



Northern Ireland
Assembly

Committee for Agriculture and Rural
Development

OFFICIAL REPORT (Hansard)

Reservoirs Bill: Institution of Civil Engineers

25 March 2014

NORTHERN IRELAND ASSEMBLY

Committee for Agriculture and Rural Development

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Members present for all or part of the proceedings:

Mr Paul Frew (Chairperson)
Mr Joe Byrne (Deputy Chairperson)
Mr Thomas Buchanan
Mr William Irwin
Miss Michelle McIlveen
Mr Oliver McMullan
Mr Ian Milne
Mr Robin Swann

Witnesses:

Mr Alan Cooper	Institution of Civil Engineers
Mr David McKillen	Institution of Civil Engineers
Mr Jack Meldrum	Institution of Civil Engineers
Mr Stephen Orr	Institution of Civil Engineers

The Chairperson: I welcome Alan Cooper, Jack Meldrum, David McKillen and Stephen Orr. Thank you very much for attending. Members have already had an opportunity to read your briefing papers, so I ask you to take no more than about 10 minutes, if that is possible — I know there are four of you — and then the Committee will go straight into questions, if that is OK. I do not know who is leading off. OK, Alan, without further ado, thank you.

Mr Alan Cooper (Institution of Civil Engineers): Thank you, Chairperson. The Institution of Civil Engineers (ICE) welcomes the opportunity to discuss the Bill with the Committee, and we thank you for your invitation. My name is Alan Cooper, and my colleagues are Jack Meldrum on my left, David McKillen on my right and Stephen Orr on my extreme left. Jack, David and I are all experienced panel engineers in terms of the Reservoirs Act 1975 as it applies in England and Wales, and Stephen is in the process of training to become a supervising panel engineer.

David, Stephen and I represent a committee of the Institution of Civil Engineers in the Northern Ireland region. We have provided a technical advisory role to DARD regarding the guiding principles of the Reservoirs Bill. Jack and I are both reservoir panel engineers, but Jack is here specifically to represent the institution's reservoirs committee in London. He will inform us later, halfway through my talk, about the function and mechanisms of the reservoirs committee.

Before we start, I should say that flooding arising from the uncontrolled release of water from storage is entirely different from flooding from rivers and surface water following heavy rainfall. They are totally different, because the failure of reservoir structures produces fast-flowing deep water, which, as history tells us, has claimed lives and damaged livelihoods. The institution is a professional body with

many members engaged in design, operation and the maintenance of reservoirs, so we are acutely aware of the need for vigilance in order to protect life and property from undue risk from the failure of dams.

I and my colleague Jack will give a brief statement on behalf of the civils institution, following which we will be pleased to answer any questions you might have. First of all, the reasons for the Bill. We support the introduction of the Bill to establish the legal and administrative frameworks for regulating reservoir safety in order to reduce the risk of flooding as a result of failure. It is estimated, at the latest count, that there are approximately 150 impoundments that will come within the scope of the Reservoirs Bill. Public reservoirs in Northern Ireland have been managed by the statutory authorities, notably Northern Ireland Water, which is the largest owner of reservoirs in Northern Ireland. It has generally followed the provisions of the Reservoirs Act 1975 — which, as I said at the start, is applicable in England and Wales — as best practice, even though the Act does not apply in Northern Ireland.

The institution is strongly supportive of the introduction of specific legislation for the safety of reservoirs in Northern Ireland. However, owners of private reservoirs have no obligation to follow the 1975 Act. The introduction of the Bill will ensure public safety assurance for all reservoirs of a capacity of 10,000 cubic metres and above. The institution supports the adoption of that threshold of 10,000 cubic metres. Until the reduction from 25,000 cubic metres, there had been concern for some time within the profession that the threshold of 25,000 cubic metres was based on an outdated understanding of the current risks to reservoir safety. The 25,000 cubic metre capacity corresponds to reservoirs of at least the size that were responsible for the fatal incidents in the 1920s in north Wales and Scotland. There have been a number of incidents at smaller reservoirs in recent years where there was a potential for the loss of life, and the figure of 10,000 cubic metres capacity was therefore concluded to be the right figure for assessing risk to the public from reservoir failure.

However, the institution is pleased to note that the safety record of reservoirs in Northern Ireland has been good, with no fatalities reported, even though some reservoirs have failed — and some quite recently. However, we cannot be complacent, and, since many of the reservoirs are in excess of 100 years old, a well-structured and enforceable Bill will provide assurance for the safety of the public. We support the Bill's assertion that the inspection and supervision regime of all high- and medium-risk reservoirs requires qualified civil engineers, referred to as panel engineers, to carry out inspections and make recommendations. That is the only suitable means of managing the risk of failure. However, we recommend that even low-risk reservoirs should have some regular form of inspection, rather than relying on change of downstream conditions being identified by planning processes or the review by the enforcement authority.

There will be financial implications arising from regulation, as we just heard from the meeting ahead of us, and these will cause concerns, especially among owners, many of whom have limited resources to meet the requirements. Existing impoundments contribute to the environment in terms of habitat, flood alleviation and amenity use, to the overall benefit of society at large. Consequently, it is important that the costs associated with regulation do not result in owners modifying their reservoirs to remove their capability of holding water completely or to reduce it below the threshold in order to avoid the financial burden of routine maintenance and inspection.

At this stage I will hand over to Jack, who will explain the process for panel appointments and inspections, and, in fact, the general working of the Bill in GB.

Mr Jack Meldrum (Institution of Civil Engineers): As mentioned by my colleague, Alan Cooper, I am an all reservoirs (AR) panel engineer and currently a member of the ICE reservoirs committee, which I represent here. I have been a panel engineer since 1987. I will deal with the general workings of the Reservoirs Act 1975 first, and then explain the panel engineering system that services the Act and how engineers are appointed to the panels.

The Reservoirs Act 1975, with changes currently enacted from the Flood and Water Management Act 2010, provides a registration, surveillance, supervision and inspection system for large raised reservoirs. Prior to the latest changes, that covered all reservoirs that are capable of storing more than 25,000 cubic metres above the lowest surrounding ground level. The Flood and Water Management Act 2010 introduced a risk-based criterion for the requirement for continuing supervision and inspection of reservoirs and made provision to reduce the minimum size. The 2013 secondary legislation brought in the risk-based criteria and that is currently being introduced; we are going through a changeover phase at the moment. The register of all large raised reservoirs is kept by the enforcement authority, which is the Environment Agency. It keeps details of the reservoirs and copies

of all reports and certificates, monitors compliance and keeps records of incidents. It also takes action when non-compliance occurs, although that is normally managed by reminders.

The Act requires that the design and construction of all new large raised reservoirs must be supervised by a construction engineer. That engineer will issue certificates that permit impounding and also provide a certificate that provides a record of the design and construction. After three years and provided that he is satisfied that the reservoir no longer requires his supervision, the construction engineer's responsibility ends. The reservoir then comes under a supervising engineer, and that will be the same for old, existing reservoirs that have not been caught up in the Act before. They would come in at that point and come under a supervising engineer. The supervising engineer appointment is a continuous appointment. The supervising engineer will typically visit a reservoir once or twice a year to check that no safety issues are arising, that necessary maintenance is being carried out to identify any further maintenance required and that the reservoir undertaker is keeping the necessary records. The supervising engineer will provide an annual statement to the undertaker advising him of any issues. That will also be copied to the enforcement authority so that it is aware of any safety or compliance issues. If the supervising engineer has concerns about the safety of the reservoir, he may call for an inspection. When I talk about the reservoir undertaker, I believe that your terminology is "reservoir safety manager".

Two years after a new reservoir is completed and thereafter at intervals of normally 10 years, periodic inspections by an inspecting engineer are required. Those inspections consider the condition of the structure as well as reviewing aspects such as the structure's stability and spillway and scour capacity. If any shortcomings are identified by the inspecting engineer, he may require measures to be taken in the interests of safety, and the undertaker will have to comply with that. For recently built reservoirs, the likelihood of such measures may be expected to be low, but, for older reservoirs, requirements are more common.

I will move on to the panel engineer system that we operate under. There are currently four panels under the 1975 Act: all reservoirs; non-impounding reservoirs, and by "non-impounding", I mean reservoirs that are not on a river but are off stream; service reservoirs; and supervising engineers. All-reservoir panel engineers may carry out any of the duties required from panel engineers under the Act, including being the construction engineer and inspecting engineer that I mentioned previously, whereas supervising engineers are responsible for providing continuity of reservoir safety. The members of the non-impounding reservoir and service reservoir panels have the same responsibility as the all-reservoir panel engineers, but they are restricted in the type of reservoirs that they may deal with as construction and inspecting engineers. The current numbers on each panel are 39, two, four and 141 respectively; the principal panels are the all-reservoirs and the supervising engineers panels.

The all-reservoir, non-impounding reservoir and service reservoir panel members are generally senior members of the civil engineering profession and have significant experience in reservoir engineering. The supervising panel engineers generally are engineers who have experience in reservoir engineering, often in operation and maintenance or assisting in the design and construction of reservoir works. Ideally, supervising engineers should be based in the same region as the reservoirs that they supervise so that they are more readily available to attend call-outs and also to minimise cost. Construction and inspecting engineers frequently work outside their region. Construction, inspecting and supervising engineers are selected and engaged by the reservoir undertakers. In Great Britain, the names of the panel engineers, together with their addresses and contact details, are kept on a database available on the Environment Agency website. There are no fixed fees for the various duties of the panel engineers.

