

THE INFLUENCE OF REGULATIONS ON THE MANAGEMENT OF DREDGING AND DREDGING DISPOSAL ON INLAND WATERWAYS IN THE UK

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SUMMARY

For most of the 200 years of canal history disposal of dredgings was an unregulated process. In 1988 dredgings lost their exempt status and were included within the definition of controlled waste. This change, together with additional regulations in 1992 and the obligations of the Duty of Care, brought in the new requirements for licensing of disposal sites and a need to understand quality.

The requirement to licence had a dramatic effect on the progress of dredging work. Time taken to licence sites was typically 40 weeks and in some cases more than 2 years. There were also substantial cost implications in obtaining licences, obtaining sediment quality data, meeting the new licence conditions for site set up, fencing, monitoring and site restoration.

A further round of regulations implemented in 1994 brought in new requirements for management of tips, fees and charges for licensing and maintenance, and set out some specific exemptions applicable to inland dredging disposal.

The implementation of a regulatory framework has not been an easy experience. Representations to Government initially had a limited hearing as arisings from the dredging produced by British Waterways are perhaps 0.5% of the total waste handled in the United Kingdom. Nonetheless, on an industry wide basis it has been possible to achieve some success in lobbying Government which has brought helpful changes to the regulatory environment..

The paper describes the UK experience in working within the developing regulations, the measures taken to influence the legislators and regulators, the steps taken to characterise and classify sediments, and other changes that have followed in how work is planned and costs managed.

KEY WORDS:

legislation, EPA 1990, liability, sediment, classification, cost, guidance, exemptions, initiatives, planning

1. HISTORICAL PERSPECTIVE

The canal system of the United Kingdom dates from 1757 to the 1830s. The system was built to service the needs of the industrial revolution and transects many of the industrial heartlands in the United Kingdom.

In 1948, the majority of canals and waterways came under Government control in the form of the British Transport Commission. The management of the canals and waterways passed to the successor body, British Waterways Board, a statutory corporation, in 1963. The extent of the British Waterways network is shown in Map 1.

Today the network of waterways under British Waterways' control is managed principally for leisure and tourism and as an environmental and heritage asset of national importance. Freight transport continues to be important on the broad river navigations and canals in the north east.

Dredging is an important part of the sustainable management of all canals and river navigations.

It is necessary to provide for navigation and to maintain and enhance wildlife and fishery interest.

Localised sections of waterway have sediments contaminated by historical industrial activity.

Removal of this material is part of the on-going process of renewal which the waterways have enjoyed in recent years.

2. THE DEVELOPMENT OF REGULATION

For most of the 200 years of canal history, disposal of dredgings was an unregulated process. Prior to regulation of dredgings as waste in 1988, dredging disposal costs, other than plant and labour were minimal:

- sites were acquired for very little;
- no analysis was carried out;
- site preparations were limited;
- fencing was minimal;
- no environmental monitoring was necessary.

In 1988 custom and practice was that British Waterways had many small dredging disposal sites along the length of the waterways. The typical size of a disposal site was 10000 m². Dredging relied on the knowledge and expertise of the individual dredging crews with little or no survey information. Quantities were estimated for bonus purposes but were based on hopper movements rather than measurements of channel profile.

2.1 Collection and Disposal of Waste Regulations, 1988

The introduction of the regulations in 1988, classifying dredgings as “waste to be treated as industrial waste” meant that dredgings now became “controlled waste” as defined in the Control of Pollution Act, 1974. As a result there were requirements to:

- licence disposal sites for dredgings
- ensure exempt deposits did not cause environmental harm
- carry out limited site monitoring.

Waste Disposal Licences were issued by the Local Authority Waste Services Departments located within the **County Councils**.

Initial assessments suggested that British Waterways might need 139 licensed sites around the country. This would have made us the largest operator of licensed tips in the country, albeit that many of those sites would be small, often less than 20,000 m³. In practice these early predictions have not been borne out.

Time taken to licence suitable sites was a major problem. Typically 40 weeks was required and more than 2 years in the case of some. As a result the dredging programme slipped and was halted for a period, giving rise to a number of practical problems and difficulties in public relations with waterway users.

The new requirement for licensing proved to be a significant burden in other ways. There were costs associated with the new licensed sites that had not been experienced before. The requirements varied widely depending on which County authority was involved. For example, high security fencing was often specified and there were new requirements for landscaping and signing, as well as the installation and monitoring of small shallow fixed gas probes to monitor the potential landfill gas. In addition, there were costs in the recruitment and training of specialist staff needed to progress licence applications. Training was also required for operational staff in the day to day running of sites in compliance with licence requirements.

