAID: Could I remind the Board
21 that in Exhibit H-39, Volume 1 of 3, there is certainly
22 reference to comments received from the Town of Milton,
23 Morrison Beatty Ltd., and this was back at an early
24 stage in the drilling process, and comments from
25 Morrison Beatty about certain aspects that they wanted



1 to see in a drilling program.

2 I think that the area of knowing what
3 Dr. Charlesworth received from Morrison Beatty, whether
4 he in turn either passed on that information or wanted
5 to have more information, is certainly relevant.

6 MR. LANCASTER: Those questions would
7 be, yes.

8 MS. CRONK: Before this is finished,
9 there is another troubling aspect of this and I have
10 already brought it to the attention of Mr. Hodgson and
11 Mr. McQuaid. There are two streams of information
12 exchange clearly arising from the documents Mr. Hodgson
13 has brought to your attention this morning and the
14 first is between legal counsel and the second is as
15 between consultants. I don't want to be in a position
16 of being said to give evidence, but I can tell the
17 Board that my information is somewhat larger and
18 different from some of the information that has thus
19 far been put forward to you this morning. I have
20 alerted Mr. Hodgson and Mr. McQuaid.

21 If he is going to pursue the matter any
22 further, we will have a problem, because perhaps what
23 NSP's consultants, Morrison Beatty, say occurred could
24 be different from Mr. Sobanski's understanding from Mr.
25 McQuaid, and so I raise that caution. If there is any



1 complaint about the propriety of information
2 disclosure, surely that is a matter ultimately for
3 argument and you can't through this witness put a third
4 or half a story. I brought that to Mr. Hodgson's
5 attention before I raised it. There is more to it.

6 MR. LANCASTER: If there is an
7 impropriety somewhere in the woods, I don't think you
8 can visit it upon this witness.

9 MR. HODGSON: I wasn't suggesting by any
10 of my questions that this witness had done anything
11 improper and I don't think I implied that in my
12 questions.

13 MS. CRONK: He was more direct than
14 that.

15 MR. LANCASTER: You had a question that
16 never did get answered.

17 MR. HODGSON: I think in all the
18 circumstances it's time to change subjects.

19 MR. LANCASTER: I think so. We get
20 your point, but I don't think this is the proper place.

21 MR. HODGSON: Q. Dr. Charlesworth, when
22 we left off yesterday, we were looking at two of the
23 figures from Exhibit H-39, Drawing 12 and Drawing 13.
24 You have been kind enough to put onto Drawing 12 the
25 bedrock topography, you highlighted for us the bedrock



1 contour line at 165 and the bedrock contour line at
2 170.

3 DR. CHARLESWORTH: A. Yes, that is
4 correct.

5 Q. Then we were looking at
6 simultaneously an overburden thickness map and the
7 overburden thickness map appears to be very similar,
8 would you agree, to the bedrock contour map?

9 A. Yes, I would. I have an
10 observation here. Now, this may not be relevant, but I
11 will mention it in case it comes out. You will notice
12 the map I originally put up yesterday had some red
13 lines, and there are a couple of minor errors, or I
14 think there are errors, numbers that don't quite jibe,
15 but I only mention them because Mr. Hodgson, I believe,
16 specifically mentioned those ones, but I make the
17 elevation, for example at (MB)OW-3 going from the data
18 or the elevation of bedrock from the data going to the
19 information in the Trow report to be closer to 159.

20 Q. That is H?

21 A. That is (MB)OW-3. I'll just check
22 the number. I may be misreading something, but the
23 one marked as 156 I think should be closer to 159 for
24 (MB)OW-3 and I think HC2-85 from the data in the Trow
25 report I looked at should be 156. It could lead to



1 some re-interpretation of this depression and probably
2 having the 155 maybe coming in.

3 Q. The information you are giving us
4 would suggest that the 155 contour line may be
5 incorrect in its northern line and in fact the 155 may
6 be approximately the depth of the bedrock depression?

7 A. Yes, that seems to look like that,
8 yes. It may not be important, but I thought I would
9 mention it in case your line of argument centres on
10 that.

11 Q. I want to follow that up. To the
12 extent you are correct, the deepest point in the
13 bedrock depression would in fact follow a line from
14 approximately HC5-84 to HC1-85.

15 MR. ESTRIN: Excuse me, but I lent the
16 witness my copy and I would like to look and see what
17 Mr. Hodgson is talking about. Do you have another copy
18 of that?

19 DR. CHARLESWORTH: It might be something
20 like that, and this was quickly done and you can always
21 re-interpret points, but I am suggesting that maybe the
22 155 may extend in a little but not continue as that
23 depression shows, as the depression shown here.

24 MR. HODGSON: Q. What do we now have up
25 on the overhead?



1 DR. CHARLESWORTH: A. That is a sketch I
2 attempted this morning, a possible redrawing of the
3 contours based on those adjusted values if those values
4 prove to be correct, and it's not a major difference,
5 but I'm just noting that.

6 Q. If you are happier with your
7 interpretation than Trow's interpretation, do you want
8 to mark your interpretation?

9 A. I think at this point we can
10 probably -- I would suggest not at this point
11 but I noted it in case it becomes important and didn't
12 want to spring it on you at that point.

13 Q. The minor details of the bedrock
14 topography are not important to me, Dr. Charlesworth,
15 but the broad framework however, is. What I would like
16 you to agree with is that this site basically has a
17 true east-west bedrock depression running through it?

18 A. Yes.

19 Q. And the true south portion of the
20 site in fact sits up on the sides, is I think the word
21 we agreed on last night?

22 A. Yes.

23 Q. And again, looking to the north,
24 when we get off site we see the 165 contour line and
25 the 170 contour line and the sides of this bedrock



1 depression rise sharply again as we move up towards
2 Britannia Road?

3 A. Yes.

4 Q. Then would you agree with me that
5 looking at the overburden thickness map, which you also
6 have up, that because the topography of the site is now
7 relatively uniform in height....

8 A. Yes.

9 Q. What's the word. Elevation?

10 A. Elevation, yes.

11 Q. In elevation. The overburden
12 thickness is an inversion of the bedrock depth and we
13 find the thinnest overburden where we find the
14 shallowest bedrock?

15 A. We happen to have this section up
16 here and it sort of illustrates the point Mr. Hodgson
17 is making. Because the top is relatively flat, as the
18 bedrock drops the thickness of the overburden
19 increases.

20 Q. Thank you. The change in
21 elevation -- sorry, the change in thickness of the
22 surficial units overlying the bedrock, looking at
23 Drawing 13, they go from greater than 26 metres deep at
24 about HC5-84?

25 A. Yes.



1 Q. To 14 metres deep at approximately
2 the Ford farm, HC3-85?

3 A. Yes. There isn't actually a datum
4 point beside 5-84.

5 Q. I was pointing at HC3-85.

6 A. I thought before that you said
7 from 5-84?

8 Q. Just eyeballing it?

9 A. Eyeballing it, yes.

10 Q. Do you accept the eyeballing as it
11 is your evidence?

12 A. Could you give me the eyeball
13 again?

14 Q. I suggested it was deeper than 26
15 metres at that point.

16 A. I would agree with that.

17 Q. And it is 14.6 metres at HC3-85?

18 A. Yes.

19 Q. And 12.2 metres at MB(IN)OW-2,
20 Morrison Beatty's hole across First Line?

21 A. Yes.

22 Q. Taking HC5-84, which is right at
23 that intersection of the L, there is a very sharp rise
24 in the overburden -- sorry, sharp change in the
25 overburden depth between that point of the site, HC5-



1 84, and the true southern corner of the site?

2 A. The way the contours are drawn,
3 the steepest change in gradient appears to be just
4 north of HC2-86. It seems to come up and then level
5 off somewhat.

6 Q. That is fair. The rate of change
7 -- you are saying there is a sharp rate of change
8 between HC5-84 and HC2-86?

9 A. Somewhere along that line.

10 Q. And then a slower rate of change
11 and that is what the contour lines show?

12 A. That is what the contour lines
13 show.

14 Q. Can we work the other way for a
15 moment? From HC5-84 and looking true north, it becomes
16 a lot shallower very quickly as you move up to
17 MB(IN)OW-3?

18 A. Yes.

19 Q. Now, looking true northwest, HC3-
20 84 is 15.3 metres?

21 A. That is correct.

22 Q. Which is roughly comparable to
23 HC3-85 in the southern corner, 14.6 metres?

24 A. That is correct.

25 Q. Looking across to (MB)OW-1, which



1 is on Highway 25, it's at 19.3 metres?

2 A. (MB)OW-1 is 19.3 metres.

3 Q. We have had evidence, Dr.
4 Charlesworth, that the upper till is fairly uniform in
5 depth. Is that fair? There are clearly some
6 variations, but it is fairly uniform in depth.

7 A. It is fairly uniform, yes.

8 Q. To the extent we see a lot of
9 variation in the depth of the overburden materials,
10 that variation comes in the lower till, does it not?

11 A. The major variation comes in the
12 lower till and, as you can see for example, on this
13 cross-section.

14 Q. Could I ask you to turn up your
15 Figure 6 from M-438?

16 A. Yes.

17 Q. First if you would, would you
18 agree with me -- if we can first of all agree -- as you
19 have drafted Figure 6, and I am not being critical and
20 I am using your data and trying to understand and
21 trying to interpret your data, but as I read your data,
22 you have clearly identified the upper granular unit as
23 appearing in exactly six boreholes, HC2-85, Comcor No.
24 2, right nearby it, HC2-86, HC4-85, (MB)OW-4 and
25 GL84-1; would you agree with that?



1 A. Well, I will just check those.

2 Q. HC2-85?

3 A. I am just taking my time and we
4 recorded it -- I should say when you say "our data",
5 it's our interpretation of Trow data.

6 Q. I wish to be fair, your
7 interpretation, six holes?

8 A. We have said it's in 2-85 and we
9 indicated it as being with a question in C-2, we have
10 shown it in 2-86 and have interpreted it in 4-85 and we
11 have interpreted it in (MB)OW-4 and we have interpreted
12 it as being in GL84-1, yes.

13 Q. Can we look first at those six
14 boreholes. Would you agree with me that the deepest
15 section of the upper granular unit that was detected is
16 in borehole HC2-85?

17 A. Yes.

18 Q. Just looking at Figure 6, the
19 number you give is 2.1 metres?

20 A. Yes.

21 Q. In fact that is the place on the
22 site or approximately there where Trow did a pumping
23 test?

24 A. Yes.

25 Q. Would you also agree with me that



1 there is substantial variability to the thickness of
2 the upper granular unit in the six boreholes where you
3 have identified it. We find it, and I don't know how
4 to interpret your interpretation at C-2 and can you
5 tell me what you mean when you say 1.2 or .3?

6 A. There were two horizons there. If
7 you go to Comcor - 2, which is in our Appendix B, and
8 if you look down around 11 metres it says "Cemented
9 silt with fine to very fine sand & some gravel (dry)."

10 Q. Is that the 1.2 metres?

11 A. That's the 1.2 metre unit and we
12 can come back to discuss dry if you like and then just
13 below it it goes back into till, "grey/brown silty clay
14 till with pebbles, evidence of cobbles," and then
15 "wet red silt & very fine sand with coarse sand and
16 gravel," a thin unit, and that is the one we showed at
17 171.2 or possibly .3 of a metre. So, two stratified
18 drifts, if we went back to the log we were talking
19 about earlier this morning.

20 Q. Looking at the data you present on
21 HC2-85 and also remembering the pumping test results,
22 what was found at 2-85 was a granular unit with a
23 hydraulic conductivity which I think in the end we all
24 agreed was approximately 1.2×10^{-2} ?

25 A. Yes.



1 Q. Which is a fairly high hydraulic
2 conductivity?

3 A. Yes.

4 Q. Would you agree from the first
5 description, "Cemented silt with fine to very fine sand
6 & some gravel (dry)" it is going to have less hydraulic
7 conductivity?

8 A. Yes, but the piezometer in that
9 borehole which is above that dry unit was one of the
10 piezometers that Trow used in their pumping test of the
11 upper granular unit and took the data from that as part
12 of their interpretation.

13 So, although it does say dry in there,
14 there was evidence of a connection certainly and it was
15 used by Trow as being an assumed part of the upper
16 granular unit for that purpose.

17 Q. Would you agree that when Trow did
18 that pumping test, they did not have available to them
19 this borehole log?

20 A. Certainly.

21 Q. Would you also agree with me, to
22 go back and answer my question, and I appreciate your
23 comment, but the description "Cemented silt with fine
24 to very fine sand & some gravel" doesn't suggest a
25 material with as high a permeability as sandy gravel,



1 does it?

2 A. Generally no.

3 Q. Below that is .3 of a metre of wet
4 red silt and very fine sand with coarse sand and
5 gravel. How would you interpret from the information
6 presented there the hydraulic conductivity in relation
7 to what was found at HC2-85?

8 A. It is less, but the value they
9 calculated at 2-85 was based on observations in part
10 made at this location.

11 Q. I appreciate that, but I am trying
12 to understand as we go along, the variability of what
13 it is....

14 A. I understand what you are doing,
15 but I think it is important to recognise some of the
16 uncertainties involved here. It's sort of a case of
17 not being able to have it both ways and you can't use
18 this to arrive at a value and then say this doesn't
19 look like it fits that value.

20 Q. It wouldn't occur to me to want to
21 have anything go both ways. HC2-86 is another hole
22 where you clearly identified the upper granular unit?

23 A. Yes.

24 Q. Here we find two-thirds of a metre
25 of sand and gravel suggesting a unit with a



1 permeability in the range of the permeability found at
2 HC2-85?

3 A. Yes.

4 Q. But a very diminished thickness?

5 A. A reduced transmissivity.

6 Q. Interestingly enough, would you
7 agree with me that moving between HC2-85 and HC2-86, we
8 see the upper granular unit appearing to be pinching
9 out in a manner that mimics the bedrock depression?

10 A. Could you say that again? I'm not
11 sure I followed that.

12 Q. The till is thicker over HC2-85
13 than HC2-86?

14 A. Right.

15 Q. So is the upper granular unit?

16 A. Yes, okay. You phrased it
17 differently. It certainly is -- where the overall
18 thickness of the overburden is thickest, the upper
19 granular unit was also thickest, yes.

20 Q. Looking at HC4-85, this is the
21 hole in which Trow found a lot of material in the lower
22 granular unit, and we will come back to that, but in
23 the upper granular unit they found at .32 silty sand
24 gravel?

25 A. Yes.



1 Q. The unit seems to be thinner here?

2 A. Yes.

3 Q. Would you agree with me that a
4 silty sand gravel suggests a material with less
5 permeability than a sandy gravel?

6 A. Yes.

7 Q. Just for completeness, you have
8 interpreted the unit as existing in GL84-1 and would
9 you confirm that when Gartner, Lee bored GL84-1 they
10 did not instrument the hole?

11 A. That is my understanding.

12 Q. Fortunately Morrison Beatty did
13 instrument their hole?

14 A. Yes.

15 Q. With GL84-1, you find 1.3 metres
16 of silty sand, and I am putting a Y on it, but is that
17 improper?

18 A. I would have to look back as I
19 don't remember all the details of the logs, but it's
20 not a major difference.

21 Q. I don't for a minute suggest that
22 you should remember all the details of the logs,
23 notwithstanding that the detailed logs are useful, but
24 it is your interpretation, and I only want to
25 understand it, because silt sand suggests to me and I



1 would ask you if you could confirm, there is less
2 permeability in the unit than would be suggested by
3 sandy gravel at HC2-85?

4 A. It is suggested, yes.

5 Q. At (MB)OW-4 we find a unit at
6 almost the same depth, 1.37 metres -- a unit the same
7 thickness also at the same depth, 1.37 metres, and
8 sandy gravel is suggested, which suggests a higher
9 permeability again?

10 A. In general terms, yes, it is a
11 higher permeability.

12 Q. What you must have been doing, you
13 couldn't put the whole borehole log information on here
14 so you were interpreting from the borehole log
15 information to suggest your interpretation of the
16 variations, were you not, and that was the point of
17 doing this?

18 A. Yes. It's your point about
19 suggesting lower or higher permeabilities, and I'm
20 saying yes it suggests it. If you have a measured
21 value, that is another matter, but yes it suggests it,
22 but these are our simplified interpretations of the
23 description of the unit that could be the upper
24 granular unit at those points.

25 Q. Now, if we could, let me review



1 briefly with you the data base that you have available
2 here. As I count the data you have aggregated just on
3 Figure 6, and I don't mean this critically, but there
4 are boreholes outside the configuration shown on
5 Figure 6.

6 Just looking at the information
7 aggregated on Figure 6, as I count it you have got
8 twenty-four data points or twenty-four boreholes?

9 A. You are probably right, yes.

10 Q. Of those twenty-four boreholes six
11 were not continuously cored and the six not
12 continuously cored were HC3-84 at the top, and it's
13 probably worth marking them with an X.

14 DR. KINGHAM: They are marked.

15 MR. HODGSON: Q. HC3-84, HC6-84,
16 HC4-84, HC5-84, HC7-84 and HC8-84.

17 DR. CHARLESWORTH: A. Yes.

18 Q. So we have six boreholes that were
19 not continuously cored and eighteen that were?

20 A. I would have to take your word on
21 the number.

22 Q. Count will you, because the
23 numbers are important.

24 A. Okay. I make it seventeen. What
25 was your number for continuously cored?



1 Q. I got twenty-four boreholes in
2 total and eighteen continuously cored.

3 A. I have seventeen, but I may have
4 missed one.

5 Q. It wouldn't surprise me to learn
6 that I can't count.

7 A. I still come to seventeen, but
8 maybe I am missing one.

9 Q. Subject to check, let's agree
10 there are seventeen continuously cored?

11 A. Okay.

12 Q. The situation is -- there are
13 twenty-three boreholes, I see, so I have miscounted.

14 MS. CRONK: There are twenty-four.

15 MR. HODGSON: The consensus behind me,
16 and I apologise, but it is that there are twenty-four
17 boreholes and seven that are not continuously cored and
18 that is where I made my mistake.

19 DR. KINGHAM: That is the way the
20 Board read it.

21 MR. HODGSON: That is the reason why
22 lawyers don't give evidence in these proceedings.

23 MR. LANCASTER: They sometimes try
24 though.

25 MR. HODGSON: I can't think of an



1 occasion where that has occurred, Mr. Chairman.

2 Q. Can we agree that there are
3 twenty-four data points?

4 MR. ESTRIN: He had better confirm it
5 because our count is that there are six.

6 DR. CHARLESWORTH: How about we take a
7 break and count them.

8 MR. HODGSON: Could we take a break and
9 get our act together and we can do the counting before
10 we come back?

11 MR. LANCASTER: Including C-3.

12 DR. KINGHAM: If you include C-3, there
13 are seven not cored out of 24.

14 MR. ESTRIN: C-3 on our
15 information....

16 MR. LANCASTER: According to this
17 exhibit.

18 MR. ESTRIN: The dash means it doesn't
19 go deep enough.

20 MR. HODGSON: It says borehole....

21 DR. KINGHAM: Can the witness tell us
22 what the dash under the numbers means?

23 DR. CHARLESWORTH: There isn't data
24 relating to that unit, but it may be continuously
25 cored, but it may not reach that unit.



1 MR. HODGSON: Q. Let's look at Comcor
2 C-3 and the log is in Appendix B and it says drilling
3 method, hollow stem auger, and does that convey any
4 information to you?

5 DR. CHARLESWORTH: A. Let me just find
6 C-3. It also says continuous sampling.

7 MR. McQUAID: So say six and a half.

8 DR. CHARLESWORTH: It also notes
9 continuous sampler at the bottom. It's difficult to
10 tell if they continuously sampled all the way or not.
11 It appears they may have.

12 MR. HODGSON: Q. There is no suggestion
13 they did split spoon sampling?

14 DR. CHARLESWORTH: A. It says CS.

15 Q. Either they continuously sampled
16 or they augured without doing a split spoon and one way
17 they would get some information and the other way they
18 would get none?