Is it all right for me to continue?

The Chairperson: I am going to stop you there, Jack. I note that we are reading off the presentation: we have the presentation, and we have all read it. Your ten minutes is up, so I will stop you there. If you want to paraphrase the end of your written presentation or if any of your colleagues want to step in for a few minutes, I will give you time for that. We will, of course, be asking questions, which should glean more information from you. However, please assume that all members have read your written presentation.

We will move straight into questions.

Mr Byrne: I welcome the presentation. It is good to hear from such experts as civil engineers.

The accusation is that the Reservoirs Bill is a civil engineers' charter, and there is grave concern among many in the voluntary and community sector who look after impounded waterways that the cost will be prohibitive and they will be put out of business. What is your answer to that charge?

Mr Cooper: Owners of reservoirs have responsibilities as they stand, and that has to be faced.

Mr Byrne: Why, therefore, do we need the Reservoirs Bill, if they already have obligations?

Mr Cooper: I am saying that they have a responsibility in the sense that they are liable at the minute.

Mr Stephen Orr (Institution of Civil Engineers): I would like to add to that. As Alan said, there is a liability on the owners, but there is not an obligation to positively act to safeguard the community or public life. Therefore, if something did go wrong, there is a liability under law that they could be taken and prosecuted for it. However, we would still have dead people.

Mr Byrne: Are you saying that we have been living in such dangerous times but did not realise it?

Mr David McKillen (Institution of Civil Engineers): You were certainly living under an unrecognised risk by those who were looking after the reservoirs. They realised the asset that they had but, perhaps, did not fully understand the impact that the release of the water could have and, therefore, the risk that they were responsible for. The legislation tries to regularise that and to take an approach that is in the interests of public safety downstream. It tries to control that risk by identifying it to the owners, thereby allowing them to take appropriate measures to put an appropriate level of inspection in place to help manage that risk robustly.

Mr Byrne: Yes, I can see your perspective. However, there is a fear that we are now using a sledgehammer to crack a nut.

Mr Orr: Effectively, bringing the legislation into Northern Ireland is bringing Northern Ireland into line with the rest of the UK.

Mr Cooper: Do you mean that, because we have not had a disaster, there is no need for caution?

Mr Byrne: I mean that engineers have been observing the reservoirs before and surveys have been done before, including the one that we heard about earlier — the Wolfhill Middle — and nobody rang great alarm bells.

Mr Cooper: That is not true.

Mr McKillen: That is incorrect. The survey that was carried out on the three reservoirs that are held by the organisation that presented previously identified significant problems. Two of the reservoirs have had those problems resolved by one landowner who has resolved the upper and the lower reservoir. The middle one has not gone through the same robust remedial exercise. Therefore, a question remains over the middle one. However, the other two have been resolved.

Mr Byrne: Are you saying that, at the moment, the middle one is a risk to the public at large?

Mr McKillen: The middle one is an unknown quantity, in that, since the original inspection, there has not been a further inspection of it by a qualified civil engineer.

Mr Cooper: In fact, I have written a letter saying that the middle reservoir is a problem. That letter is on the record.

Mr Byrne: Does that letter signify a warning signal to those people?

Mr Cooper: It should have done.

Mr McKillen: It should have done.

Mr Byrne: How many reservoirs should a supervising engineer look after? Is it reasonable for a supervising engineer who is responsible for a reservoir here to reside in England or GB?

Mr Cooper: I will ask David to deal with that.

Mr McKillen: As a supervising engineer, I look after a couple of reservoirs in England. The reason that that mechanism works is that they are a particular type of reservoir, and the client understands the operation that I carry out here to maintain the safety of the reservoirs. He carries out inspections and reports his findings. It is not necessarily a difficulty to have a remote person; it can work.

As for your question about the number of reservoirs, that depends on their proximity and whether the clients are individual or different clients. For instance, in the Wolfhill situation, the fact that the three reservoirs are adjacent to each other means that you are most likely to inspect them together, which actually provides cost efficiencies to the reservoir owner and manager. Therefore, you can inspect them along with a number of others. It would be quite reasonable to look after 15 or 20 reservoirs in that context, bearing in mind that you inspect them once a year.

Mr Byrne: Given that you, as an institution, are now over the complexities and the issues associated with the implications of bringing in the Reservoirs Bill, have you done an audit of the existing reservoirs across Northern Ireland?

Mr Cooper: No, we have not.

Mr Byrne: So, so far, there is an observational survey.

Mr Cooper: As I understand it, Rivers Agency has carried out an exercise on the entire portfolio of reservoirs that could come within the Act. However, we, as an institution, have not done that.

Mr Byrne: Have you guys had sight of the survey report?

Mr Cooper: No. As I understand it, the full details of the reservoir inundation mapping and the database are not in the public domain at the moment. We, as an institution, have no access to that information.

Mr Byrne: Is it reasonable to assume that, given the critical role that you guys as professionals will play in the surveys, Rivers Agency should provide that report to you as an institution?

Mr Cooper: We, as an institution, have no responsibility for reservoirs. However, if we as individuals were asked to inspect a reservoir, it would be reasonable for us to approach Rivers Agency and ask for a copy of the flood map for that reservoir, and that would probably be forthcoming.

Mr Byrne: The reason I ask that question is that you stated very clearly here that you welcome the Reservoirs Bill, and I am wondering why you are so welcoming of it if you do not have the full report of the survey.

Mr McKillen: The answer is that it regularises, and provides some framework to manage in a consistent way, the risks associated with reservoirs. Up until now, and before this legislation was brought forward, it was left to the professional and robust approach of individual reservoir owners to deal with the safety and risks of their particular reservoir in order to minimise downstream risks to the population, industry and the environment. The legislation regularises that and provides a consistent approach to it.

Mr Byrne: So, are you saying that you welcome the Reservoirs Bill because you feel that so many owners out there do not realise the risks that they are responsible for or the liability consequential of any accident?

Mr McKillen: It is probably fair to say that the legislation provides support and reinforcement to any such reports and recommendations that are made. As I said, up until now, recommendations to any reservoir owner did not have to be carried out and, in some cases, have not been carried out. That is because there is no enforcement of legislation behind the actual report that is being provided to a particular reservoir owner.

Mr Cooper: Basically, we see it as a preventative measure.

Mr Byrne: Just on this point, is the implication there that some reservoir owners have been irresponsible in not having these surveys done?

Mr McKillen: When reports are done, they are left to the individual owners to deal with them. In many cases, it is done; in other cases, it is not done as robustly as it should be.

Mr Byrne: Thanks, Chair.

The Chairperson: OK, Joe, thank you. David, Joe's questioning brought something out. You talked about the three reservoirs collectively at Wolfhill. They could well be owned by various people. You mentioned that there would be cost savings in reviewing all three reservoirs at the one time. How would that be itemised, if there were three separate owners?

Mr McKillen: There is nothing to stop owners coming together as combined bodies. Look at other fishing clubs, for instance, not Wolfhill: there is nothing to stop the Ulster Angling Federation or whoever saying, "We have x number of reservoirs, and we want someone to carry out the supervising function." They can then get a quote from supervising engineers to carry out that function. There is absolutely nothing in a commercial environment to stop that taking place.

The Chairperson: I can understand the scale and the cost-effectiveness of doing three at the same time, but that would be one overall bill, which —

Mr McKillen: — they then distribute out.

The Chairperson: It would be distributed out between the three or four owners, depending on how many there were.

In your presentation, you mentioned the availability of engineers. How many engineers of your ilk are there in the UK? How many are in Northern Ireland? I ask that because, last week, it was stated that there were very few in Northern Ireland.

Mr Cooper: As Jack said, there are different levels of panel engineers. Correct me if I am wrong, Jack, but I think that there are 39 AR panel engineers. I am the only one in Ireland, currently. There are about 300 supervising engineers.

Mr Meldrum: There are 141, of which one is in Northern Ireland.

The Chairperson: Would the engineers who are based in England, Scotland and Wales be willing and able to work in Northern Ireland?

Mr Meldrum: I would not see a problem, but, as I said in my talk, I would see the supervising engineers as coming largely from Northern Ireland. They may not be there to begin with, but I would see the Northern Ireland consultancies picking up the task and getting their engineers trained. In my opinion, you would probably need a pool of about 10 people trained as supervising engineers to cover the 150 reservoirs. The maximum might be 20 to 30 on one individual engineer, but there will be engineers coming on to the list at the young end, and there will be those retiring at the other end and, probably, shedding the number of reservoirs that they do. Those are the sorts of numbers that you are talking about.

The ICE, for Northern Ireland, should certainly be trying to service with the supervising engineers, but the inspecting engineers, construction engineers and AR panel engineers are more difficult. There is one at the moment. There is no reason why there should not be more in the future, as the good supervising engineers move on and become competent enough to become AR panel engineers. However, I expect that, for a decade or so, you will see some servicing from the mainland — from England and Scotland — where there are a number. For example, we still do a lot of work in Hong Kong, and AR panel engineers are required for reservoirs there. So, panel engineers are willing to travel.

The Chairperson: By what percentage did the work increase in England due to the legislation?

Mr Meldrum: The large increase came when we brought in the 1975 Act. The supervising engineers were not required before that time, which was the major change. That brought in a lot more work under the supervision phase.

