

Submission to DETI

Fermanagh Fracking Awareness Network

June 2012

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1.0 INTRODUCTION & BACKGROUND

Fermanagh Fracking Awareness Network

- 1.1** FFAN is a cross-community network of individual Fermanagh residents. FFAN is not affiliated to any political party or other organisation, but works with a broad range of groups and individuals who are concerned about the risks of hydraulic fracking

Our Vision

- 1.2** Our vision is for County Fermanagh to be an inclusive, progressive and vibrant county where its people and resources are respected, regenerated and sustainably managed. We want communities in Fermanagh to be prosperous & healthy, and be great places to bring up families in a clean and unspoilt environment. We want this vision to be sustainable for the generations that follow.

Background: What is Fracking?

- 1.3.1** The process of hydraulic fracturing [fracking] has been used since the late 1940s to help get “that last bit” of conventional oil and gas out of the ground. Conventional means that it is easy to get out, not tightly trapped between, or in the rocks, which is essentially the definition of unconventional oil and gas. Fracking for that last bit of conventional gas, or oil, has traditionally involved pumping no more than 80 thousand gallons of water down a single bore hole/well and although it has resulted in some contamination of the surrounding areas, it has not been on a massive scale.
- 1.3.2** Unconventional gas and oil only became available for exploitation over the last 10-15 years because several existing technologies were married together and combined with new breakthroughs in drilling. This allowed a huge increase in both the scale and density of drilling, such that the volumes used are on average 4-8 million gallons of water per well¹, with normally eight to twelve wells² per drilling pad. A more correct name is High Volume Hydraulic Fracking [HVHF], as it uses 50 -100 times more water compared to “traditional fracking”. The fracking industry that now exists

¹ It should be noted that Tamboran have indicated a need for only 1 million gallons of water per well (substantially lower than the industry norm) – they believe that up to 25% of the water initially injected will return to the surface as contaminated frack flowback fluid and believe that they can purify this sufficiently using newly developed ‘Ecosphere’ technology; thereby reducing water demand to only 750,000 gallons for each of the 2,880 (phase one) wells. It is entirely unclear whether this estimate is based on a single frack per well (many wells have to be fracked 3 to 5 times each to ensure optimal flows are maintained) – if this was the case, the volume of water involved would be immense.

² Tamboran have indicated that they are targeting 24 wells per pad – again, this appears to be highly unusual and will result in significant cumulative risk from the density of boreholes in one area.

for unconventional gas & oil did not exist in the 1990s; indeed, it has only taken off in the USA since 2005 when the Government exempted the industry from seven major environmental laws.

- 1.3.3** Since 2005, the US government has noted several problems with the fracking industry and is now in the process of trying to “rein in” the companies to gather more evidence on the risks to water, air and soil from the whole process, not just the fracking part. Thus the issue of public health in relation to fracking is beginning to be discussed in the USA. The argument that fracking has been about for sixty years and caused no problems is not appropriate as HVHF was in its infancy only ten years ago.
- 1.3.4** Science takes time and one of its basic tenets is the precautionary principle which can be summarised; if an action is suspected of causing harm, then in the absence of scientific consensus, the burden of proof falls on the individual or organisation taking the action. Thus “absence of evidence is not evidence of absence”. This basically means that just because we have not yet seen any significant problems/issues with a new technology, tablet or treatment is not evidence that such a problem does not exist. As this document shows later, the evidence is beginning to accrue that HVHF has a significant negative impact on Public Health.
- 1.3.5** FFAN consider that in light of the concerns identified below and the widespread fears and anxiety existing within the local community (who have yet to be directly consulted by the company), there is an over-riding need to apply the precautionary principle to this project. Given the scale and the fact that shale gas extraction is planned for four areas across Northern Ireland, given this is a new and still experimental technology, given that our regulatory framework is not robust enough to keep up with a “moving target”, we in FFAN say stop and wait. FFAN are calling for the Assembly to enact a moratorium on shale gas extraction pending further studies into the risks to Public Health.

Fracking will affect more than just Fermanagh

- 1.4.1** In Northern Ireland a total of four licenses have been granted in 2011 by the Department of Enterprise, Trade and Investment to '*search and bore for and get petroleum*' onshore:
- Tamboran Resources PTY Limited has been granted a license for an area of ca. 750 sq km in the western part of County Fermanagh.
 - Infrastrata plc, has been granted a license for an area of approximately 663 sq km in Central Larne - Lough Neagh Basin, County Antrim.

- Rathlin Energy Ltd. has been granted a license for an area of ca. 880 sq km in Rathlin Basin, County Derry.
- PR Singleton has been granted a license for an area of approximately 15 sq km in Rathlin Basin, in County Antrim.

1.4.2 The licenses granted in Northern Ireland are for five years. In most cases, within the third year a decision to drill a well or abandon the project will have to be made. All licensees are required to secure the necessary permissions (planning, landowner, etc.) and an Environmental Impact Assessment before proceeding with well drilling beyond shallow exploration (including for the purposes of hydraulic fracturing).

1.4.3 In the Republic of Ireland, the license options cover a total area of ca 1,948 sq km. A further 4,000 sq km in the North West Carboniferous Basin and approximately 3,300 sq km in the Clare Basin have been identified by the Department as “additional acreage”. The license options allow for initial exploration, primarily as desk study, and drilling to a maximum depth of 200m to assess the resource commercial viability. If successful, the companies holding the license options will have a first, but not exclusive, right to an exploration license.

1.4.4 The Minister for Communications, Energy and Natural Resources has stated that any work beyond the above, including hydraulic fracturing, could be performed only after securing the appropriate permissions and after having being successfully gone through an Environmental Impact Assessment.

1.4.5 Of all the licensees in Ireland, north and south, Rathlin, Tamboran and Langco are exploring for natural gas, but only Tamboran has declared that hydraulic fracturing is the technique to be applied. Infrastrata has expressed interest only in conventional oil, while Enegi is exploring the oil potential of the Clare Basin.

1.4.6 In Fermanagh, there are two layers being pursued by Tamboran – the Bundoran Shale and the Dowra Sandstone. These geological formations are classified as Locally Important Aquifers, and **are directly underlain by a Regionally Important Karstified aquifer and separated from an overlying Regionally Important Aquifer by ca. 400-600m of fractured shales and sandstones.** Both the Regionally Important Aquifers are used as sources of water by public supplies. Numerous water-dependent protected areas are located within the area under study. FFAN considers that the proposed technique has several potential flaws which may lead to significant detrimental impact on the quality of groundwater and/or surface.

