

## APPENDIX B: EXAMPLE SCHEMES

### FOWEY CATCHMENT

The Fowey Catchment scheme looked to fund capital investments on farms in order to improve water quality in the River Fowey. The PES scheme was part of South West Water's Upstream Thinking Initiative. As part of that initiative, the Westcountry Rivers Trust had been charged with distributing money to farmers for capital investments delivering water quality improvements in certain strategically important catchments.

The Rivers Trust's advisors liaised with farmers in to identify projects eligible for funding through the scheme. Where projects were identified, farmers were offered a *fixed-price* deal in which South West Water would pay 50% of the costs of the capital investments.

The scheme was based around a reverse auction with £360,000 to distribute. The auction was a simple design where all farmers in the Fowey catchment were contacted and provided with a list of capital investments eligible for funding under the scheme. Farmers were asked to enter bids indicating which of those were required by their farm business and the grant they would need from South West Water to proceed with the investment. For each bid, an environmental improvement score was calculated based on how greatly the proposed project would improve water quality. The fund was extremely popular and oversubscribed, receiving bids for £776,000 of investment.

The auction stimulated competition between farmers by only funding bids that offered the best value for money for South West Water. In this case, 'value for money' was determined by dividing a bid's environmental improvement score by the grant request.

Bids were entered onto a secure website or via post. Bidding was open for six weeks with three rounds. Each farmer received feedback on the likely success of their bid during each round.

It has been estimated that the the Fowey River Improvement Auction delivered between 20% and 40% better value for money than the fixed-price alternative.

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=18245>

## DRAFT STRATEGY FOR MANAGING NITROGEN IN THE POOLE HARBOUR CATCHMENT TO 2035

An expansion of macroalgal mats fuelled by rising levels of nitrate and inorganic nitrogen compounds is causing a problem within Poole Harbour. It has failed to meet 'good ecological status' under WFD due to elevated nitrogen in harbour waters and has also failed to meet the SPA requirements of 'favourable conservation status' because of the extent of the microalgal mats.

76% of the nutrients originate with rivers, 7% direct discharges and c.17% from the English Channel. In total it is estimated that diffuse agricultural pollution contributes 86% of the loading to the harbour. Nitrogen loading is expected to peak at 2500 tonnes/yr in 10-20 years and it is predicted that it takes 30-35 years for diffuse nitrate to move through ground water into the harbour.

The strategy lays out clear target reductions namely - 1721 tonnes-N/yr. This reduction is made up of 700 tonnes-N/yr from agricultural sources and an additional 32-57 tonnes/yr adjusted for population growth in 2025 and 2035. Overall phosphorous reductions are planned to be achieved through adoption of Catchment Sensitive Farming measures such as: changing crops; adoption of winter cover crops in arable rotation; and 10% reduction in stocking density. Point source reductions are planned to be achieved through nitrate stripping at STWs and lowering operation rates, although this has high capital, operational and environmental costs. The scheme is also suggesting that all new development is nitrate neutral.

The success measures for the scheme are: the extent of algal mats with biomass >2kg/m is limited to <5% across Poole Harbour and <10% cover over individual mudflats over 5 year period. In order to achieve this the plan proposes the following mitigation has been proposed: purchasing high nitrate leaching land and replacing it with other land cover types, implementing management changes, and removing nitrate at STWs and requesting that developers purchase managed grassland or arable land and revert it to woodland, heathland or fen. Interestingly this scheme was not supported by two of the Local Authorities because it was seen to put to significant burden on developers without anything appearing to impact on what the main polluters were doing.

Bryan, G., Jonas, P., Money, R., Kite, D. and Bardon, R. (2012) *Draft Strategy for Managing Nitrogen in The Poole Harbour Catchment to 2035*.

<http://ecosystemsknowledge.net/resources/programmes/pes-pilots/poole>

## **NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM**

The Ecosystem Enhancement Program's mission is to provide cost-effective mitigation alternatives that improve the state's water resources.