Generally, there has been an increase in the AR panel work at the higher level, for a number of reasons. There has been an increased awareness of some of the problems: as you find one failure mechanism or situation, you look at your other reservoirs in the same way. There has been an updating of the understanding of floods, so that has brought in more work. Public acceptance of difficult situations is less. The big utility companies have more corporate responsibility and do not wish to have problems on their patch. Those sorts of things all influence the amount of work. So, there has been an increase from that side, but, at the moment, it has stabilised.

The next thing that is going to happen is that we will see the risk base, which you are adopting to begin with, and we will see a decline in the amount of supervision work from that, because we have a large number of small, low-risk reservoirs, which I expect to fall out at the supervision stage. If we drop down to 10,000 cubic metres, which is what is being talked about, we will see a few increases.

The Chairperson: Do you have any thinking on how many? From 25,000 cubic metres down to 10,000 cubic metres. Is it going to double the reservoirs?

Mr Meldrum: It is difficult to tell, because there is a degree of conservatism to start with in the approach of the Environment Agency, which is the enforcement authority, to deregulation of the reservoirs; ie the deeming of them as low risk. It will take two or three years at least for that to unwind and for us to find out. Early figures that I have heard indicate that we may be losing a quarter of the reservoirs.

Mr McKillen: I want to add to that to help inform you about the numbers of engineers and the process. There is one AR panel engineer and one supervising engineer who, due to personal business reasons, given the organisations that we work in, have had an interest in reservoir design and development work throughout the island of Ireland and across other areas of Europe. I referred to looking after a couple of reservoirs. In order to be a panel engineer, you need to be looking after some reservoirs, from a supervising point of view, under the GB legislation. That is why I have looked after some.

There are a number of others — Stephen is one example — who are in training, and I know some who have applications prepared. That would assist in increasing the number of supervising engineers. So, I would not be as concerned.

I am not sure what discussions you have had with Northern Ireland Water, but it has quite a number of engineers who are involved in ongoing inspection work. It depends on the commercial decision by Northern Ireland Water as to whether it will formally have its trained people go through the panel appointment process or whether it will outsource it — that is a debate for Northern Ireland Water — but it has a number of individuals who could go through that process.

The Chairperson: If the legislation came into force, would the requirement to be looking after reservoirs in England change?

Mr McKillen: I presume that it would and that looking after reservoirs here would allow you, by default, to be a panel engineer, which you would otherwise not have been able to be.

The Chairperson: Are there any concerns about the age profile of panel and supervising engineers?

Mr McKillen: I will answer that, because my colleague keeps asking me when I am putting in my AR panel application. I have been working on reservoirs for 30 years, and I am at a stage where I should be putting in my all reservoirs panel application. I am not saying what age I am. *[Laughter.]*

Mr Cooper: As an institution, we are concerned that the average age of the supervising engineers is higher than it should be. We would like it to be much lower.

The Chairperson: The panel of supervising engineers who look after reservoirs only look after reservoirs; they do not build bridges or anything else.

Mr Cooper: Very few supervising engineers do nothing else but supervise reservoirs. That is not a healthy situation; we would not like to encourage a situation where supervising engineers do nothing else. Jack would agree with that.

Mr Meldrum: I absolutely endorse that. You need people to have a good, broad-based understanding of the engineering aspects that are involved with reservoirs. For example, it probably takes up no more than 20% of my time.

The Chairperson: Looking after reservoirs?

Mr Meldrum: Yes, reservoirs in GB.

Mr Swann: If engineers are dedicated only to looking after reservoirs — they seem to be governed by your organisation — who sets the fee for an inspection?

Mr Meldrum: There is no fixed fee; there is fee competition. Different clients have different approaches to it, as do different engineers. It depends on the amount of work that is involved, the complexity of the reservoir and, with some clients, what exactly the client is expecting. Some clients are far more proactively involved and want to know, review and discuss what is happening, while others are not so involved.

Mr McKillen: I will give you another example of things that will influence the cost of an inspection. On some occasions, the staff or the owner of the particular reservoir will take an interest and be involved in keeping an eye on the reservoir, and they will work with the supervising engineer such that he requires less input to the overall process. He talks to individuals, reviews what they have been looking at, considers any concerns that they have had and then writes his report. If it is left totally to the supervising engineer to keep an eye on the reservoir, and he is responsible at all times, he will have to look at it more frequently and will spend more time. If there is a collaborative approach by the reservoir owner, the supervising engineer can take a different view on cost.

The other thing that influences cost is the period of appointment. The supervising engineer may be appointed for a year, after which the appointment will go out to competition and someone else has to do it for another year. The difficulty with that is that if you are doing it on a consistent basis, you gain an understanding of how a particular reservoir works and performs. That makes it easier and more cost-efficient to look after a reservoir. If you are coming into a new reservoir every time, and you have to research the background and understand everything that is going on, that adds cost. It means that a one-off inspection for looking after a reservoir for one year is more expensive than if you were looking after it for a three-year or five-year period.

Mr Swann: A number of the private individuals who have appeared before the Committee are, I suppose, scared of what the initial fee is going to be. A lot of them are ignorant or unaware of what will be involved in the legislation. I can see a lot of reservoir owners/managers asking you how much it is going to cost them. For a minimum input from them, because they are unaware of what their responsibility is, what would your ballpark figure be?

Mr McKillen: Have you heard from Glenowen Fisheries from Derry and other organisations like that?

The Chairperson: No.

Mr McKillen: You are moving between ICE and normal work. In the past, we sat down with a number of owners and explained the process, and we would like to give them an understanding of what is involved. It is better for reservoir owners to understand what we are doing, and we always prefer that to be part of the process. That is what I try to do when working with a client on a reservoir supervision project.

Mr Swann: David, what is the ballpark figure for someone coming to you for the first time?

Mr McKillen: It is difficult to say. It depends whether it is Ben Crom or a Wolfhill one, which is a different kettle of fish.

Mr Swann: Take, for example, Wolfhill Middle.

Mr McKillen: Supervision work for Wolfhill Middle will not cost any more than £1,000.

Mr Swann: Would that be a one-off cost or every three years?

Mr McKillen: The engineer might come and have a look at it on a couple of occasions, talk to the client and then write a report on its condition.

Mr Cooper: For our committee, a far bigger funding issue is the cost of repairing these dams and bringing them up to the standard of public reservoirs. For some, tens of thousands of pounds would be needed to bring their overflows or whatever up to standard. As a committee, we have talked about the fact that the funding not only of inspections but of repairs is a serious issue if we are to avoid many dams being taken out of service and abandoned, which would be a great pity.

Mr Buchanan: Do you have an agreed method of assessing the likelihood of a reservoir flooding?

Mr Cooper: This is a big, big issue. The proposed legislation merely sets out a process; there is nothing about how to make dams safe. There are various modes of failure for an engineer to consider when approaching a dam. It depends, for example, whether it is a concrete dam or an earth dam. An all reservoirs panel engineer is appointed on a personal basis; it is not the case that his firm is appointed. A panel engineer takes personal responsibility for what he reports, and it is his opinion. There are lots of guidelines in the industry, professional and otherwise, but, basically, the panel engineer will make his personal recommendation on how safe a reservoir is against various modes of failure. There are many, but there is not time today to go into all of them. It is a very technical area.

Mr Buchanan: You are telling the Committee that it is down to an individual engineer's opinion: any mitigating circumstances that might, to some, make a reservoir safe will be seen only through his eyes; and any recommendations will be based on that engineer's opinion.

Mr Cooper: It is the opinion of the panel engineer. Currently, under the 1975 Act, a panel engineer produces what is known as a section 10 report, which requires him to look at all aspects of a reservoir. He will carry out a very thorough examination of the records and any other available information. He will ask for previous reports, the supervising engineer's statements and all of the monitoring information. Before signing off on what is a very serious report, he goes through all of that. When he finishes his report, his job is done. The supervising engineer's role goes on and on over the period of his appointment. The section 10 report is complete when the supervising engineer signs and submits it, unless he is instructed to do further work.

Mr Buchanan: Yes, but there is no agreed method of assessing the likelihood of reservoir failure, so there could be an added cost to individual owners. A panel engineer could determine that x amount of work needs to be done, but that would be based solely on his opinion and not on any agreed method of how to assess the likelihood of a failure.

Mr Cooper: There are lots of guidelines. Are you saying that, if an owner wants a second opinion, he should get one?

Mr Buchanan: No. I am asking you, as an engineer, what method of assessment there is. You are the professionals. You are the boys who will get paid to do this, so the question that I put to you is this: what mechanism do you have to assess the likelihood of a failure?

Mr Cooper: There are so many aspects to look at. Take, for example, the overflow. There are general guidelines on the design of a spillway, which are universal and accepted. A panel engineer has to keep himself fully up to date with current industry guidelines and expertise. It is a big, big subject, and there are very many modes of failure.

Mr Buchanan: Fair enough. We will leave it at that.

If a reservoir manager implements a recommendation, repair or maintenance programme, as set out by an engineer to make a reservoir safe, that would greatly reduce the risk of failure and should leave that reservoir subject to a lower level of regulation, inspection, maintenance and repair. In a case like that, what would that lower level of risk be?

Mr Cooper: You have to be very careful when talking about risk. Risk is a combination of the likelihood of failure and the consequence of that failure. Are you talking about the likelihood of failure?

Mr Buchanan: Yes.

Mr Cooper: The section 10 report makes recommendations. When those are carried out, they are signed off. The panel engineer will sign them off only if they are carried out to his satisfaction. You are right to say that the recommendations are what need to be done in the opinion of the panel engineer.

