Tay Estuary Forum

Occasional Paper Series
2

Economic, Social and Environmental Sustainability – Do they really overlap?

David Wishart, Catchment Tay Ltd

Economic, Social and Environmental Sustainability – Do they really overlap?

Occasional Paper for the Tay Estuary Forum Conference
Author:- D Wishart, Catchment Tay Ltd

Summary:-
The paper aims to provoke consideration of the economic impact of some aspects of current and future environmental costs and whether they are necessary and can be sustained relative to the ability of the population within the TEF area to create sufficient wealth to pay the costs [Note 1].

Text:-
The Tay Estuary Forum (TEF) area, and in particular the Tay Estuary (zone 1), is recognised as one of the least developed and least polluted in Europe and is a benchmark for sustainability. The demands placed upon the river and estuary to support wildlife, leisure and tourism may seem to contrast with those applied by the human population but that impression underestimates the capability of the natural environment to accommodate the effects of human habitation and development. In reality the current environmental and economic demands are well balanced and have created, and sustain, high levels of amenity and water quality across the TEF area.

One of the purposes of the TEF is to provide information and perspective for users of the management plan and to enhance the overall understanding of all of the inter-related factors applicable to the TEF areas. An integral part of that is an appreciation that the Tay Estuary is already an area of exceptional environmental quality and that it is a product of the interaction of natural and human processes.

In respect of water quality it is often suggested that sewage and industrial discharges are polluting the estuary, which of course is true. What is usually missing from such headlines is that almost all discharges of these types are either partially or fully treated and that relative to the capacity of the estuary they have limited significance if the required treatment standards are met [Note 2]. To illustrate this status a table has been included to show the major, direct treated sewage inputs from the major population centres within the TEF area (Table 1).

Table 1- Major, direct treated sewage inputs from the major population centres within the TEF area.

TEF Geographical Zone (outfall discharge point)	Population Centres	Water Environment (Controlled Activities) (Scotland) Regulations 2005 daily dry weather flow (DWF) consent value (m3/day/CUMEC) (1)		Approximate population using GROS 2006 figures (4)	Average daily flow (Actual 2007 data or estimate based on 1.45 multiple of DWF, m3/day/CUMEC)		Storm flow (Actual 2007 data as an equivalent daily flow, m3/day/CUMEC or an estimate based on DWF) (2)		Peak storm flow (actual 2007 data, CUMEC, or an estimate based on DWF)	Final Effluent Biochemical Oxygen Demand - actual values or pro-rata using largest discharge population as baseline (Tay Pfi, 3mg/l as kgBOD/day)
		m3/day	CUMEC	Population	m3/day	CUMEC	m3/day	CUMEC	CUMEC	BOD
3	Montrose (3)	5600	0.065	11870	8120	0.094	2912	0.034	0.034	18
3	Dundee, Carnoustie, Arbroath	71400	0.826	205000	103530	1.198	37125	0.430	4.320	311
1	Perth, Bridge of Earn	19440	0.225	46000	28188	0.326	10108	0.117	0.117	70
1	Newburgh	720	0.008	2100	1044	0.012	374	0.004	0.004	3
1	Wormit, Newport, Tayport	2992	0.035	8160	4338	0.050	1556	0.018	0.018	12
2	Guardbridge/Leuchars	1200	0.014	3760	1740	0.020	624	0.007	0.007	6
2	St Andrews	7862	0.091	16640	11400	0.132	4088	0.047	0.047	25
	Totals	109214	1.264	293530	158360	1.833	56787	0.657	4.548	445
NOTES										
(1)	Includes all domesticand industrial flows plus infiltration (CUMEC = cubic metres per second for comparison with river flow data)									
(2)	Mainly surface water with low levels of dilute domestic and industrial water									
(3)	Brechin discharge from c. 7000 population also goes into South Esk estuary/Montrose Basin but is not included									
(4)	Scottish population estimated to be 5.12m; TEF area population centres = 5.7% of total population of Scotland									