The program offers four voluntary In-Lieu Fee (ILF) mitigation programs to the public and private sectors to satisfy compensatory-mitigation requirements in state and federal laws and regulations. The initiatives offset unavoidable environmental damage from transportation-infrastructure improvements and other economic development, and help to prevent harmful pollutants from endangering water quality in sensitive river basins.

The Program is designed to assist in meeting loading requirements for nitrogen and phosphorus in the Neuse and Tar-Pamlico River basins, and in the Jordan and Falls Lake watersheds, as part of the nutrient-management strategies in these areas.

Developers may choose to use a "buy-down option" and request to pay a fee to EEP to meet their nutrient loading requirements. Once payment has been accepted and received by EEP, a receipt is issued which allows the developer to receive final approval from the local government. Upon receiving the payment, EEP assumes the responsibility for the mitigation requirement, including mitigation site construction and monitoring of buffer-restoration sites or other types of nutrient-offset.

Once the offset calculation has been completed, a developer needs to complete a nutrient reporting form for their project which provides the information needed to determine the developer's need and eligibility to purchase offsite nutrient credits.

The applications are reviewed to identify whether the developer has met the requirements necessary to seek off-site offsets. If so the developer is then authorised to purchase the credits.

Developers can offset the required nutrient loads themselves (either onsite or offsite) or seek a third-party offset provider such as the NC Ecosystem Enhancement Program. Though the use of 3rd party providers is allowed they must be able to abide by a number of specific offset rules and statutes.

Once payment is made to the approved nutrient offset provider, a receipt is issued which is provided to the local government to demonstrate the developer's compliance. Only at this stage can the developer start work.

If the developer cannot find a third party to deliver the offsets for them they remain obligated to meet the loading requirements for the project either through increased on site measures or through their own approved off-site nutrient reduction measures.

## **Costs**

This program is interesting because the costs are based on “The Actual Cost Method.” The Actual Cost Method (ACM) is a procedure that ensures the EEP Nutrient Offset Payment Program sets rates based on the actual costs of providing nutrient load reduction credits.

The ACM accounts for all costs associated with achieving nutrient reductions inclusive of contracts, restoration projects, expenditures for land acquisition and program administrative costs.

The ACM is based on a simple equation:

$$\text{Actual Costs} / \text{Total Pounds} = \text{Actual Cost per pound}$$

Actual Costs include: completed projects, terminated projects, existing projects in process, and administrative costs (staff, supplies, rent) and all costs are adjusted to present day values.

Total Pounds is also determined using present day values to represent the true cost of implementing a new project, factor in changes in regulations and ensure the rates will never be below actual cost.

In addition, if EEP’s Nutrient Program’s total costs are greater than the Program’s receipts, an Adjustment Factor is applied to the fee calculation. This ensures that fees are commensurate with the actual costs of the program.

The rules require that rates be set using the ACM at least annually. Quarterly adjustments are made if income and expenses for the program show significant discrepancies. In new rate areas the highest Program rate is used until two nutrient reduction projects are available for use in determining the rate for that area

Onkapinga catchment based auction trial aims to increase the cost effectiveness and environmental benefits of public funded schemes for private land management actions. In particular, it aims to improve biodiversity and water quality under threat from productive agricultural land use. The auction is managed by the Onkapinga Catchment Management Board.

The auction process is similar to that adopted in the BushTender Trial, where officers visit interested landholders to assess sites and develop detailed site action plans. These plans are submitted with a bid to the Board along with the required level of cost sharing for implementation of actions. Bid assessment is very detailed in this case and incorporates risk analysis as outlined below:

$$\text{Risk} = \text{Value of Land} \times \text{Threat Value}$$

$$\text{Impact} = \text{Threat Reduction from proposed Actions} \times \text{Risk}$$

Environmental Benefits = Impact x Area

Environmental Benefits/\$ = Environmental benefits/Cost

Bids are then ranked according to this benefits index with contracts awarded to those which offer most benefit per dollar spent for their bid price. (Bryan et al, 2005)

Computer-based simulation was used to test the bid ranking and selection techniques prior to implementation. The trial contacted 224 landholders, 42 of which participated in site visits resulting in 29 bids from 27 landholders. Seventeen bids were accepted within the trial budget of \$150,000