2.0 ECONOMIC IMPACT OF FRACKING IN FERMANAGH

- 2.1.1** The company awarded the exploratory license for a cross-border area spanning Fermanagh and Leitrim, Tamboran Resources plc has provided a variety of figures relating to potential job creation associated with the project. **The variation of these figures themselves is indicative of the lack of clarity about the extent and scale of the project** – this is perhaps entirely unavoidable due to the lack of information around the viability and economic profitability of the field but this itself is the cause of much frustration and concern within communities located in the Frack-zone.
- 2.1.2** What is clear is that Tamboran are extremely concerned to present the optimal case in terms of job creation associated with the project and to discount any risks of job losses associated with extant sectors within the region.
- 2.1.3** No-one would deny that the region in question is suffering a severe crisis in terms of unemployment and no one locally would casually oppose any significant job creation initiative but there are very real concerns among the affected community. Most specifically the complete absence of any form of local consultation in the immediately affected areas of Fermanagh has left local communities feeling powerless and with little to no contact with people who are threatening to come in and fundamentally and radically alter the local environment.

Tamboran Job Creation Figures

- 2.2.1** The April 2012 Tamboran figures estimated that net direct additional employment will be 600 full-time equivalents by 2025 and that this would create 2,400 further jobs (indirect employment). The initial headline figures suggested that this was net job creation for Fermanagh but communication direct from Tamboran to FFAN and other associated groups confirm that the net job creation target of 600 is for the cross-border region as a whole (with an estimated 300 direct jobs created either side of the border).
- 2.2.2** Tamboran's indirect job creation figure assumed a Type I indirect employment multiplier³ of 5.0 which would appear entirely indefensible and it is entirely unclear where such a multiplier originated⁴. The most appropriate employment multiplier

³ Defined as the ratio of direct plus indirect jobs created to the number of direct jobs created; like all multipliers it assumes a permanent stimulus of economic demand so is not applicable to short-term or temporary job creation or stimuli.

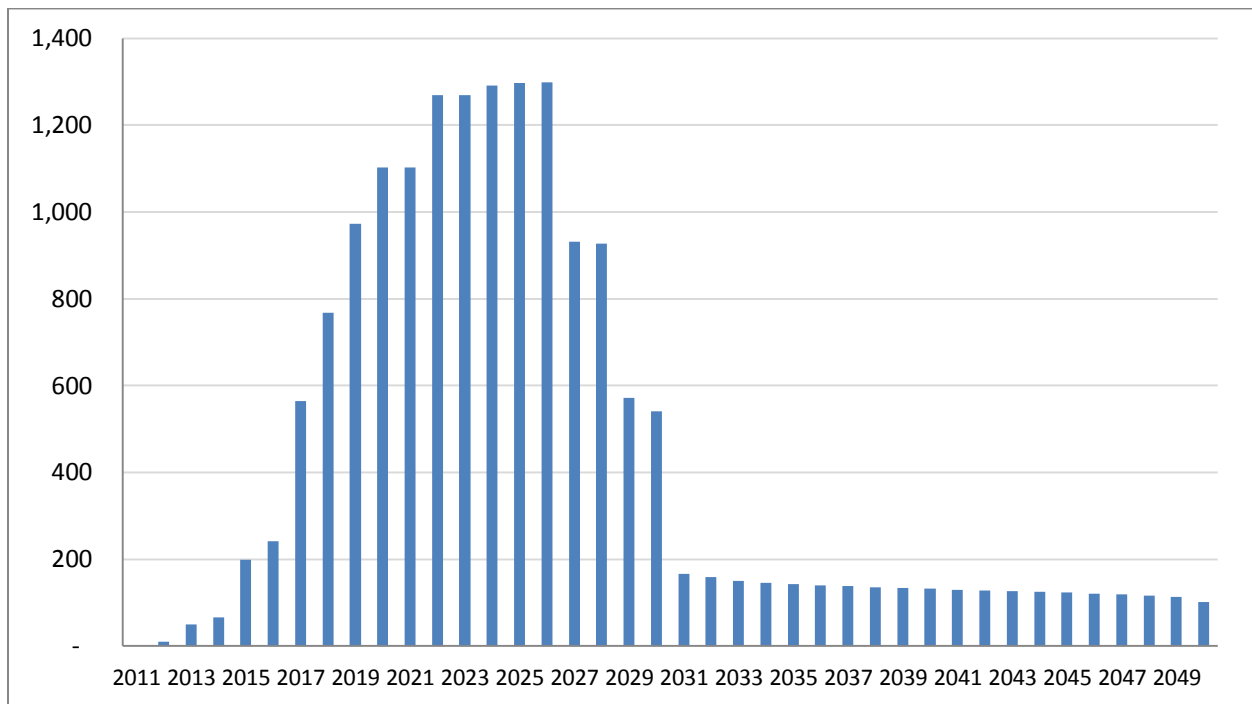
⁴ No multiplier as produced for Northern Ireland. In 2008 estimates were produced (as opposed to using more rigorous input-output analysis) by the Economic Research Institute of NI but these were not employment but economic output multipliers and they were only statistical estimates. Economic multipliers were last produced in the Republic of Ireland in 2002 (rigorously) but these did not include employment multipliers and given the passage of time and significant changes

FFAN could find was that produced by the Scottish Executive in 2007. This is 2.04 for the Gas and Extractive industries (significantly lower than the Tamboran figure of 5.0).

2.2.3 The likelihood is due to the small and structurally-dependent nature of the NI economy and the absence of significant oil and gas industries or sub-supplier chains, **the employment multiplier associated with this project in Fermanagh is likely to be very much smaller.** However, basing our assessment on this figure would suggest a net job creation (direct and indirect) associated with the project of approximately 612 Full-time equivalents (FTEs) on the Fermanagh side. However, there are further concerns about this figure being substantially over estimated due to a number of factors which are discussed below.