Mr Buchanan: If all that work is carried out, does that reduce the risk?

Mr Cooper: It reduces the likelihood of failure.

Mr Meldrum: It does not change the risk category.

Mr Cooper: It does not change the risk category, but it reduces the likelihood.

Mr Meldrum: I will just explain that. The risk category is dependent on what the consequence of the failure is. So, if there are 100 houses downstream, the only way to change the risk category is to remove the houses.

Mr Buchanan: If the recommended work is carried out, that reduces the number of inspections and the level of maintenance and repairs. Is that right?

Mr Meldrum: There can be differences. You have hit on a pretty good point. You can tackle problems in different ways. If something is seen as a problem, in certain cases, increasing surveillance is a way of managing the risk of it failing. Looking at it daily to see whether anything is going wrong is one way of managing something that you think could happen. Take the example of an embankment leaking. Leaks, in the long term, potentially lead to failure. However, if somebody is watching that leak and it is not progressing, you can carry on in the monitoring phase for longer. Without the assurance of that monitoring, you would have to do something preventative sooner. Have I explained myself?

Mr Buchanan: Yes, but, really and truly, if an engineer comes out to look at a reservoir and recommends that certain works need to be done to make it safe and that work is then done, that should reduce the number of inspections, as well as the maintenance and repair that have to be carried out. If it does not, the recommendation put forward in the first place was not correct.

Mr Cooper: Absolutely, a stitch in time. If the thing is fixed early, so much the better. We all agree with that. If you have a roof tile missing, you want to get it fixed pretty quickly, do you not? Improved surveillance is fine and worth doing, but it will not necessarily stop the dam failing.

Mr McKillen: There are two types of recommendation. The report could include some that are due to the fact that a reservoir does not comply with standards. If, for example, the spillway does not have enough capacity, you have to change it so that it does. Other recommendations are much more immediate, such as a leak, and require further monitoring. Carrying out more monitoring to keep an eye on the leak is one way of managing it; fixing the leak is another. It is likely that more regular monitoring will be required before all the issues are resolved, at which point you go back to the default position of a 10-yearly inspection and supervision twice a year. The default position applies when a reservoir is returned to a satisfactory condition: it meets standards and does not require a lot of urgent inspection monitoring work. The default position is set out: biannual and 10-yearly inspections.

Mr Orr: The legislation is very well designed in that it takes a risk-based approach. The problem with the risk-based approach is that, at the moment, there is no universally accepted standard to assess the likelihood of a dam failing. However, the legislation, as it stands, is beneficial in the sense that you will not have to come back and re-enact primary legislation when a risk-based approach to dams has become accepted worldwide. You can then invoke that through secondary legislation. Your legislation, as drafted, is risk-based, but it is risk-based according to the consequence: if the dam fails.

I accept your points. David was trying to outline that, if you carry out works, you will benefit in the sense that your inspections will be a bit cheaper because you will not be looking at things in as much detail. However, that does not reduce the number of inspections required. The legislation, as it stands, will not take you from a high risk to a medium risk because there is not a worldwide acceptance of the likelihood of failure. Research on that is being done across the world. The legislation, as it stands, will permit that to come in at such times as it is accepted. Hopefully, that helps you.

Mr Buchanan: So, once a high risk, always a high risk.

Mr Orr: At present, the risk is based on the consequence and the number of houses downstream. Work is ongoing to understand the balance of the number of houses versus a very good, well-maintained, brand new dam that has low risk of failure. Once that knowledge becomes standard, worldwide practice, it will be enacted in Northern Ireland. However, at the moment, it is not standard practice.

Another point is that dams fail quite rapidly. I appreciate that it was 150 years ago, but Dale Dike in Yorkshire failed. At 5.00 pm, somebody noticed leaks starting to come through the dam. At 2.00 am, the entire dam failed and people were dead. Back in 2007-08, Ulley failed through high rainfall etc. It overtopped as the spillway was inadequate. That caused the M1 in England to be shut — in England, they do not shut motorways — because it was a risk to the main north-south gas main. The failure occurred rapidly. They had not seen it coming for weeks. I have seen the pictures of the Fire Service trying to pump down the dam. All the sluices were open, there was a big scour hole on the front slope, and the dam was at risk. Unfortunately, things do happen.

The Chairperson: That begs this question: why did the supervising engineer not pick that up?

Mr Orr: That is a very good question and maybe the subject of your — *[Inaudible.]*

The Chairperson: The kernel of the point is that you are basing risk on a false premise. Everybody, no matter what society or job they are in, has to manage risk.

Mr Orr: Yes.

The Chairperson: What you are doing is not managing risk.

Mr Orr: Yes.

The Chairperson: I take the point that flooding is completely different from river levels rising. It is a surge or a tsunami, for want of a better way of describing it. You mentioned the Hoover Dam, for instance. You cannot tell us that, if you recommend £10,000 of repairs to a dam wall, that cannot and will not change the risk. Surely the risk must be based on impact and probability.

Mr Orr: We concur with that, and your legislation is drafted as such. However, we, the institution, do not believe that there is an internationally recognised approach. If you were to adopt something here in Northern Ireland, it would have to be based on something developed here, presumably by Rivers Agency, which would not be based on research or knowledge elsewhere in the world.

Mr Cooper: It is very important to distinguish between likelihood and consequence. The likelihood of a dam failure can change very quickly. A tree could come down and block a spillway and, in half an hour, change the likelihood of that dam being overtopped and people being killed. It is as stark as that.

The dams in Northern Ireland that we are most concerned about are the privately owned ones, which are, largely, embankment dams. An embankment dam is made up of three main features. Imagine your bath. There is the retaining structure, the overflow and the plug to let water out. Once you have improved the spillway to the standard appropriate to the downstream consequence, and provided the spillway is kept clear, that should be it finished. You are then talking about any deterioration in the embankment or the draw-off works. Those do deteriorate with time and need to be maintained. That is the reality. Those are the three big features of an earthing embankment.

In the 1970s, I, along with a colleague, brought all of the 60 publicly owned water-supply reservoirs in Northern Ireland up to a good standard. They have been extremely well maintained by the water service, as well as anywhere in the world, we would say. However, a lot of the privately owned reservoirs have had absolutely nothing done to them in the past 40 or 50 years, which has to be a concern for the Committee.

The Chairperson: The point that Tom and I are trying to get at is that, if you were to supervise and spotted a wee leak, you would supervise more. I take it that you will be doing the surveillance, which will incur more cost —

Mr Orr: Not necessarily.

Mr McKillen: Not necessarily, no. In the current situation, I am not required to do the surveillance. I can provide advice to a particular owner that they need to keep an eye out. However, there is no legislative requirement for any reservoir owner to involve me in that supervision. It can be carried out by them until such time as the legislation requires it to be carried out by a qualified civil engineer.

The Chairperson: If you produce a report that recommends certain investment, no matter what type of reservoir it is, and that work is done, is it not a waste of time and resource for you still to come out twice a year to inspect something that is probably state of the art? You will know that, in all probability, that dam will not breach or fail. If it does, it will fail within hours, so two inspections a year might not catch that. Are we saying that the six-monthly inspections are appropriate, or am I hearing that they might never be appropriate? Given that a breach can happen within hours, we might never catch one, so does that mean that this Reservoirs Bill is redundant?

Mr McKillen: I will explain that by going back to the fact that, in the normal process, the biannual attendance is in conjunction with discussions with the reservoir manager's staff. It is not that this is the only level of keeping an eye on things. What is expected is that the owner's organisation has an understanding, as I mentioned to your colleague, of what we are looking at and how the reservoir performs. We involve them with that process, and then, on the biannual inspections, we discuss that operation. It does not need to be an onerous task. People from fishing clubs are around all the time. They can have it in the back of their head that, if they see a damp piece, they should refer it to such and such. They can be involved with the whole process to keep the burden to a minimum. Taking a collaborative approach to managing will allow that level of inspection.

The Chairperson: Yes, but you still have an involvement that puts a burden on the reservoir owner. No matter whether the owner is NI Water, a local angling club or someone involved with an environmental association, they still have an annual cost burden that could be around £4,000, which might put them under.

Mr McKillen: Sorry, where does that figure of £4,000 come from?

The Chairperson: The £4,000 comes from two inspections a year and any required work.

Mr McKillen: Are you talking about a combination of inspection and maintenance work?

The Chairperson: Yes.

Mr McKillen: I am not clear on the cost of the maintenance work.

The Chairperson: I have information here for Mackie's Dam in Belfast. In 2010-11, the cost of a supervising engineer was £4,000, and, in 2013-14, the cost of an inspecting engineer was £5,000. Maintenance work over the past five years has cost £24,500.

Mr McKillen: I would not have thought that the inspection work was to that value. Certainly, in one of the years, there is probably a section 10 and a section 12.

The Chairperson: What do you mean by section 10 and section 12?

Mr McKillen: Sorry, a 10-yearly inspection as well as a section 12. That could not be right. I would need to see the detail of that, but that is strange.

The Chairperson: That information came from the Department for Social Development. We will have to get that checked out.

Mr McKillen: Right, OK.

The Chairperson: If you can give us any supporting evidence —

Mr McKillen: I suggest that the figure that I mentioned is a fairly typical local figure for that sort of service.

The Chairperson: You said £1,000.

Mr McKillen: Yes.

The Chairperson: A year?

Mr McKillen: Yes.