19 A. My interpretation was they
20 continuously sampled and the reason it is not marked is
21 it may not go down to the depth of the upper granular
22 unit, which is why we said no data, but it terminates
23 at 174.6.

24 MR. HODGSON: Could we take our break
25 and I would like the witness to also check during the



1 break. C-3 isn't in fact very deep, but I believe it
2 does go down to the upper granular unit.

3 MR. LANCASTER: Before we do so, you
4 have that letter, 494, and do you wish to leave that
5 in?

6 MR. HODGSON: I do and I will have it
7 copied over the break.

8 MR. LANCASTER: Mr. Estrin has No. 155
9 of the Board. If you want to use it, you may.

10 MR. ESTRIN: I don't need it.

11 MR. LANCASTER: Just leave it here.

12 --- Recess

13 MR. LANCASTER: Please be seated.

14 MR. HODGSON: Q. Dr. Charlesworth, when
15 we left off we were engaged in a counting exercise.
16 Did you have an opportunity to decide how many data
17 points we have on Figure 6?

18 DR. CHARLESWORTH: A. Yes. It came to
19 twenty-four and seven not continuously cored.

20 Q. The seven not continuously cored
21 were HC3-84, HC6-84, 5-84, 4-84, 8-84, 7-84 and what
22 other hole was not continuously cored?

23 A. I don't believe this. I have six
24 highlighted and seven I counted. Maybe it's six not
25 continuously bored.



1 Q. Subject to check, can we agree
2 there are six not continuously cored?

3 A. I will agree.

4 Q. If you decide later we have made a
5 mistake, I would like you to correct it for the record.

6 A. It looks like it's six.

7 MR. LANCASTER: May I ask what may be a
8 silly question, but if there are six not continuously
9 cored, is that the same as no data, or is that
10 something else?

11 MR. HODGSON: Mr. Chairman, I was
12 actually going to come back to that subject later, but
13 this would be as convenient a time as any to in fact
14 address exactly that point.

15 Q. Dr. Charlesworth, over the break I
16 gave you a copy of my cross-section RH and in fact
17 would you agree with me that this cross-section RH is
18 the preliminary preliminary draft of your cross-
19 sections, the preliminary cross-sections which became
20 M-158 and the final versions are incorporated into your
21 Exhibit M-438 and this in fact is a copy or a document
22 you gave to Mr. Sobanski in our office?

23 A. That appears to be correct, yes.

24 Q. Would you agree with me that on
25 this copy of RH, borehole 6-84, as a result of your



1 discussions with Mr. Sobanski or further research, I
2 don't know which, but you in fact changed your
3 interpretation of where the upper granular unit is in
4 that hole?

5 A. Yes. We dropped the line down
6 slightly and that does come to the point about no data
7 you raise, Mr. Chairman.

8 Q. To help the Chairman, Dr.
9 Charlesworth, could I take you to H-39A, borehole
10 HC6-84, and would you also put up for everyone's
11 edification a copy of your cross-section RH, the
12 final version?

13 DR. KINGHAM: When you refer to RH, you
14 mean the original M-158?

15 MR. HODGSON: Q. Is this not RH? Do you
16 not have RH in this final series?

17 DR. CHARLESWORTH: A. We do.

18 Q. RH from Exhibit M-438, which would
19 be M-438-D5, which says it is cross-section RH-RH.
20 Could you point out for the Board please,
21 Dr. Charlesworth, where HC6-84 is?

22 A. On the cross-section?

23 Q. On the cross-section.

24 A. This point here.

25 Q. Would you -- perhaps you could



1 take, and I don't want to do it in red, but could you
2 take a pencil and mark on HC6-84 where you originally
3 interpreted the upper granular unit?

4 A. What did you want me to mark?

5 Q. You can look at your original RH
6 draft?

7 A. And mark it.

8 Q. Just eyeball it. Nothing turns on
9 this other than to illustrate perhaps the usefulness or
10 lack of usefulness of the borehole data?

11 A. Roughly something like that.

12 DR. KINGHAM: Can you tell us so we
13 know, are these old exhibits, cross-sections from M-
14 158, are they overtaken by this and do we disregard
15 these for the time being?

16 DR. CHARLESWORTH: Yes, the M-438 series
17 are the final version.

18 MR. HODGSON: To answer your question I
19 am going to refer in my cross-examination to at least
20 one of those cross-sections to the original M-158
21 cross-sections.

22 DR. CHARLESWORTH: A. It was slightly
23 above.

24 Q. Could you assist me and explain to
25 the Board, HC6-84 was a borehole that was not



1 continuously cored?

2 A. That is correct.

3 Q. What you get in a continuously
4 cored borehole is a continuous core, a piece of coring
5 of whatever depth or whatever diameter your coring
6 material is, of four or five inches?

7 A. Correct.

8 Q. If the hole was 30 metres deep,
9 you would have 30 metres of continuously cored
10 material?

11 A. That is correct.

12 Q. What you can do is lay it out on a
13 table and look at it all at once?

14 A. Yes. It's similar to the cores,
15 and taken with a different technique, but similar to
16 the rock cores we were looking at from the shale, but
17 it's in the till and the surficial deposits.

18 Q. Until approximately 1983 or 1984,
19 continuous coring was not done in Ontario, was it?

20 A. That is correct. I would say for
21 example at the time these '84 boreholes were being
22 done, some of it was being done but it was not a
23 standard technique.

24 Q. It had to do with the availability
25 of the drilling rigs from the drillers?



1 A. I think there were two aspects,
2 and one was that the drillers were not equipped and one
3 company did get the equipment. At the same time,
4 there was more emphasis put on the kind of
5 uncertainties that can arise from split spoon in
6 landfill hearings and stuff. So, there was a move then
7 to go to the continuous sampling so you could avoid the
8 kind of discussion we are embarking on, I feel.

9 Q. We won't have a long discussion on
10 it, and I'm not trying to criticise you for anything,
11 but I just want your evidence to assist the Board in
12 understanding what data we have from HC6-84 and also,
13 and you will want to emphasize this, but what data we
14 don't have.

15 When HC6-84 was done, the drilling rig
16 did not continuously core the hole; correct?

17 A. That is correct.

18 Q. If we look at page 1 of HC6-84,
19 would you agree that what happened is the drilling rig
20 drilled down to approximately 1.5 metres?

21 A. Yes.

22 Q. And at that point the drill was
23 withdrawn?

24 A. That is correct.

25 Q. And a sample was taken by a



1 technique known as a split spoon sample?

2 A. That is correct.

3 Q. At 1.5 metres you lower into the
4 hole a device called a split spoon?

5 A. Correct.

6 Q. What does a split spoon look like?
7 I take it it's not something you eat yoghurt with?

8 A. Not. It's a cylindrical device
9 that you can drive in to collect the soil.

10 Q. How big is it?

11 A. You collect a sample eighteen
12 inches long.

13 Q. You lower your split spoon down
14 into the hole?

15 A. Yes, and then drive it with a
16 weight usually.

17 Q. And you drive it with a weight
18 until you have it full of material and you get eighteen
19 inches of material?

20 A. Correct.

21 Q. In effect what it is is a
22 technique for coring continuously for eighteen inches?

23 A. Yes.

24 Q. You withdraw it and bring out
25 eighteen inches of material?



1 A. And examine that.

2 Q. And examine it?

3 A. Yes.

4 Q. Would you agree with me that
5 looking at HC6-84, in the righthand column, we can see
6 from one and a half to two metres that that grey
7 checking mark in the margin, that cross-hatching
8 indicates that that was a split spoon sample taken over
9 that segment of the borehole?

10 A. Correct.

11 Q. There is a circle on the page
12 parallel with where the split spoon sample was taken
13 under N value (ASTM) D something, blah, blah, blah, and
14 how would you as a hydrogeologist interpret that
15 circle?

16 A. Where it plots on the graph, I
17 think those are the blow counts and it gives you some
18 indication of the texture of the material.

19 Q. Be more definitive for the Board.
20 What do you mean by blow counts and what is actually
21 happening?

22 A. The number of times the spoon has
23 to be hit to be driven in to collect the full length of
24 the sample and so the harder the tighter the material,
25 usually the more blows you have to count and with loose



1 material you will have less blows.

2 Q. Can we interpret from this
3 borehole that they drilled down -- the first split
4 spoon sample ended at the 2 metre mark and they drilled
5 down from the 2 metre mark to the 3 metre mark and then
6 took another split spoon down to the 3.1/2 metre mark?

7 A. That is correct.

8 Q. I guess what you do is you drill a
9 metre and then take eighteen inches of sample?

10 A. Yes, you can drill different
11 distances, and the standard in the past has been to go
12 either every five feet, two and a half feet, ten feet.

13 Q. What did Trow do?

14 A. They appear to have drilled for a
15 metre and then taken a split spoon sample.

16 Q. Would you agree they sampled
17 something on the order, or continuously cored one-third
18 of the borehole?

19 A. In this particular hole it appears
20 to be about one-third which has been sampled and two-
21 thirds has not been sampled.

22 Q. For my assistance and for the
23 Board, on HC6-84, let's turn to page 2. At what depth
24 did you originally describe there being -- at what
25 depth did you originally interpret that there was an



1 upper granular unit on that figure RH which I gave you?

2 A. I don't have the notes of the
3 original interpretation, but it's in the order of....

4 Q. Let's do it this way. Let's look
5 at M-438-D5 and scale off how deep you have got the
6 upper granular unit and where you have got the upper
7 granular unit in relation to the surface of the earth?

8 A. On this or the original?

9 Q. Let's work with your document, Dr.
10 Charlesworth, and I don't think we need to use the old
11 one.

12 A. We are showing it here at about 10
13 metres. Now, this is by way of clarification for the
14 Board, but these lines, particularly in these kind of
15 situations where we have question marks, I was going to
16 say they are not carved in stone and that's not
17 appropriate, but there is some flexibility. They are
18 just drawn in generally.

19 MR. LANCASTER: They aren't carved in
20 bedrock.

21 DR. CHARLESWORTH: Yes. What did I
22 say, ten metres?

23 MR. HODGSON: Q. You have interpreted
24 the upper granular unit at 10 metres.

25 DR. CHARLESWORTH: A. We have said, and



1 we have drawn question marks beside it and said it is
2 conceivable that the upper granular unit could be at
3 that location somewhere just below 10 metres depth.

4 Q. I'm not questioning the fairness
5 of your interpretation, but I am trying to nail down
6 the details?

7 A. I realize that, but I think it is
8 important for the Board to understand my perspective of
9 how we approached it.

10 Q. And I want that evidence. So we
11 take our pens and where on this borehole, where could
12 we draw a set of parallel lines to define where you
13 interpreted the upper granular unit?

14 A. I think it would be -- before I
15 answer your question, I will caution you that there is
16 no clearly defined point where you can draw those two
17 lines and that is why we have the question marks.

18 Q. But you have drawn....

19 A. If I may?

20 MR. LANCASTER: Yes, proceed.

21 DR. CHARLESWORTH: We have drawn a line
22 with question marks and if you look at the borehole log
23 we are doing is interpreting where it could be, given
24 the lack of data. If you go down page 1 of the log for
25 HC6-84 at around 10 metres it says:



1 "SILTY CLAY TILL: Grey, wet, very
2 stiff,"

3 and then it says:

4 "... rudimentary bedding, may be
5 reworked lacustrine material."

6 And that flags in our mind that is at
7 the elevation where the upper granular unit may be
8 roughly and there is a notice, and we did not attach
9 too much importance to the description, but it was
10 something slightly different and then we looked at the
11 legend of where the samples are actually collected and
12 we see that in fact the bottom of the previous sample
13 was 9.6 metres and the top of the next sample was 10.6
14 something, say 10.6. So, we have about a metre of
15 depth there without a split spoon sample at about an
16 elevation where one may conceivably have the upper
17 granular unit, and those are the lines we have drawn in
18 with question marks.

19 Q. Just to be clear, between 9.6 and
20 10.6, we have one metre of material that wasn't
21 continuously sampled and if there is an upper granular
22 unit, the maximum depth it could be is one metre?

23 A. We have a stretch there that
24 wasn't sampled.

25 Q. Just for my understanding, would



1 you agree with me that in the old method before
2 continuous coring, when you were split spoon sampling,
3 you usually have a geologist or a hydrogeologist in the
4 field with the drilling rig and both the driller and
5 the hydrogeologist, in addition to split spoon
6 sampling, would pay attention to how the drilling rig
7 was handling the materials it was coring or drilling
8 through?

9 A. A good driller and a good
10 geologist or geological technician on site will make
11 those observations, yes.

12 Q. If, for example, they drilled
13 through a unit that was very soft and very permeable
14 and very wet, is that something that the drill rig
15 itself would signal to the driller and the
16 hydrogeologist?

17 A. One would hope and one would
18 expect if there was a major difference, that they would
19 detect it. However, Mr. Chairman, I think that it is
20 now recognised that that is by no means a foolproof
21 method, which is why we have gone to the process of
22 continuous coring, just to remove the kind of
23 uncertainty that arises from that approach.

24 Q. I appreciate that, Dr.
25 Charlesworth. What I am trying to understand is



1 No. 1, you are sampling about one-third of the hole
2 with your split spoon?

3 A. Yes.

4 Q. No. 2, an experienced driller and
5 an experienced hydrogeologist in the field also have
6 some information between their split spoon samples from
7 the behaviour of the drill rig itself?

8 A. They have some information and of
9 course that depends upon how experienced the person is
10 who is doing the work.

11 Q. What they are doing in the field
12 is in fact drilling and looking for more permeable
13 zones, are they not? That is the nature of the
14 enterprise?

15 A. One would hope that that is what
16 they were doing, Mr. Chairman.

17 Q. Just for completeness, would you
18 show us this borehole where you have interpreted the
19 upper granular unit -- the lower granular unit?

20 A. The lower granular unit we say
21 could be the unit from about 14 metres, and let me see
22 on here, 6-84. It's the bottom part of the borehole
23 and from 14 metres it goes into something described as
24 silt and they have stopped describing it as till and
25 say:



1 "SILT: Reddish brown, small quantities
2 of sand and shale fragments, saturated,
3 very still, stratified."

4 So a change in the nature of the
5 material there and then the borehole terminates within
6 that unit and not of course -- you must look at all of
7 this in relationship to the other boreholes and the
8 only information we had when we were drawing this was
9 to say that there is a change which starts here and the
10 borehole finishes here and then you look at adjoining
11 boreholes to see if there is any degree of continuity.
12 It's the same kind of approach Trow took in the drawing
13 of their cross-sections.

14 Q. I am not being critical, but I am
15 trying to interpret this?

16 A. I appreciate that, Mr. Hodgson.

17 Q. Just for completeness, just before
18 you interpreted the upper granular unit at 14 metres,
19 there was a split spoon sample taken and it doesn't
20 appear to be 18 inches long. Is that fair? It's a
21 shorter sample than the other samples drawn on here?

22 A. Yes.

23 Q. Would you interpret for the Board
24 please the fact that the circle is over on the
25 righthand side and it has typed behind it 110 over 6



1 inches?

2 A. They are into material that is
3 harder, denser or more competent, and it makes it more
4 difficult for them to drive the split spoon -- in fact
5 they have only driven the split spoon -- they have had
6 110 blows and have driven it 6 inches. I don't know
7 how far, but it's 110 blows to drive it 6 inches.

8 Q. If you look at the circle at the
9 top, how far did they drive it with what appears --
10 that looks like 25 or 30 blows?

11 A. I assume that is the eighteen
12 inches.

13 Q. When they took a split spoon
14 sample at the eleventh metre, 25 blows drove it 18
15 inches and at 14 metres, 110 blows drove it 6 inches?

16 A. Yes.

17 Q. So we are dealing with a lot
18 harder material?

19 A. Yes.

20 Q. Not only could that be detected
21 with the split spoon sampler, but you would agree that
22 that would be something that would be detected by the
23 driller who is operating his rig?

24 A. Yes, and then for the next sample
25 they have dropped back down to a much less number of



1 blows.

2 Q. You would agree that where we have
3 holes that weren't continuously cored, we have less
4 information, but we are not exactly in a position where
5 we have none?

6 A. Obviously we are not in the
7 position of having no information. We have less
8 information, and if you are looking for what may be
9 important, but not necessarily major features in terms
10 of their depth or their change in characteristics, then
11 you may miss them.

12 Q. But we do have some information
13 from those holes?

14 A. We have some information, yes, Mr.
15 Chairman.

16 Q. Could we then go back to Exhibit -
17 - to your Figure 6 and compare it with the two figures
18 for the bedrock contour and overburden thickness map we
19 have up. To go back, you have agreed that you have
20 interpreted the upper granular unit to have been found
21 in six boreholes?

22 A. We have said that from the data
23 presented, the data we had to work with, yes, it is
24 definitely present in six boreholes and as definite as
25 one can ever be in the circumstances.



1 Q. I understand. That is six
2 boreholes out of a total of 24 data points?

3 A. Yes, that is correct where we have
4 said it is definitely there.

5 Q. Of those 24 data points, 18 are
6 continuously cored?

7 A. Yes.

8 Q. Just looking at the 6, (MB)OW-4
9 and CC-2, those were the detailed borehole logs that
10 you gave to Mr. Sobanski last June and it's found in
11 those two holes?

12 A. Yes.

13 Q. That is important information?

14 A. Yes.

15 Q. And GL84-1 is a Gartner, Lee
16 borehole log that I think was also found in Trow's
17 Exhibit H-39?

18 A. That is correct.

19 Q. Unfortunately that hole was not
20 instrumented?

21 A. It was not instrumented.

22 Q. If we look at just Trow's holes,
23 Trow found it in three continuously cored holes, HC2-
24 85, HC2-86 and HC4-85.

25 A. It's in there and appears to be a



1 clearly identified unit and in our interpretation we
2 used their pump test connection between some of those
3 holes to help infer the extent of the unit.

4 Q. Would you agree with me, Dr.
5 Charlesworth, that one of the reasons we don't know a
6 lot about this upper granular unit is that it wasn't in
7 found in very many places on the site?

8 A. I think, Mr. Chairman, that I
9 would phrase that differently. On our map, Figure 6,
10 we have shown maximum possible extent and we have
11 discussed that and said that is the absolute maximum.
12 What I think is interesting is if you look at Figure 6,
13 look at the continuously holes where you can say
14 conclusively that it is absent and as opposed to where
15 there is what may be a sort of lateral extent, if it is
16 thinning out. If you look at that, you can see 3-86
17 where there is none, and Trow didn't find anything that
18 looked like the upper granular unit. In 6-85 at the
19 bottom, it wasn't present. In 1-86 over to the
20 righthand side of the figure and the Gartner, Lee 84-4.
21 Those are four boreholes where you are saying that it
22 is not present, or five boreholes, because there is 5-
23 85. So, we are saying what have we proven in terms of
24 given that there is some uncertainty about the extent
25 of it or if you believe there is some uncertainty about



1 the extent of the unit, where with good holes,
2 continuous holes, have you proven it -- have you
3 proven it not to be there? I did this very quickly at
4 the coffee break, but I would say there, pointing to 3-
5 86, 6-85, 1-86, Gartner, Lee No. 4, 5-85. I may have
6 missed something, but if you are approaching it from
7 the point of view of saying let's show where it is not,
8 hard data that is quite spread out and which does not
9 give a great coverage from the landfill and just while
10 I'm on this topic, if Mr. Hodgson will bear with me,
11 because I think it will help the Board understand it,
12 it might be interesting to look at 2-86. 2-86 is a
13 borehole where Trow have acknowledged the upper
14 granular unit is present because when they pumped here
15 they got an effect there and if you turn to 2-86 in
16 the borehole log for 2-86 in the appendix, and if you
17 turn to the second page of that, it starts off at silt
18 till, very hard, stony green red silty till and then
19 around 171.25, that is where they describe:

20 "Sandy Gravel - Fining upwards
21 from poorly Sorted Angular Fine Gravel
22 to Coarse Sand and Some Silt."

23 Extending from 171.25 to 170.49, and
24 that is less than a metre, which was our interpretation
25 of where the upper granular unit is and I think that is



1 also Trow's interpretation.