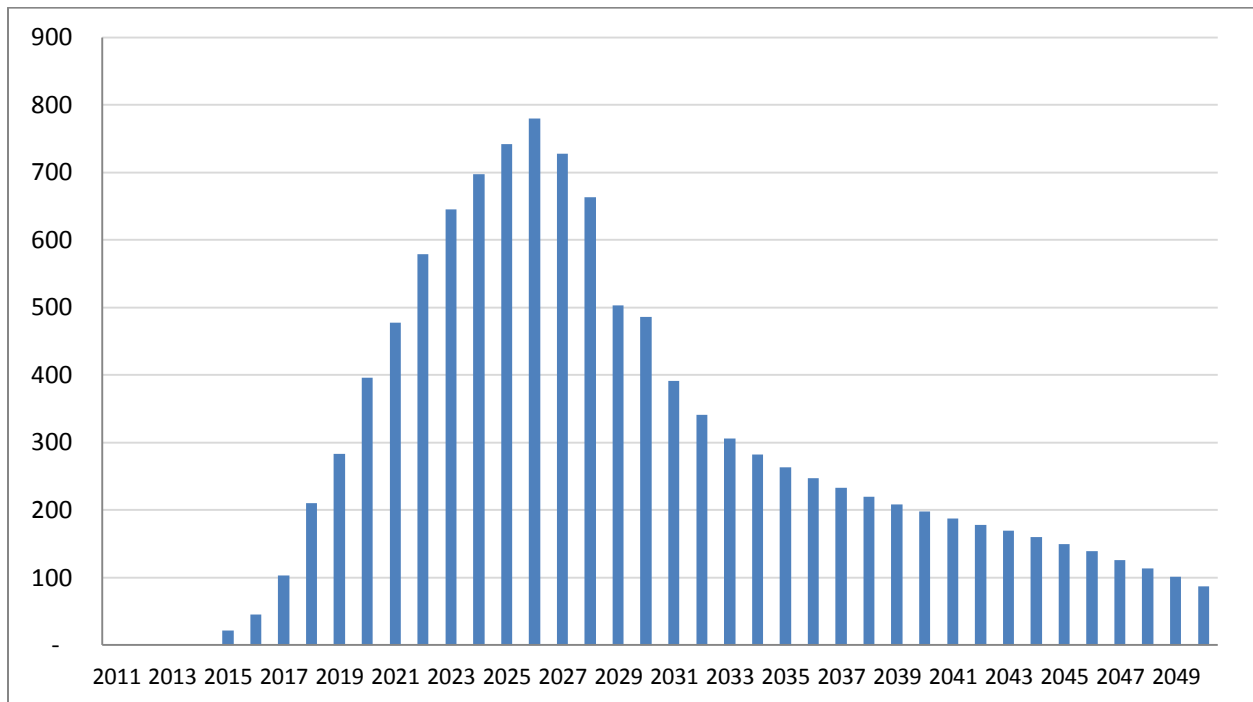
2.2.4 The graphs below and overleaf show anticipated investment, daily production and net direct employment – these graphs were supplied by Tamboran to our campaign directly and, as such, are unchanged in their entirety.

Graph 2.1: Tamboran’s Estimation: Annual Investment

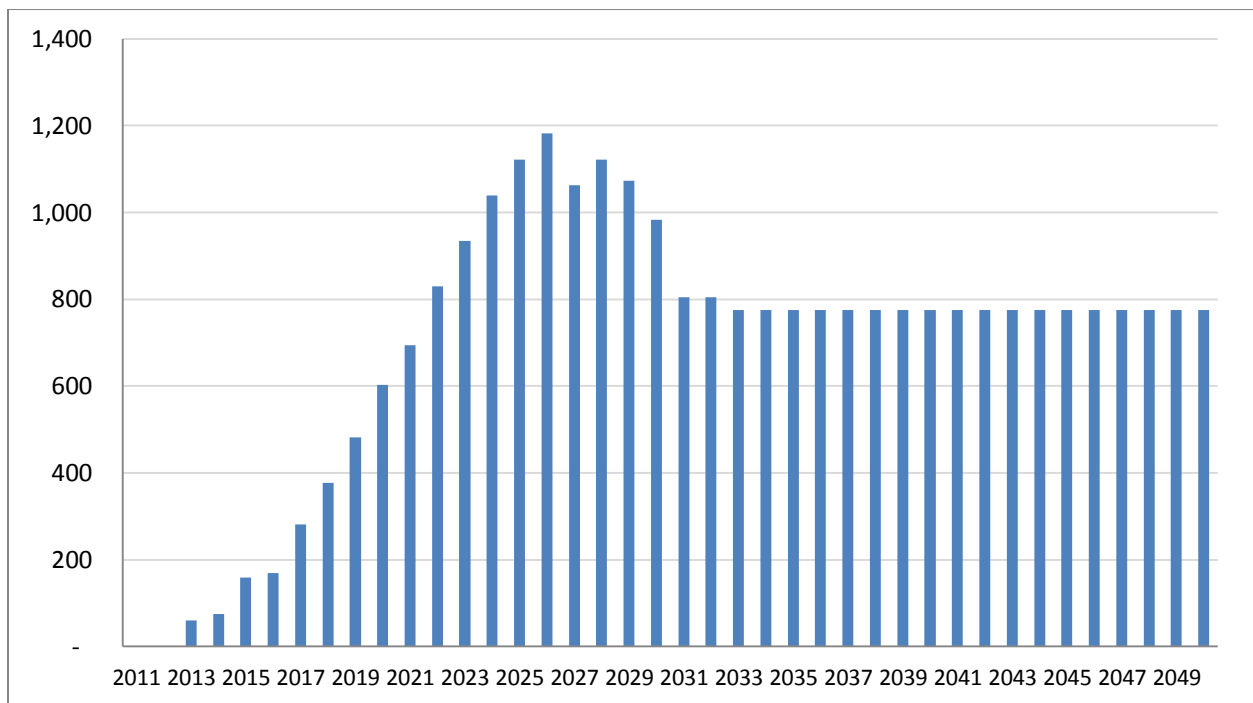


to fundamental economic structure they are both inapplicable and no longer at all reliable. So Tamboran's figures appear to come from another source or to have been simply guessed to justify a headline 3,000 net job creation figure.