Mr Orr: For two inspections. It is £500 per inspection. Chairperson, I have been to a large, raised concrete dam in Scotland, which is owned by Scottish and Southern Energy. Since the day and hour that it was constructed, it has had leaks. The bitumen sealant between the concrete sections squeezes through over time. I was kindly taken there by Scottish and Southern Energy and a particular supervisor, who goes there twice a year with a team of people to check whether the leak is continuing. In fairness, he has a team of people because they have 90 reservoirs. Even with spending capital money on a dam, even an earth bank dam, it will continue to leak. Dams leak, and regular supervision is simply about keeping an eye on it and ensuring that things are not changing that would raise alarms.

The gentleman from Scottish and Southern Energy goes every six months and told me that, in winter, because it is cold, the bitumen does not seep through just as much as it does in summer. He has that sort of knowledge, whereas, if someone new turned up and saw water leaking through and stalactites hanging, they would panic. It is about having that long-term understanding of the dam to ensure that there is not a problem and reassure the owner of that. So it is about keeping a regular eye on the dam for that safety reason.

Mr Milne: A lot of the questions that I was going to pose have been covered. You said that the average cost is roughly £1,000 for two inspecting engineer visits every year. What about the follow-up by the supervising engineer? How is that calculated, and how much will that cost?

Mr McKillen: For the sake of clarity, I should say that we were talking about Wolfhill Middle, and that was a ballpark figure for the supervising service for that period. The inspecting engineer's role is required once every 10 years.

Mr Milne: How much would that cost?

Mr McKillen: It is probably fair to say that, at that time, it could be £3,000 or £4,000 once every 10 years. So that is about £300 or £400 a year. Is that fair to say?

Mr Cooper: It depends on the scale. For a small reservoir, it could be much less than £2,000. It could be £1,500.

Mr Orr: It depends also on whether they can be grouped. If, for example, an engineer is based in Belfast and has to inspect a dam in west Tyrone, it is better if they can visit three in that area so that they travel that distance only once.

Mr Milne: I would like to follow up on Thomas Buchanan's point. If a panel engineer gives an opinion and makes a recommendation, is it possible that another engineer might have a different opinion, or do they sing from the same hymn sheet?

Mr Cooper: There is pretty good consistency across the board. The first point to make is that there is no British standard for dams. It is not a matter of simply ticking boxes. So the section 10 report by the

all reservoirs panel engineer is his personal opinion. His is a personal appointment by the Secretary of State, and he stakes his reputation on it. However, the question of getting a second opinion arises. The legislation covers a situation in which an owner says that the engineer's report is a load of rubbish.

Mr Milne: Does the owner have to pay for the second opinion?

Mr Cooper: It very rarely happens. Jack, do you want to speak on that?

Mr Meldrum: It very rarely happens, but there is an appeals process. Within so many days, someone can object and ask for a second inspection. I, personally, have not known one that has gone through that route. I believe that it has happened that somebody has had a different opinion, but, by and large, the issues are seen fairly much in the same way by panel engineers. There will always be a degree of subjectivity. We are individuals with our own opinions and our own thresholds at which we consider something safe or unsafe. Your colleague asked whether there is a quantitative approach. All these structures are individual, so it is very difficult to be quantitative. You can look at a big portfolio of reservoirs and judge them on a quantitative basis to prioritise when and where you spend your money, but it is difficult.

Mr Milne: From an engineer's point of view, why can probability not be taken into account?

Mr Cooper: We are moving in the direction of looking at the qualitative risk analysis. The science of qualitative risk analysis is developing. It is not an exact science and, ultimately, it is largely the judgement of the engineer.

Mr Meldrum: Subjective judgements have to be made even if one takes the route of quantitative assessment.

Mr Cooper: I will try to explain this in very practical terms. You are looking at a particular embankment reservoir, which was built 100 years ago. You are told, "We have no record drawings. We understand that it has clay in its core, but we're not sure what width". Often, the difficulty in trying to come up with a standard method is that all reservoirs are very different and have been there for many years. You cannot tell by looking at the outside what exactly is on the inside. Therefore, you do not know how wide it is and how much clay is in it. You would have to do a lot of investigation, and, even were you to investigate, there is so much potential for variation that it makes coming up with a standardised approach quite difficult. I am sure that you are probably aware that people have made boreholes in some places and found all sorts of other things between the boreholes.

Mr Milne: So, if you are quantifying how many cubic metres there are in a reservoir, you know that a certain amount of silt, glaur or muck — whatever you call it — is in it. So, you are basing your cubic metres on the actual water that is in the reservoir.

Mr Cooper: It is the volume that can escape.

Mr Milne: How do you find out how much liquid is in that reservoir? Is doing that in an engineer's remit?

Mr McKillen: Yes. Sometimes particular reservoir owners have a bathymetric survey done; therefore, you are able to determine what it is. There are, at times, some records from previous original designs where there is what is called a high-capacity curve. Information is sometimes available. Aside from that, by looking at the topography and profile of the valley, you can calculate what is likely to be in the reservoir. If you are not going to spend money doing a bathymetric survey, you can come to some geometric means of calculating what is there and what might be released by the failure of an embankment. So, there are different ways to do it, depending on the information that is available from a particular reservoir owner.

Mr Orr: Making that calculation would not sit with the panel engineer; it would sit with the Rivers Agency as the enforcement authority.

Mr McKillen: Yes.

Mr Milne: Right. I suppose, then, that I need to ask the Rivers Agency how it arrives at that capacity.

What types of defects would you expect to find in a typical reservoir? You talked about the bath, the plug, the leak, the overflow and all that.

Mr Cooper: We are focusing on privately owned earth dams in Northern Ireland that have not been maintained, but in an earth dam, or any dam, one critical feature is a means of entering the reservoir quickly in case something happens. Were I to be called out to a leak in a reservoir in the pitch dark at 2.00 am, the only thing that I could do there and then, if it is safe to do so, is to open the scour valve and get the water level down. That is because a reservoir that is emptied is made safe. That is the only on-site plan that you can have in the middle of the night, when you are working alone or almost on your own by torchlight. So, that is a very important feature.

I mentioned the overflow. The risk of overtopping an earth dam is high. If the spillway is fixed for the appropriate downstream consequence and does not block, it should not be a concern anymore. However, the embankment and the draw-off facilities are a continuing concern, because they can deteriorate.

Mr McKillen: If you are looking for specific risks — you talked about the embankment that Alan looked at — the upstream face will have likely pitching to stop the wave action eating into the embankment. If you walked along that, you would often find that the material between the pitching has been sucked out by the wave action. You can often find voids behind that pitching. You can find growths such as trees and whatever along the crest. The difficulty is that sometimes a tree that gets to a particular size can fall over and take a chunk of the embankment with it, thereby creating the potential for a release of water. Equally, a tree's roots can go through the core. If there is supposed to be a clay core in the middle, the roots can go through. Even if you cut down the tree down on the downstream side, the root can decompose and you have a route along which the water can seep out. So, quite a number of things can happen, and all sorts of training sessions are held to look at the things that can potentially go wrong with reservoirs. Understanding how a dam is constructed informs the type of defects that are associated with it.

Mr Milne: Are you concerned about the structure of any of the 150-odd reservoirs that are here? If so, why?

Mr Cooper: Any that we have seen we have dealt with. I have been to about 100 of Northern Ireland's reservoirs at some stage and have been advising Northern Ireland Water on its 48 reservoirs since 1973. Currently, about half those are out of service. I have reported on most of them.

The firm that I worked for at that time was involved in building or raising a number of reservoirs. If we raised a reservoir by more than 25,000 cubic metres, I did not report on it under section 10 but asked someone from another firm to report. That is to do with independence. I cannot comment on the reservoirs that I have not seen, and there is one in particular that I do not want to mention.

I really have to say that we need legislation. If you want to see what a breach looks like, I suggest that the Committee asks David Porter to lift a gate at Toome to simulate a breach. It would scare the life out of you, as would the noise of it. If one of our dams, say Woodburn in Carrickfergus, were to go, it would be appalling, and the loss of life would be absolutely enormous. I have lived with that and have been giving advice since 1972.

Northern Ireland's dams are in terrific shape, but, having said that, the Silent Valley nearly failed in the 1970s. Very few people know about that. David spoke about revetments. The revetment in the Silent Valley was undermined by material that was being washed out through the cracks, and the crest wall was about to go. If that storm had gone on much longer, believe it or not, the Silent Valley would have been breached. It is staggering.

Mr Milne: How was it repaired? This is very interesting.

Mr Cooper: A firm called Binny's was involved in the original project. As you know, there was a big problem with the cut-off in the Silent Valley. A chap from Binny's engineered a complete restructuring of the revetment, and they rebuilt the entire revetment to make sure that that did not happen again.

That reservoir was built only in the 1930s. A lot of the dams that we are talking about go way back. For instance, Lough Island Reavey reservoir was built in 1839. It is a very old reservoir and was built

when techniques were really quite primitive. The Silent Valley is very well built, yet it needed maintenance. However, it was saved.

The Chairperson: How was the potential failure identified?

Mr Cooper: The revetment suddenly collapsed during a storm. The material was being sucked out from under the big ashlar blocks in the revetment, and the gravel from underneath was being washed out. People were not aware of that, and it suddenly collapsed in a storm. I am sure that you are all familiar with the Silent Valley. The crest wall was undermined, and, had the storm gone on for much longer, there was a real risk of a breach. That is a bit scary.

Mr McKillen: That was prior to Northern Ireland Water's inspections.

Mr Cooper: Yes. It was at the very start.