2 To continue the discussion about split
3 spoons, it is quite conceivable that if that hole had
4 been split-spoon sampled rather than continuously
5 sampled, the unit could have been missed, but in fact
6 we know it's there because we have continuous sampling.

7 Q. Now, could I have an answer to my
8 question?

9 A. Maybe you could repeat the
10 question because I thought I had answered it.

11 Q. The question was, isn't one of the
12 reasons why we don't have much information about the
13 upper granular unit the fact that we don't find it in
14 very many places?

15 A. One of the reasons we don't have
16 much information....

17 Q. You have interpreted it can
18 definitely be found in only six of eighteen
19 continuously cored holes, and bear with me for a
20 second, and wouldn't you agree that we can't assume
21 simply because there are six split-spoon holes, that it
22 was missed in all six holes, can we? If it was only
23 found in one-third of the continuously cored holes, we
24 can't assume it is present in all the split-spoon
25 holes?



1 A. No, you can't assume that.

2 Q. So it would be safe to assume that
3 it is absent in some of the split-spoon holes?

4 A. One could assume that the
5 likelihood is that it is absent in some of them and you
6 can't count on that definitely. If I can just continue
7 with your question, that is what these two lines show.
8 We are not saying that is where it is, but we are
9 saying that is the maximum extent with question marks
10 even in that case.

11 Q. Can we look around the site for a
12 minute. You were kind enough to point out for the
13 Board places where it is clearly shown that it isn't,
14 but just translating that information you have given to
15 the overburden thickness map and also the bedrock
16 contour map, you would agree that the unit appears not
17 to extend off-site in a true easterly directly?

18 A. I would say that it appears not to
19 extend off site? Yes, the most definitive number of
20 holes showing its absence is in the easterly -- true
21 easterly corner.

22 Q. Where we find the unit in fact or
23 where you say we have definitively found the unit is in
24 fact sitting right over the top of that bedrock
25 depression, is it not?



1 A. No. Just let me orient myself.
2 I would say it's straddling -- I would say for example
3 it is absent in the bedrock depression at 3-86 and
4 located over the depression here.

5 Q. We need this for the record.
6 It's located over the bedrock depression and you were
7 pointing at HC2-85 and could you indicate where you are
8 pointing when giving your evidence?

9 A. I am pointing at 2-85 and it's
10 absent at 3-86, which is over the bedrock depression
11 and it is present at 2-86, which I would say has come
12 out of the bedrock valley and we are up on the flank
13 there, and it is present at 4-85, which is probably in
14 this little blip in the bedrock valley. So, I wouldn't
15 agree with the general statement that you made.

16 Q. You don't find it sitting up on
17 the side of the bedrock depression, do you?

18 A. I would say 2-86 is on the side of
19 the bedrock depression.

20 Q. And that's as far as it extends,
21 as far as we know?

22 A. We have conclusively shown it --
23 Trow has conclusively shown it to extend in this
24 instance to the upper side of the bedrock depression at
25 2-86 and has shown it not to be present, although there



1 was a minor blip in the nature of the material, but we
2 will assume that it is not present as a significant
3 horizon at 6-85. Somewhere across this upper part of
4 the bedrock valley, it appears to thin out if you are
5 going in a true south direction, but it certainly is
6 present outside the bedrock valley.

7 Q. Let's look at where else it is
8 present. It is present at (MB)OW-4 and GL84-4
9 according to your interpretation?

10 A. Yes.

11 Q. At reasonable thicknesses, 1.3 and
12 1.37?

13 A. Yes.

14 Q. It would appear then that if the
15 upper granular unit extends off site, it extends off
16 site in a true westerly direction?

17 A. Well, I think we don't know.

18 Q. That is the evidence we have.

19 MR. ESTRIN: Let him tell you what the
20 evidence is.

21 DR. CHARLESWORTH: I would say it could
22 extend off-site in a true westerly direction and it
23 could extend off-site in a nominal westerly direction.

24 MR. HODGSON: Q. We can come back to
25 that. At any rate, would you agree with me -- let's go



1 back around the site. Do you have a copy of H-39
2 present?

3 A. H-39?

4 Q. Exhibit H-39, page 44?

5 A. Yes.

6 Q. Let's read for a minute together
7 the last paragraph on page 44:

8 "Pumping test No. 2 was carried out in
9 March, 1986. The test well...."

10 that was near 2-85?

11 A. Yes.

12 Q. "The test well was pumped for
13 49 hours in order to examine boundary
14 conditions. Pumping test results from
15 the pumped well and nearby observation
16 wells indicated the presence of a low
17 permeable boundary near the pumping
18 well. By using an Image Well
19 Analysis"

20 Is that a standard technique?

21 A. It is.

22 Q. "...as outlined in the United
23 States Department of the Interior
24 'Ground Water Manual' the distance to
25 and direction of this boundary was



1 estimated to be 30 m to the east of
2 Pumping Well No. 2...."

3 and can you show us where 30 metres to the east of
4 pumping well No. 2 is?

5 A. Over here somewhere.

6 Q. In the buffer?

7 A. Yes.

8 Q. Of the proposed landfill?

9 A. Yes.

10 Q. "It was noted that the trans-
11 missivity of the unit decreased with
12 increasing distance from the pumping
13 well. This is caused by decreasing
14 thickness of the Upper Granular Unit
15 beyond the pumping well."

16 Would you agree with that?

17 A. Yes.

18 Q. So, what Trow detected in the
19 pumping test was a boundary condition to the east of
20 the pumping well and, in fact, would you not agree from
21 your own document, Figure 6, there isn't much evidence
22 that the upper granular unit extends off-site in an
23 east or north-easterly direction?

24 A. Yes. That is one of the reasons
25 why we shaded this. I looked at the pump test



1 analysis and there is an indication of boundary
2 conditions and it may be -- it is difficult from the
3 data to pin it down, but I can accept that that data
4 suggested a boundary, certainly, and it's not
5 conclusive and that's one reason why we haven't made a
6 case for extending it, although there is some
7 indication of the unit there. The boundary may be
8 thinning and the aquifer, if there is an aquifer in
9 that area, it may thin and widen out again.

10 Q. The evidence would suggest there
11 isn't much -- the evidence suggests that the unit does
12 not extend off-site to the north, would you not agree?

13 It's not there in HC3-86 and at least
14 there is some evidence it is not present in HC3-84?

15 A. It comes into the question mark
16 situation again.

17 Q. Now, let's look for a minute at
18 the southerly area. It's not present in HC6-85 and if
19 there is evidence it's in HC3-85, it is very, very
20 small at that point?

21 A. Yes.

22 Q. If there is evidence it is in
23 (MB)OW-2, it has become very small as well?

24 A. The nature of the material has
25 changed and it is about .2 of a metre here and .2 of a



1 metre here.

2 Q. 20 centimetres?

3 A. Yes, that's right.

4 Q. If it's there at all?

5 A. If it's there, and the evidence
6 suggests it's only thin.

7 Q. Just from the evidence from your
8 document, would you not agree that the only substantial
9 evidence of this extending off-site is it is extending
10 off-site perhaps in a westerly direction?

11 A. My concern with this is what we
12 really need, Mr. Chairman, is the evidence that it is
13 not extending off-site. I would agree there is a
14 question mark about this zone here, what really happens
15 (indicating) and we sort of don't know what happens
16 around here (indicating) and 5-84 is another one of
17 these boreholes that falls into -- whether it is
18 between the split-spoon samples or not, and it's
19 unfortunate because it is quite a critical location.

20 My point is that I have doubts, I have
21 concerns about how extensive it is. It may not extend
22 off site, but I don't think the case is proven.

23 Q. Dr. Charlesworth, since you have
24 concerns about where the upper granular unit is, would
25 you propose to the Board a drilling program to identify



1 the upper granular unit from your perspective? Where
2 would you drill to satisfy yourself as to where this
3 upper granular unit is or is not and perhaps if you
4 wouldn't mind using your own overhead, perhaps you
5 could put an X on the points on that overhead where you
6 say it would be appropriate to develop further
7 information?

8 A. I had already done this, and this
9 is basically the same. I will take this out for the
10 moment, but it is the outline of the site and the blue
11 dots, if I can move it up a little, the blue dots I
12 hope are the existing cored holes and those are the
13 Comcor holes which are also continuously cored.

14 MS. CRONK: "Those"?

15 DR. CHARLESWORTH: The open circles.
16 The blue dots are continuously sampled existing holes
17 and the red dots are what I think is the kind of
18 program that would be needed to answer my concerns
19 about this. I have one here, located beside 5-84,
20 because I think quite a lot hinges around it and there
21 is quite a gap, quite a space, and ignore this red dot,
22 but there is quite a space in here and this is the
23 area....

24 MR. HODGSON: Q. The area in here is
25 the area around the existing 5-84?



1 DR. CHARLESWORTH: A. Around 5-84 and
2 we have this questionable data from 5-84 and we have a
3 big gap here. I would think to satisfy my concerns,
4 certainly one should go back with a continuous hole
5 down to the rock at that location.

6 Q. Would you mind, if you have a pen
7 that would mark that, would you number your proposed
8 holes so we can reference them by number and the
9 transcript may be clearer?

10 MR. ESTRIN: Perhaps we could mark this
11 as an exhibit so we know what we are talking about.

12 MR. LANCASTER: Yes.

13 This is H-495.

14 --- EXHIBIT NO.H-495: Overhead with markings
15 made by Dr.Charlesworth

16 MR. HODGSON: We are creeping up to the
17 half millennium.

18 DR. CHARLESWORTH: That would be my No.
19 1 hole. I would then want to focus on the area of
20 First Line and this question of whether the unit
21 extends over in that direction, and I would propose --
22 I am trying to think of the order, I would have two
23 holes -- three holes, but I would start with two, so I
24 would go 2, 3 and then come back and sort of infill
25 with No. 4, but continuously sampled boreholes.

MR. HODGSON: Q. And were you



1 suggesting you would drill 2 and 3 and look at what you
2 got and then decide to do No. 4 or are you just
3 indicating the order in which you drill?

4 DR. CHARLESWORTH: A. That is the order
5 I would drill. I think 4 -- that is the order I would
6 drill in and I would recommend you drill all of them,
7 and my technique here, or my approach -- well, I would
8 continuously sample and drill into the rock and I
9 wouldn't at this stage try to install piezometers
10 immediately, and that is another topic we can come to,
11 but for future monitoring, et cetera, I would install a
12 piezometer in the rock and I would then go away and
13 look at all the data and analyze the cores that have
14 come in before I went back and actually installed the
15 piezometers in the surficial deposits.

16 Then, I think there is still uncertainty
17 in this area to the north. We do have a domestic well
18 up in that area, so as we saw, we have -- we are
19 lacking data here and there is a domestic well here and
20 we know that the surficial deposit is not at 3-86, so I
21 would put a hole along the local convention north of
22 the site.

23 Q. Just so I understand your
24 evidence, you are not assuming that the domestic well
25 that's on site will continue to be used for domestic



1 purposes while landfilling is taking place?

2 A. No, but I feel the existence of
3 the domestic well raises questions about what is
4 happening in the groundwater system. That combined
5 with filling the gap. This location could very well
6 become a future monitoring location. Those would be my
7 first order of priority.

8 Q. That evidence is given in relation
9 to holes 1 through 5 on M-495?

10 A. Yes. Then I would address the
11 area or the areas of uncertainty located between 5-84
12 and 4-84, which were not continuously sampled. Some of
13 these holes I should have said also relate to the lower
14 granular unit as well, and I am trying to get a handle
15 on both units so if I was up at 5, I would say then 6,
16 7 and 8, but there is nothing magical about that order.
17 I think that is the kind of program that I would like
18 to see carried out at the site in order to answer my
19 concerns.

20 Q. All right. Could we then put that
21 document aside, and I would like to come back to it,
22 but I would like to take you to the lower granular unit
23 and this is your Figure 8.

24 First of all, would you agree with me
25 that perhaps we should count again?



1 A. I anticipated this.

2 Q. Let's agree we have twenty-four
3 data points?

4 A. Yes.

5 Q. We can assume the photocopier got
6 something right?

7 A. I think the photocopier got most
8 things right.

9 Q. And we still have eighteen
10 continuously cored holes, so we have nailed down. So,
11 for the record, let's indicate that you are
12 interpreting the lower granular unit at HC1-85?

13 A. Yes.

14 Q. Comcor 3 and is that a yes or a
15 no?

16 A. It's not deep enough.

17 Q. You are not interpreting it?

18 A. It does not extend deep enough and
19 probably does not even extend to the upper granular
20 unit, let alone the lower.

21 Q. GL84-1?

22 A. Yes.

23 Q. (MB) OW-4?

24 A. Yes.

25 Q. HC3-86?



Nethercut & Co. Ltd.

Toronto, Ontario

21242 .

Rowe, Charlesworth,
cr ex (Hodgson)

1	A.	Yes.
2	Q.	HC6-84?
3	A.	Yes.
4	Q.	C-2?
5	A.	Yes.
6	Q.	(MB) OW-3?
7	A.	Yes.
8	Q.	HC2-85?
9	A.	Yes.
10	Q.	HC4-85?
11	A.	Yes.
12	Q.	HC5-85?
13	A.	Yes.
14	Q.	HC6-85?
15	A.	Yes.
16	Q.	And GL84-4?
17	A.	Yes.
18	Q.	I make that to be twelve
19		identifications?
20	A.	Yes, so do I.
21	Q.	Out of a total of twenty-four data
22		points?
23	A.	Yes.
24	Q.	Of the twelve, you identified it
25		in one split spoon hole, 6-84?



1 A. I have lost 6-84 for the moment.

2 Q. 6-84 is almost in the middle of
3 the site, in the fill area?

4 A. Yes.

5 Q. In fact, to the extent, and I know
6 this is very crude, but to the extent that both you and
7 Trow have modelled the site making the assumption that
8 the lower granular unit is two metres deep, there is
9 less chance of missing the lower granular unit with a
10 split spoon hole than missing the upper granular unit?

11 A. In the areas where it is thick,
12 yes, but it may well thin out, of course.

13 Q. That is exactly what I wanted to
14 come to next. Let's look first at where it is thick.
15 It's thick at HC4-85, would you not agree? That is
16 where pumping well No. 1 was installed?

17 A. Yes.

18 Q. There it is 4.84 metres deep?

19 A. Yes.

20 Q. And it's thick at Comcor 2, 3.3
21 metres thick?

22 A. Yes.

23 Q. It's thick at HC3-86, 2.89 meters?

24 A. Correct.

25 Q. Would you agree with me, just



1 looking at those three boreholes and the thickness of
2 the unit in those boreholes, that those boreholes are
3 at or very near the deepest areas of the site from the
4 point of view of bedrock?

5 A. It was 4-85, 2-85 and C-2.

6 Q. 4-85, C-2 and 3-86?

7 A. Yes. 4-85 is this peculiar --
8 has this peculiar little depression in the bedrock
9 surface, but yes.

10 Q. Dr. Charlesworth, at about 3:00
11 a.m. this morning I carried out a mathematical exercise
12 which I am sure will be almost as faulty as all my
13 others. Could I ask you to look at HC4-85 and it's
14 4.84 metres deep?

15 A. Thick.

16 Q. Thick. All right. Do I take it
17 the number 170.68 is the upper elevation of that unit?

18 A. I believe so, yes.

19 Q. Would you agree that even when a
20 lawyer subtracts that, what you get is the lower
21 elevation of the unit?

22 A. Yes, I hope so.

23 Q. If you take 4.84 from 170.68, and
24 if you take the subject to check, it gives a lower
25 elevation of the lower granular unit at that point of



1 165.86?

2 A. That sounds to be correct.

3 Q. This is purely a mathematical
4 exercise. At Comcor C-2, it's 3.3 metres deep and the
5 upper elevation is 166.69, which gives a lower
6 elevation of 163.39?

7 A. That sounds correct.

8 Q. At HC3-86, the upper elevation is
9 167.15; subtract 2.89 metres of thickness and you get
10 an elevation of 164.26?

11 A. Yes.

12 Q. Now, would you go to the bedrock
13 drawing, Drawing No. 12, and compare the elevations of
14 the deepest part of the lower granular unit in those
15 three boreholes with the 165 metre contour line in the
16 bedrock?

17 A. That was 4-85, C-2 and 3-86?

18 Q. Yes.

19 A. You are asking me to compare them?

20 Q. Let's look at 4-85.

21 A. I didn't write them down.

22 Q. I can give them to you again.

23 Now, perhaps it's worthwhile writing them on Drawing
24 12, but at 4-85, according to the data you are
25 presenting, and I am not questioning your data...



1 A. I appreciate that.

2 Q. You are putting the elevation at
3 the bottom of the lower granular unit at 165.86?

4 A. Yes.

5 Q. At Comcor 2, and you will have to
6 put it on because Trow didn't have that data, but it's
7 almost half-way between HC3-86 and HC2-86?

8 A. Or between 2-85, I apologise.

9 Q. Yes.

10 A. What was the elevation?

11 Q. 163.39.

12 A. And for 3-86?

13 Q. For 3-86 it was 164.26.

14 A. Okay. I will just drop those on
15 the map here. HC3-86 was 164.26, C-2 was 163.39 and 4-
16 85 is 165.86. Yes.

17 Q. With that data and no other data,
18 and looking at Drawing 12 from H-39, would you agree
19 with me that something funny has to happen to the lower
20 granular unit if it's going to ride up over the bedrock
21 at the 165 contour?

22 A. Yes. I am not sure I would call
23 it funny, but it will either abut onto the bedrock or
24 the unit, the base of the unit is going to rise.

25 Q. Or it will thin out and disappear?



1 A. That is what I implied. If the
2 base is rising, the unit will be thinning at the upper
3 part of the level.

4 Q. That would be true, both to the
5 south and also to the north?

6 A. As you say, just looking at that
7 data, yes.

8 Q. Can we go back to your Figure 8,
9 please. Let's look at where we don't find the lower
10 granular unit. First of all, we don't find it in
11 Morrison Beatty OW-2, where, according to Drawing 13,
12 the overburden is only 12.2 metres deep?

13 A. (MB)OW-2, yes.

14 Q. And we don't find it in HC3-85?

15 A. If it's there, it's pretty tenuous
16 to claim that it's there.

17 Q. We don't find it or it is tenuous
18 and the overburden is 14.6 metres deep. We don't find
19 it in HC2-86, where the overburden is 16.1 metres deep.
20 So, it would appear that it pinches out to the south as
21 the bedrock topography becomes elevated; would you
22 agree?

23 A. Yes. And looking at it in that
24 light, yes, that seems reasonable. Bear with me a
25 moment while I get oriented here.



1 Q. If you have better data, I would
2 be more than happy to have it.

3 A. Oh no, sorry.

4 Q. Just for the sake of completeness,
5 can we look to the north? I will come back to the
6 cross-section.

7 A. Sure. But for my own benefit, and
8 it would help if I could see it. Yes.

9 Q. Working from your Figure 8, and we
10 can come back to the cross-sections, we don't find the
11 lower granular unit in C-1?

12 A. Or if we do, it's pretty tenuous.

13 Q. And we don't find it in (MB)OW-1?

14 A. C-1 has silt, sand clay, so it has
15 some stratified unit other than the till and a little
16 higher in elevation.

17 Q. Silt sand clay also isn't very
18 permeable?

19 A. Oh certainly, but if we are trying
20 to define the limits of the unit, one could conceive of
21 it changing in texture as it got to the edges of the
22 unit, and so it's worth keeping these figures in mind.

23 Q. It doesn't appear to be present or
24 present in any considerable manner in (MB)OW-1?

25 A. (MB)OW-1. We have two units there



1 and we had half a metre of what was described as sand,
2 gravel and clay at 170 and then sand, gravel, 9
3 centimetres at 167. It is not a substantial unit if
4 it's present.

5 Q. In fact when you inferred the
6 maximum extent of the unit, you didn't infer it over at
7 MB-1 or OW-1?

8 A. We put question marks, as you can
9 see on the map.

10 Q. If we look at overburden thickness
11 map 13, would you agree with me that first of all we
12 find the lower granular unit at its greatest thickness
13 right over the bedrock depression and, secondly, that
14 it thins out on the sides of the bedrock depression,
15 both to the south and north and in fact really
16 disappears to the south?