Graph 2.2: Tamboran's Projection: Daily Production (MMcf/d)



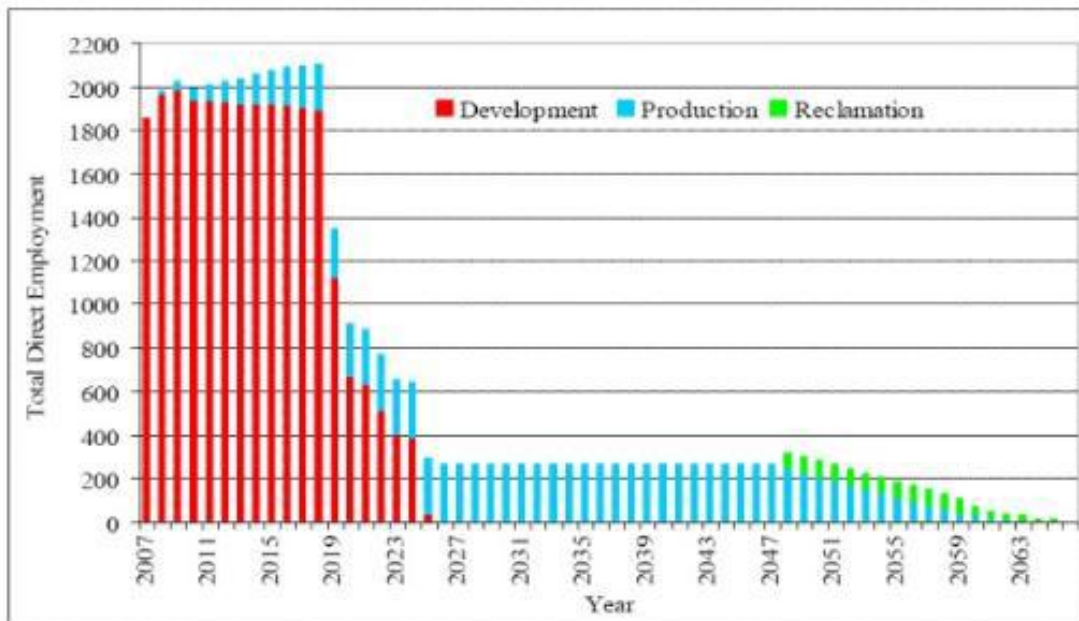
Graph 2.3: Tamboran's Projection: Direct Employment



2.2.5 There would appear to be a close approximation between the investment graph and that of daily production (a fact reflecting the exponential decrease in flow arising from fracking – Tamboran’s own assumptions are for Year 2 gas production to be only 54% of that of Year 1 and to continue to fall dramatically thereafter). However, in order to justify an average job creation across the whole field of 600 FTEs over a 30 year period, Tamboran have had to assume a constant employment even after gas production halves (in 2031) from its peak (in 2026) until it falls to less than one-eighth of peak production. It would appear highly unlikely that any company would continue to employ a full complement of maintenance staff while production falls exponentially.

2.2.6 The graph below should be compared to the graph produced by Tamboran as it illustrates employment creation associated with Fracking in Wyoming – this graph should be compared and contrasted with the graph produced by Tamboran above.

Graph 2.4: Wyoming Shale Gas – Total Direct Employment

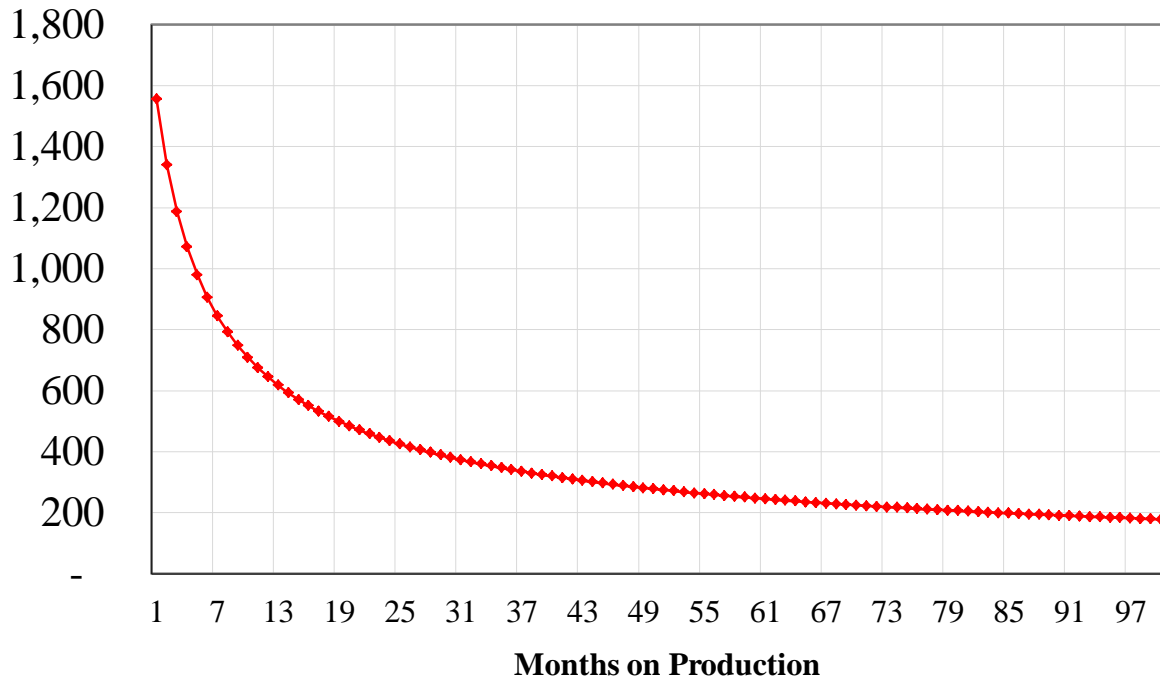


2.2.6 Furthermore, even this is based on a series of hard-to-justify assumptions. Specifically:

- Tamboran assumes rates of gas production decline which are continuous (when information we have received indicates a discontinuity in the rate of decline – resulting in a significantly greater fall than that assumed by Tamboran);

- Tamboran’s gas depletion curve is defined by a number of parameters these include a ‘b’ or hyperbolic decay constant which they have assumed takes a value of 1.5 which would appear very high compared to other cases (where it would struggle to get over 1.0). The net impact of using industry-standard values would be to make the wells uneconomic up to a full ten years prior to the 2050 cut-off date given by Tamboran.

Graph 2.5: Estimated Well Production – Tamboran Figures (Output Mcf/d)



- Tamboran’s job creation figures assumes very high staffing numbers associated with the pads – given that they are assuming 24 wells per pad (an extremely high number – one that might be considered unreasonable from the perspective of cumulative risk to well-bore integrity especially where the drilling is so shallow) – this results in total (non-drilling) employment of 8-9 FTEs per pad for a lifetime of almost 35 years. This would appear unrealistic given the fact that gas wells require little staffing once they have been fracked. We would like to highlight the fact that in September 2011, Tamboran estimated three jobs per pad and a total of 60 pads for Fermanagh.