## **BUSHTENDER TRIAL, AUSTRALIA**

Australian conditions which present problems concerning nutrient and salinity control and vegetation conservation requiring some form of land-use change (eg. Stoneham et al, 2003) afford many opportunities for the application of auction based land management techniques. The need for additional cost effective management of native vegetation on private land in Victoria prompted the

Department of Sustainability and the Environment to consider the viability of auctions as a potentially efficient technique to increase biodiversity in the area. Two trials occurred during 2001-2 and 2002-3 in North Central/North East Victoria and Gippsland respectively. The first trial accepted 97 bids submitted by 73 landholders who collectively received \$400,000 (Aust \$). The Gippsland trial awarded predominantly 6-year contracts (with an option to extend to 10 years) to 33 successful bidders for \$800,000.

The auction was initiated by requests for expressions of interest from landholders who were visited by government officers. During these visits, ecological information was collected to devise a Biodiversity Significance Index used to indicate a benefit:cost ratio of bids. The benefit component of this index comprised a conservation or biodiversity value to reflect scarcity of vegetation type multiplied by a habitat service score to reflect the quality change resulting from proposed management actions. The cost component equalled the bid value. Contracts were drawn up individually between government and landholders. A discriminatory sealed bid auction was conducted with bids ranked and allocated until the budget was spent. (Stoneham et al, 2003)

Compliance is reported at around 95% with an estimated saving of 700% compared to alternative fixed price schemes (Stoneham et al). However, this estimation is criticised as an overestimation because they do not consider that bids contain value of information rents i.e. the difference between how much has been bid and the actual cost or opportunity cost to the landholder (Latacz-Lohmann & Schilizzi, 2005)<sup>13</sup>.

### **Conservation Reserve Program**

The Conservation Reserve Program has been operational since 1986 and is the first known application of an auction for conservation purposes. The auction aims to reduce soil erosion and improve water quality. Farmers enter into a 10-15 year contract with the US Department of Agriculture (USDA). Land that is heavily eroded or environmentally sensitive is retired from crop production. Land cover is converted to natural vegetation through planting. In return, farmers receive annual rent from the Commodity Credit Corporation with initial costs shared. The program is

administered by the Farm Service Agency with decisions regarding land, producer or practice eligibility made by the Natural Resources Conservation Service.

Initially simple, the bid design has been developed to employ an environmental benefits index (EBI) to compare bids for land retirement for conservation use. Bids are scored according to land characteristics, such as erodability, and land management practices, such as land cover, before being weighted according to environmental priorities, such as improved water quality. Bid value enters the index as a negative score. Bids that exceed a threshold score will be accepted. (Latacz-Lohmann & Schilizzi (2005).

The program is largely successful with an estimated 34 million acres of retired land achieving average rents of \$45.95/acre (Latacz-Lohmann & Schilizzi, 2005; Sullivan et al, 2004). The benefits of the program, in addition to reduced soil erosion and improved water quality include reduced agricultural diffuse run-off, development of wildlife habitat, reduced sedimentation in water bodies, maintained soil productivity and provision of a source of income for farmers (Riechelderfer & Boggess, 1988; Huang et al, 1990; Young & Osborn, 1990; Kinsinger, 1991). In addition, Dunn et al (1993) reported that ecological benefits are likely to be hidden and are likely to also include reduction of landscape fragmentation and a positive impact on carbon balance.

A report conducted by Sullivan et al (2004) investigates the economic impacts of the CRP on communities within the local region and reports that initial impacts, such as low level unemployment from rural areas, are short lived. No evidence of migration from the region was found and expenditure on outdoor recreation increased. Adaptation to the CRP in the long run appears to balance any short term effects, with a small overall impact dependent on local economic conditions.

## **SAN JOAQUIN VALLEY (CALIFORNIA)**

The Grassland Area Farmers is a regional drainage entity which works together to improve water quality in the channels used to deliver water to wetland areas. There are many programs schemes which they adopt, one of which is a tradable loads program. The total allowable selenium load is allocated among member irrigation and drainage districts. The districts can either buy or trade their load allocation

The scheme is based on a bilateral market between point and non-point sources. Trades are for either monthly or annual allowances, with no banking permitted. The units of trade are pounds of selenium per year.