17 A. Yes. Yes. According to our
18 interpretation there as well, it certainly thins out.
19 To the north it is more tenuous and that is where we
20 have it shaded in here.

21 Q. You are pointing to M-438-D4?

22 A. Correct. And saying when you go
23 from OW-3 to C-1 there are question marks about it,
24 which is how we have shown it on Figure 8.

25 Q. If we could go back and look at



1 the boreholes on each side, the boreholes where we have
2 identified the lower granular unit as having its
3 greatest thickness, would you agree with me that
4 looking in a north-south direction, say from Comcor 2,
5 the lower granular unit appears to thin out both to
6 the south and to the north?

7 A. I would say yes.

8 Q. And similarly at HC3-86?

9 A. Yes, yes, certainly.

10 Q. It's thinner also, would you not
11 agree, at HC1-85?

12 A. 1-85? It's thinner than at the
13 other locations.

14 Q. In fact looking along First Line
15 where you do identify the lower granular unit, it is
16 thinning out, is it not?

17 A. Yes.

18 Q. Given that its greatest depth is
19 at approximately the 165 metre mark, that is more or
20 less what you would expect from looking at the bedrock
21 map, is it not?

22 A. Yes, and as the bedrock rises, one
23 might reasonably expect it to thin out. It raises the
24 question from looking at it, that going from 4-85
25 towards C-2, which is sort of along the axis of the



1 bedrock valley, where we haven't shown it being present
2 in the same way one might expect it to thin out on the
3 flanks, one might expect it to extend along the valley
4 by the same logic.

5 Q. It doesn't appear to extend along
6 the valley to the east, does it? It thins out at HC5-
7 85 and there isn't much left by the time you get to
8 GL84-4, assuming it is continuous?

9 A. Yes. There is a lack of data.

10 Q. Dr. Charlesworth, there is not a
11 lack of data.

12 MR. ESTRIN: Twice the witness has been
13 interrupted in trying to answer these questions. He
14 was interrupted when he was talking about the potential
15 for the unit extending from HC4-85 towards C-2 and Mr.
16 Hodgson said wait, let's not talk about but go the
17 other direction and now he is trying to stop him from
18 talking about that. Could we have the witness'
19 evidence?

20 DR. CHARLESWORTH: Well, I'm just trying
21 to help the Board and Mr. Hodgson I guess, and thoughts
22 have come to me in looking at this. If we go from
23 4-85 to C-2, which is sort of along the axis of the
24 valley Mr. Hodgson is talking about, we have shown it
25 as not being present because there is a lack of data



1 and the lack of data is borehole 5-84. If we actually
2 look on cross-section RD, which runs or which cuts
3 across that valley, 5-84, and you will see borehole 5-
4 84 stops above where we would expect the lower granular
5 unit and so we don't know and we have a great dearth of
6 information and I sort of come back to my overhead of
7 proposed drilling. We are seeing the lower granular
8 unit and we are seeing it here and Mr. Hodgson has
9 quite rightly suggested it may have some relationship
10 to this bedrock valley which runs off some distance in
11 that direction and we don't know if it's present here,
12 and here being where my No. 1 -- adjoining HC5-84,
13 because HC5-84 is not deep enough.

14 MR. HODGSON: I am prepared to give you
15 three and a half to four meters of lower granular unit
16 between HC4-85 and C-2. What I asked you about and
17 what I want an answer to is what is happening in a true
18 easterly direction, and I'm asking you to agree that
19 from 4-85 it thins to 5-85 to 1.1 and at HC1-86, it may
20 not be present at all and you have a question mark and
21 it would appear it's not present and at GL84-4 you have
22 .8 of a metre. A unit that was once 5 metres thick
23 can't be 5 metres thick at HC7-84, can it? Wouldn't
24 you agree with me from the data that you have presented
25 on Figure 8, that the lower granular unit is



1 disappearing to the east just from your data, and we
2 will look at more data later, but I want an answer
3 relating to this piece of data?

4 DR. CHARLESWORTH: A. I am going to
5 answer that and I have an overhead which I think will
6 help in my answer if you can bear with me for a second
7 while I look for this.

8 MR. HODGSON: I think I am entitled to
9 an answer to my question. I am not trying to prevent
10 this witness from giving you any evidence he wants to,
11 but what happens is that he has an overhead or an idea
12 or he has a way he would like to go off and I must
13 remember ten minutes later what question I asked and
14 the fact is, I would like to have an answer and I think
15 I am entitled to have an answer to my question and by
16 all means let him expand.

17 MR. LANCASTER: From Figure 8, can you
18 not answer? There may be additional information.

19 DR. CHARLESWORTH: That is about what I
20 was about to do and I apologise for any delay. As I
21 understand the question, it was does it thin or does
22 the unit not thin from 4-85 to 5-85 to GL84, and I
23 would say from the evidence we have presented, yes, it
24 is thinning in that direction, but I feel I have to
25 qualify that if I am going to give my best opinion to



1 the Board and, with your indulgence, these are the
2 contours I showed this morning and they follow the same
3 general trend of the depth to rock and I am just
4 putting it on for the purposes of the overhead. You
5 will see we are looking at 4-85 in this embayment of
6 the side of the valley and the next borehole is into
7 the shallower overburden, shallower depth to rock, and
8 similarly down in this corner, there is what could be
9 construed as the axis of the valley extending through
10 where I am pointing on the overhead between the 160
11 contours, and we don't know about the lower granular
12 unit in that area, and I think that is an important
13 point. Sure it thins across here where we have the
14 fluctuations in the bedrock surface, but we don't know
15 what's happening down here.

16 MR. HODGSON: Q. One thing we do know
17 that is not happening down there is we know we are not
18 landfilling down there?

19 DR. CHARLESWORTH: A. Yes, but we don't
20 know whether there may be the movement of groundwater
21 from beneath the landfill down there or not.

22 Q. Let's look to the true west and at
23 Figure 8 again. The lower granular unit appears from
24 the data you are presenting to extend off-site in a
25 true westerly direction?



1 A. Yes.

2 Q. That would be consistent with its
3 being present in the bedrock depression, would it not?

4 A. Yes, it would.

5 Q. However, the data you present also
6 suggests that as it moves in a true westerly direction
7 it thins out?

8 A. Yes, that is correct.

9 Q. In fact by the time we get to HC1-
10 85, it is down to 1.25 metres in thickness?

11 A. That is correct.

12 Q. If we could, I would like to
13 concentrate for a minute on the hydraulic conductivity
14 of this unit. A pumping test was conducted at HC4-85
15 and the results showed that the unit had a permeability
16 of 3×10^{-4} ?

17 A. Yes, that is correct.

18 Q. 3×10^{-4} on a unit that is
19 described here as sandy silt?

20 A. Yes.

21 Q. Now, would you agree with me from
22 the data you have presented, that the most permeable
23 area of the lower granular unit appears to be found in
24 (MB)OW-3 and that is one of the Morrison Beatty
25 detailed borehole logs from which you have extracted



1 information?

2 A. Yes, looking at the data.

3 Q. Sand and gravel?

4 A. Yes.

5 Q. You would expect that sand and
6 gravel would have a higher permeability than sand,
7 silt?

8 A. Yes.

9 Q. Now, just looking at HC1-85, if
10 HC4-85 is sand, silt, how would you compare the
11 hydraulic conductivity of the silt, sand at HC1-85?

12 A. How would I compare it with....

13 Q. ...HC4-85.

14 A. Sand silt; silt, sand.

15 Q. If a sand silt is pumped and has a
16 permeability of 3×10^{-4} at HC4-85, wouldn't you agree
17 that a silt, sand is likely to have a lower hydraulic
18 conductivity?

19 A. I would have to look at the
20 description in more detail and the grain sizes, but it
21 may be similar.

22 Q. That is the description you put on
23 this document, and how would you like to interpret your
24 data?

25 A. I wouldn't interpret this data in



1 terms of hydraulic conductivities. It could be
2 similar.

3 Q. It could be lower too.

4 MR. ESTRIN: The witness has said he
5 would like to have a chance to look at the description
6 in his report or in Trow's report.

7 MR. HODGSON: I don't think the witness
8 needs Mr. Estrin's help, Mr. Chairman.

9 DR. CHARLESWORTH: I would be reluctant
10 to say -- I could say it may be less, but you need more
11 than what we have extracted and put on this table.

12 MR. HODGSON: Q. But you have agreed
13 that this is what you have extracted?

14 A. This is what we have extracted in
15 defining the extent of the unit, but not what we
16 extracted in terms of looking at the hydraulic
17 conductivity.

18 Q. The information doesn't suggest
19 higher hydraulic conductivity, does it, in HCl-85, does
20 it?

21 A. No.

22 Q. It suggests lower?

23 A. I would want to refer back,
24 because that is a fairly important question and I would
25 want to look at the description before I agree, and you



1 may well be right. I would say there are horizons
2 within the greater thickness at 4-85 that are more
3 permeable than the material at 1-85, and there are also
4 horizons which are probably less, but given the great
5 thickness, it would have a higher transmissivity, I
6 would imagine, at 4-85 than 1-85.

7 Q. Where in borehole log 1-85 are you
8 interpreting the lower granular unit, starting at
9 168.86?

10 A. Yes, and it is silt with some clay
11 and sand and fine sand, traces of silt, well sorted and
12 wet and so we are looking at a fine sand unit.

13 Q. Where is this?

14 A. 168.09. So going back to look at
15 the original, I would say it is likely to be more
16 transmissive at 4-85.

17 Q. "More transmissive"?

18 A. I would say on average it would
19 also have a higher hydraulic conductivity at 4-85 and I
20 would agree with you on that point.

21 Q. And subject to check, would you
22 agree that that's also true from your descriptions of
23 the silt sand at GL4-85 and (MB)OW-4?

24 A. Yes.

25 Q. And HC2-85, sand, silt clay.



1 Clay would lower the permeability, would it not?

2 A. It depends upon how extensive it
3 is and if it's a distinct clay horizon with sand above
4 and below or something...

5 Q. At HC5-85, not very far from this
6 deep zone at HC4-85, we have silt (till), which would
7 suggest a lower permeability.

8 A. Yes.

9 Q. At HC6-85, silt, sand, shale, and
10 a lower permeability?

11 A. Yes, and I don't know what the
12 shale is referred to there.

13 Q. GL84-4, as it wends its way to the
14 east is clayey silt sand and that is pretty low
15 permeability stuff, isn't it?

16 A. Yes, but of course we may be on
17 the flanks of the feature there, as I was indicating a
18 few moments ago.

19 Q. Can we agree, just from the data
20 presented on Figure 8, that to the extent we find the
21 lower granular unit at or in the vicinity of proposed
22 Site D, it appears to have its highest permeability
23 right over the site, where it also has its greater
24 depth and the permeabilities appear to wane a little
25 bit as we move off-site either to the north, to the



1 south, the east or the west?

2 A. It's very important to qualify
3 this answer. There is a dearth of information about
4 the hydraulic conductivity of the lower granular unit.
5 So when I agree to these statements, when I agree with
6 Mr. Hodgson in making these statements, it is based on
7 not very good data as there are only two data points,
8 as I recollect, other than the pumping test where they
9 have measurements of hydraulic conductivity.

10 So, one may infer it from the
11 descriptions as we have extracted them from the logs,
12 but that's about as far as you can go.

13 Q. How many pumping tests do you
14 think should have been run on the lower granular unit,
15 Dr. Charlesworth?

16 A. I think the extent of the lower
17 granular unit should have been better defined, and I
18 would think that more in situ testing of some sort,
19 whether it was pump tests or not, should be done if you
20 are really going to get a handle on how it functions in
21 the flow system.

22 Q. Would it have been helpful and
23 better in defining the lower granular units if the
24 borehole logs for (MB)OW-4 and Comcor 2 and OW-3 had
25 been available?



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Rowe, Charlesworth,
cr ex (Hodgson)

1 A. The more data you have, obviously
2 it is preferable.

3 MR. HODGSON: Thank you. Mr. Chairman,
4 this would be a good time.

5 MR. LANCASTER: Yes, I think it would be.
6 Until a quarter to.

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9 --- Luncheon Adjournment (12:30)

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1 --- Upon resuming at 1:45 p.m.

2 MS. CRONK: There is a rumour afoot that
3 the Board may have some inclination or thoughts about
4 when you might be sitting in June and July and some
5 counsel are a bit in the dark, in fact speaking for
6 myself, the schedules we have undertaken, so if there
7 was some clarification you could provide?

8 MR. LANCASTER: There certainly is. We
9 have a target completion date as far as the Board is
10 concerned.

11 MS. CRONK: I will mark that in red.

12 MR. LANCASTER: June 23rd, and if not
13 then, it will have to be in August some time.

14 MS. CRONK: You will not be sitting in
15 July.

16 MR. LANCASTER: Hopefully we can finish
17 all the evidence by that date.

18 MS. CRONK: If the evidence was in and
19 argument not complete, we would be sitting in August
20 for argument?

21 MR. LANCASTER: Yes. Perhaps a bit of
22 time might be required, but I am hoping the evidence
23 will be completed by that date.

24 MR. HODGSON: Ms. Cronk has bought a new
25 cottage in Muskoka but she hopes to visit it in 1988.



1 MS. CRONK: You promised not to disclose
2 that.

3 MR. LANCASTER: Why should you be any
4 different than anyone else?

5 MS. CRONK: I can give you a few
6 reasons.

7 MR. HODGSON: I think if I ask quickly,
8 I can get an answer I want.

9 My next question is I want to know what
10 the geometric mean and thickness of the lower granular
11 unit is and I will get some calculations done while we
12 are waiting.

13 DR. KINGHAM: While we are getting
14 settled in, perhaps we could give the witness panel the
15 assurances of the Board that we have noted your
16 qualifications with regard to your answers being based
17 on the data available and we will assume that when you
18 give an answer it is based on data available to you
19 rather than anything else and you can take that as a
20 given.

21 MR. HODGSON: I didn't understand what
22 you meant by "data available".

23 DR. KINGHAM: The point has been
24 frequently made that based on the data available to the
25 witnesses, they are giving their answers, and I wanted



1 to assure them that we had heard that loud and clear.

2 MR. HODGSON: I want to assure the Board
3 that I have framed my questions on the assumption that
4 we are interpreting what we in effect have.

5 DR. KINGHAM: So we are all clear.

6 MR. LANCASTER: There is a bottom line
7 there somewhere.

8 MR. HODGSON: A bottom line somewhere
9 near the bedrock.

10 DR. CHARLESWORTH: But not carved in
11 stone.

12 MR. HODGSON: Q. While you were out of
13 the room, I asked you a question and I notice you
14 haven't computed the answer yet, and since you don't
15 know the answer, perhaps I could tell you the question
16 and I don't ask you to do this immediately, but I think
17 you agreed with me this morning, just working from your
18 Figure 8 on the lower granular unit, that you give a
19 clear identification to the lower granular unit in
20 exactly twelve boreholes and I would just like you, if
21 you would over the break this afternoon, to calculate
22 the geometric mean thickness of the lower granular unit
23 as you have interpreted it in those twelve boreholes.
24 I have done it and would like to have your number.

25 DR. CHARLESWORTH: A. Is it the



1 geometric mean you require?

2 Q. I don't even know. You are the
3 witness. What kind of number do I want, the average
4 thickness?

5 A. I think you want the average
6 thickness.

7 Q. I would be happy with the average
8 thickness.

9 MR. LANCASTER: I assume the same
10 information will arrive at both answers.

11 DR. CHARLESWORTH: A slight difference.

12 MR. HODGSON: Q. Dr. Charlesworth,
13 could you first please put up Geocon's four cross-
14 sections and before lunch I gave you a photocopy blown
15 up, expanded, and is that Figure 1?

16 DR. CHARLESWORTH: A. It looks like
17 Figure 1 out of our report.

18 Q. It is Figure 1 out of your report.
19 What we have done to it, to be clear, your cross-
20 sections are indicated by black lines?

21 A. Correct.

22 Q. What we have done is prepared some
23 new cross-sections, H-492A, B, C and D, and they are
24 indicated, superimposed on yours with red lines. I
25 have some tacks and could you put up the plan view.



1 DR. KINGHAM: There are some on the
2 table.

3 DR. CHARLESWORTH: One inch nails would
4 be more appropriate.

5 MR. HODGSON: Q. Dr. Charlesworth, could
6 we start and I have done these by using your numbers,
7 RB, RG, et cetera, and would you mind taking a felt pen
8 and marking up each of those with a large RD, RB, RG
9 and RH?

10 DR. CHARLESWORTH: A. Can you not see
11 the blue?

12 Q. I can't see it very well. Could
13 you put it in the upper righthand corner in red or
14 green. Am I to understand that in preparing these
15 cross-sections, as in preparing almost all of the
16 evidence, your evidence, your intention was to be
17 conservative?

18 A. Sometimes on these cross-sections
19 we were conservative in the opposite way to the way we
20 had been -- to the opposite way it had been used in
21 connection to the landfill and in-chief I pointed out
22 some locations where we had actually not extended the
23 units where Trow on their original cross-sections had
24 actually extended the units and we were more
25 conservative in terms of the extent of the unit, but



1 less conservative....

2 Q. I would like to forget about Trow
3 and concentrate on your interpretation of the units and
4 what you are doing on these figures, and I simply want
5 to know if in interpreting the thickness and lateral
6 extent of the granular units at Site D, is it your
7 intention to be conservative? The next thing I will
8 ask is what that means, but answer that first?

9 A. We have in some cases been -- we
10 have extended the units where there is not data and
11 where there is missing data and where the unit could
12 conceivably extend, but we have not always taken that
13 absolutely as far. For example, we do not necessarily
14 on here correspond to Drawings 7 and 8, which show the
15 possible maximum extent. We have tried to be
16 reasonable on these drawings to show where the unit
17 might reasonably exist, recognising that it is not
18 proven at those points.

19 Q. Let's take it a piece at a time.
20 No. 1, where you know it exists you have put it on
21 here?

22 A. That is correct.

23 Q. No. 2, where you don't know it
24 exists, what have you done? Is the interpretation the
25 interpretation that says it is most likely there or is



1 it an interpretation that says a conservative view
2 would be that we will assume it's there, because we
3 don't know; which have you done?

4 A. We have done something somewhere
5 between that, Mr. Chairman. We have extended it beyond
6 -- we have interpolated and extended it beyond where we
7 know it to be, but we have not necessarily said if it's
8 not there, let's assume it's there. I think that's
9 probably as fair an answer as I can give. We have not
10 necessarily carried it long distances. If we were
11 being really conservative, we have put question marks
12 there, and all we have is a water well record and we
13 have ended the unit and extended it and said let's
14 assume the water well does take water from the lower
15 granular unit, but we have not carried it right through
16 to the water well, talking about water well 4074 on
17 Section RH. We stopped just short of that and if we
18 were being conservative in the context you are using
19 it, I suppose could have drawn it way out there, but we
20 have no data out there, so we stopped here. We have
21 not drawn the worst case in terms of the extent of the
22 unit.

23 Q. In fact on RH where you are
24 pointing, you don't have any data to suggest it is
25 anywhere between (MB)OW-4 and that water well, do you?



1 A. As I say, we have tailed it off
2 and put question marks and said maybe, maybe this well
3 extends. We know it's there and we have no reason to
4 expect that it will truncate very dramatically there,
5 so we have tongued it out.

6 Q. Let's try this from another point
7 of view then. Can we take it from your evidence that
8 you are trying to give this Board as fair a
9 representation of where you think these units are
10 likely to be based on the data we have? Is that away -
11 - you said, you are somewhere between reasonable and
12 conservative, and are you trying to be fair?

13 A. I am trying to be fair but saying
14 that it may be there. We are trying to show where it
15 could quite reasonably be. We have not tried to be
16 unreasonable and I think that sums it up, I think.