Economic Displacement and Dislocation

2.3.1 Even assuming the Tamboran figures, a greater concern arises which is that the estimated 612 FTEs created as a result of their activities will be achieved at the cost of many jobs within already existing sectors (and with an opportunity cost including

potential new entrants who will be discouraged from establishing new local businesses). The key sectors likely to be severely impacted by the development are Tourism and Agriculture.

- 2.3.2** The scale of the proposed development is substantial. Tamboran’s figures estimate that an area of 80,000 acres will be developed of a 100,000 acre zone within the license area (overall area 280,000 acres) – the 20,000 acres not included in the initial target area are identified by Tamboran as being ‘undrillable due to special areas of conservation, etc’. This fracking area is estimated to roughly fall 50% in either jurisdiction with an estimated 120 pads being constructed. Tamboran’s own estimates are that the ‘Initial pad size 7 acres at first drilling...Final pad size 4 acres after removal of tanks and water pond.’
- 2.3.3** Assuming the least of these two estimates will involve (at minimum) 480 acres of industrial development in a highly rural and underdeveloped area – assuming the upper limit would take this to 840 acres. It should be noted that this does not include infrastructural development required for this initiative including pipe-interconnections between the wells, access roads. The nature of the equipment used (very heavy) and the upland bog characteristics of much of the target area are such to necessitate large-scale use of concrete surfacing and potentially piling.
- 2.3.4** It should be noted in passing that Tamboran have already indicated their interest in both increasing the overall area fracked and/or extending the length of the lateral wells to 2km (from 1km): “We expect to move this to longer laterals (perhaps 2 km someday), meaning fewer pads per given area (or larger area, if geology allows - project could be up to 3 times bigger (280,000 acres possible), but only if geology cooperates (we won't know that until extensive drilling takes place over the next five years).”
- 2.3.5** Tamboran also are considering increasing the number of wells drilled from under 3,000 to up to 9,000 (including a move to more shallow – and more dangerous drilling): “could someday be up to 3 times as much (call it 9,000, except for faulted areas), but has to be justified by shallower drilling. All initial drilling will take place below 750m to 1,500m. If (and only if) shown to be safe to move upwards without any risk to groundwater or faults, will drill shallower at 500m or deeper. Will most likely take 5 to 10 years to gather enough data to reach confidence in that decision.”

Likely Adverse Impact on Tourism

- 2.4.1** The net impact of this will be to fundamentally change the appearance of the licensed area in rural Fermanagh. The area which is the primary target zone for

fracking is almost entirely contiguous with that of the cross-border Geopark. The most recent DETI figures indicate that the tourism sector generates over £36 million per annum reflecting the relative significance of the sector: indeed on a per capita basis, income from tourism in the county is second highest in Northern Ireland.

- 2.4.2** Very many tourism-related businesses are established in the area – which has pioneered the development of eco-tourism (through the cross-border INTERREG-funded GreenBox initiative which pioneered the adoption of ‘eco-flowers’ by local tourism providers to identify environmentally-friendly tourism providers). Clearly, the large-scale industrial development of the area would be highly damaging for the ability of local businesses to promote the area as a centre of green-tourism and not conducive to the promotion of the area as a Geopark attraction.
- 2.4.3** Key strengths of the sector locally are the distinctive product-offering with a strong, environmentally-friendly branding. The county’s promotional logo is ‘Fermanagh Welcomes you Naturally’. This would be entirely undermined by extensive Mining activities across 100,000 acres. The Destination Fermanagh strategy sets out a vision for the sector locally which is coherent with DETI’s own Draft Tourism Strategy (2020) and sets out to ‘value what the tourist values’. Fermanagh District Council’s Tourism Strategy specifically highlights the importance of the Geopark as a ‘key marketing tool, putting Fermanagh/Cavan on an international platform in the environmental tourism arena.’
- 2.4.4** In the case of Fermanagh, this is its unspoilt beauty and clean, pure environment. The emphasis throughout is environmentally-friendly development and sustainable tourism. Opposition to fracking has been expressed by both Fermanagh District Council (January 2012) and by Fermanagh Lakeland Tourism.
- 2.4.5** The area has benefited from considerable SEUPB and Executive funding for a range of rural tourism investments. The long-term sustainability of these in the context of large-scale development of the picturesque Fermanagh area is clearly at risk – as is the value of those investments.
- 2.4.6** The area in question is home to some of the most significant visitor destinations in Fermanagh including:
- Belleek Pottery – 165,297 visitors in 2011;
 - National Trust Properties including Florencecourt Castle (40,314) – adverse impact to the Fermanagh product will also impact dramatically on visitor numbers to Castle Coole (34,875) and Crom Castle (17,252)

- Marble Arch Caves Global Geopark (the first cross-border Geopark in the world and one of the largest in Europe) – 54,092 visitors in 2011;
- Visitors to local Forestry plantations (extensive throughout the licensed area in Fermanagh) amounted to an estimated 79,000 (Forest Service NI figures, Planning Review 2011) – and extensive fracking will impact pedestrian access to 240km of Forest roads and 28km of pathways;
- There are four Special Areas of Conservation (SACs) within the immediate frack-zone.
- The extensive industrialisation of Fermanagh will also threaten the wider development of Outdoor Activity Tourism in Fermanagh. This is a burgeoning growth sector with over 75 water based events having taken place since 2008. (In 2007 the market value of Activity Tourism was approximately 10% of Total visitor spend and this is only likely to have increased substantially).

2.4.7 The 2001 Census gave total employment in Hotels & Restaurants of 640 and ‘Other Community, Social and Personal Services’ (which would include many tourism-related businesses at 194 within the five super-output areas constituting the license area of Fermanagh).

2.4.8 The likelihood is that the numbers employed in tourism have increased substantially since the 2001 Census was conducted – a local survey conducted by FFAN of tourism providers located between Belleek and Florencecourt (not including the whole of the target area for fracking – which includes much of Kinawley & Florencecourt and Derrylin wards) of 438 (not including voluntary staff numbers).

2.4.9 It is envisaged that there would be highly adverse impact on the employment within these sectors as a result of a proposed development of this scale. Necessarily there would be indirect unemployment associated with this (due to the negative employment multiplier – which is normally substantially higher for tourism-related services than for Gas & Extractive industries – so this will be disproportionately higher).

