

Questions & Answers from 'Exploring the Benefits of SRC Willow Planting for Water Quality and Waste Water Management Seminar – Crowne Plaza Hotel – 5th March 2020



Exploring the Benefits of
SRC Willow Planting for
Water Quality Protection
and Waste Water
Management

CROWNE PLAZA HOTEL, DUNDALK
5th MARCH 2020
10:30am to 3:30pm

Catchment CARE
Community Actions for Resilient Ecosystems



This project has been supported by the EU's INTERREG VA Programme, managed by the Special EU Programmes Body (SEUPB).

Question 1 Are there any similar schemes further south?.

Answer Caldecott Cottages in Fingal is a zero discharge plant which incorporates willow. Developed as a Pilot Project between Fingal Co Co. and TUD. There is also a plant in Donore Co Wicklow that deals with Primary effluent. I am not clear as to its current operational status. The ACP is working in a very similar way with regard to monitoring water quality, but to date, the ACP focus is on evaluating the Nitrates regulations in place, and not looking into additional mitigation measures. i.e. The ACP has not trialled additional mitigations actions, such as willow plantations.

Question 2 Does the EPA measure presence of PFAS in domestic water?

Answer Answer to come.

Question 3 At the site at Burt, where effluent is disposed, do you conduct soil analysis - is there any evidence of an increase in heavy metals in the soil ?

Answer Yes, soil analyses are conducted and no evidence of HM build-ups. HM levels in effluent are very low and willow bio accumulates HMs such as Cd & Zn. The EU sludge Use in Agriculture Regs (for land application of sewage sludge, which naturally would contain some HMs although not much given the absence of heavy industry in this region) control the application of HMs in agriculture. At Bridgend, we are talking about primary and secondary treated wastewater, not sludge.

Question 4 How many livestock animals are there on the island of Ireland? How does this relate to the number of humans?

Answer For NI, Here are the data <https://www.daera-ni.gov.uk/publications/farm-animal-population-data>. There was 6.9 million cattle on 111,300 farms in Ireland, giving an average herd size of 62 cattle. Over 60% of the cattle were located in 52,700 farms in the SE region, where the average herd size was 81 cattle. The Population of Ireland North and South is 6.5million. More cattle than people!
<https://www.cso.ie/en/releasesandpublications/er/lld/livestocksurveydecember2018/>

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Question 5 Will there be planning approval granted or is there funding available for the use of reed beds, wetlands and willows for single house wastewater treatment?.

Answer This is an issue for Local Authorities who are guided by EPA Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses (p.e. < 10). Guidance gives information on Reed beds and wetlands and whilst it mentions Willows, no design guidance is provided.

Question 6 What impact do poultry facilities have regarding greenhouse gas emissions?

Answer Much of the CO₂e that is generated from the poultry is primarily from the utilisation of fossil fuels. This may be from purchased electricity, propane use in stationary combustion units (such as furnaces) and diesel use in mobile combustion units such as tractors and generators. In the animal industry the consumption of plants (feed) by animals results in the division of the carbon into animal biomass (meat & eggs), CO₂ respired by animals and faecal deposition of carbon in utilised coproducts (manure).

Question 7 18% drop of GHG by 2030 in the “other” section, what sections do they represent

Answer Answer to come.

Question 8 Are there plans to develop a sustainable agriculture strategy in Ireland. If not would such a strategy be useful? the UK have developed one to address ghg target

Answer AgClimatise is being developed and a strategy will be in place from a Climate/Environment Perspective over the next number of months. It should be a very useful strategy to address GHG emissions.

Question 9 For John. Why is the phosphorus input from humans greater than livestock when the nitrogen level is the complete opposite?

Answer The footprint of farming across the Irish landscape is broader and N loss is higher. The relative inputs of N is exponentially higher than P so losses would reciprocate also.

Question 10 Are there meaningful incentives in place for anaerobic digestion?

Answer In NI the ROCs finished in 2017 so unless the AD unit was registered then, there if nothing since.

Question 11 Does the stock levels include poultry numbers? Do we know if we have sufficient suitable ground for land spreading all of the organic fertiliser produced?