17 Q. You have tried to show where it
18 could quite reasonably be?

19 A. Yes.

20 Q. Now, let's look at where it could
21 quite reasonably be on cross-sections RB and RD,
22 and just so we can orient the Board, RB is a cross-
23 section you have done down First Line. I am sorry --
24 yes, RB you did down First Line?

25 A. Yes.



1 Q. RD is a cross-section that runs
2 from a north-east to south-western direction, more or
3 less down through the middle of the site and in fact it
4 runs down on the eastern flank of the fill area, does
5 it not?

6 A. That is correct.

7 Q. Is it fair to look at RB and RD.
8 Suppose we were standing, and notionally can you put
9 your pointer on GL84-2 off to the lefthand side of
10 First Line? Imagine we are all standing at that point
11 and we are looking toward the landfill site and the
12 first thing we would see is the cross-section RB
13 running north-south along First Line and the second
14 thing we would see would be RD, running north-south
15 along First Line?

16 A. Yes.

17 Q. Eyeballing your cross-sections RB
18 and RD, and remembering RB is closer and RD is further
19 away from this line of perspective, would you agree
20 with me that the evidence for the upper granular unit,
21 by eyeballing it, is about the same in each one?

22 A. RB and RD. The evidence for the
23 upper granular unit. No.

24 Q. What is your view?

25 A. I would say that it's much more



1 clearly -- the evidence is stronger on RD and we have a
2 number of question marks all along. We have question
3 marks here and here.

4 Q. "Here" won't do because we will be
5 doing this for about two hours.

6 DR. KINGHAM: Did you say the upper
7 granular unit or the lower?

8 MR. HODGSON: I said the upper granular
9 unit.

10 DR. CHARLESWORTH: I was talking about
11 the lower.

12 DR. KINGHAM: Perhaps you could re-put
13 the question.

14 MR. HODGSON: Q. I will ask about the
15 lower granular unit.

16 DR. CHARLESWORTH: A. Yes.

17 Q. Were you answering about the
18 lower?

19 A. I was answering about the lower
20 granular unit.

21 Q. Let's complete that and assume the
22 question was the extent of the lower granular unit,
23 although I think I would phrase it slightly
24 differently, but would you agree with me in respect of
25 the lower granular unit that it is much more prominent



1 in the RD cross-section on the eastern flank of the
2 fill area than it is on the RB cross-section?

3 A. Yes.

4 Q. With regard to the upper granular
5 unit, how does it appear between the two cross-sections
6 RB and RD? For the record, we are looking at M-438.

7 A. RD has it through a thicker zone
8 but in both cases there are a number of question marks
9 and the lateral extent is similar, yes.

10 Q. Would you agree with me on cross-
11 section RD, that you have interpreted the upper
12 granular unit to be within the fill area for the new
13 landfill?

14 A. Yes.

15 Q. Would you agree with me that on
16 cross-section RD you have interpreted the upper
17 granular unit to extend off-site along First Line to
18 the north from the fill area?

19 A. On RD?

20 Q. On RB, the upper granular unit,
21 that it goes off-site along First Line towards the
22 north?

23 A. We have put question marks all
24 along there. It is a very possible extent up there, up
25 there being north of the fill area, but we have



1 qualified it with question marks.

2 Q. In addition to qualifying it with
3 question marks, would you also qualify it in terms of
4 its thickness in that area?

5 A. A few centimetres, it may be 10
6 centimetres or something like that.

7 Q. Very small?

8 A. Very thin, yes.

9 Q. Very unpromising as a pathway for
10 contaminant migration along there, would you agree?

11 A. If it exists as such, it is a
12 potential pathway, but it is not as extensively
13 developed as it is for example by GL84.

14 Q. It's not a metre thick by 390
15 metres wide that we need in our case 8, is it?

16 A. No. It's not as modelled by
17 either Trow or Dr. Rowe.

18 Q. Now, you have interpreted the
19 upper granular unit to pinch out sort of half-way down
20 the fill area on cross-section RB?

21 A. That is correct.

22 Q. And in cross-section RD, you have
23 interpreted it to pinch out about three-quarters of the
24 way in a souther-easterly direction at the eastern
25 flank of the fill area?



1 A. That is correct.

2 Q. Could we also briefly look at your
3 cross-section RH. Cross-section RH, if we go back to
4 the plan view map behind Dr. Kerry -- sorry, Dr. Rowe
5 -- this has been going on too long.

6 A. RH runs east-west using the sort
7 of local notation across the middle of the proposed
8 landfill site and the top of the lower part of the L.

9 Q. Could we imagine if we were
10 standing on the southern flank of the fill area, the
11 south-east flank of the fill area, that we would be
12 looking in a kind of north-easterly direction at this
13 cross-section RH?

14 A. Yes.

15 Q. Looking briefly at this cross-
16 section, would you agree with me that we have precious
17 little data that the upper granular unit extends off
18 the fill area to the right, past HC5-84?

19 A. Yes, this is one of the areas I
20 noted there is a lack of data.

21 Q. But the data we have from HC5-84
22 suggests that if it exists there, it has to exist
23 between two split-spoon samples?

24 A. That is correct.

25 Q. We are not talking about a 2.1



1 metre unit as we are at HC2-85, are we?

2 A. We would be talking about at the
3 most a metre.

4 Q. At the most a metre and likely a
5 lot less than a metre, given that the split spoon
6 sample is unlikely to have missed it altogether. If
7 it was exactly a metre and you split spooned and only
8 left a metre gap, isn't it unlikely that you would have
9 missed it altogether?

10 A. I think the gap is slightly more
11 there. The gap between the bottom and the top of the
12 split spoons there is about 1.35 metres and so I think
13 it is reasonable to say it might be about a metre if it
14 was there. It could be a metre quite easily.

15 Q. Or it could not be there at all.

16 A. Or it could not be there at all.

17 Q. HC6-84, it could not be there at
18 all as well?

19 A. That is possible.

20 Q. You have interpreted it as being
21 in fact present at (MB)OW-4?

22 A. We have, yes.

23 Q. We have no data whatsoever to
24 suggest it goes across the First Line, do we?

25 A. On Section RH we have no data. We



1 have this water well and we have not assumed the water
2 well takes its water from the upper granular unit, so
3 we have terminated it and at the east end we did not
4 join it up to this sand and gravel located in the well
5 log at Highway 25. We just coloured that in yellow on
6 here.

7 Q. Ignoring Section RB and looking
8 for a moment at Sections RD and RH, would you agree
9 that RH crosses the bedrock depression at an oblique
10 angle?

11 A. Yes.

12 Q. Would you agree with me that
13 cross-section RD crosses the bedrock depression at an
14 oblique angle?

15 A. Yes, that is closer, but yes.

16 Q. I was under the impression that
17 you had a coloured-up set of cross-sections H-492A, B,
18 C and D?

19 A. We were given a set which we
20 marked on and then you gave me a set last night to put
21 up.

22 Q. I will give you my set.

23 A. Let's tape them onto this board.

24 Q. Dr. Charlesworth, cross-section
25 H-492A, which Dr. Rowe kindly helped me put up on the



1 board behind you, is a cross-section that runs, would
2 you agree, more or less down through the bedrock
3 depression?

4 A. Yes, the cross-section runs more
5 or less through the bedrock depression.

6 Q. Working from the map that is
7 behind you, since I can't interpret the one in front of
8 me, would you agree that the upper granular unit is far
9 less extensive in both dimension -- both lateral
10 dimension and in thickness on cross-section A-A,
11 Exhibit 492?

12 A. Than?

13 Q. Than the lower granular unit?

14 A. Yes.

15 Q. Would you agree with me that on
16 this cross-section, tracing the bedrock valley
17 depression, that the upper granular unit appears to be
18 more or less in the area of the fill and not to extend
19 off site, either in a true easterly or true westerly
20 direction. You find it, do you not, between C2 and
21 HC4-85?

22 A. You find it between C2 and 4-85
23 and 3-86 is the hole we noted where it was absent.

24 Q. You noted that?

25 A. Yes.



1 Q. In fact, if I could take you back
2 to your exhibit, Figure 6 from Exhibit M-438, we can
3 see really the plan view from your Figure 6, and in
4 cross-section from H-492A, that the upper granular
5 unit, tracing the bedrock depression at its deepest,
6 appears to exist on site and not to be extensive off
7 site, either to the north or to the south?

8 A. Off the site, yes, to the north or
9 to the south. Yes. We have these two grey areas with
10 question marks around C1 and north of 1-85, but in
11 general, yes.

12 Q. With regard to the lower granular
13 unit, would you agree with me that to the extent that
14 it has substantial thickness, that substantial
15 thickness exists under the fill area from H-492?

16 A. Yes.

17 Q. That data replicates data you have
18 reproduced on your Figure 8, does it not?

19 A. Yes.

20 Q. Would you agree with me, looking
21 at cross-section H-492, that in a true east-west
22 direction, the lower granular unit does not appear to
23 extend off site to the east?

24 A. The lower granular unit.

25 Q. You will see in the cross-section



1 at the eastern end, there is superimposed HC1-86 and
2 GL84-4 and a well at the corner of the site, MOE 2475,
3 which I believe in looking at your cross-section is a
4 well right down in the extreme eastern corner of Site
5 D.

6 A. I would say -- I don't think you
7 can say that. As drawn, it is not extended, but there
8 are these units, these sandy units or shall we say
9 units we had indicated may have some correlation in
10 GL84, and so it is conceivable, and it is scarcely
11 there in 1-86, but it is conceivable that it extends in
12 that direction.

13 Q. Would you agree with me that if it
14 is conceivable it extends in that direction, to the
15 extent it extends in that direction, it appears to be
16 pinching out?

17 A. It is not as thick as it is
18 beneath the site, if that ties in with that, and there
19 is a question of the elevation of that one, but I am
20 saying, you know, it may join up with that....

21 MR. ESTRIN: I am sorry, but "that"...

22 DR. CHARLESWORTH: I am sorry, at HC5-85
23 it may join up with something in GL-84, particularly if
24 you move the cross-section line a little further north
25 so there is an area of uncertainty.



1 MR. HODGSON: Q. I agree there is an
2 area of uncertainty, but would you agree with me,
3 looking at your Figure 8, that to take into account or
4 to consider the area of uncertainty, one thing you
5 would look at in addition to any evidence on thickness
6 is also some evidence about quality and what we find in
7 HC5-85 is that it is a silt till and in HC1-86, you
8 have till in brackets and at GL84-4 you have suggested
9 it is a clayey silt sand. Would you agree that not
10 only does it appear to be pinching out in this
11 direction, but as a water aquifer it is developing
12 increasingly unpromising qualities as it moves to the
13 east?

14 DR. CHARLESWORTH: A. Yes. I think we
15 are back to the point we debated this morning. We
16 don't know what happens as it goes through there, but
17 through a line somewhat to the north of your cross-
18 section, the zone in the upper part of the bottom part
19 of the L, but certainly along this line as we
20 discussed, going from GL4-85, it certainly appears to
21 be becoming less -- what was your phrase, less
22 promising as a water-bearing zone.

23 Q. Looking to the north, would you
24 agree with me that if the lower granular unit extends
25 off-site, it is more likely to extend off-site in a



1 true westerly direction, the lefthand end of this
2 figure being due west?

3 A. Yes.

4 Q. Would you agree with me that as
5 the unit is measured in HC3-86 and again in HC1-85, it
6 also appears again to be pinching out as it moves to
7 the north?

8 A. Yes. May I just check the log of
9 1-85? Conceivably it could be closer and we looked at
10 that log this morning, but it could be somewhat thicker
11 in 1-85.

12 Q. You have suggested on your
13 interpretation in Figure 8 that it is 1.25 metres
14 thick?

15 A. And I am not sure of how thick
16 that is on there, but I could scale it off.

17 Q. At HC3-86, you have it as almost 3
18 metres thick?

19 A. I am sorry, I didn't realize, but
20 it is thinner at 1-85 than at 3-86.

21 Q. And it has thinned out
22 considerably, would you not agree?

23 A. It has thinned out probably by a
24 third as drawn on this section and it could be thicker,
25 conceivably a bit thicker there, but it has thinned



1 out, yes.

2 Q. On your figures it goes from 2.89
3 to 1.25 metres?

4 A. Yes.

5 Q. Thank you. Now, Dr. Charlesworth,
6 we have looked at cross-section A-A and what I would
7 like to do is put up four cross-sections, cross-section
8 B, your cross-section RG and cross-sections C and D,
9 which will give us an indication of what is occurring
10 when we draw lines that are perpendicular to the
11 bedrock depression. Dr. Charlesworth, can you see
12 that?

13 DR. KINGHAM: Why don't you do this in
14 lazer paleography so we could have it in three
15 dimensions?

16 DR. CHARLESWORTH: We will be doing that
17 at Peel.

18 MR. HODGSON: Q. For those of you who
19 are buying admission tickets.

20 DR. CHARLESWORTH: A. Half the people in
21 the room may be at that one as well.

22 DR. KINGHAM: And possibly also some
23 Board members.

24 MR. HODGSON: I don't have an invitation
25 and won't be at that one.



1 DR. CHARLESWORTH: I'm trying to sell
2 mine.

3 MR. HODGSON: I apologise to the Board.

4 Q. Dr. Charlesworth, can we look at
5 these four cross-sections and could you back up. We
6 didn't mark as an exhibit the plan view, which is a
7 blow up of Dr. Charlesworth's Figure 1 from Exhibit M-
8 438 and perhaps it could be marked as M-438A.

9 MR. LANCASTER: That will be Exhibit
10 M-438A.

11 --- EXHIBIT NO.M-438A: Blow up of Figure 1 from
12 M-438, plan view.

13 MR. HODGSON: M-438A contains not only
14 information put on it by Dr. Charlesworth, but also it
15 indicates where the cross-sections that are now
16 exhibited as H-492A intersect the site.

17 DR. KINGHAM: On that point, I would
18 like some clarification. Those indicated cross-
19 sections are generalized from what the actual lines
20 are; is that the case? Perhaps Dr. Charlesworth could
21 tell us.

22 MR. HODGSON: Q. Can you confirm on
23 cross-section B, for example, that what has happened is
24 that the borehole information has been projected into
25 the cross-section lines?

DR. CHARLESWORTH: A. Yes, GL-84 has



1 been projected up onto the line and 1-85 has been
2 projected down, and that has occurred on C2, which has
3 been projected onto A and I am not quite sure what
4 happened down here, but it looks like GL-84 was
5 projected.

6 DR. KINGHAM: I think that's adequate.
7 We just wanted to confirm that, but the Board had come
8 to that conclusion.

9 MR. HODGSON: Q. Did you have an
10 opportunity to review cross-sections A, B, C and D?

11 DR. CHARLESWORTH: A. I did, Mr.
12 Chairman. These were given to me this week some time.

13 Q. Do you agree with the
14 interpretations as presented on A, B, C and D?

15 A. In general terms, yes. There are
16 minor differences, but I would say they are
17 substantially in agreement.

18 Q. If you could turn around to M-
19 438A, the plan view, and indicate, there is a little
20 red flag in the extreme eastern corner of the plan view
21 where it says A. Can we agree that when we are looking
22 at cross-sections B, RB, C and D, it's as though we are
23 viewing the site along the line A-A, standing at the
24 eastern end?

25 A. When we are looking at which ones?



1 Q. When we are looking at cross-
2 section B.

3 A. It's as though we were looking
4 west or in a westerly direction from the corner, from
5 the eastern corner of the site.

6 Q. So the southern side of the site
7 is to our left as we look at those cross-sections and
8 the northern part of the site is to the north as we
9 look at those cross-sections?

10 A. Yes.

11 Q. First of all, do you agree,
12 looking at all four cross-sections, that the cross-
13 sections B, RB, C and D illustrate the bedrock
14 depression on the site?

15 A. Yes.

16 Q. Cross-section RB was prepared by
17 you?

18 A. RB, that's correct.

19 Q. Just briefly, comparing cross-
20 sections B, which is the most northerly cross-section,
21 RB, C and D, would you agree with me that these four
22 cross-sections suggest that the upper granular unit is
23 more extensive off-site than it is -- excuse me, more
24 extensive on-site than it is off-site to the east?

25 First of all, we are looking at cross-



1 section B and do you see the upper granular unit,
2 cross-section B?

3 A. Yes. B essentially runs almost
4 north-south.

5 Q. It does?

6 A. It just clips across a corner of
7 the site and there is a lack of data really on either
8 side of it.

9 MR. ESTRIN: Either side of what?

10 DR. CHARLESWORTH: A lack of data on
11 either side of the point where the upper granular unit
12 has been drawn in there. It certainly shows the upper
13 granular unit just in this corner of the site, the
14 north -- well, I suppose if we are using true north it
15 would be the western corner of the site, but in the
16 vicinity of 1-85 with a question mark and I would have
17 drawn a question mark on that side as well, to the west
18 side as well.

19 MR. HODGSON: Q. Could you locate for
20 the Board as well, GL-2 on the plan view?

21 DR. CHARLESWORTH: A. I am now pointing
22 to GL84-2.

23 Q. You understand GL84-2 was a
24 continuously cored hole?

25 A. I understand it was.



1 Q. Would you agree it doesn't
2 indicate any evidence of either an upper granular unit
3 or a lower granular unit at the elevations we find in
4 and around the vicinity of the proposed landfill?

5 A. No, it doesn't, but that is some
6 distance off to the west.

7 Q. But you would agree with me that
8 it doesn't provide any evidence that these granular
9 units are extensive in that direction?

10 A. I would agree.

11 Q. In fact it provides evidence they
12 are not extensive in that direction, do they not?

13 A. Yes. There was siltified sand at
14 depth and deeper than we might expect, but how it may
15 correlate over that kind of distance is a question, but
16 there isn't evidence of the two units there.

17 Q. In fact, Dr. Charlesworth, if we
18 look at your cross-section RH, which is now laying on
19 its face on the panel there, could you put up your
20 cross-section RH briefly, it would suggest that if
21 there is a granular unit off-site, that it is not
22 correlated with the granular units on the site?

23 A. That would suggest it, yes, and we
24 didn't attempt to correlate that.

25 Q. Then, going across, would you



1 agree with me that the evidence for granular units in
2 and around the vicinity of Site D is evidence in the
3 north-east corner of the site and there appears to be
4 some evidence that the granular units are in that
5 corner?

6 A. Yes. I might comment as a point
7 of clarification that it may be that this peculiar
8 chink in the lower granular unit shown on B is because
9 of the projected, one borehole from the north and one
10 from the south, and that may have led to some
11 distortion, I don't know.

12 Q. Would you agree with me that water
13 well MOE 2476, which is the Martin well that was
14 tested, does not appear to correlate with any of the
15 granular units at Site D?

16 A. That is not the well we tested.
17 That was some of the confusion I thought we were
18 resolving at the beginning. The Martin well we tested
19 was down in this corner.

20 MR. ESTRIN: Where?

21 DR. CHARLESWORTH: The southern corner.

22 MR. HODGSON: I'm sorry, but I think
23 the exhibit is M-462, the summary of well data.

24 DR. CHARLESWORTH: I haven't got a copy.
25 Sorry, yes I do, I do have that one.



1 MR. HODGSON: Q. Looking at that
2 exhibit, Dr. Charlesworth, and I am not as hesitant to
3 correct you as your own counsel was when you made this
4 mistake in-chief, but the Martin well is 2476 and it is
5 indicated on your plan view, M-438A, and also is so
6 indicated on Exhibit M-462. Would you agree that MOE
7 2476 is the Martin well?

8 DR. CHARLESWORTH: A. I thought that
9 this is what we resolved, that that was an error and
10 the Martin well is 1G, which is down in this location
11 and the wells we tested were all in this area and this
12 was in error, an error in the listing on the table.

13 Q. Did you not test water well 2476?

14 A. No.

15 Q. Are we to disregard the data on
16 M-462?

17 A. No. That is from well 1G located
18 down here.

19 Q. Where then is the Reed well?

20 A. The Reed well is 14HC.

21 Q. Would you agree with me that we
22 should stroke 2476 off M-462 and the Martin well you
23 were testing is right next door to the Reed well?

24 A. That is correct.

25 Q. In what is to be the fill area in



1 the southern corner of this landfill site?