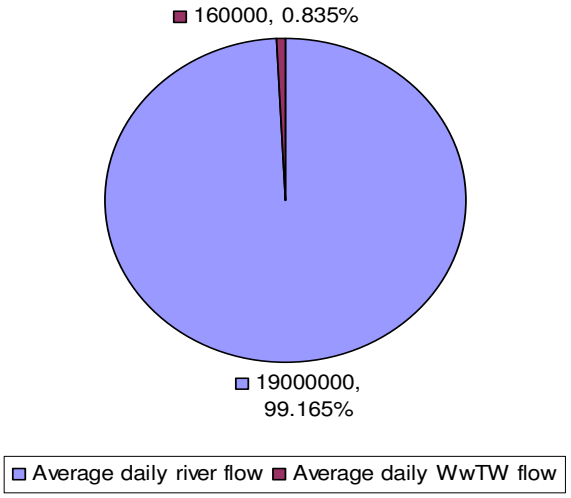
Whilst these are only part of the picture, as there are many other diffuse and indirect sources of sewage effluent (septic tanks, small treatment works) it illustrates that the majority of such inputs are treated to a high standard. In addition, a table indicating the flows of the main rivers in the TEF area is included to facilitate a comparison of 'human derived' and 'natural' flows (Table 2, Ref 1). Finally, some figures are provided for the daily tidal movement of water within the estuary, inclusive of river discharges, which provide dilution and transport to dissolved and suspended matter from all sources.

Table 2- Mean Annual Flow Rate of Rivers within TEF Area.

TEF Geographical Zone	Rivers	Mean annual flow rate (cubic metres per second) - (1)	Mean annual flow rate (cubic metres per day)	Lowest daily mean flow rate (cubic metres per second) - (1)	Highest daily mean flow rate (cubic metres per second) - (1)	Logging station - (1)	Data Record - (1)
		CUMEC	m3/day	CUMEC	CUMEC	Location	Years
3	North Esk	19.10	1650240	2.03	377.00	Logie Mill	1976 - 2005
3	South Esk	N/A	N/A	N/A	N/A	N/A	
3	Lunan	N/A	N/A	N/A	N/A	N/A	
3	Dighty	N/A	N/A	N/A	N/A	N/A	
1	Almond	N/A	N/A	N/A	N/A	N/A	
1	Tay	167.90	14506560	11.46	1965.00	Ballathie	1952 - 2005
1	Earn	28.73	2482272	2.12	350.10	Forteviot Bridg	1972 - 2005
2	Eden	3.93	339638	0.58	68.85	Kemback	1967 - 2005
	Totals	219.66	18978710	16.18	2760.95		
NOTES							
(1)	Data derived from the National River Flow Archive						

The main population centres within the TEF area host an estimated population of over 400,000 of which 293,530 are served by large sewage works whilst the rest are served by smaller works and septic tanks. Whilst some of the table values are estimated, they are reasonable and typical values and provide sufficient detail to establish perspective and scale. The major rivers that discharge within the TEF area have a combined average flow rate (measured upstream of the tidal zone) of over 219 cubic metres per second (m^3/sec). The same rivers have a combined range of flow rates from 16 m^3/sec to over 2760m^3/sec. The same values for the combined large sewage works give an average of less than 2m3/sec and a peak of less than 5m3/sec. The average daily flows for rivers and sewage works are just under 19,000,000m3/day and 160,000m3/day respectively [Figure 1].

Figure 1: TEF Area average daily river vs WwTW flow



The Tay estuary alone (Zone 1) has an estimated spring tide exchange volume of 286,000,000m3, which is approximately 60% of the total volume of the estuary [Ref 2].

High flow conditions, caused by rain and precipitation (rain, snow), result in flows within the river and sewage catchment areas that will contain surface debris, soil, agricultural runoff and other polluting loads which can temporarily affect water quality (pathogens, sewage debris, litter). However such events do not change the overall high quality of the TEF area waters and the innate capacity to sustain the current natural and human demands placed upon it.