Mr McKillen: That was at a stage prior to Northern Ireland Water having instigated the regime that it has in place. I am sure that it has mentioned that to you.

Mr Cooper: That would not happen now. The system that we have with Northern Ireland Water means that there are inspections at different levels of personnel. There is a very important monthly inspection. The inspector checks against a whole lot of different features. It is almost like a very thorough checklist. It is signed off, and then it goes up the line. There are two other additional inspections, and then there is the yearly inspection. So, as you go up, more senior people deal with it. There is also the 10-yearly inspection. Northern Ireland Water has been doing those carefully since 1972.

Mr Milne: Thank you. I found your presentation and conversation very interesting.

Mr Irwin: We have heard from a number of private sector owners. Some of them have been seriously considering decommissioning, abandoning or discontinuing their reservoirs because of the onerous duties that the Bill will impose on them. What are your thoughts on the decommissioning of a reservoir? Are you aware of whether that has been done anywhere else, such as in England or Scotland?

Mr Meldrum: Yes. It is actually covered by our legislation. There are two things that you can do. One is to abandon a reservoir, and the other is to discontinue it. One is where you basically stop it from being able to store water at all, and the other is where you take it down below the threshold level, which, at present, is 25,000 cubic metres. In England, Wales and Scotland, a panel engineer has to certify that. So, the works have to be safe. Of course, you could do it in such a way that means that somebody could just drive a bulldozer through the bank, leaving it in a pretty unstable, unsafe state. When you get a flood through the reservoir, it could start to wash out raw material, and you would have a large mess downstream.

So, there is experience, and it is done. I do not have examples here, but there are a number of examples of where people have had it done. The other issues that occur with it are quite often planning and environmental. They are all associated with it.

Mr Irwin: OK. Can your institution train non-engineers to carry out the routine observation of a reservoir? If so, what benefit is that to the supervising engineer? Could a private sector owner or manager, for instance, be trained to carry out that work?

Mr McKillen: If you asking whether the ICE can train people to carry out that work, I can tell you that there is nothing to prevent any individual in a private sector or community group or whatever going through the training process and applying and being appointed to the supervising panel, provided that they have the requisite experience. If they do that, they can carry out that role as a supervising engineer with the same right as any other supervising engineer.

As I indicated, there is also a sort of intermediate level whereby they can reduce the cost and input that are required by a trained supervising engineer by carrying out a lot of the ongoing work on keeping an eye on the reservoir and having a bit of training and understanding that helps them to assist the formal supervising engineer in carrying out his or her annual statement.

So, yes, it goes back to what I said: a collaborative approach is very much the best one, because it keeps a closer, more regular, ongoing eye on the reservoir. People understand when issues occur, if they occur.

Mr Irwin: I have concerns about the bigger picture. You mentioned the Silent Valley and the number of very large reservoirs that could be a major risk if they were breached. Although we are aware that many of the private, smaller reservoirs pose little or no risk, there is concern among those owners that this could be very onerous for them.

Mr Cooper: Could I stop you there? I am sorry, but the interesting thing that has come out of DARD's work is that some of those smaller reservoirs have a very big consequence downstream. This has possibly come as a bit of a surprise to this Committee, but imagine a small reservoir sitting above Hollywood. There are two such small reservoirs: Church Road Upper and Church Road Lower. If the upper one goes, it will take the lower one with it, but the loss of life in Hollywood would be high. You are aware of the topography of Hollywood. It is steep and is a confined valley that opens out through the town of Hollywood. A failure of the Church Road Upper reservoir does not bear thinking about. I do not live in Hollywood, but I am familiar with how steep the Hollywood hill is. That water would roar down through the town.

Some of these smaller reservoirs have a high consequence. It is not by any means just the Woodburns, the Spelgas and Silent Valleys. Having said that, a big reservoir like Altnaheglish/Banagher sits above Dungiven, but Dungiven is on a hill, so by the time that the flood would hit Limavady, which again is sitting quite high, there would be many fatalities from Altnaheglish. That is a big reservoir, and I had to stabilise it 30 years ago, because it was going to lift off its foundations. It is a 40 metre high dam and is the highest in Northern Ireland. It is a big reservoir, but its failure would not kill as many people as a small reservoir in Hollywood.

So, be very careful. Do not think that, because the reservoir is small, the risk is limited. It depends on where it sits above a population. You would not want some of these small ones to fail.

Mr Irwin: That is interesting.

Mr Milne: Thank you for letting me back in, Chair. The more that I hear about reservoirs, the more it seems that they provide a service to communities. Is that what you are saying?

Mr Cooper: Yes. Out of the hundreds —

Mr Milne: It is maybe not you that I should be asking, but if they provide a service to communities, surely communities have a shared interest in the cost of preserving them. It should not be left to private landowners, some of whom inherited the reservoirs. My point is that there is a public responsibility. I hear people talking about the value of these dams to wildlife and so forth. Therefore, if it is in the public interest, I think that the public should be very much involved in the expenditure on them.

Mr McKillen: That is absolutely correct. One thing that I would add —

Mr Milne: So, I am asking whether these reservoirs provide a service to the public.

Mr Cooper: Of the 150 reservoirs in Northern Ireland, about only 24 supply water to the public. The other half of their portfolio is out of service, but every single one of the 150 provides an amenity, such as a wetland, as well as flood attenuation. They all provide uses that are way beyond a commercial use, in that sense. Maybe there is a case for a reservoir trust such as a wildlife trust or the Woodland Trust. The water service wants to sell half its reservoirs. Who would buy them? I ask that because there is the cost of maintaining them to consider. It is a big issue. We talked about it in committee, and we do not have a solution. However, it is a big issue, and they should not be abandoned.

Mr McMullan: I think everything has been said, from the demise of Hollywood to other issues. Getting back to the potential risks, surely that fault lies with the planning authority or other authorities that knew that that reservoir was there and allowed houses to be built on a hill in the face of a reservoir. You have floodplains, but never once in any planning application did I hear of the risk from reservoirs. You have not factored in the cost. Are we looking at a situation where the planning authority will charge the applicant for an engineer's report on a dam if he wants to build downstream? The fault has

to lie with other people, instead of putting the blame on the owner. We are quick to say that some of the smaller ones are at a bigger risk than some of the bigger ones. However, what would happen if some of those smaller ones were reclassified as something other than a reservoir?

Mr McKillen: If they were reclassified in so much as removed from being subject to the requirements of the Bill, they would not become a risk to the downstream.

Mr McMullan: Exactly. Why has that not been said today? That is clearly something that you can do.

Mr McKillen: However, it is about finding a balance between your colleagues, the environmental benefit, the flooding benefit and the community benefit that those reservoirs provide.

Mr McMullan: That is fine, but the fact that you can reclassify was not mentioned today. You can take them out of that, and that would spare the expense to the owner.

Mr Cooper: What do you mean by the term "take them out"?

Mr Orr: To reclassify, you would have to bring it to below the 10,000 cubic metre threshold, as Jack said, or abandon it entirely.

Mr McMullan: Is that impossible to do?

Mr Orr: No.

Mr McMullan: So, it is something that we can do, but it has not been set out as an alternative to the owner.

Another thing that has been set out is this: if we came in here to inspect these reservoirs, there would be a cost. I think that some of my colleagues said that it would be a cost to the owner. If that owner cannot pay, would you carry out your inspection, knowing that you were not going to get paid? Under the derelict buildings order, councils, for example, can slap an order on you. They say, "We'll do the work, but we'll charge you." Are we coming into that sphere? I think, gentlemen, that there is a lot more that we have not teased out in the Bill. We have talked about all the costings and everything else, but we have not got away from who is responsible.

Mr Cooper: The owner is responsible. Currently, the manager is responsible.

Mr McMullan: With all due respect, how can the owner be responsible if he was not notified or advised? Are you going to tell me now that, if the planning authority, for example, has never come to the applicant or advised him about building houses or multiple houses in the path of a reservoir, the owner of that reservoir is responsible for the lives of those people downstream?

Mr McKillen: Historically, the owner has always been responsible. It is an asset that he has. If you had a wall that fell over on to the road or a car, you would be responsible for it. It is the same thing. He has an asset that he has always been responsible for.

Mr McMullan: Are you responsible for your report?

Mr McKillen: I am responsible for the report, and our company is responsible for a report that we do.

Mr McMullan: If anything happens over and above your report, are you responsible?

Mr McKillen: It depends on how it relates to what is in the report.

Mr McMullan: Exactly, and the reservoir owner will say the same thing. He will ask questions too, as you would if it were your report.

Mr McKillen: If you lived downstream of that reservoir and it failed and you were washed out as a result, under current common law, you would have the ability to get redress from the individual who owned that reservoir.

Mr McMullan: Under common law.

Mr McKillen: Yes.

Mr McMullan: Do you think —

Mr McKillen: My understanding is that, as a result of the Rivers Agency work, applicants who make planning applications where there is a reservoir above are referred to the need and the risks of that reservoir.

Mr McMullan: Who does the applicant for that house get the report from?

Mr McKillen: Let us take a theoretical situation where a developer is building downstream of a reservoir. The process is that the developer is required to carry out a flood risk assessment. You can check this with Rivers Agency, but it is my understanding that the developer is required to carry out a flood risk assessment and to liaise with the owner of the reservoir, because the reservoir has an impact on that assessment.

Mr McMullan: Who pays for all that?

Mr Orr: The applicant, which is the developer in this case

Mr McMullan: What about the flood plans that the Rivers Agency already has?