2 A. That is correct.

3 Q. Do you have data on that well and
4 do you know how deep that well is?

5 A. We have the owner's report that
6 it's a bedrock well.

7 Q. Do we know how deep the bedrock
8 well is?

9 A. Yes. I would have to check on the
10 records, but I think it was 60 feet, but I'm not sure.

11 Q. Looking again at cross-section B,
12 would you agree with me that water well MOE 2476, and
13 we will pass over the fact that that is also named
14 Martin, appears to be screened in a granular unit that
15 is unrelated to the granular units that have previously
16 been identified and discussed so much at this hearing?

17 A. It appears to be, yes.

18 Q. Can we look at your cross-section
19 RB -- I'm sorry, yes, RB?

20 A. RB.

21 Q. I am sorry, we have put up the
22 wrong cross-section. The cross-section should be RG.

23 A. RG, which will fit in with the
24 pattern.

25 Q. Now, this is your cross-section?



1 A. Correct.

2 Q. Which you prepared last spring?

3 A. Yes, initially and it was then
4 revised later in the year and I don't think there were
5 any substantial if any changes to this.

6 Q. I wonder, Doctor, if you would
7 mind taking a darker blue pen and marking your upper
8 granular unit so it is a more impressive unit than the
9 one that appears at present?

10 A. I'll give you your pen back and
11 use this one.

12 Q. Do you mind filling them both in
13 or do you want to be able to read them? I am trying to
14 make it look as impressive as it does on the others, or
15 as unimpressive?

16 A. I will just leave the legend. How
17 is that?

18 Q. That's fine. I should go back and
19 correct the record. I was asking you earlier about a
20 comparison of the four cross-sections and I assisted
21 you in putting up the wrong one and then I described it
22 incorrectly. The four cross-sections which we want to
23 study which run along the bedrock depression, are B,
24 RG, C and D. Now, looking at your cross-section RG,
25 could you trace on plan view M-438A where RG runs?



1 A. I'm pointing to RG, which runs
2 from the vicinity of C1 through (MB)OW-3 across the
3 northern part of the site, and down towards (MB)OW-2.

4 Q. First of all, do you agree with me
5 that as you have depicted the upper granular unit in
6 RG, it does not extend off site in the direction of
7 First Line?

8 A. Yes.

9 Q. Secondly, would you agree with me
10 that most probably, based on the information contained
11 in the Trow Report, that they found boundary effects to
12 the east and the upper granular unit does not extend
13 off site to the east in cross-section RG?

14 A. I agree it is possible it doesn't
15 as there is a lack of hard data there, so possibly it
16 doesn't.

17 Q. If it does, would you agree that
18 if it is in fact in (MB)OW-3, it is very, very small?

19 A. It is certainly small.

20 Q. It's not a metre deep, is it?

21 A. I will refer to our plan to see
22 what we noted it as. It was 1.3 metres of sand and it
23 would appear to be at the edges of the unit there.

24 Q. Would you also agree, based on
25 your cross-section RG, that first of all to the extent



1 we find an upper granular unit, we seem to find it
2 right in the fill area for the most part?

3 A. Yes.

4 Q. Would you agree, based upon the
5 continuous core information we get from HC3-86, which
6 is right in the middle of your cross-section RG, that
7 the upper granular unit does not appear to be
8 continuous, even when we find it on site in the fill
9 area?

10 A. You have to be careful about
11 interpreting this section. You must remember the
12 section is a slice and it is conceivable, if you
13 recall....

14 Q. Dr. Charlesworth, we can only take
15 it one slice at a time and this is your slice, and I'm
16 asking you to interpret your slice. We are all aware
17 of the fact that we are only interpreting one slice at
18 a time and I'm not suggesting nothing else is happening
19 in an east-west direction, but we are looking in a
20 north-south direction as you have interpreted it.

21 A. Your question was, would I agree
22 that that shows that it is not continuously leaving the
23 site and I'm saying no. Just along that slice it
24 appears it is not continuous.

25 Q. Dr. Charlesworth, look at your



1 Figure 6.

2 A. Yes.

3 Q. We have some data from HC6-84 and
4 very good data from HC3-86, but the upper granular unit
5 if it exists, kind of to the east and kind of to the
6 west of the fill area, kind of doesn't exist in the
7 middle of the fill area and also in the answer would
8 you include -- no, that is enough.

9 The question is, isn't it very possible
10 that the upper granular unit to the extent it exists
11 off-site, isn't continuous even on site?

12 A. It is possible.

13 Q. Isn't it likely?

14 A. I wouldn't say at this time -- it
15 is likely, and we know there are areas where it is
16 absent, for example 3-86. That does not mean if it is
17 absent at 3-86 that it is not continuous elsewhere.
18 Certainly there are locations where it is absent and it
19 is also possible -- it does exist elsewhere and we just
20 don't know how extensive it is.

21 Q. What I am trying to work toward,
22 Dr. Charlesworth is two things; No. 1, I want your
23 evidence based on the evidence we find at this site as
24 to what is the most reasonable, that is to say what is
25 the most likely place you will find the upper granular



1 unit if we drilled down and looked for it, and,
2 secondly, of course I want your evidence as to what
3 would a hydrogeologist proposing to landfill here,
4 conservatively assume about the upper granular unit?

5 A. Okay.

6 Q. Mr. Sobanski and Mr. Beechinor
7 gave evidence that they have conservatively assumed
8 that the upper granular unit extends off-site in all
9 directions at a depth of one metre. Secondly, they have
10 conservatively assumed that the upper granular unit is
11 interconnected with the lower granular unit and,
12 thirdly, they have conservatively assumed that if there
13 is any contamination, it will be contamination moving
14 off site in all directions. That was their
15 conservative assumption and I am more than happy to
16 have your conservative assumption, but at the moment I
17 am asking you what is the most likely interpretation,
18 because I would like your evidence so we can assist the
19 Board in understanding the distinction between what we
20 are likely to find when we drill at Site D and what we
21 should necessarily assume if we are proposing to
22 landfill at Site D.

23 A. Okay. Their conservative
24 assumption with respect to where it extended was for
25 the purposes of their model, the same conservative



1 assumption that Dr. Rowe used. Their assumption in
2 terms of where it was on site was as depicted....

3 Q. I am not asking about their
4 assumption, but yours?

5 A. You did introduce their
6 conservative assumptions. My conservative
7 assumption....

8 Q. I want your reasonable, most-
9 likely evidence as to where this upper granular unit
10 is?

11 A. I think that it is quite possible
12 that it is somewhere between our minimum as we have
13 depicted it on Figure 6 and our maximum as depicted on
14 Figure 6.

15 Q. Thank you. Can we look at cross-
16 section C. Would you agree with me in cross-section C,
17 to the extent that we find the upper granular unit, we
18 find it in the fill area?

19 A. With regard to cross-section C,
20 yes.

21 Q. Looking at it in plan view, it
22 doesn't appear to extend down to HC3-85; is that fair?
23 The plan view, M-438A?

24 A. It does not appear to extend.
25 Yes, it does not appear to extend to 3-85.



1 Q. In fact 3-85 isn't very far from
2 the new water well you just told us about, is it?

3 A. No, it is not.

4 Q. That new water well you told us is
5 a bedrock water well?

6 A. You could conceivably be getting
7 the edge of the unit at 3-85.

8 Q. And we could conceivably not be
9 getting it there, would you agree?

10 A. I would agree.

11 Q. In fact if somebody right nearby
12 there has just developed a new well in the bedrock,
13 that would suggest they didn't find anything on the way
14 to the bedrock, wouldn't it?

15 A. The evidence of finding material
16 that could be the edge of the unit there, plus of
17 course the fact they went to bedrock nearby suggests
18 that here at point 3-85 we may be just at the edge of
19 the unit.

20 Q. Or past it?

21 A. Well, if a unit is thinning out
22 and changing in texture, then that may well be the edge
23 of it.

24 Q. If you were taking the Chairman of
25 the Board out and suggesting to him where or telling



1 him where to drill to find the edge of the upper
2 granular unit, would you suggest he drill around HC3-
3 85 or would you have a better suggestion on cross-
4 section C?

5 A. On cross-section C -- I wouldn't
6 suggest 3-85.

7 Q. Can we look briefly at cross-
8 section D? Cross-section D, if you can point to the
9 plan view, M-438A, sweeps around the eastern end of the
10 site?

11 A. It bends around the middle.

12 Q. Around this end of the site,
13 connecting up quite a number of continuously bored
14 boreholes. We don't find evidence of an upper granular
15 unit?

16 A. Yes, I would agree.

17 Q. If we look both at cross-section A
18 and cross-section D, and if we look at cross-section A
19 at the eastern extremity and cross-section D, you would
20 agree there isn't much evidence we will find the upper
21 granular unit extending off-site to the east?

22 A. There is a big gap, quite a big
23 gap in the data on the northward swing of Section D.

24 Q. It would be useful for the
25 purposes of monitoring to put a hole in there and fill



1 that gap?

2 A. It would be useful for the
3 purposes of defining the hydrogeology, yes, to put a
4 hole.

5 Q. Do you want to look at M-438, the
6 plan view, and show the Board where you say the gap is
7 on M-438A? Perhaps you could take a highlighter, your
8 purple highlighter and mark the gap across First Line.
9 Where is the gap as it goes along First Line?

10 A. First Line?

11 Q. I'm sorry, Highway 25.

12 A. There appears to be -- 4-84 is not
13 very good data and so I would say there is a gap in
14 here.

15 Q. Would the gap in part be filled by
16 the fact that what you find across Highway 25 is some
17 more bedrock wells?

18 A. That would help. If you are
19 taking a conservative approach that gives you an
20 indication, but you need more concrete data, and I
21 think domestic wells are used to alert you to possible
22 problems and they are not used to prove you don't have
23 a problem.

24 Q. Could you look at M-438A and the
25 series of bedrock wells that extend down the First Line



1 from the southern extremity of the landfill; First
2 Line, the series of bedrock wells that extend down
3 First Line?

4 A. Yes.

5 Q. It's shown better on your figure
6 than on this reduced figure. Then the series of
7 bedrock wells we see going up Highway 25?

8 A. Yes.

9 Q. Wouldn't you agree that we find
10 bedrock wells exactly where we expect to find them,
11 sitting up on the shoulders of the bedrock depression
12 where the till is the thinnest?

13 A. Yes, I would agree.

14 Q. Would you also agree that if the
15 gradients in the area are upward from the bedrock, the
16 bedrock wells in the area are protected from any
17 possible contamination?

18 A. Yes, except when you get onto the
19 flanks, because the gradients are actually downward.

20 Q. Do you find any wells on the
21 flanks, Dr. Charlesworth?

22 A. Yes.

23 Q. Not very many?

24 A. No. I'm sorry, when you get out
25 of the valley onto the higher bit or the higher area,



1 there is some evidence of downward gradients here.

2 Q. There is some evidence of downward
3 gradients when you get out on the flanks and there is
4 also some evidence that there are no granular units as
5 well, isn't there?

6 A. Yes.

7 Q. Can we go back to cross-section C?

8 A. Yes.

9 Q. You would agree from cross-section
10 D that the evidence for the lower granular unit, and we
11 are now talking the lower granular unit and I want to
12 work backward up the site. First on cross-section D,
13 would you agree that from the number of continuously
14 bored holes in the area of the eastern flank, the
15 southern, eastern flank of the site, that there isn't
16 much evidence that there is an upper granular unit
17 there?

18 A. I would agree except there is a
19 big gap in the middle of the southern arm of Section D
20 and in fact you have a split spoon hole that doesn't go
21 down to rock there and there is a big gap in the middle
22 of the other part of the section. Given those gaps in
23 the data, then there is not the evidence.

24 Q. What there is again, looking at
25 your Figure 8, what we have in HC5-85 is the unit



1 getting much thinner?

2 A. Yes.

3 Q. And becoming silty?

4 A. Yes.

5 Q. In HC6-85, if the unit is there at
6 all, it is much thinner and it is a silt, sand shale?

7 A. Yes.

8 Q. Now, looking true west from the
9 eastern flank of the site, and that is looking from the
10 bottom of these cross-sections and looking at the D, C,
11 RG and B, would you agree with me that when we look
12 from D to C and to RG and when we look from B to RG to
13 C, that is to say if we stood at the western end of the
14 site, which would be the upper corner where we find
15 HC1-85, that we see evidence for the granular units
16 getting thicker as we go toward the fill area and
17 thinner as we get away from the fill area and it
18 doesn't matter whether we look east or west, that is
19 what we see?

20 A. Yes.

21 Q. That is confirmed, is it not, by
22 cross-section A to the north and to the south?

23 A. That cross-section certainly
24 confirms it with respect to the lower granular unit.
25 It is a bit more tenuous.



1 Q. Dr. Charlesworth, forgetting about
2 a conservative interpretation or a contaminant
3 migration interpretation, and looking at this situation
4 from the point of view perhaps of even water well data,
5 wouldn't you agree with me that on a reasonable
6 interpretation, the upper granular unit is not very
7 extensive at Site D and on a most likely basis, it is
8 not very extensive. You found it in six out of
9 eighteen continuously cored holes?

10 A. When you superimpose -- you are
11 looking at cross-sections here now and when you look at
12 the data on an overall basis, it is certainly not the
13 zone that either group have modelled and there are
14 still, to my mind, questions about where it extends to.

15 Q. I appreciate your evidence in that
16 regard, but wouldn't you agree, looking at this series
17 of cross-sections, that the upper granular unit isn't
18 very extensive, and in fact it isn't very impressive?

19 A. The way it is drawn on these
20 cross-sections, there are an awful lot of question
21 marks.

22 Q. The question marks, Dr.
23 Charlesworth, relate to the fact that it doesn't appear
24 to be there?

25 A. The question marks are that it may



1 be there but the evidence is lacking.

2 Q. Let's talk about the lower
3 granular unit. Comparing the upper granular unit and
4 the lower granular unit purely in terms of lateral
5 extent, would you agree the lower granular unit is a
6 more impressive granular unit?

7 A. It appears to be more extensive,
8 yes.

9 Q. You would agree it also appears to
10 be thicker?

11 A. Yes, I agree.

12 Q. Would you agree with me, looking
13 particularly at your cross-section RG and cross-section
14 C, that the lower granular unit is sitting down there
15 in the bedrock depression?

16 A. Yes, it is within the bedrock
17 depression and from some of the other sections, it
18 extends to sort of the shoulder of it, the bedrock
19 depression.

20 Q. But it doesn't jump up on the
21 shoulder and ride it up?

22 A. No, it does not jump up on the
23 shoulder.

24 Q. If you are unlucky enough to build
25 a house up on the shoulders of the bedrock depression,



1 you have to have a bedrock well in this area, don't
2 you, Dr. Charlesworth?

3 A. There are wells down here which
4 are overburden wells.

5 Q. We know the famous wells, Chlon,
6 Chaput and Pompa, but show me the rest of the
7 overburden wells in the area of Site D?

8 A. I was answering the question if
9 you were up on the bedrock shelf, you would have to
10 have an overburden well -- you have to have a bedrock
11 well, and I am saying the existence of those wells...

12 Q. There are three wells?

13 A. Four wells, I think.

14 Q. You are not suggesting the Reed
15 well is screened anywhere in the upper till, are you?

16 A. It's a shallow well.

17 Q. Fourteen feet.

18 A. The question was -- I was
19 referring to the question you have to have a bedrock
20 well and I am saying there are wells there and you
21 don't have to have that and there are four wells there.

22 Q. Look where the bedrock wells are
23 and correlate the information you have got on the
24 bedrock wells with the information you have got on the
25 granular units and see if you can't agree with me that



1 unless you have a well somewhere very close to this
2 bedrock depression, you don't get to have your well in
3 a granular unit but you get to have it in the bedrock.

4 A. I don't actually see the over-
5 burden wells in the bedrock depression.

6 Q. You don't see overburden wells at
7 all?

8 A. That's not true, as there are a
9 few overburden wells and I'm sure for the people who
10 live there, that is a matter of concern and there may
11 well be the potential for additional....

12 Q. Show the Board where the
13 overburden wells are; in fact I would like this
14 evidence highlighted, so take a nice bright yellow or
15 bright green and circle for us where we find over-
16 burden wells. That's not bright enough. Have you got
17 a brighter colour?

18 A. No, I don't. Maybe you have?

19 Q. Let's make it look like Easter and
20 circle the yellow with purple. Ms. Cronk suggested we
21 smuch the purple.

22 MS. CRONK: I was suggesting a light
23 smuching.

24 MR. HODGSON: Q. First of all looking
25 at the site, I think you can agree that if Site D is



1 approved for landfilling, then we don't need to have a
2 great deal of concern for the water wells actually on
3 the site?

4 DR. CHARLESWORTH: A. I would agree.

5 Q. It would not be a useful exercise
6 to continue to use those wells?

7 A. I would agree.

8 Q. In fact it would be counter-
9 productive?

10 A. Yes.

11 Q. So now what we are looking at as
12 we have the Chlon well, the Pompa well and the Chaput
13 well across First Line?

14 A. Yes.

15 Q. And in the immediate vicinity of
16 the fill area you have one other overburden well,
17 wouldn't you agree, and that is 2479?

18 A. I am sorry. Yes.

19 Q. 2479, would you not agree, doesn't
20 appear to be in either the upper granular unit or the
21 lower granular unit?

22 A. It does not appear to be, but we
23 don't know for sure.

24 Q. If landfilling was approved at
25 Site D, would you agree it would be a very useful



1 exercise to make sure we monitor in the direction of
2 well 2479?

3 A. Yes, certainly. You should define
4 where the units are and you should monitor the units.

5 Q. Can we go back and would you agree
6 with me, Dr. Charlesworth, that there are a lot of
7 bedrock wells in the vicinity of Site D and those
8 bedrock wells, to correlate the data, are sitting up on
9 the shoulders of the bedrock depression?

10 A. Generally, yes.

11 Q. Would you agree with me that the
12 bedrock at Site D is the same shale we find at Site F?

13 A. It's the Queenston shale.

14 Q. The Queenston shale at Site F does
15 not have very promising water chemistry, does it?

16 A. At Site F it does not.

17 Q. Is it not more likely than not
18 that you will find better wells in the overburden than
19 you do at the bedrock?

20 A. Yes, I would think, you are more
21 likely -- and one can always be surprised, but it is
22 more likely you will get better quality wells in the
23 overburden.

24 Q. It is very unlikely with all the
25 bedrock wells in the vicinity of Site D that everyone



1 has a bedrock well because they like the water better
2 than the water found in the overburden?

3 A. I would think that that is likely.

4 Q. The most likely thing being that
5 they didn't find any water in the overburden?

6 A. Quite possible, although quite
7 often the driller is being paid by the foot.

8 Q. It is like lawyers being paid by
9 the hour, they always have another question.

10 A. Which I can assure you, Mr.
11 Chairman, often happens.

12 Q. Dr. Charlesworth, just one other
13 comment. Is it safe to assume that at some time the
14 bedrock was left exposed and that some glacier or other
15 came along and started laying down till in the area?

16 A. Yes.

17 Q. Is it not likely that a glacier
18 going through would have laid down a layer of till and
19 put some up on the shoulders and some down in the
20 bedrock depression?

21 A. Yes.

22 Q. Sort of like putting a layer of
23 peanut butter on the toast; you wouldn't leave all the
24 corners bare, you would lay it down uniformly?

25 A. That's the most amazing analogy I



1 have ever heard for glaciation.

2 Q. If we look at cross-section C,
3 yes, looking at cross-section C, and looking for
4 example at (MB)OW-2 which is Mr. Beatty's well just off
5 to the left of First Line, cross-section C?

6 A. Yes.

7 Q. Isn't it likely that the lower
8 till or some of the lower till was laid down there at
9 the same time that some of the lower till would have
10 been laid down in the bedrock depression on cross-
11 section C?

12 A. Yes, that is possible.

13 Q. So, whatever laid down the lower
14 granular unit here, it would have laid it down after
15 the till was laid down in the area of (MB)OW-2?