Answer In NI, there is not sufficient ground for spreading organic wastes.

Question 12 I am looking for outlets for sewage sludge nationally. Willow might suit per Chris presentation. Do any attendees have Willow or other and seeking feedstock?

Answer This is an approach that is widely adopted in Eastern Europe, Sweden and elsewhere (Inc. In N.Ireland in the past). An appropriate level of pre-treatment of sludge is normally prescribed prior

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to application to lands. A high degree of Quality Assurance would also be required. IW would have an interest in discussions around this.

Question 13 Do colder temperatures affect willow functionality?

Answer Yes but depends how cold. The growth can slow to zero. In the context of wastewater/sludge application, temperature affects level of evapotranspiration and thus may impact on loading rate for effluent. It would also be likely that nitrification and denitrification activity in soil reduces as temperature reduces as microbial kinetics are generally impacted on by temperature. This may impact on allowable loading rates. Willow treatment has been deployed for effluent in Canada and a number of recent papers have been published relating to same, which may be insightful. In Denmark, domestic units include storage to address seasonality.
www.researchgate.net/publication/323884220 [Willows for environmental projects A literature review of results on evapotranspiration rate and its driving factors across the genus Salix](#) and www.sciencedirect.com/science/article/abs/pii/S0925857419300485?via%3DiHub

Question 14 What happens to surfactants in water treatment works using willows?

Answer Willow is generally used for polishing effluent downstream of primary or secondary treatment; as such, effluent benefits from upstream treatment prior to discharge to willow, which should mitigate presence of surfactants. Detergents can contain phosphorus, which is a plant nutrient.

Question 15 For a landfill site generating approx. 35,000m³ of leachate annually, what area of willow plantation would be required approximately?

Answer This will depend largely on the N concentration (high NH₃) however this recycling route is not a currently licensed practice and any projects I am aware of are trials and proof of concept.

Question 16 What happens with sludge from waste water as it ant go through irrigation pipes to willow beds

Answer Sludge is not applied through irrigation system. Where sludge is used, it is normally applied at the beginning of each rotation to provide nutrient to support growth over a 3-year cycle. Technically, it can be applied annually using roll out hoses but I gather this practice is less common in Sweden where significant activity in this area occurs. The sites discussed at the conference are recycling / irrigating treated wastewaters and NOT the sludge. Any solids (ss) that might be present in the wastewater either will be taken out by the filter or if not, irrigated through the pipes and open irrigation pores (3mm to 4mm in size).

Question 17 For Chris- has anyone looked at the impact of willow buffer zones on biodiversity particularly adjacent to aquatic habitats?

Answer yes; QUB and other have done quite a lot of work on this. Suggest contacting Kevin Lindegaard on this (reference his presentation at the event kevin@crops4energy.co.uk)

Question 18 For Chris - what percentage of NI Soils are Peaty?

Answer 14% of NI soils

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Question 19 Chris' figures for Bridgend in 2019 do not add up - looks like 3-4 months when not irrigating willows. ICW is much better option for wastewater treatment

Answer It is surely not about one nature-based system versus another. Willows provide a very versatile option for managing wastewaters while developing a circular economy via production of bio-resources. With reflection on Mark O'Callaghan's presentation (Irish Water), willows works synergistically with the climate and the environment and this is a strong argument why such Nature Based Solutions could be implemented throughout the country. One of the key challenges for ICW's is seasonality of nutrient removal, particularly as they age. Significant decline in ICW P and N performance during winter months is evident, and P may be released back into effluent as vegetation decays. However, as receiving water flows are generally high during winter and riverine vegetation is dormant the impact on it would appear to be minimal. Winter P management could possibly be addressed by judicious addition of Alum Sludge from Water Treatment plants to ponds. (EPA Strive).

Harvesting of Willow removes a quantity of the nutrients from the locus which does not general occur with ICW's. Both systems depending on size may result in zero discharge during drier months when receiving waters are at their most sensitive to nutrients.

Often the size of an ICW may be a barrier to its deployment due to land availability. In such cases, initial polishing might be carried out in smaller ICW ponds with subsequent polishing in Willow. Ponds would offer buffer storage so that dosing could be controlled at sustainable rates to willows. Equally, Willow offers a commercial return, which may be more attractive to a landowner than outright sale of lands. Both systems have benefits either depending on local circumstances, individually or acting together.