2.4.10 Even aside from the concerns around the visual and physical impact of Fracking and health and environmental pollution concerns, there are wider issues which will adversely impact local tourism providers. These include the general risk of being perceived as a contaminated area, noise of machinery/ pumps/ traffic, the heavy volumes of traffic associated with the scale of the development (FFAN estimate this as likely to average 100 HGVs per day on B-, C- and unclassified roads), amount needed for fracking for each well (2.5 million gallons per frack) consequences on the level of water rivers/lakes, fishing and eutrophication. There are also concerns

around the potential for seismic tremors in relation to the Marble Arch Cave system associated with Fracking.

2.4.11 There is also a not-insignificant threat directly associated with extensive fracking activities within the Lough Melvin water basin area given the importance of this water body in particular in terms of angling and the scale of water diversion required (and potential for large-scale contamination associated with shallow fracking) but there are further concerns as to the impact on fishing throughout Fermanagh. Almost 3,000 visitor angling licences are sold annually in the county which accounts for over 85% of the Northern Ireland total, generating direct revenue of over £178,000. In 2005, the angling industry alone was identified as underpinning 778 full-time jobs in the area.

Likely Adverse Impact on Agriculture

2.5.1 Fermanagh remains characterised by its dependence on agricultural production (with tourism this is the most significant productive sectors within the local economy). Much activity has occurred recently in the development of niche agri-food and organic food production and the county has much potential in regard to these new higher value-added sectors. Any concerns over water quality or any concerns about the release of radioactive elements or benzene-related hydrocarbons will obviously have a substantial and dramatic negative impact on these sectors in the locality.

2.5.2 Agriculture and the wider agri-food sector remains a core segment of the Northern-Ireland economy and, indeed, has been identified as one of the best performers during the current economic downturn. In 2011, total output associated with the Agricultural sector was £1.71 billion (up 13% on 2010) employing 3.1% of the workforce. Gross-value added by the sector was £437 million (an increase of 23%). The trends on these statistics lie in stark contrast to the other trends within the local economy.

2.5.3 The agri-food and food processing sectors also contribute heavily to the local economy. Provisional DARD estimates indicate that the Food Processing Sector enjoyed a gross turnover of £3.7 billion in 2010 (an increase of 8.3%). Gross-value added in the sector was estimated at £608.2 million in 2009 (latest available), an increase of 8.6% over the previous year. Net employment in the sector in 2010 was 19,700 FTEs, an increase of 1.1% over the previous year.

2.5.4 The NI economy is more dependent upon agriculture than any other UK region. This can be illustrated through its share of the economy, employment and business base. The agriculture, forestry and fishing sector accounts for 1.6 per cent of Northern

Ireland's GVA. This represents the largest share of any of the UK regions and compares with just 0.6 per cent for the UK as a whole. The reliance on the wider agri-food sector is evident if the manufacturing industry's food, drink and tobacco sector is also included.

- 2.5.5** Although figures are not produced disaggregated on a Fermanagh-wide basis, it is known that the sector remains the backbone of the local economy. Total employment in 2011 within the sector in Fermanagh was estimated by DARD Statistics Department at just under 4,996, or roughly about 18% of the current total labour force indicating its local significance and size to the county as a whole. More locally-based statistics are only available from the 2001 Census which indicated that total Agricultural, Hunting, Forestry and Fishing employment in the five wards in the license area of Fermanagh was 561 or 11.2% of the total labour force at that time.
- 2.5.6** The impact will not be confined to organic or specialist breed farmers in the area indeed, any significant benzene contamination scare will affect not just local farmers but potentially agriculture from across Northern Ireland would be hugely impacted. The potential impact of such an outcome would be many times greater than the putative employment that might be created by Tamboran. Given recent statistics around well failure rates this is not an insignificant risk – particularly with at least 2,880 wells being planned for the region.

Wider Adverse Impact on Local Economy

- 2.6.1** Any contamination of the local aquifer would inevitably result in a contamination of Lough Erne as all water in the area eventually finds its way to the wider system. This could contaminate local water supplies and potentially undermine wider economic activity. The impact of any concerns over local water quality will inevitably affect local businesses with a high reliance on local water quality (such as a newly established local brewery in Derrygonnelly and even Belleek Pottery itself potentially).
- 2.6.2** The perceived risk of environmental pollution and degradation of the landscape associated with fracking will undoubtedly impact residential house prices in the area and this is likely to further undermine local economic demand at a time when local demand is very weak as it is.
- 2.6.3** There is also a potentially significant health cost associated with the range of adverse environmental risks associated with such an extensive proposal as that being identified by Tamboran Plc. Although there are a number of research papers which

are beginning to consider these, there is an absence of any life-cycle analyses which might provide evidence of potential costs associated.

3.0 WIDER ENVIRONMENTAL CONCERNS

- 3.1.1** Extraction of natural gas by hydraulic fracturing associated with horizontal drilling has occurred in several countries, but with particular intensity in USA and Canada. In both countries a large number of events have occurred where groundwater, surface water and/or soil have been subject to pollution originating from the procedure.
- 3.1.2** The two big issues presenting arise from the density of the operating pads and therefore the sheer size of the resources required for performing the process, and the cumulative effect which will come into play particularly at the later stage of the process. In the case of the former, experience shows that accidents happen, particularly when a large number of machinery is involved. In the case of the latter, when fracturing is repeated 3-5 times on 2,880 wells (or up to 9,000 wells in the more expansive Tamboran plans) the progressive shattering of the host bedrock will make increasingly more difficult to prevent unduly migration and escape of fracturing fluid and/or gas.

Concerns Around the Construction Phase

- 3.2.1** Excavation and ground movement for the construction of the pads and of the associated infrastructure can lead to pollution of soil and/or water in several ways:
- accidental spillages, from trucks and machinery;
 - “washing-out” of fine sediments, and possibly chemicals, into surface water or groundwater;
 - improper storage of excavated soil and subsoil.
- 3.2.2** During the drilling phase of the project, a negative impact on the quality of soil, surface water and groundwater can derive from a number of sources:
- accidental spillages during storage or transportation;
 - leakage through faulty well casings;
 - escape of drilling mud and of fine sediments produced by the drilling rig.
- 3.2.3** FFAN note that a recent UK study carried out by the House of Commons Select Committee on Climate Change concluded that, ‘There is no evidence that the hydraulic fracturing process poses any risk to underground water aquifers provided that the well-casing is intact before the process commences’. However, recent

communication from Professor Ingraffea⁵, to DETI indicated his criticism of this committee's exclusive focus on the process of hydraulic fracturing as the only risk, which failed to take account of the far more