To illustrate this point a crude oxygen balance can be made, where oxygen use and supply are the benchmarks of pollution and health respectively. Dissolved loads discharged from the major sewage works, estimated at just under 450kg of biochemical oxygen demand per day are discharged into the combined tidal and river discharge flows on a daily basis. If the river discharges are assumed to have an average dissolved oxygen supply concentration of 4mg/l then the combined daily oxygen supply is over 75,000kg. The estuary water movement is significant but full exchange takes an estimated 6 tides but it can still be regarded as a reservoir of oxygen with a total indicative capacity of over 2.8 million kilograms of dissolved oxygen at a modest 6mg/l concentration. Whilst there are many diffuse dissolved loads present and specific factors such as sewage discharges being localised, the balance between oxygen use and supply is generally very healthy and this is reflected in the SEPA classification of river and estuary waters in the TEF area.

The Eden and Tay estuaries are expected to be fully Class A water quality zones in 2008 as litter/sewage debris treatment is now operational for almost all direct discharges; this also applies to zone 3 coastal areas. The Montrose Basin is expected to remain as Class C due to nutrient enrichment issues (flow figures are not available for the South Esk).

The condition of the waters within the TEF area are generally excellent but there are still areas where improvements in amenity can be achieved, litter being a good example. However, the treatment of all sewage discharges has a significant cost and this is likely to continue to rise together with the costs of controlling and minimising other, diffuse pollution sources. The water quality debate centres upon whether improvement, in all its forms, is necessary and whether the costs associated with proposed improvements can be justified based on benefits or the prevention of losses and the means by which such benefits and losses are expressed to the public.

By way of example, using only the major direct treated sewage inputs to the TEF area, indicative costs for the facilities and treatment involved at the locations listed in Table 2 are given in Table 3 below. As an illustration of the cost at a local level it costs every person in the TEF area approximately £100 per year for the treatment of wastewater from major population centres. To give this figure perspective, the recent consultation on Scotland's first marine bill, 'sustainable Seas for All', valued the fishing industry (landing value, Ref 3) at £369,000,000 or the equivalent of under £72 per person of the Scottish population (5.14m).

Table 3 – Indicative per capita sewage treatment cost

Number of major treated wastewater discharges in TEF area	Average daily flow (Actual 2007 data or estimate based on 1.45 multiple of DWF, m3/day)	Indicative cost per m3 treated (1)	Total indicative daily cost (£)	Total indicative annual cost (£)	Indicative cost per capita based on TEF area population (£)
	m3/day	£0.5/m3	£/day	£/year	£/person/year
7	158360	0.5	£79,180	£28,900,755	98
NOTES					
(1)	Cost of collection, transfer, treatment and disposal/recycling of by-products together with asset costs & depreciation				

This simple example is set against the background of potential improvements to remove nutrients, very low level persistent materials, storm water attenuation, flood and tidal surge impacts on drainage systems, odour regulations and other matters allegedly for the benefit of the public and/or protection of the environment. However many of these improvements are sought without due consideration of the true long term cost of the additional treatment, particularly in terms of consumption of raw materials, maintenance and energy; the latter may well result in a decline in environmental quality (Figure 2, courtesy of solo syndication)

We have, as a whole country, become all too familiar with the concept of living beyond our means in recent months and we need to know what we are expected to pay for and why. It also underlines the necessity to create wealth to pay for the environment we want, or have committed to provide over the long term, with some confidence that the figures balance and are sustainable. It is also prudent to have a 'Plan B' if we are unable to afford or sustain the changes, and possible to reduce the levels of treatment currently employed.

To illustrate this requirement at an individual level, an example of the personal wealth of an average Scottish family is shown in Table 4, together with Table 5 showing the costs of the 5 most widely recognised environmental organisations [Refs 4 – 10]. The example shown uses typical household costs in order to quantify environmental costs relative to income, or more specifically perceived 'disposable' income, and therefore frame the main question for discussion; 'would you choose the environment over other costs and what are you prepared to give up or level of indebtedness are you prepared to commit yourself/our society to?'.