Question 20 Is there a future for willow on clay soils?.

Answer We have managed to establish willow in clay soils. It is not ideal but the willow growth does then start to improve the soils with time. It takes time and careful management.

Question 21 How much carbon will a Hectare of willow take in over rotation vs the carbon intake of spruce per rotation?

Answer If a ha grows about 10 dry tonnes per year the as 50% of the biomass is C, this is 5 tonnes per year. Isabella quoted further soil sequestration of around two tonnes/ha/y

Question 22 How long is a rotation of willow?

Answer For energy purposes, this has generally been every 3 or 4 years.

Question 23 Stop start, boom and bust policies do not work. The sector needs structured long-term support via both environmental legislation and financial supports.

Answer A third input could be wastewater effluent. Evidence suggests that up to 35% higher yield can result; primarily related to provision of water during summer where growth potential is highest, but often constrained by limited availability of soil water. There are also benefits in context of fertigation and possibly soil improvement depending on nature of effluent. Notionally a "gate fee" might also be put on the table.

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Question 24 Can willow to actively reduce ammonia discharging directly to a watercourse or is the ammonia just converted to nitrates by the passage of time?

Answer The willow does actively reduce the discharge of ammonia. This is very apparent when experimenting with high NH₃ effluents such as landfill leachates. The NH₃ will be nitrified in the soils however; it can also be used directly by the plant. Plants absorb ammonium and nitrate during the assimilation process. In case of wastewater, if TN is used as part of the design criteria then effective ammonia removal can be achieved from a Primary effluent. Ammonia in secondary effluents would generally be lower than that in Primary effluents.

Question 25 What happens to effluent in the non-growing season and how long can this be for?

Answer Willow plantations are generally used for polishing of treated effluent. During non-growing season, effluent would receive normal treatment, and where capacity exists in Willow plantation to absorb effluent (non-saturated); part of load may continue to discharge to plantation with balance discharging to receiving water. The extent to which this might apply would depend on the size of plantation relative to hydraulic load at WWTP, soil characteristics and weather. Technically could be managed through monitoring of Soil moisture deficit or rainfall accumulation and/or intensity. Certain sites currently have all round licenses for application. Soil microbial processes continue.

Question 26 What is the most potentially polluting effluent you can use?

Answer Leachates can be quite high in N and Cl. Some agri-food processing effluents can be very high in BOD. Farms effluents can be very high in P.

Question 27 Is there a way to use willow to deal with excess slurry issues?

Answer It will be looked at as the same as any other agricultural crop. I.e. 170kg N and nutrient according to crop requirement.

Question 28 How many acres of willow required to remove 1ton of carbon

Answer If a ha grows about 10 dry tonnes per year the as 50% of the biomass is C, this is 5 tonnes per year. Isabella quoted further soil sequestration of around two tonnes/ha/y

Question 29 How do you make willow more attractive than forestry or leasing?

Answer We need to develop a market for it...

Question 30 What happens to the ash resulting from willow burning?

Answer Potentially could be used as a fertiliser or element of compost. Generally, this goes out on the land again replacing the nutrients removed during its growth.

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Question 31 Is there a future for willow on gley soils?

Answer We have managed to establish willow in gley soils - in the Fermanagh region for example. It is not ideal but the willow growth does then start to improve the soils with time.

Question 32 How is nitrogen use on Willow governed?

Answer By the Nitrates Directive and interpreted regionally. In NI the Nitrates Action Programme 2015-2018 and Phosphorus Regulations

Question 33 In the ACP catchments how do the results compare to EPA Catchments monitoring in these waterbodies. Could these sub catchments be included in a RBMP priority area?

Answer The ACP catchments are smaller than the EPA water bodies, and we only monitor six catchments, vs. 2355 in the latest Water Quality report. However, we take a sample every 10 minutes, vs. at most five per year in the EPA's monitoring. Currently only one of the ACP catchments is in a Priority Area for Action. The objectives of the PAA and the ACP are not the same, so it is not surprising that they do not overlap. It is hoped that the processes that impact on water quality established by the ACP's high resolution monitoring in a small number of catchments can lead to a better understanding of what is happening in the large number of water bodies being monitored (at a lower frequency) by the EPA.