Costs of the scheme are seen by those involved as reasonable. Administration costs are low, as the program piggy backs onto existing organisations of farmers and systems of monitoring and record keeping. Most districts report negligible costs for implementing a trading, with only one district reporting \$500-\$1000 for having a lawyer. A total of \$14,320.00 changed hands during the first 5 years of the agreement.

[http://water.epa.gov/polwaste/nps/success319/Section319III\\_CA.cfm](http://water.epa.gov/polwaste/nps/success319/Section319III_CA.cfm)

## **CHATFIELD RESERVOIR (COLORADO)**

The Chatfield Reservoir scheme is a phosphorus trading scheme based around a clearinghouse market, but which also accepts bilateral agreements. The units of trade are pounds of phosphorous per year. The Chatfield watershed authority accepts credits from nonpoint sources and pools them as credits to be purchased by point sources. Point sources can alternatively contact point sources directly to pursue a trade, subject to approval.

A \$100 application fee to cover administrative costs is required for point sources to apply for increased discharge through trading (Chatfield Watershed Authority 2000). Credits that enter the pool are sold at a price that reflects the cost of nonpoint source reduction projects, costs associated with the pooling program, and costs incurred by the Authority to administer the trading program (Chatfield Watershed Authority 2000). Exact costs are unknown, but the monitoring program has been estimated to cost \$58,500/year.

<https://www.cbd.int/financial/pes/usa-peswatersurvey.pdf>



## **CHERRY CREEK BASIN (COLORADO)**

This scheme involves phosphorus trading between point and non point sources via a clearinghouse market. Two types of point to non point trades are possible. The authority can grant credits from the reserve pool to point sources that have completed a new trade project, or have extended wastewater service to semi urban areas.

It can also sell or lease credits from the Phosphorus Bank to point sources that can demonstrate compliance with past effluent limitations and the adequate designs/operations to meet future effluent limitations. The program also allows for one kind of point to point trade. The authority may transfer phosphorus allocations from one wastewater facility to another for a single year or for multiple years, as long as the receiving discharger is committed to “take all reasonable interim steps to decrease, to the extent practicable, the total phosphorus loading”(CDPHE 2001, p9.)

The authority charges each project owner submitting an application to create reserve pool credits \$2500 to cover the costs of consultants. Dischargers seeking credits from the Phosphorus bank must deposit \$500 for the consideration of their request.

<https://www.cbd.int/financial/pes/usa-peswatersurvey.pdf>

## **BEAR CREEK (COLORADO)**

This scheme involves phosphorus trading between point sources. One urban point source (Forest Hills) is allowed to discharge more than its permit, with Evergreen Metropolitan District, a large point source polluter offsetting the difference. It is estimated that Forest Hills saves over \$1.2 million, equivalent to the cost of an expensive system replacement that would be necessary to meet their allocation without a trade. Each year Evergreen Metro reduces phosphorus releases in a trade of 40-80 pounds per year and in exchange for this Forest Hills pays an undisclosed amount of money.

<https://www.cbd.int/financial/pes/usa-peswatersurvey.pdf>

## **DILLON RESERVOIR (COLORADO)**

This scheme relates to non-point source trades of phosphorus involving connection of septic systems to sanitary sewer, however it has recently expanded to include point source to non point source and non point source to non point source trades.

The scheme is based around bilateral negotiations in which each transaction must be carefully negotiated between individual buyers and sellers of credits. Buyers and sellers are responsible for agreeing upon the terms of trade.

<https://www.cbd.int/financial/pes/usa-peswatersurvey.pdf>

## **LONG ISLAND SOUND (CONNECTICUT)**

This is a scheme based around point source to point source trading of nitrogen with trades taking place via a clearinghouse market. It is estimated that reaching the 15 year nitrogen reduction goal without trading would cost approximately \$1 billion, and that trading will save 20% of that cost over those 15 years.