Mr McKillen: We do not have the flood plans. They would be with Rivers Agency.

Mr McMullan: Everyone washes their hands of this, and it keeps coming back to the man who owns the reservoir. *[Laughter.]*

The Chairperson: No. It is not just as flippant a case as people washing their hands. It is a very serious issue.

Mr McMullan: I am being flippant in a way, but I really think that there are parts of this that we are not getting to the bottom of. You can redesignate the reservoir. That information is in front of all the members here.

The Chairperson: With all due respect, we have been looking at this for weeks, Oliver.

Mr McMullan: That is OK, but no one has mentioned it today, with all due respect.

The Chairperson: It has been mentioned every week.

Mr McMullan: Can you redesignate the reservoir if it is below or above 10,000 cubic metres?

Mr Orr: Perhaps I can take a couple of your points. As we already said, if the reservoir has a capacity of 10,100 cubic metres, it can be brought down below the level that is specified in the Bill, but that has to be done formally. Unfortunately, in the context of your question maybe, that must be done with the involvement of a qualified engineer. It has to be done safely, but it can be brought down from 10,000 cubic metres to 9,900 cubic metres.

You could also formally abandon the reservoir and take it entirely out of service. That is possible, but again it would require the services of an engineer, and it would bring in the wider context of planning and all the other environmental issues that your colleague mentioned.

I will answer some of the questions that can arise from that. Reducing the reservoir from 10,100 cubic metres to 9,900 cubic metres can be done. However, if the reservoir failed, albeit that it would be below the level specified in the legislation, there would be little difference in the impact. There is still a fundamental risk with a reservoir of under 10,000 cubic metres.

Let me also take your points about planning. We, as the institution, cannot comment on what has happened in planning. Things have happened in the past, and housing developments have been built

and things have been built on the floodplain. I know that, over the past number of years, Rivers Agency has undertaken works that largely correct flood defects in areas that have been developed only recently, such as areas around Ballygawley and another town that was recently flooded. Those were things that Planning Service granted approval for not that long beforehand. As a consequence, that now has to be dealt with. There are historical and legacy issues that have gone through in the past, when knowledge of flood risk and other matters has perhaps not been as advanced.

Where the reservoir owner is concerned, if someone comes along and wants to build a housing development of 100 houses downstream of the reservoir, that should not cost the owner anything. It is the developer's responsibility to undertake a flood risk assessment and to pay for it as part of his planning process. That follows PPS 15, which I know is being looked at in the context of an upgrade.

Mr McMullan: You say that in England there is a threshold of 25,000 cubic metres.

Mr Orr: Yes.

Mr McMullan: Why can we not start at that threshold here?

Mr Orr: We tried to cover that in our paper.

Mr McMullan: I know that you did, although I want to go back to it briefly.

Mr Orr: Ten thousand cubic metres is seen as the accepted level. Since the 1975 Act, knowledge has developed and moved on, and 10,000 cubic metres is around the threshold level for reservoirs.

Mr McMullan: Are you bringing the 25,000 cubic metres threshold that pertains in England down to 10,000?

Mr Meldrum: That is certainly what was planned, and, although the Floods and Water Management Act 2010 does not actually state the lower figure, that is what was envisaged. At the moment, we do not know what is going to happen. The secondary legislation is not there, and we do not know exactly what will happen. I can say that Wales is going for 10,000 cubic metres. Scotland is going initially for 25,000 but intends to phase that down to 10,000.

Mr McMullan: Over how long?

Mr Meldrum: I do not know what the period is; I do not have that information.

Mr Orr: Scotland has the legislation in place but has not yet enacted it. So, it is still running at the 25,000 threshold under the 1975 Act, as enacted in Scotland. It has the new legislation on the statute book, but it has not yet pressed the "Go" button.

Mr McMullan: The legislation is there for 10,000.

Mr Orr: For 10,000, yes.

Mr McMullan: But that has not been brought in.

Mr Orr: Yes.

Mr McMullan: OK. Thank you.

The Chairperson: Oliver, there is a reply from the Department of the Environment giving a planning perspective on the Bill. It says something similar to what Stephen Orr stated. For your information, there is further clarification from pages 27 to 30 of the Members' packs.

Alan, you touched on low-impact reservoirs. To a certain degree, you will be blinded on them. Are you comfortable with that?

Mr Cooper: We are saying this: do not forget about the low-consequence ones. They are still there. The danger does not just disappear when the level drops by a few hundred cubic metres. That is the issue. We should not forget about them.

The Chairperson: You are talking about the reservoirs that lie below the designated controlled reservoirs.

Mr Cooper: Yes.

The Chairperson: But there are also controlled reservoirs that sit at the low risk. Are you blinded on them? Is that something that worries you? Do you lose sleep at night over them?

Mr Cooper: I have lost a lot of sleep in the past 50 years. We have to be jolly careful. We may have been lucky. In fact, I think that we have been lucky. We have had failures. The last one was at Tildarg above Doagh, but there was no loss of life. The upper one at Creggan failed. That was fairly small, and it was absorbed by the middle one. The dam at Keady failed way back in the 1800s. It swept right down the valley, the Cushier, and wiped out a lot of Keady. So, they fail. I think that the danger is that you can be complacent.

I think that the issue is money. Nobody is against this legislation. It is very necessary, because I am afraid that those in the private sector will not address their dams unless there is legislation. I think that it has to happen. The issue is money. They need help. A farmer could go out of business if he had to fork out money on this scale to fix a spillway or whatever, and he just could not afford that. They should not be dug through. The logical thing would be to dig through them, and that is a danger. The whole community will lose out. They are very valuable to the landscape and to wildlife. As I said earlier, every single one of the 150 dams has an amenity, and they should not be destroyed.

Mr Milne: On that point, if they all have an amenity and are of public interest, surely the responsibility cannot lie with the private owner.

Mr Cooper: You are going outside engineering here.

Mr Milne: I understand that, but I want to make this point, and I have been making it.

Mr Cooper: You are absolutely right.

Mr Milne: I think that there should be a public responsibility, rather than putting the onus onto the private owner.

Mr Cooper: They have all these other benefits such as flood alleviation and flood attenuation; they do absorb floods. They provide wildlife and fishing. Fishing is the biggest amenity. There is even fishing on the ones that are used for potable water supply. Quite rightly, there is no boating on them; there should be no boating on a reservoir used for potable supply. People fish in them and walk around them. They are too valuable to lose. The private owners need help.

Mr Orr: It is outside our remit, but ICE would be supportive of a grant-aid system. As we see it, through our consultations on the policy as it was developed, the problem with the legislation is that you have to rest responsibility somewhere, and, unfortunately, it rests with the owner or the manager in that respect.

The Chairperson: Let us be clear: under common law now, the reservoir owner is responsible.

Mr Orr: May I just address your question about low-risk reservoirs? Through our consultations on the policy, we fed back to Rivers Agency, and it has taken that into consideration. We genuinely believe that a low-risk reservoir has to be looked at at some point in time. Effectively, we are turning our back on them, and that was your point when you asked whether we are completely unsighted on them. ICE debated that in our committee, and the general feeling was that it needs something, but it should be a downgraded version of inspection — maybe not the supervision inspections, but a qualified pair of eyes looking at it at some point in time and feeding back, but with a much lower profile in respect of the fact that it is a low risk.

Mr McMullan: With the power of planning going back to council, and as councils are the owners of some of those reservoirs, there is a conflict of interest there.

Mr Cooper: I will ask Jack to talk about the Environment Agency in GB.

Mr Meldrum: It has reservoirs and it manages those reservoirs. It wears, basically, two hats, I think, and it does it well. Because it is the enforcement authority, it has to set a good example.

Mr Swann: Thanks, gentleman, for your patience. Going back to Ian's train of thought, if they are all public amenities, maybe Rivers Agency and the Department should pay for those inspections.

Mr Milne: Yes, that is why I was making reference to it. They are sitting back there.

Mr Swann: You could maybe ask Michelle the next time you see her. There was a train of thought that Oliver started that did not reach finalisation. If one of your engineers inspects a reservoir and gives it a certificate or report of fitness, walks away and it breaches within five minutes, does the engineer retain any liability?

Mr Orr: I could take that under my commercial hat for my organisation. When an owner employs an engineer, they require them, under the standard of law, to exercise reasonable skill and care. If the engineer has not exercised reasonable skill and care, quite frankly, the lawyers will take them to the cleaners. It will be the case, but you will have to get another engineer and go through the court proceedings, certainly if the engineer has got it wrong and has not spotted something that they should have spotted, or whatever. You have heard from Jack about the panel system. I am mid-career. I have spent 20-plus years after graduation getting experience, and I am currently going for the panel, so I have had to build up a wealth of experience before I can even get on to the supervising panel, never mind the two gentlemen to my right who are on the all reservoirs (AR) panel and are at a much higher level. You are dealing with highly specialised people.

Mr Swann: So, unless you can get another engineer to say that the first engineer was at fault, the answer is no.

Mr Orr: You will always get an engineer to act as an expert witness.

Mr Swann: Who would be a member of the same institute as the original engineer who did the inspection.

Mr Orr: Absolutely, yes.

Mr Cooper: Engineers are human beings and can make mistakes. They are not infallible, but it would be very surprising for a dam to fail shortly after a thorough inspection.

Mr Swann: But you do not incur liability.

Mr Cooper: That would be very rare.