Table 4 – Sample family budget

Single Income Family	Earnings	Deductions	Assumptions	
Gross Earnings	**24,908**		£479/week, Reference 4.	
Typical core living costs			Personnal Allowance	6035
Tax & NI		**6,514**	Tax 20%, NI 11%	34800
ONS 2007 average weekly spend annualised		**23,868**	£459/week, Reference 5.	
Total	**24,908**	**30,382**		
Residual 'disposable income'	**-5,474**			

Double income family	Earnings	Deductions	Assumptions	
Gross Earnings	**49,816**		£479/week	
Typical core living costs			Personnal Allowance x2	12070
Tax & NI		**13,029**	Tax 20%, NI 11%	34800
ONS 2007 average weekly spend annualised		**35,880**	£690/week, Reference 5.	
Total	**49,816**	**48,909**		
Residual 'disposable income'	**907**			

Table 5 – Examples of environmental costs (excluding water/wastewater, agriculture, fisheries and council services)

Organisation	Projected 2007-2008 costs (m)	Comments	Source
Scottish Natural Heritage	70.80	Inc. £15m allocated grants but all costs deemed to apply locally	Reference 6
Forestry Commission Scotland	54.70	Net of sales, exc non-cash treatment of assets	Reference 7
SEPA	33.50	£13m central grant support but charges apply costs locally	Reference 8
Total	159.00		
Population of Scotland (m)	5.14		Reference 9
Working population of Scotland (m)	2.68		Reference 10
Annual equivalent cost per person (£)	30.93		
Annual equivalent cost per person of working population (£)	59.33	receive equivalent income support payments	

Discussion:-

Given the reducing production of wealth in Scotland as a whole it is vital that we maintain the overlap of social, economic and environmental spheres as all issues start with, involve and finish with people and the resources that they need to thrive and survive. The ideal that we seek is that this imperative can be achieved in parallel with meeting the same objective for wildlife, air, water and soil quality. In many cases the environmental debt from our industrial past remains unpaid but we are only seeing significant improvement following the demise of industry and the implementation of energy and resource intensive practices (including sewage treatment) that may well be unsustainable in the long term.

The conclusion of these views is that sustainability must be created and supported on a local basis 'at source', starting with raw material/food production and processing to energy generation and the control of pollution. This approach is likely to require a higher level of voluntary input than is presently provided and tolerance to activities and developments that may not currently be regarded as acceptable in the wider, sanitised global economy [Figure 3, Ref 11]. The features described here could also be translated to mean a drop in the standard of living but that really depends on your conclusion about how that standard should be judged and over what timescale but it is certain that in 2009 many people are already experiencing a drop in their standard of living.

There are many substantial plans, consultation documents, legal and legislative requirements that may seem to overwhelm or diminish the importance of groups such as the TEF. However, this 'the bigger the better' theme generally only serves to complicate what would otherwise seem like common sense, that we and the local environment have limited resources and it is necessary to know what there is, how much is being used and therefore how long can it last; if the answer is a small number then that is not good and the smaller the number the quicker things need to change to correct that imbalance.

With national and international legislative processes taking decades to reach compromised targets, e.g. Carbon emissions for 2050, the required timescale of environmental change, and rate of change, appears to stand in stark contrast to the methods of delivery of change.

Since the 2008 TEF conference we have seen many examples where local, focussed effort has, with modest financial inputs, resulted in improved environmental, social and economic status of the locality involved. This approach is at the core of sustainability but there needs to be a focus on making more room for wealth and resource generation as a central part of sustainability, equal with social and environmental spheres. In summary, an equitable overlap of priorities.

Reference List

1. National River Flow Archive.
2. C.R.Bates and D.J Oakley. Int. J. Remote Sensing, 20 November, 2004. Vol 25, No.22, 5089-5104.
3. Sustainable Seas for All: a consultation on Scotland's first marine bill. The Scottish Government Publications, 2008.
4. Office for National Statistics, Annual Survey of Hours & Earnings [ASHE] 2007-2008, Median Gross Weekly Full Time Income.
5. Office for National Statistics, Family Spending 2007.
6. Scottish Natural Heritage Annual Review 2006.
7. Forestry Commission Scotland, Corporate Plan 2005-2008.
8. Consultation on the Water Environment Charging Scheme 2006.
9. General Register Office for Scotland, Mid-2007, Population Estimates Scotland @24/07/08.
10. Office for National Statistics, Labour Market Statistics Regional Monthly Data, National Labour Market Summary by Region, Summary of Labour Force Survey Data December 2008.
11. Permitted development rights for domestic microgeneration equipment: analysis of consultation responses. The Scottish Government Publications, 2008.