[http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325572&deepNav\\_GID=1635%20](http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325572&deepNav_GID=1635%20)

## **WATSON PARTNERS AND THE SOUTHERN MINNESOTA SUGAR BEET COOPERATIVE (SMSBC) (MINNESOTA)**

This is a scheme based around a 2:6:1 trade ratio for nonpoint source of phosphorus. Remedies centred on best management practices including; cattle exclusions, buffer strips, constructed wetlands, setasides, and cover cropping. This was to allow construction of a new wastewater treatment plant.

SMSBC implemented best management practices on approximately 18,000 acres/year, generating an average of 5,765 lbs of phosphorus reduction credits. Since SMSBC paid farmers \$2/acre to implement spring cover crop, the cost to SMSBC of nonpoint source offsets was \$6.22/lb. However, this does not reflect that farmers themselves incurred a cost of \$6/acre, which would bring the actual cost of phosphorus credits to \$18.65/lb, while including transaction costs could drive the cost higher than \$24/lb. Fang and Easter (2003) conclude from this analysis that SMSBC's trading was not more cost-effective than the phosphorus controls for a small-to-medium sized waste water treatment plant. SMSBC, however, disputes Fang and Easter's conclusions. Fang and Easter (2003) compared the nonpoint source controls to the cost of reducing point source discharge from 1.5 mg/L to 1.0 mg/L, but SMSBC was actually looking at bringing the limit down to 0 mg/L, a scenario in which trading did indeed lower compliance costs.

## **RAHR MALTING (MINNESOTA)**

The Rahr Malting scheme is an agreement to offset five day carbonaceous biochemical oxygen demand (CBOD<sub>5</sub>) discharge from Rahr Malting's new WwTP by funding upstream nonpoint source phosphorus reductions. It is a sole source offset scheme. Rahr is responsible for identifying and contracting for nonpoint source credits to satisfy its NPDES permit.

The unit of trade is a cap of 2mg/L of phosphorus and 12 mg/L CBOD<sub>5</sub>. To secure nonpoint source offsets, Rahr established a program with a \$275,000.00 fund. In the 5 years of the project, Rahr achieved the nonpoint source credit requirement through 4 trades.

Overall, the nonpoint source phosphorus control did appear to be cost-effective. The four nonpoint source projects controlled phosphorus at costs ranging from \$2.22 to 2.64/lb during the five years permit phase, which sets the cost of credits (calculated with a 2:1 trading ratio) from \$4.44-5.28/lb P. Including the transaction costs raises the average cost of nonpoint source phosphorus control to \$8.56 over five years, but if the structural improvements last twenty years, which is likely, then the annualized cost is reduced to about \$2.10/lb P. To compare this to pollution control costs outside of a trade, we have to use the cost of controlling CBOD<sub>5</sub> to 1 mg/L through the municipal WWTP. Senjem (1997) estimated this point source control at \$4-18/lb P for capita and operating costs, based on a 20 year investment and an 8% annual interest rate.

<https://www.cbd.int/financial/pes/usa-peswatersurvey.pdf>

## **CHESAPEAKE BAY PROGRAM:**

### **Maryland Nutrient Trading Program**

This scheme provides a public marketplace for buying and selling of nitrogen and phosphorous credits. Credits traded within 3 defined areas: Potomac basin, Patuxent basin, and everywhere else. Phase I of the scheme concerns point source trading and industry generating credits. Phase II covers agriculture non point sources, certain land uses, agronomic practices and BMPs. All are eligible to create credits for the scheme.

The value of the unit is 1 credit = 1lb of nitrogen or phosphorus delivered to the main stem of the bay per year. The trade is set up and administered on line via the Chesapeake Bay Nutrient trading program

<http://www.mdnutrienttrading.com/>

### **Pennsylvania Nutrient Trading Program**

This scheme is an online trading between point sources, non-point sources and third party aggregators within a defined watershed. To be eligible to generate and trade credits, certain baseline and threshold requirements need to be met, and each organisations needs to have an appropriate permit for point source pollution. Online trades are set up concerning pounds of nutrient per year.