Question 34 for Eddie. Should controls on nutrient additions to land be catchment / soil specific rather than a general N loading max and closed periods?

Answer A very simple answer to this is probably "yes", as our findings show that different catchments behave very differently, and "one size does not fit all" when regulating for good water quality. Some areas are Nitrate risky and others are not, but if nitrates are not lost to water there may be "pollution swapping" and gaseous emissions could be more significant where losses to water are small. The ACP results do support the "closed Period" as a disproportionately high load of nutrient leaves catchments during this period.

Question 35 Has the catchments study examined the impact or potential of the different organic status of soils on nutrients?

Answer None of the six ACP areas are located in high organic matter (peat) soils and soil organic matter contents do not vary much (generally 6 to 10 %). While all six catchments are located on intensively farmed mineral soils, we have undertaken research on organic & inorganic manures response on different soil types, where soil OM is one of many factors being considered.

Question 36 Is there any consideration of the emission of methane from wetlands specifically reed beds?

Answer There is a large body of research on methane emissions from Reed beds, primarily in context of natural and restored wetlands with less data available on ICW and Engineered Reed beds. As a rule Carbon, availability and low water depth minimises anaerobic activity and methane emissions. As ICW will generally meet both these criteria, emissions are likely to be lower than generally reported for wetlands. In case of reed beds at small plants, the surface area is small in that generally they are used to polish effluent and as such have minor impact on emissions. Fundamental issue is whether

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NBS solution is less carbon intensive in comparison with other available solutions over their lifecycle and the additional value put on ecosystem services provided by it.

Question 37 Re: proposed seasonal discharge consents, surely the treatment process should be improved instead of exploiting the assimilative capacity of the receiving water.

Answer It comes down to effective and efficient use of resources. Treatment using NBS confers multiple benefits vis a vis conventional systems; Better outputs - Climate, Biodiversity, Social and Economic and less dis-benefits - Operational Carbon, visual intrusiveness etc. If a balance is to be struck then it is not unreasonable to leverage available natural receptor capacity, which varies seasonally, to maximise nett benefits, whilst still achieving a better water quality outcome. For example, a small plant discharging to a small river in summer could affect significantly on water quality whilst a larger discharge during winter could have significantly lower impact. NBS are highly effective in attenuating pollutant load through reduced flow and incredibly effective removal of pollutants during growing season. The quid pro quo is that it is less so in winter but as nature tends to work in harmony winter, flows in rivers are generally a multiple of summer levels whilst biological receptors (algae and plants) are generally inactive. Nutrient are purged to a larger downstream watercourse and eventually the sea, where a significantly greater assimilative capacity may exist.

Ultimately it comes down to how the cake is divided and the reality we find ourselves in - imagine being given the choice; we could build 5 Zero impact plants or 500 NBS, the latter giving significantly better benefits for society (environmental, economic, social)- which do you choose? It has been argued by some that the carbon cost of enhanced treatment may more than offset water quality benefits through negative carbon impacts and impact of iron panning in watercourses - LCS Studies in South Australia for example.

As indicated, NBS is not a panacea and a case-by-case approach would have to apply. More importantly, we need to adopt a holistic approach and perspective to maximise benefits we can accrue from limited resources without further depleting it. Looking at water in isolation of other pressures is becoming untenable.

Question 38 Do you have to apply for planning permission to plant and harvest willow plantations?

Answer This is an agricultural process so no.

Question 39 Are there guidelines for establishing and managing willow plantations? Similar to Forest Service guidelines for forestry operations?

Answer The AFBI / Teagasc Best practice guidelines were there at the Dundalk event. They are also at the following link - www.afbini.gov.uk/sites/afbini.gov.uk/files/publications/Short%20rotation%20coppice%20willow%200best%20practice%20guidlines.pdf

Question 40 Most if not all previous entrepreneurs were let down and lost a lot of money. The public sector needs to provide guarantees and contracts on a large scale.

Answer This is a comment.