Dolphins in danger

Jumping for joy: But the white-beaked dolphin is now under threat

Warmer seas mean they will vanish from Scottish waters in 10 years, say experts

By **Kurt Bayer**

SCOTLAND'S dolphin population is under threat and could disappear from our shores within ten years, warn marine experts.

The white-beaked dolphin in particular has become such a rare sight that it has been branded Scotland's version of the panda.

The Aberdeenshire coast was named one of the best places in Britain to spot whales and dolphins earlier this year after seven species, including killer whales, were recorded in the North Sea this summer.

Bottlenose and white-beaked dolphins, harbour porpoise, minke whales, common dolphins and Risso's dolphins were also spotted.

But researchers fear that rising temperatures and the knock-on changes in food supplies could soon mean many of these frequent visitors become a thing of the past.

Sea Watch Foundation co-ordinator and cetacean researcher Ian Sim, based at Stonehaven, Kincardineshire, said: 'Research is vital for the dolphins' preservation. It would be devastating if they disappeared from our coast, but there is real concern for their future.'

Both these dolphins are already starting to spend longer periods away from Scotland. Mr Sim, 51, estimates that if sea temperatures continue to rise there will be no sightings of white-beaked dolphins within ten years.

They favour the cold waters of the North Atlantic but are regular visitors to the Aberdeenshire coast in the summer months. Mr Sim said: 'They used to be quite frequent but they now seem to be fading out.'

Ian Hay, of the East Grampian Coastal Partnership, which promotes development to protect the East Grampian coast, said the species was becoming so rare it was considered similar to Scotland's version of the endangered panda. He added: 'Everyone knows about the Moray Firth dolphins but I don't think many people have heard of white-beaked dolphins. They are like little killer whales and love bow-riding boats.'

Mr Sim has been gathering information on dolphin populations in the North Sea for the last eight years.

On his last outing this week, he recorded a group of 12 bottlenose dolphins near Stonehaven. He stressed that it was not only dolphins that are affected by the changes in sea temperatures.

He said: 'I have seen a difference, not just with the cetaceans but puffins as well.'

He hopes to raise £10,000 to buy a research vessel and equipment that will allow volunteers to spend more time at sea recording data.

White-beaked dolphins, which grow to 11ft long, have an appetite for cod, but also mackerel, herring, squid and octopus.

They have been seen to use fish herding techniques by surrounding schools of fish and rushing to the surface in a group. This panics the fish and they scatter where they are easily picked off by the waiting dolphins.

They have also been observed communicating with others in the group, using whistles, breaches, tail slaps and somersaults.

FACT FILE

- Dolphin numbers have been reduced by fishermen in Canada and the Faroe Islands
- White-beaked dolphins can grow to 11ft in length
- They like cold North Atlantic waters and feed off cod
- They are among the most acrobatic dolphins and put on spectacular leaping displays

PHOTO 1

PHOTO 2

PHOTO 3

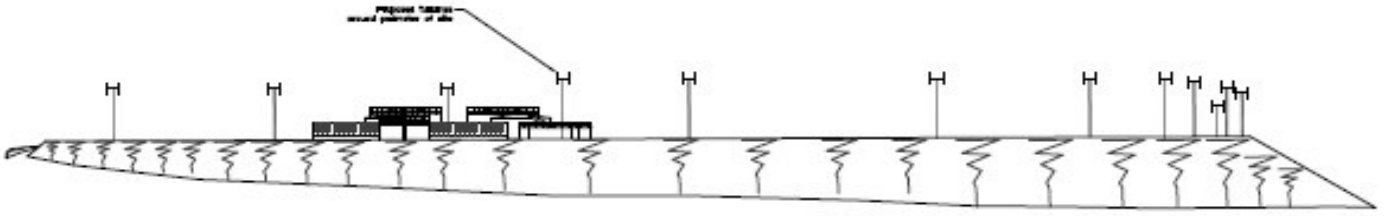
PROPOSED VIEWS

PHOTO 1

PHOTO 2

PHOTO 3

EXISTING VIEWS



ELEVATION A—A

Key Plan:

Notes:

DATCHMENT

Halcrow

HATTON WATW
WIND TURBINES

PHOTOMONTAGE IMAGES
AND ELEVATION

SHSPA/030/203

D