16 A. I'm sorry, could you develop that
17 again for me?

18 Q. I am trying to understand, and
19 perhaps you can help me explain to the Board if you
20 would, why it is likely that we would find the lower
21 granular unit down in this bedrock depression. I am
22 trying to understand that when the first till -- will
23 you first agree with me that what we have in the lower
24 till is probably something in the order of three or
25 four different till sheets?



1 A. In the lower till?

2 Q. Yes.

3 A. I don't know.

4 Q. It's several, is it not?

5 A. Yes. There are tills and there is
6 this interbedding between the tills.

7 Q. I understand that, but would you
8 agree that what we find between granular units even in
9 the very few places we find both granular units in one
10 borehole, is a till sheet?

11 A. Yes.

12 Q. In fact that till material has a
13 much lower hydraulic conductivity than does the
14 granular material on one or other side of it?

15 A. Yes.

16 MR. HODGSON: Mr. Chairman, this would
17 be a good time, if you wanted to take a break this
18 afternoon.

19 MR. LANCASTER: Yes, we will.

20 --- Recess

21

22 MR. LANCASTER: Be seated, please.

23 MR. HODGSON: Q. Dr. Charlesworth, could
24 I ask you to refer first of all to your cross-section
25 RB.



1 DR. CHARLESWORTH: A. RB?

2 Q. RB. Am I correct that you have
3 interpreted in cross-section RB that the three wells of
4 most concern, you agree the three wells of most concern
5 are the Chlon, Pompa and Chaput wells?

6 A. And Chaput, yes.

7 Q. Those three wells are indicated by
8 three arrows on your figure?

9 A. Yes.

10 Q. Would you agree with me, and first
11 of all as regards the bedrock in this cross-section,
12 you have three data points, HC1-85?

13 A. Yes.

14 Q. GL84-1?

15 A. Yes.

16 Q. And (MB) OW-2?

17 A. Yes.

18 Q. Now, somebody in preparing this
19 cross-section has somewhat in a free-handed fashion
20 drawn a line between those data points that curves
21 downward; do you see that?

22 A. Yes.

23 Q. The reality is that we don't know
24 where that bedrock is between those data points; is
25 that correct?



1 A. That is the reality.

2 Q. I wonder if you would take a long
3 ruler, or one of these pieces of hard material and lay
4 it -- by some chance we have a long ruler, but draw a
5 straight line, if you wouldn't mind, from HC1-85 to
6 GL84-1 to show -- will you use a highlighter?

7 A. From HC1-85?

8 Q. To your next data point, GL84-1.

9 A. You mean from the bedrock contact?

10 Q. Yes.

11 A. Yes.

12 Q. Would you do so as well from
13 GL84-1 to (MB)OW-2?

14 A. To (MB)OW-2?

15 Q. Yes.

16 A. Yes.

17 Q. Would you agree that that blue
18 line you have just drawn on your cross-section RB is at
19 least as fair as interpretation of the bedrock
20 configuration between those boreholes as the line you
21 previously drew?

22 A. Yes.

23 Q. It dips down?

24 A. It is obviously not a straight
25 line, but we have no reason to know it would be a curve



1 as we depicted it here.

2 Q. With the bedrock interpreted as I
3 have suggested between GL84-1 and (MB)OW-2, would you
4 agree that it would appear that the Chlon, Pompa and
5 Chaput wells are very near the bedrock as you have
6 interpreted RB?

7 A. Yes, I would, yes.

8 Q. Would you also agree with me that
9 if one were to engage in a freehand exercise with the
10 bedrock and instead of dipping down you were to dip
11 up, you wouldn't have to dip up as much as you would
12 have to dip down to put each one of those three wells
13 in the bedrock?

14 A. You could curve the line across
15 and include those in the bedrock, yes.

16 Q. Could you hold your cross-section
17 RB up beside your cross-section RG? Cross-section RB
18 runs in a north-east, south-west direction down First
19 Line?

20 A. Yes.

21 Q. Cross-section RG is the cross-
22 section we examined previously that runs at right
23 angles to the bedrock depression?

24 A. Yes.

25 Q. In fact if we look at the lefthand



1 end of RG and the righthand end of RB, you are
2 interpreting the same area, approximately, where three
3 water wells of significant are located, would you
4 agree?

5 A. Yes.

6 Q. What you show when you drew RG-
7 RG, you could have projected those three wells into RG,
8 and I am not suggesting it was inappropriate in you not
9 doing so, but you could have projected them into RG-RG?

10 A. We could have.

11 Q. Had you done so, it would suggest
12 they are not connected to the granular unit at Site D?

13 A. On that cross-section, yes, it
14 would suggest that.

15 Q. I wonder if we could, for whatever
16 significant it turns out to have, if we could engage in
17 a bit of intellectual history. Would you put your copy
18 of RG up where it was previously?

19 A. I should add that projecting the
20 wells may have led us to extend the lower granular unit
21 along there, but your point is taken. What are you
22 asking me to put up?

23 Q. I am asking you to put RB up where
24 you had it before. What I am showing you, Dr.
25 Charlesworth, is an exhibit Mr. Estrin put to Mr.



1 Sobanski, M-158-RB-RB¹. Making allowances for the
2 fact that between doing M-158-RB-RB¹ and doing Exhibit
3 438-RB, you changed the scale of the drawing?

4 A. That is correct. This is 1:4000
5 horizontal scale and 1:2000, so there is vertical
6 exaggeration.

7 Q. I am not meaning -- there is no
8 implied criticism and, if anything, it was appropriate
9 to change the scale on your RB so it coincided with the
10 scale of all the other cross-sections which would give
11 a fairer representation?

12 A. The original one had been
13 compressed to get a long section onto the same size
14 board and we kept the same vertical scale and that gave
15 the distortion.

16 Q. Would you agree with me that on
17 your original RB-RB¹ you had interpreted at least two
18 of those water wells to be in the upper granular unit?

19 A. I think you are right.

20 Q. Show the Board where you drew the
21 upper granular unit in RB-RB¹?

22 A. It's the yellow here.

23 Q. And it intersects at least water
24 well 4665?

25 A. We have it intersecting 46 --



1 which one are you referring to?

2 Q. I meant 5665.

3 A. 5663. Yes, we have it intersecting
4 5663 and at that time we drew it down and it's my
5 recollection, and I would have to check and we probably
6 don't want to bother doing that, but I think that that
7 is the way Trow interpreted it. Anyway, we thought on
8 re-examination that it was more reasonable to bring up
9 the lower granular unit, but it could be either way.

10 Q. If you would step back from your
11 re-interpretation on RB where you have extended the
12 lower granular unit to those three wells and
13 discontinued the upper granular unit to at least one,
14 step back and look at cross-sections B, RG, D and C.
15 Is it fair to say, Dr. Charlesworth, that since you
16 prepared those cross-sections in June that you have
17 concluded that the lower granular unit is much more
18 important in understanding the hydrostratigraphy of
19 Site D than the upper granular unit?

20 A. I want to give you a very honest
21 answer to this.

22 Q. I want you to give us a very
23 honest answer to every question.

24 A. I think what has happened, in my
25 own interpretation of the site, is that I began to



1 think that the lower granular unit could well play a
2 more important role in the hydrogeology of the site
3 than I had originally thought or that I felt other
4 people's treatment suggested. I think it's fair to say
5 I started to assume in my own mind -- I still don't
6 think that we have a good handle on exactly what role
7 it plays, but I think it is more important than I
8 initially thought.

9 Q. Would you agree with me that you
10 think that because the more you look at the evidence
11 for the upper granular unit, the less convinced you are
12 that it goes anywhere?

13 A. No, no, I wouldn't agree. I
14 looked at these sections and I have no fundamental
15 disagreement with them.

16 Q. "These sections" being the
17 sections I put to you today?

18 A. The new sections that I indicated
19 and I went over those, but I still feel there are
20 uncertainties and in trying to answer that, I tried -- I
21 have an overhead here, and this may help in
22 understanding things. What I tried to do very quickly
23 on here....

24 DR. KINGHAM: I think we are going to
25 have some difficulty with that.



1 DR. CHARLESWORTH: Does anyone have any
2 bright ideas?

3 MR. HODGSON: This is called obscuring
4 the evidence.

5 DR. CHARLESWORTH: What I have done on
6 here, this is the same map, our cross-sections and
7 these new cross-sections presented by Mr. Hodgson.

8 MR. HODGSON: Q. You have been busy
9 since Monday morning.

10 DR. CHARLESWORTH: A. This was at 3:00
11 in the morning at the same time you were up.

12 Just quickly roughing on the cross-
13 sections, and this is for the upper granular unit, and
14 this is a magnificent overhead and it's a pity that is
15 spoiled by the screen, but I have marked on here where
16 Trow on their new sections and where we have indicated
17 the existence of the upper granular unit and also the
18 question marks, or where there are question marks
19 related to it. As you can see, hopefully that is the
20 outline of the site and there is a lot of green on
21 there, question marks, question marks. I still feel,
22 and I am still particularly concerned about this area
23 here, both existing users -- the area west of First
24 Line and there are a few existing users and potential
25 uses, and I did the same thing for the lower granular



1 unit and here again I have marked where we have show it
2 on your cross-sections and where Trow has shown it on
3 the new cross-sections and question marks where we
4 really don't know and once again there are questions
5 that need to be answered before we fully understand
6 what is happening at this site.

7 MR. ESTRIN: Before we continue could we
8 mark the overheads as exhibits.

9 MR. HODGSON: Are you sure you want them
10 as exhibits?

11 MR. ESTRIN: We can make copies for you.

12 MR. HODGSON: Could they have separate
13 numbers because that makes it easier to keep track.

14 MR. LANCASTER: M-496 is the upper
15 granular units and M-497 being the lower units.

16 --- EXHIBIT NO.M-496: Overhead of location of
17 the upper granular units.

18 --- EXHIBIT NO.M-497: Overhead of location of
the lower granular units.

19 MR. HODGSON: Q. Dr. Charlesworth, I
20 want to come back to ask you some questions about those
21 cross-sections, but I want to go back to cross-section
22 RB, your new cross-section RB.

23 DR. CHARLESWORTH: A. Right.

24 Q. I want to suggest to you that if
25 there are upward gradients from the bedrock up to the



1 granular units, and if indeed it should turn out that
2 those three wells are at or very near the bedrock,
3 wouldn't you agree that there are likely to be upward
4 gradients towards those three wells from the bedrock,
5 looking at your cross-section RB?

6 A. I just want to refer for my own
7 memory to an overhead before I answer that. I guess
8 my concern is we seem to have a downward gradient in
9 that, and I am now referring to Exhibit M-460A, but we
10 have a downward gradient in this south-west corner of
11 the site.

12 Q. Let's take those cross-sections
13 down because I can't deal with your evidence this way.
14 It's too fuzzy. Now, could you put your cross-
15 section up, please.

16 Dr. Charlesworth, on this cross-section
17 I would like you to first look at the plan view on M-
18 438A and I would like three little x's as close as you
19 can to the actual location of those three water wells
20 across the First Line?

21 A. On which exhibit?

22 DR. KINGHAM: Do you want it marked on
23 460A?

24 MR. HODGSON: 460A, the overhead. He
25 is telling us about the gradients in the bedrock and I



1 would like to know where those wells are.

2 Q. I suggest you have them far too
3 low and the most northerly well you have in the plan
4 view almost at the middle of the site opposite
5 (MB) OW-4?

6 DR. CHARLESWORTH: A. Yes, you are
7 right. So let's say we have one here and it comes
8 about half-way down and so here and probably here.

9 Q. You are showing the wells as three
10 circles?

11 A. Yes.

12 Q. And the three x's you previously
13 indicated are now meaningless data on this document?

14 A. That is correct.

15 Q. In case we all lose it later,
16 could you take -- do you have a purple pen or anything
17 but red or green? I have got one.

18 A. I did have this morning. I have
19 some here.

20 Q. I have black and would that do?

21 A. I have purple.

22 Q. Circle it with purple. Oh, that
23 is red. Could you go outside it and circle it with
24 black and mark in the legend that those are the Chaput,
25 Chlon and Pompa wells as interpreted by you. You were



1 about to tell us about the gradients in the vicinity of
2 these three wells?

3 A. I was saying that as you come down
4 to the south-east corner of the site...

5 Q. Borehole 3-85?

6 A. ...we seem to have a downward
7 gradient into the rock, so there is a change of
8 pattern. We are working with a very scant amount of
9 data, but we seem to have upward gradients along the
10 valley and downward gradients -- I guess that is still
11 partly in the valley, but as you come out onto the side
12 of the bedrock valley, down towards the south-east
13 corner -- south-west corner of the site, there seems to
14 be a downward gradient, and I am not sure we can rely
15 on the upward gradients from the rock.

16 Q. Accepting you have very limited
17 data, wouldn't you agree that what you have from the
18 data there is you tend to have downward gradients --
19 no, I'll take that question back.

20 Let's go back to the Chlon, Chaput and
21 Pompa wells?

22 A. Yes.

23 Q. Isn't it at least possible that
24 those wells, if they are at or near the bedrock, are
25 protected by upper gradients?



1 A. Protected from?

2 Q. Leachate migrating from the
3 landfill by upper gradients?

4 A. I don't think that follows at all.
5 It may well be you have the lower granular unit with
6 gradients down toward it and gradients up towards it
7 and in which case in the flows from the bedrock, they
8 are probably very small, so no, it doesn't follow.

9 Q. Aren't they more protected if they
10 are upper gradients than if they are not upper
11 gradients?

12 A. What counts is the gradients down
13 to the unit they are taking the water from and that is
14 the critical factor.

15 Q. Let's go back. isn't there a
16 significant chance that those three wells aren't in
17 fact in a granular unit that is in any way connected
18 with this site?

19 A. I think that is one of the issues
20 and that, of course, was where I was going to drill or
21 where I proposed or suggested a hole, and that is a
22 question that needs answering.

23 Q. Would you put up the exhibit that
24 has your suggested holes please and would you mind
25 putting on this exhibit, the Chlon, Chaput and Pompa



1 wells?

2 A. I'll try and do this reasonably
3 accurately. What was the other one? Oh, Pompa.

4 Q. Dr. Charlesworth, let's suppose
5 that you drill your new borehole 5 first. No, let's
6 be fair to your ordering and let's go to borehole 1
7 first. Let's suppose you drill borehole 1 first and
8 then we discover that we have a metre of upper granular
9 unit and two metres of lower granular unit; is that a
10 fair assumption?

11 A. I don't know if it's a fair
12 assumption. That's the purpose of drilling the
13 borehole.

14 Q. We have fulfilled the purpose and
15 found the units. What difference does it make as to
16 whether or not the Board approves landfilling at Site D
17 that you have found the upper granular unit and the
18 lower granular unit at borehole 1. Do we know from
19 looking at your plan view on Figure 6, that we have got
20 the units in -- we have the upper granular unit in HC4-
21 85 and HC2-85 and the lower granular unit in HC4-85 and
22 HC2-85, so how could it possibly matter to this Board
23 that we now discover we have it in the vicinity of HC5-
24 85 where you have written your No. 1 on Exhibit M-595.

25 A. 5-84. It is important because it



1 is my opinion that it is important to understand the
2 flow system at this site, and knowing the extent of the
3 units, Mr. Chairman, it is my opinion it is an integral
4 part of the design and the monitoring at this site and
5 it is important to know those facts. Each of these
6 holes will help to better define either or both of the
7 units. It will fill in the gaps I see in the data, or
8 the uncertainties that exist.

9 Q. Dr. Charlesworth, if Site D is
10 approved for landfilling, it is absolutely necessary to
11 monitor the site, don't you agree?

12 A. Yes, I agree.

13 Q. The proposal to landfill has been
14 made on the assumption that these upper granular units
15 and lower granular units are there and are extensive,
16 isn't that right? That was Mr. Sobanski's evidence?

17 A. Yes.

18 Q. We will assume they are there and
19 if we are going to landfill, we want to be absolutely
20 sure that we know where they are?

21 A. Certainly.

22 Q. Therefore it is important before
23 we proceed to landfill to carry out a drilling program
24 that defines the unit better and allows you to monitor
25 the unit throughout the life of the landfill. Do you



1 not agree?

2 A. Yes, I think it is important to
3 know prior to approving and prior to, for example -- if
4 you are going to attach much credibility to a model
5 that tells you the site is safe, you need to have a
6 better idea....

7 Q. Doctor --

8 MR. ESTRIN: Let him finish.

9 DR. CHARLESWORTH: You need to identify
10 these things.

11 MR. HODGSON: Q. Dr. Charlesworth, it
12 doesn't take a hydrogeologist, wouldn't you agree, to
13 come along and tell us that there are some gaps in the
14 data and we could always use more data to understand
15 Site D.

16 DR. CHARLESWORTH: A. I don't know if
17 it takes a hydrogeologist or not. I have looked at
18 this as a hydrogeologist and in my opinion there are
19 deficiencies which indicate that we do not at this time
20 understand the flow system beneath the site and there
21 is the potential for off-site migration, which I
22 believe should be of concern to the Board.

23 Q. The potential for off-site
24 migration was taken into account in the proposal to
25 landfill at Site D, don't you agree? It is assumed



1 there will be off-site migration if the leachate is
2 allowed to escape this landfill and that is the point
3 of designing the hydraulic trap; do you agree?

4 A. That is the point of designing the
5 hydraulic trap, yes.

6 Q. Do you not also agree that if the
7 hydraulic trap fails, that it will be necessary, by one
8 means or another, to prevent that leachate from
9 migrating off-site?

10 A. It will be essential to prevent
11 that from migrating off-site, yes.

12 Q. That will mean either developing
13 cells in the wells and cells at the landfill and
14 pumping the leachate out directly or it will mean
15 developing wells in the buffer zone or somewhere else
16 in those units capable of taking the leachate off-site
17 and pumping those wells so that that leachate doesn't
18 escape the site. Is that the assumption of
19 landfilling at Site D?

20 A. Yes, but I don't think that at
21 this time the ways by which that can be effectively
22 done are known.

23 Q. Dr. Charlesworth, the issue is
24 whether or not this Board has enough information to
25 landfill at Site D. Looking at your proposed borehole



1 1 on M-495, why would the information that the upper
2 granular unit and the lower granular unit exist at that
3 borehole assist this Board in deciding whether or not
4 it was safe to landfill at Site D?

5 A. Because I believe it will help in
6 evaluating the overall hydrogeological regime beneath
7 this site, which I believe is something that should be
8 done.

9 Q. Let's go to the Chlon, Chaput and
10 Pompa homes. Would you agree with me that if
11 landfilling is approved at Site D, that it is essential
12 to understand the relationship between those three
13 wells and the hydrostratigraphic regime on Site D?

14 A. Yes.

15 Q. Do you agree with me that it would
16 be appropriate to drill at or near those wells to
17 determine in what kind of a geological unit those wells
18 are screened?

19 A. Yes.

20 Q. Do you agree with me that if it
21 turns out that those wells are screened in overburden
22 units that it would be appropriate to work backward
23 from those wells on Site D to determine the
24 connectedness between Site D and those wells?

25 A. It would be necessary to do that.



1 Q. Did you answer?

2 A. Yes, I said it would be necessary
3 to do that.

4 Q. Do you agree with me, that if you
5 drilled borehole 2 and pumped it, you might be able to
6 detect some influence on those three wells, assuming
7 they were connected to the strata you were pumping?

8 A. You might be able to. If you
9 drill a pumping well there, yes, you could.

10 Q. But it might turn out that those
11 three wells aren't connected to Site D, might it not --
12 I am sorry, they are not connected to pumping well 2?

13 A. Yes, and we might find a variety
14 of different scenarios.

15 Q. Would you mind drawing on this
16 exhibit, M-495, with a freehand pen, the worst scenario
17 you can imagine for each one of those three wells and
18 give the Board your idea of the worst possible
19 geological situation that could exist in connection
20 with each of those three wells from the point of view
21 of landfilling across the road at Site D?

22 A. I don't think I have to draw it on
23 there. The worst scenario would be the maximum extent
24 of the unit as shown on our Figure 6.