Mr Orr: It would probably also last for a period of time, say, if the dam failed five years after a full statutory inspection, and you went back to show that the AR inspector had missed something. I will give you a scenario. I was at a meeting yesterday with Severn Trent Water. The gentleman who is the reservoir manager used to be the enforcement person for the Environment Agency and he has a policy of changing the inspecting engineer each time so that he gets a fresh pair of eyes and it is not the same person looking at it each time. His current inspection engineer has picked up an issue in one of the dams, and it will be written up. The British Dam Society is running its biannual conference in Northern Ireland in September, and it will be written up in one of the papers for that. That particular inspecting engineer has said that it is a similar spillway to Silent Valley. It goes down and around a bend, and he picked up a concern with that, which has prompted modelling. The paper will look at how 50 years have gone by without someone raising an issue on that.

Mr Swann: So, are you saying that it is good practice to have a new set of eyes every time?

Mr Orr: Some owners believe that it is good practice. I certainly think that, in respect of the supervising engineer, familiarity is good, because you are asking for someone to inspect it every six months, and they need to understand it. Alan or Jack may be more versed and able to comment on that, but that particular owner has a preference to rotate. I believe that the company I mentioned earlier, Scottish and Southern Energy, also rotates. It uses a small panel of three or four engineers for its 90 dams, but it rotates them. If you inspect one now, you will not inspect the same one in 10 years' time.

Mr Cooper: The supervising engineer looks for change. Therefore, as David said, a degree of continuity over, say, three or four years has merit. There are two basic things that change in the embankment: deformation, which is a change of shape, or leakage. Those are key issues for the embankment. Leaks are very serious, because soil is erodable. The dams that we are talking about are earth dams. We have only four major concrete dams, which you will be aware of: Spelga, Ben Crom, Altnahinch and Atlnaheglis. All the others in Northern Ireland are earth dams, so they are erodable. As Stephen said, once a leak starts, you might get warning, but soil erodes quickly. Therefore, failures are quick. The failure of a concrete dam is totally different. A concrete dam is lifted off its base with uplift pressure. If Spelga ever fails, it will be because it lifts off its foundations. The uplift pressure on all four of our concrete dams is very low. I am monitoring those. They will not lift off their foundations. Failure of an earth dam is different. That is due to internal erosion through the dam, and, when it happens, it can be quite quick. That is the worrying bit.

Mr Swann: Alan, you mentioned earlier that you have been involved with Water Service, or NI Water, for 30 years and have inspected all its dams, which are pretty much at a good standard. Do you see the legislation as being solely to bring private owners into line with that inspection?

Mr Cooper: It catches us up with what happened after Dolgarrog in north Wales. In 1925, around 15 people were killed at Dolgarrog. The legislation did not come in until 1930. I do not know why it did not come in here immediately; it should have. We are playing catch-up. Luckily, we have had no loss of life since 1925. Since the 1930 Act, there has been no loss of life from the failure of a dam in the whole of GB. There has been loss of life from the failure of a canal, but not from an impoundment. That is remarkable. We are killing people at a terrific rate on the roads, but our record on reservoirs is fantastic. Here, we have been lucky, I think, but we have managed it. The legislation is not just for the private dams. It will bring everybody up to the same standard.

The Chairperson: There are only a couple more questions, gentlemen. Thank you very much for your time. The session has been very good and very informative.

I want to get back to the operational mechanics of it. Let us say that you go out to inspect and supervise, and you find a leak in an earth dam. Is there a degree of professional discretion as to whether you recommend to the owner that the reservoir will need a monthly inspection for a year, at £500 a go, or, because the leak could lead to something bigger, that it needs fixed right now and that you will inspect it when it is fixed or in six months' time?

Mr Cooper: As Jack said, there is judgement there. It depends of the nature of the leak. If the leak is starting to move material out of the bank, if you can see soil coming out of the bank, you start drawing the reservoir down. There is no question about that. You take immediate action, if there are signs that the leak is causing what we call progressive internal erosion. Material is eroding, and it forms a pipe. Eventually, that pipe will get to such a size that you get a collapse and a breach. If the leak is starting to move material out of the bank, there is imminent failure, and you do not mess around, so you bring the reservoir down. As I said earlier, you want to have the capability in the reservoir to draw the reservoir down at a certain amount. Very roughly, you are talking about from 300 millimetres to 500 millimetres a day. Those are the sort of guidelines. It depends on the size of the reservoir, the catchment and all sorts of things. That is with nothing coming in. In other words, you have a pipe that will draw the reservoir down fairly quickly, depending on the nature of the leak, where it is and whether it is linked in some way to the pipe through the dam. Drawing the reservoir down quickly may not be the thing to do, because you could make matters worse. It depends on where the leak is. Is it near the outlet pipe? Is it away from the outlet pipe? What is the nature of it? Is it moving material? So, there are big issues there, and it is the judgement of the engineer to decide what the best thing to do is. If it is a minor leak, you start monitoring it, and you ask whether this has changed much. So, it really depends on the condition.

The Chairperson: Will there always be an option of remedial works to solve it now, even though it may not get bad for another two or three years? I am trying to establish whether an unscrupulous

engineer, if there is such a thing, could say, "I am on a banker here, and I am going to do 12 visits over the next two years". You know what I mean. Or, is it that the engineer advises to get that fixed and says that it will cost a one-off payment of whatever?

Mr Cooper: The engineer will behave very responsibly. We are talking about life and death, and the people who become supervising engineers are, invariably, fully chartered. I think that the bulk of them are fully chartered engineers or equivalent. They are very senior and are probably aged over 40. They are mature people, and they realise what a responsible position they are in. It is incredibly important that they behave responsibly.

The Chairperson: Yet, as you said, they are human beings.

Mr Cooper: Yes, they can make mistakes. That is the price that you pay for being a human being. However, they are well trained.

Mr McKillen: If your concern is on the side of whether there will be quite regular inspection of this leak, in my experience, that inspection does not necessarily need to be carried by the supervising engineer. It is done in liaison with the supervising engineer, but some of the owner's staff can be keeping an eye and measuring the flow. In some cases, you would put in some sort of mechanism to allow you to do even the simplest procedure, such as putting a measuring cylinder in to try to find what the rate of flow is. You would often try to look at that rate of flow in relation to the upstream water level and see whether it is the climate conditions that are causing this or whether it is directly related to the water level in the reservoir. If you drop it down a bit, does it reduce? You are trying to get information, because, when you ask whether there is an immediate way to fix it, you need to know what you are fixing. So, you need to understand what is causing this. Is it coming from the upstream side or where is it actually coming from? You need to know that before you can understand how to actually fix it. You are saying that people have to have the experience of understanding how reservoirs are built and how they work to understand how to fix them.

Mr Meldrum: I want to say something on the unscrupulous engineer, dare I say it. The panel appointments are made on a five-year renewable basis. Panel engineers have to reapply, and there are cases of people who have not been reappointed. I believe that your proposed legislation covers for the removal of people from the panels. So, I think that that is covered.

The Chairperson: That brings me to my next question, Jack, so you have done very well. Does the institution itself have any disciplinary powers or levers?

Mr Meldrum: The institution has disciplinary procedures, but I have never known a panel engineer who has gone through that process or been taken through that process. There is a disciplinary process whereby clients who have engaged engineers can take issue with the ICE about the conduct of the engineers.

The Chairperson: How will the operating regime for high-risk reservoirs in England compare to that here if the legislation goes through unchanged?

Mr Meldrum: Could you ask that again, please? I missed the first part.

The Chairperson: How does the operating regime in England differ from what is proposed in this Reservoirs Bill?

Mr Meldrum: We are playing catch-up. We have moved to a risk-based approach, which is coming in at the moment. The Environment Agency is reviewing each of the cases. It is starting with the low-risk to remove those that are likely to be in that category. We have low- and high-risk categories; we do not have an in-between. I will not say that we have got it right and you have got it wrong: you have probably got it right and we have got it wrong. I do not know. You may have a better approach that is in-between.

Mr Milne: In England, for example, are private owners helped financially?

Mr Meldrum: I am not aware of any help, unless they can get grants for other reasons. The difficulties that you are discussing are very similar to those that we see. As an AR panel engineer, the reservoirs

that I dread going to are fairly large, were built 100 years ago and are in the hands of private owners, having previously been under the ownership of a municipal water authority. That is because those structures demand a lot more maintenance and ongoing cost. I sometimes feel that the private owners are not aware of what can happen.

A relatively minor repair could cost £50,000, but it could go up to millions. I looked at one last week, which belonged to a water utility. The two costs that it was looking at were £5 million and £10 million. That was to sort out a spillway, where clearly something had to be done. So, there are large costs involved in some of these structures.

The Chairperson: With regard to those types of reservoirs, how do we sit with GB? Obviously, we have a lot of earth dams, dating back to the industrial revolution and the mills, including the flax mills. Does England have the same types?

Mr Meldrum: We have the Pennine dams, which are of a similar age and probably, if we look at them closely, have similar problems. We have got a few others. We have a newer generation of farm reservoirs, which you do not have here, a lot of which come into the low-risk category. We also have the ornamental lakes and the bigger water supply reservoirs.

The Chairperson: Thank you very much for your presentation and this lengthy question-and-answer session. We really appreciate your time, your answers and, as always, your expertise. It is important that we hear from all sectors during the scrutiny of the Bill. Alan, you are right to say that it is very important that we get this right, and, as Chair, I have been ensuring that the Committee looks in every nook and cranny in scrutinising each clause, line by line. Again, thank you very much for your time today.