*“significant risks associated with the entire life cycle of shale gas development. A more complete assessment of these risks to underground water aquifers would include the risk of surface spills and leaks of drilling fluids, fracturing fluids, and flowback fluids, a risk when such hazardous fluids are very close to such aquifers, not separated by thousands of feet of rock. This risk extends not only to the drilling pad area, but wherever such fluids are transported, stored, and disposed.”*⁶

3.2.4 FFAN would like to highlight that Tamboran's proposals for drilling in Fermanagh include multi-layer drilling and drilling to within 1000m deep (initially). This is multiple times smaller than the depths involved in HVHF activities in Lancashire (indeed the large depths involved there have been actually used by Fracking companies to illustrate the safety of their activities). Moreover, Tamboran's activities will see globally unparalleled numbers of drill holes per pad and this risks significant risk as illustrated in this further quote from Professor Ingraffea:

*“[The DETI response] is incorrect in implying that a well-casing, both the steel and cement portions, would always be “intact” and provide complete protection from migration of hazardous materials outside the wellbore. Industry data show that loss of wellbore integrity by failure of cement and/or casing is common, with or without hydraulic fracturing. These data show that loss of integrity can occur in about 5% of wells immediately after they are put into production, and can occur in up to 50% of wells over their lifetime. Each of these failures has the potential to contaminate underground water aquifers with fracturing fluid, flowback, and hydrocarbons. Further, **an essential characteristic of shale gas development is the use of multi-well, clustered pads resulting in very high spatial intensity of wells. Even with a small failure/accident rate this can produce a large number of actual events.**”*

⁵ Professor Ingraffea has taught and researched structural mechanics, and rock fracture mechanics at Cornell University for 35 years with extensive knowledge and expertise of the processes related to hydraulic fracturing via over 25 years of direct R&D interaction with the oil and gas industry.

⁶ Communication to Minister Arlene Foster, Feb 24th, Anthony R. Ingraffea, Ph.D., P.E. Dwight C. Baum Professor of Engineering and Weiss Presidential Teaching Fellow Cornell University; President, Physicians Scientists & Engineers for Healthy Energy.

Concerns Around the Operational Phase

3.3 Hydraulic fracturing can have a negative effect on the quality of water and/or soil through the following:

- Overflow of hydraulic fracturing exhaust fluid ponds or tanks.
- Accidental spillages from oil or chemical storage tanks or transporting lorries, and considering the very large number of lorries and trucks movements required for the operation of each single pad (over 5,000 return trips by 20-ton lorries during its lifespan), an accident is likely to happen. Tamboran claims that there will be no need of such chemicals due to the shallow depth of the reservoir (700-1200m) and other advances in technology but this will be a world-first.
- **Escape of hydraulic fracturing fluid or gas via a failed or faulty casing.**
- Propagation of fractures in the reservoir to overlying or underlying aquifers. On this matter **there is evidence of induced fractures extending for several hundreds of metres, and increasing the risk of gas migration. This risk of fracture propagation and gas migration is more likely at the shallow fracking depths that Tamboran are planning, as the intrinsic pressure is obviously less at 750 metres than 3,000 metres which is a typical USA shale gas level.** It should be noted that the local area is already characterised by extensive cave systems (the most extensive system in Northern Ireland).
- Change in the hydrogeology of the reservoir, as the development of a network of new fractures in the bedrock is **likely alter the hydrogeological conditions of the area, with potential negative impact on water wells, surface water and wet areas.**
- If the water required for each hydraulic fracturing event is sourced locally through a water well to be installed within each pad, **it is evident that the removal from the local water cycle of the large amount of water required by the process can have a detrimental effect on availability of water** in existing wells and on the surface water, and consequently on water dependent eco-systems within the “likely to be the only viable drilling area” alone there are circa 20 protected areas (SAC/SPA/NHA/ASSI).
- Tamboran claims that the fluid recovered from a fracturing event (usually 25% of the injected volume) will be re-used for successive events. However, eventually this fluid will no longer be usable as it becomes more briny with re-use. Hence the fracturing fluid will eventually have to be disposed of. **There is no treatment facility on the island capable of dealing with the volumes and poor quality of exhaust fracturing fluid.** Therefore this fluid is either exported for treatment or disposed of in some other ways. Tamboran is considering the possibility of re-injecting the exhaust fluid in the bedrock.

At this stage it is not clear if this is intended as re-injection on-site or off-site and in what kind of bedrock. However, this procedure may be in breach of Article 11(3)(j) of the Water Framework Directive.

Impact on Global Warming

- 3.4.1** One of the justifications given for the adoption of HVHF techniques in obtaining natural gas are that natural gas is a low carbon alternative to oil and coal. However, recent research ⁷ has demonstrated that the **global warming potential for unconventional natural gas is higher** than that of conventional natural gas, oil, and coal. This is especially true over a 20-year time period.
- 3.4.2** While methane doesn't stay in the atmosphere as long as CO₂, it is a much stronger greenhouse gas. 3.6% to 7.9% of the methane from shale-gas production escapes to the atmosphere in venting and leaks over the lifetime of a well. Natural gas may burn cleaner than other energy sources such as coal, but a full life-cycle analysis must be taken into account when considering its global warming potential. Both the United Nations and NASA climate change scientists (Shindell et al) have highlighted the need to get methane under control. Unless society acts quickly, the global climate changes system will reach a tipping point in the next 15-20 years. Shale gas will not only aggravate global warming over the next few decades, but it will distract politicians and the public from needed action as we move towards a renewable future.
- 3.4.3** The CO₂ emissions related to the burning of methane might be mitigated through the deployment of carbon capture and storage [CCS] technology, which traps the greenhouse gas before it leaves the electricity power generating plant; However, this is in its infancy and will not be commercially viable in the timescale that Tamboran plan to sell on the gas and this should act to delay development of this resource at this time.

⁷ <http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf>

4.0 NEGATIVE PUBLIC HEALTH IMPLICATIONS

4.1.1 The following is a list of some of the known human health issues related to the processes of fracking and associated with fracking-related chemicals from recent reports and studies. Notably, chemical-free HVHF and 100% recycling, even if these were possible, still would involve the production of hundreds of millions of gallons of contaminated water that may end up in the wrong place and cause health problems. **Human error is a recurring theme in the history of fracking, resulting in contamination entering water courses and then entering the animal and human food chain.** Air pollution is now noted to be a major, yet previously under-researched area of health impact. The prevailing wind direction in Fermanagh means that any air pollution will blow eastwards over the rest of the Province.