25 Q. Does that mean that the worst



1 scenario is that those wells actually turned out to be
2 in the upper granular unit? Is that what you are
3 saying?

4 A. Yes. If you will just give me a
5 moment to phrase my answer. We are into a sort of
6 hypothetical situation, but I think it is fair to say
7 that the worst scenario would be an upper granular unit
8 extensive beneath the site feeding wells just off the
9 site, yes.

10 However, there is now this uncertainty
11 about the role the lower granular unit plays in the
12 hydrogeology of the site and so it could also be bad
13 for those wells if they are in the lower granular unit
14 and the lower granular unit extends in that direction.

15 Q. Would you mind then -- could we
16 take this one at a time and here is my suggestion,
17 let's take the most northerly well near your borehole 4
18 and draw somehow a connectedness between that well and
19 the upper granular unit on Site D and making
20 assumptions the whole way that the upper granular unit
21 extends directly from Site D to that well. Can you do
22 that?

23 A. I'm not sure, maybe I can, but I'm
24 not sure. Draw the connectedness?

25 Q. Let me show you something and some



1 figures I have drawn and you can pick from them what
2 you think would be the most exciting possibility. I
3 tried to imagine a worst-case situation and under no
4 circumstances do I want them to go into evidence. Do
5 they give you any idea how the granular units could
6 extend from Site D to these three wells so as to create
7 the maximum problem from the point of view of
8 protecting these wells should there be a landfill at
9 Site D. Can you give me the worst case and if you
10 want to include both units, then by all means put one
11 well in one unit and the other well in the other unit.

12 A. The worst-case would be quite
13 simply the unit extending, let's say the upper granular
14 unit extending off-site across First Line with
15 gradients in that direction toward those wells.

16 Q. Can you draw it, Dr. Charlesworth?

17 A. I have said....

18 Q. Can you draw it. Put the well in
19 the upper granular unit. Put one in the upper
20 granular unit and if you want one in the lower granular
21 unit, by all means put one in the lower granular unit.

22 A. I am not sure what I'm drawing.

23 Q. Please draw what you just outlined
24 and use dotted line to indicate where the granular
25 units are that extend on site and include those wells?



1 A. Okay. I already have it. Here
2 are the wells and the maximum possible extent.

3 Q. Can you draw that on M-495,
4 please. You don't have to match it exactly, but I am
5 looking for a worst-case situation and in a freehand
6 way connect those wells to the upper granular unit on
7 the site, the hypothetical upper granular unit on the
8 site.

9 Now, Dr. Charlesworth, how would
10 drilling at borehole 2 and the discovery that the well
11 nearby is screened in the upper granular unit and the
12 discovery that by pumping well No. 2 there is a direct
13 hydraulic connection to the upper granular unit
14 underlying Site D, how would that make any difference
15 to whether or not Site D should be approved for
16 landfilling.

17 A. If this is the situation and given
18 the scenarios Dr. Rowe has modelled, then there are
19 serious problems with this site and drilling the well
20 there won't rectify those problems, but it will help to
21 identify whether this situation exists or not.

22 Q. Dr. Charlesworth, we have assumed
23 there are serious problems with the site and the design
24 has assumed that you can't let the leachate escape the
25 site until that leachate is sufficiently innocuous that



1 it can't possibly do any harm, and that means it must
2 either all be captured in the cells or it must all be
3 pumped out of the cells or it has to be captured in the
4 buffer zone as it attempts to leave the site. If the
5 upper granular unit is as extensive as you have drawn
6 it on this drawing between those wells and the site,
7 why, if those wells are screened in the upper granular
8 unit can't you put a well in the upper granular unit on
9 site and pump the upper granular unit and prevent any
10 off-site migration in the vicinity of those wells.

11 A. It may well be you would have a
12 serious impact on the yield of the wells themselves if
13 you were trying to intercept the flow after it was
14 moving off in that direction.

15 Q. Mr. Sobanski has given evidence it
16 would be a minor impact and are you saying it would be
17 a major impact?

18 A. I am saying, Mr. Chairman, that
19 the evidence is such that not understanding the hydro-
20 geology in detail, you cannot accurately predict what
21 the effect will be at this time. It seems to me we are
22 faced with a situation where I am merely saying there
23 are questions about the hydrogeology and you cannot
24 rely upon the hydrogeology to protect the site. Dr.
25 Rowe is saying we can model the site and there are



1 problems and Trow has said they have modelled the site
2 and there aren't, and that is the dilemma that one has
3 to resolve. Both -- one model says everything will be
4 okay and the other says there will be no problems and
5 they are both based on a data base which still must be
6 substantiated.

7 Q. I am cross-examining you on your
8 evidence and not Dr. Rowe's evidence. I am asking you
9 if the upper granular unit is interconnected between
10 the Chlon, Chaput and Pompa wells and Site D, don't you
11 agree with me that if it is determined that the
12 leachate is moving across the buffer zone, that it
13 would be necessary to install wells and pump the buffer
14 zone to prevent that migration?

15 A. I would not recommend landfilling
16 at a site such as that where -- if this situation
17 existed...

18 Q. I am sorry to interrupt, but I am
19 not asking you to recommend landfilling at Site D. I
20 am not naive enough to think you would come here and
21 recommend landfilling at Site D, but I am asking for
22 your evidence as to what is possible from the point of
23 view of a hydrogeologist about intercepting the
24 movement of contaminants across the buffer zone at Site
25 D on the assumption that they are escaping and on the



1 assumption that they are moving towards three wells
2 which you have told me are connected in that zone to
3 the site. Tell me yes or no, can you pump the upper
4 granular unit in the buffer and prevent off-site
5 migration of leachate, yes or no, Dr. Charlesworth, and
6 then give your qualification?

7 A. Yes, you could if you had a
8 uniform aquifer like that and the qualification is that
9 you may adversely affect those wells.

10 Q. Have you done a calculation to
11 determine to what extent it would adversely affect
12 those wells?

13 A. No, because we don't know if this
14 is a situation that exists.

15 Q. I want you to hypothesize the
16 worst possible situation you could imagine and then I
17 want your calculation, Dr. Charlesworth. I want your
18 evidence one way or the other about whether or not it
19 will adversely affect those wells. Would you agree
20 with me that this is your worst possible scenario, that
21 they are interconnected in the upper granular unit and
22 you agree you can pump that upper granular unit and
23 prevent the off-site migration of leachate, don't you?

24 A. I agree, and I don't know how many
25 wells it would take and that is my qualification of the



1 answer, but in theory, you could intercept it.

2 Q. How many wells did it take at
3 pumping well No. 2 up by HC2-85 to get a cone of
4 influence spread all the way down to HC2-86 in forty-
5 eight hours?

6 A. It took one well.

7 Q. One well.

8 A. In the thickest part of the unit.

9 Q. Would it be a heart-breaking
10 situation if it took two wells in the buffer to prevent
11 the interception instead of one; would that be a
12 problem?

13 A. Theoretically you could have a
14 string of wells down here that would intercept movement
15 both to these wells and to any potential users. It is
16 possible, certainly it is possible.

17 Q. Don't obscure your evidence by
18 talking about potential users. You are not suggesting
19 after the landfill is built somebody will come along
20 and build houses beside the landfill, are you?

21 A. I understood that that was one
22 criterion that had to be looked at, the future
23 reasonable use of the adjoining property.

24 Q. Would you buy a lot across the
25 road and build a house, Dr. Charlesworth?



1 A. It would depend upon the
2 circumstances. I may well buy the property to use for
3 something else and people do buy properties. I would
4 be unlikely to buy a house to live there, but I may buy
5 it for some other activity. That land will not be
6 sterilized because a landfill goes in.

7 Q. Dr. Charlesworth, how does it make
8 any difference to the approvability of this application
9 to drill wells, 1, 2, 3, 4, 5, 6, 7 and 8 and find even
10 that the upper granular unit and the lower granular
11 unit extend off-site in every direction for massive
12 depths. How does it make any difference to this
13 application if the application is premised on the
14 assumption that you have to capture all the leachate at
15 the site until that leachate is so weak that it can't
16 possible do any harm to anyone. How does that make any
17 difference?

18 A. Because there are failure
19 scenarios and the remedial measures that may be
20 undertaken if those failure scenarios occur may
21 adversely affect adjoining landowners, water users.

22 Q. Failure scenarios means
23 monitoring. Take out a different colour pen and put an
24 X everywhere that you say that this Board should
25 recommend or this Board should order, because it has



1 the power to order and will undoubtedly exercise it,
2 but let's have your evidence as to where we will put
3 the monitoring wells, assuming Site D is approved for
4 landfilling?

5 A. Under this hypothetical, worst-
6 case scenario?

7 Q. Let's take it one step at a time,
8 Dr. Charlesworth. Let's suppose the Board doesn't
9 accept your evidence that we don't have enough
10 information to approve the site, and let's take a
11 hypothetical situation that the Board approves Site D
12 for landfilling and that the fill area is as proposed
13 by Trow. All right?

14 A. Yes.

15 Q. Can you accept those assumptions?

16 Now, as an experienced hydrogeologist
17 who has been retained on more than one occasion to
18 design, implement, carry out a monitoring program,
19 would you please explain the steps you would take in
20 designing a monitoring program on the assumption that
21 your eight boreholes weren't drilled before the site
22 was approved for landfilling, but on the assumption
23 that the landfilling has not yet commenced. You have a
24 free hand, and what do you want to do now?

25 A. I would still go with a program



1 initially similar to this but before I could design the
2 program, I would have to understand more about the
3 extent of these units, and a program such as this would
4 be the first step.

5 Q. I just want to interrupt you so
6 your evidence is clear. Could you modify program by
7 initial drilling program and monitoring program,
8 because I think you are mixing two things up, are you
9 not?

10 A. I am saying in order to establish
11 a monitoring program, I would first want to determine
12 that the hydrogeology of the site -- my first step in
13 defining the hydrogeology of the site would be to drill
14 a program very similar to the program I have suggested
15 on here.

16 Q. Can I suggest one difference?

17 A. Certainly.

18 Q. If the site has been approved for
19 landfilling, you wouldn't waste your money drilling a
20 borehole in an area that in fact was going to be
21 filled, because one thing you would want to do in
22 addition to defining the hydrostratigraphy is to use
23 the well for monitoring when you finished coring and
24 thinking about the core?

25 A. We could move this one.



1 Q. Let's move No. 1 and let's move
2 No. 7 if you agree No. 7 is in the fill area.

3 Let's assume for the sake of argument,
4 even though it is a bit far-fetching given the evidence
5 that we have, but in every borehole you found one metre
6 of upper granular unit and two metres of lower granular
7 unit. Let's design a monitoring program, can we
8 please, and could you use x's this time. Do you need a
9 different colour?

10 A. I think I can use green.

11 Q. The record will show the witness
12 is marking M-495 with green x's.

13 A. I would be looking for a series of
14 holes within the buffer zone along this side and in
15 this worst-case scenario we appear to have the risk of
16 flow in this direction, across First Line, and
17 therefore I would construct the monitoring holes I have
18 marked with x's and use 5 as a monitoring hole and we
19 don't know what is occurring there and we are assuming
20 we will not encounter the granular unit. We also at
21 this time do not know the extent to which flow is
22 occurring in the upper granular unit and we do not know
23 the direction. It may well be that once we have
24 established this we may find the flow pattern is
25 somewhat different, but Trow have shown a flow path



1 coming towards the southern edge of the site and it may
2 well be -- we are talking about the worst case so we
3 are assuming flow is in that direction. I would still
4 have monitoring holes down the eastern side of the
5 site. In the first instance, I would be hoping to
6 utilize these holes and I would have to go back and
7 look at the instrumentation and we have seen that in
8 fact...

9 Q. These holes....

10 A. Some of the existing holes and I
11 was talking in general terms about the existing holes,
12 and it may well be that they are not adequately
13 constructed and you might want to look closely at it,
14 but the instrumentation in the holes which do penetrate
15 the upper granular unit or the lower granular unit,
16 they are not always instrumented in that unit and one
17 would look closely at that, but for the moment assuming
18 that the holes are adequately instrumented, then I
19 would be going with a program and I would also have the
20 original holes drilled to define it off-site, they
21 would be maintained as part of the monitoring program.
22 I would be looking at a program which was a combination
23 of the red dots and the green crosses or the green
24 dots.

25 Q. I think yesterday you agreed that



1 whether we believed Dr. Rowe's frightening scenarios or
2 whether we don't, it would be appropriate to engage in
3 pressure monitoring at the site?

4 A. I did.

5 Q. Have you got a sufficient number
6 of holes to permit you to do the amount of pressure
7 monitoring you would like to do or would you consider
8 adding holes for that purpose?

9 A. It may be necessary to actually at
10 each of these installations --

11 Q. Twin them?

12 A. Twin them, yes, on a line along
13 the flow path.

14 Q. And it would be more important to
15 twin the three installations nearest those three wells
16 of most concern, would it not?

17 A. Yes, and the scenario I am
18 depicting is the worst-case, which is flow in that
19 direction and it would be most important to twin in
20 this direction down here.

21 Q. Also, Dr. Charlesworth, don't you
22 agree you would design the monitoring program at Site D
23 not to take account merely of the direction of flow you
24 had determined in the granular units, based upon the
25 pressure monitoring you did before landfilling began,



1 but also to take account of the possibility that if
2 some kind of a head built up in this landfill, there is
3 at least a possibility of creating radial flow
4 patterns?

5 A. That is right. We would have to
6 check back on the details of this borehole.

7 Q. Well "this" -- you are looking at
8 HC4-85?

9 A. I think it's HC4-85 but I will
10 just have to check it. Yes, it is HC4-85.
11 I would have to check the instrumentation. It may be
12 necessary -- I think there would be merit in twinning
13 an installation there as well so you could have
14 pressure monitoring and one would have to check on the
15 exact location -- that is (MB)OW-3 and one would
16 probably want to construct another hole beside that.

17 Q. Dr. Charlesworth, I want to ask
18 you a different hypothetical question and are you
19 finished with your answer on monitoring, because I
20 don't want to cut you off?

21 A. No. I think for a first cut.

22 Q. Have you a different colour of
23 pen?

24 A. Yes.

25 Q. I am sorry to put pressure on your



1 pen supply.

2 A. I've been losing them all day. I
3 have an orange.

4 Q. You have x's and o's, so how about
5 squares. I want you to make the assumptions we have
6 already made, that the Board has approved the site for
7 landfilling and you have been retained to engage in a
8 series of extended studies that includes the design of
9 a monitoring program and I want you to assume that you
10 have drilled your eight boreholes and you didn't find
11 any extension of the upper granular unit in any
12 direction but at borehole 3.

13 A. Right.

14 Q. Having found it at borehole 3 and
15 at no other place other than where we have already
16 found it based on the six boreholes where we in fact
17 got a positive find of this rare bird, how would you
18 now amend your monitoring program to take account of
19 the fact that it would appear that the upper granular
20 unit extends off-site in a true westerly direction at
21 borehole 3 and only at borehole 3?

22 A. You would not be designing a
23 program in that kind of isolation.

24 Q. There is no isolation. You have
25 done your drilling and that is all you found in your



1 drilling and found no granular units in any other holes
2 except that one at 3.

3 A. You would still have monitoring
4 holes around the site and if you only found it at 3 and
5 you are assuming it is absent at 4, that implies there
6 is potentially a channel of flow up there in the
7 hypothetical situation.

8 Q. There is evidence that it goes
9 off-site in that direction?

10 A. We have these two holes which
11 would be giving us some coverage. One may even be
12 moving to more intensive monitoring. I believe that
13 many landfills are actually under-monitored and this is
14 a factor that has to be taken into account.

15 Q. I can assure you that in the
16 Region of Halton there is no such thing as a landfill
17 which is under-monitored. By the time you get one
18 approved in this region it is so over-monitored --
19 could you put some squares with your orange pen....

20 A. That is a serious point, looking
21 at existing landfills, because there is a tendency in
22 many cases for them to be under-monitored.

23 Q. Do you want to add something to
24 the monitoring program in squares to indicate a more
25 intensified monitoring program to take account of the



1 one finding you made in your extended drilling program?

2 A. No. One may decide to
3 particularly concentrate on the zone of concern in
4 which case you may well decide to put a monitoring hole
5 in at that location.

6 Q. Would you also be interested in
7 heading off a little bit in a true west direction from
8 your borehole No. 3 to see what's happening with that
9 upper granular unit a little further out?

10 A. It depends on the conditions you
11 found and I'm not trying to be difficult, but you would
12 be faced -- when you are faced with your findings you
13 put a lot of thought into designing it, so this is
14 really coming off the top of my head. I would line
15 that up and it may be dependent -- it would depend on
16 the exact location at which you drilled 3 in the first
17 place. You may decide to go off here and depending
18 upon the conditions you found, the flow rates you
19 predicted within that unit and I don't think I would
20 put it so far, I would move it in a bit, but the whole
21 program would be very closely related to the findings
22 that you had.

23 Q. Having put in that monitoring
24 program, Dr. Charlesworth, if you would find or if you
25 should determine that the hydraulic trap in cell 1 has



1 failed and that leachate is in fact moving in the
2 direction of borehole 3, would you agree with me that
3 you would be confident you could retrieve it in the
4 upper granular unit by installing a well and pumping
5 it?

6 A. I think, Mr.Chairman, that we do
7 talk very glibly about purge wells. The actually proven
8 long-term viability of purge wells is something
9 that there is not a lot of data on. They are used and
10 I know they are proposed at Keele Valley and they are
11 being used to the north of Keele Valley for the old
12 landfill and I understand, and I can be corrected on
13 this, but I understand they have had a number of
14 problems with the actual operation of those purge
15 wells. It is also my understanding that they
16 ultimately needed more purge wells than they had
17 originally predicted from the studies and by a
18 significant amount. Purge wells are a thing that we
19 all refer to as a contingency measure, but they are by
20 no means proven on a long-term basis.

21 Q. Does that mean like a good car,
22 they wear out?

23 A. It means that like so many modern
24 cars, they don't last as long as you might reasonably
25 expect them to.



1 Q. Isn't it a good idea when you
2 install a purge well to monitor its performance?

3 A. It becomes a self -- almost a
4 self-monitoring thing if it starts to clog up for
5 example....

6 Q. If it starts to clog up, isn't it
7 appropriate to develop a new purge well?

8 A. Then you go back and develop a new
9 one or clean it. There are techniques for cleaning
10 them. They are there, but they don't have a long-term
11 proven track record and it is my personal opinion that
12 they are not something that you should be placing a
13 high level of reliance on if there is some other
14 alternative.

15 Q. Are you suggesting -- you are not
16 suggesting that purge wells won't purge the upper
17 granular unit and you are suggesting that any given
18 purge well can't be relied on as a long-term solution
19 unless it is carefully monitored and replaced if it
20 starts to fail?

21 A. I am making the observation that
22 it is difficult to predict, even on the basis of more
23 extensive pump tests than have been done here, how many
24 wells you will need and the effect that those wells
25 will generate and then on top of that, yes, you must



1 closely must monitor the performance and clean or
2 replace the purge wells. So they are a technology
3 that has been accepted and they are in operation, but
4 they are not a complete answer and they are not a
5 perfect solution.

6 Q. But it's a proven technology, is
7 it not, and they are used all the time in this context?

8 A. From looking at the literature, it
9 is my -- I have come to the conclusion that they have
10 not been used on a long-term basis in a lot of cases,
11 actually used. They have been proposed and put in, but
12 the actual long-term use of them....

13 Q. Perhaps we could end the day on
14 something we can agree on and that is if you landfill
15 at Site D, the one thing we know about the site is that
16 you can't put the garbage in the ground and walk away
17 from it.

18 A. That is correct.

19 MR. HODGSON: This would be a good
20 time.

21 MR. LANCASTER: A profound question.

22 MR. HODGSON: I wanted to have us agree
23 on something before we ended the day.

24 MR. LANCASTER: 9:30 in the morning.

25 --- Adjournment (4:30 p.m.)



Nethercut & Co. Ltd.

Toronto, Ontario

21351

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CERTIFIED CORRECT:

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C.F. Nethercut, C.V.R.

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(Page 21400 follows)

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