4.2.1 Of the variety of chemicals used in the overall (not fracking) shale gas extraction process: 90% have adverse effects on skin, eyes & sensory organs; 50% affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37% affect the endocrine system; and 25% can cause cancer or DNA mutations.
[Colborn et al. 2011].

4.2.2 Released chemicals from underground rocks which can return to the surface in the flowback fluid; all the following have long established and documented toxic properties:

- Benzene causes leukaemia/ cancers and neural tube defects [spina bifida]
- Mercury causes brain & kidney damage and affects developing foetuses.
- Arsenic causes cancer.
- Ethyl-benzene causes respiratory disease, fatigue and headaches.
- Toluene: birth defects and central nervous system [CNS] damage.
- Xylene causes headaches, balance and memory impairment.
- VOCs [volatile organic compounds] are now known to be endocrine disrupters.
- NORMs [naturally occurring radioactive materials]: DNA damage and carcinogenic.

4.2.3 Increased incidence of both cancer & non-cancer ill health in people living closer to gas drilling areas compared to matched people in same County further away; most of these due to sub chronic exposure to air pollutants.

[MacKenzie et al, 2012. Colorado School of Public Health]

- 4.2.4** Irreversible lung damage caused by ground level ozone production; fugitive methane gas emissions combining with large volumes of nitrous oxide from diesel driven fracking machinery create ground level ozone
[The Endocrine Disruption Index (TEDX) 2012]
- 4.2.5** Endocrine disruption caused by even very low concentrations of chemicals from frack flow back fluid (may be harmful in concentrations as low as parts per trillion). Endocrine disruption results in immune, chemical messenger and DNA/RNA damage; all resulting in many forms of ill health including neurological disease and cancers.
[Dr Law. Physician at Weill-Cornell Medical College, New York. 2011]
- 4.2.6** Sudden death, slow deaths, reproductive problems and neurological disease has been documented in twenty four different incidents, involving hundreds of farm animals, over six States in USA. Many cases involved cattle exposed to flowback frack fluid usually via secondary spills due to human error. Some of affected animals are believed to have ended up in human food chain as they were rendered for the poultry trade. Animals often act as sentinels for human disease as their life cycles are shorter than ours. Animal owners were also affected including arsenic poisoning in children and benzene derivatives in adults. “Without rigorous scientific studies, the gas drilling boom sweeping the world will remain an uncontrolled health experiment on an enormous scale”.
[Bamberger & Oswald, 2012. Veterinary Medical Centre, Cornell University, New York]
- 4.2.7** Excess risk of cancers caused by air borne contamination near gas pads. [Air pollution control division, 2008. Colorado Department of Public Health]
- 4.2.8** Silicosis from silica dust [part of fracking sand additive]; long known risk of silica exposure and irreversible lung damage, but only flagged up this year by Health & Safety Physicians in USA as major problem on well pads & downwind areas.
[Esswein, 2012]
- 4.2.9** As can be seen from the above research there is huge public health concerns over fracking and the preliminary health impacts are not favourable towards HVHF. We need more health research and this will gradually come on stream from the USA over the next ten years.

5.0 CONCLUDING COMMENTS

- 5.1.1 The range of concerns identified all would tend to support the decision passed by the Assembly in December 2011. The extraction of natural gas through hydraulic fracturing entails significant risks of pollution of groundwater, surface water and soil. **It could be possible to minimise or eliminate some of these risks, but others are inherent to the project and cannot be mitigated.**
- 5.1.2 A significant body of legislation which would apply to the proposed project already exists, although it was not drafted specifically for unconventional natural gas extraction. Self-regulation and “easy touch” light regulation cannot be applied although studies have identified questions over the ability of environmental protection agencies to adequately monitor HVHF processes. On the contrary, strict monitoring and enforcement are crucial. The benefits which could be derived from the proposed project are dubious when not completely outweighed by the probable losses. FFAN calls for a moratorium on shale gas extraction in Northern Ireland pending further investigation.
- 5.1.3 If we are told that we cannot wait and the precautionary principle is abandoned then **the bare minimum that the people deserve is a public enquiry**. That enquiry will then have to look in detail at the issues raised and decide does established local businesses in tourism and agriculture, public health and environmental preservation come before or after the profit interests of companies like Tamboran.
- 5.1.4 The direct employment creation arising from the proposal is estimated (even using Tamboran’s expansive assumptions) to be no more than 300 direct jobs (contributing approximately 312 indirect jobs). This benefit must be offset against putative losses in the strongly developed tourism sector in Fermanagh (which is of strategic local importance) and the NI-wide agricultural sector. The pursuit of gas exploration in this area, on this scale, is in direct contrast to long-term economic development priorities identified at both a local and regional level.
- 5.1.5 Fracking will severely undermine attempts to brand the area as an Eco-Tourism destination, threaten the long-term viability of the Geopark project and subvert attempts to develop high value-added, specialist or organic farming and agri-food opportunities locally (and potentially across Northern Ireland). FFAN considers it to be an open question whether this project will result in a net economic benefit to the area at all – even before additional environmental clean-up and additional human and veterinary health costs are factored in.

- 5.1.6** The natural gas supplies in Fermanagh have been present for hundreds of millions of years. They are not going anywhere and are likely, if anything, to only appreciate in financial value over time. As evidenced by the continuous improvement in the technology Tamboran are able to deploy – the extractive and processing equipment associated with this new field is developing rapidly over time. It may be the case that at some future point, natural gas can be extracted with minimal risks or deleterious environmental impact – we do not see why we should be rushed into this.
- 5.1.7** If on the other hand we proceed with fracking, and if fracking goes wrong in five or ten years from now, we cannot simply turn the fracking wells off; the causative agents/contaminants will continue to leak or leach out over many decades and their considerable adverse impact on the local area will continue. The local communities in the affected area are overwhelmingly convinced that there is a need for the precautionary principle to be employed and the proposal to take forward fracking in our area be subject to an extended moratorium until there is wider public confidence.
- 5.1.8** Fermanagh is known for its clean air, clean water and unspoilt landscape; and these aspects benefit us all in this Province greatly in so many ways, including financially. FFAN ask DETI to play their role in ensuring that Fermanagh and other parts of Northern Ireland do not end up with long term contamination issues that hinder farming, tourism and public health.

Thank you for your time.

FFAN. June. 2012