The quality of dredgings also became an issue to ensure deposits did not cause environmental harm. Analysis was carried out where necessary, the scope and detail of the chemical analyses matched the requirements coming from the individual County authorities.

2.2 Environmental Protection Act 1990

The Environmental Protection Act 1990 (EPA 1990) was an important further step in the development of the waste regulation providing the framework for the implementation of a range of detailed regulations over a number of years. Its passing into Law was a clear indication that there would be major changes to the waste regulation regime with implications for waste producers, carriers and receivers.

The Act also brought significant change in the process of regulation. Waste Regulation Authorities (WRA) were formed from the old County Council Waste Services Department with a statutory regulatory role in licensing and monitoring tips, transfer stations and regulation of waste carriers.

A key provision of the Act was the concept of "Duty of Care". In mid 1991 the government consulted on how this would apply. It became apparent that chemical analysis would be required as a pre requisite for disposal of all "industrial waste" which included dredgings. This was confirmed by the Code of Practice issued by the Department of the Environment in December 1991 (DoE, 1991). At this stage British Waterways established routine chemical testing of dredged materials to establish an accurate description on which to base all contractual matters relating to waste handling.

3. RESPONDING TO LEGISLATION

The picture was now one of increasing complexity. It was clear that a series of further changes would follow with implications ranging across broad issues of environmental liability arising from

TABLE 1 BRITISH WATERWAYS ANALYTICAL SUITE FOR SEDIMENT ANALYSIS

Air dried solids (at 300 C)
pH
Cadmium (Total)
Chromium (Total)
Copper (Total)
Nickel (Total)
Lead (Total)
Zinc (Total)
Arsenic (Total)
Mercury (Total)
Total Sulphide
Phenols (Total monohydric)
Cyanide (Total)
Antimony (Total)
Barium (Total)
Beryllium (Total)
Boron (Total)
Boron (Available)
Cobalt (Total)
Molybdenum (Total)
Phosphorus (Total)
Selenium (Total)

Silver (Total)
Tin (Total)
Thallium (Total)
Tungsten (Total)
Vanadium (Total)

Total Polycyclic Aromatic Hydrocarbons (PAH)
(Sum of 16 priority pollutants US EPA Listed)
Loss of Ignition
Organic Matter Content (taking precautions for high sulphide and chloride).

Results are expressed in mg/kg, with the exception of the following:

pH to be expressed as dimensionless value
air dried solids and organic matter to be expressed to the nearest 0.1%
phosphorus to be expressed as %P₂O₅

the new Duty of Care, through to fees and charges for each licensed site, and training of "fit and proper persons" to manage sites. To address the concerns raised by the new legislation British Waterways adopted a multi-disciplinary approach, underpinned by technical specialists. Three important requirements were highlighted:

1 To establish an overview of liabilities to British Waterways
2 To reduce cost
by tighter definition of dredging need
by maximum use of exemptions within the regulations
by reducing the volume and the difficult nature of dredging themselves
3 To influence future regulations.

3.1 Quantification of Liability

To establish an overview of the liability it was important to obtain a qualitative and quantitative assessment of the material to be dredged.

31.1 Sediment Quality

Sediment sampling was carried out in the first months of 1992. Samples of sediment were taken every 2 km. The samples were collected by waterway staff using a standard bucket and rope from the bank. Where this was not possible material was dug using a dredger or excavator. Samples were submitted to an analytical laboratory selected by competitive tender.

The 30 parameters specified in the analytical suite were based on those previously requested by regulatory authorities. The full list is shown in Table 1. All tendering laboratories were required to meet minimum standards of the National Measurement Accreditation Service (NAMAS) accreditation for analysis of sediments for metals listed in Interdepartmental Committee on

Redevelopment of Contaminated Land (ICRCL) Guidance on the Assessment and Redevelopment of Contaminated Land (DoE, 1987). NAMAS accreditation was not generally available for other parameters. The results were received as hard copy and as a Lotus spreadsheet which allowed subsequent data manipulation.

The main parameters were interpreted against national codes of practice or guidance such as the Department of the Environment Code of Practice for Agricultural Use of Sewage Sludge (DoE, 1989) and the ICRCL Guidance. In addition guidance derived from Kelly (1979) and the Netherlands guidance (Ministry of Housing, Physical Planning and Environment, 1987) was used to evaluate parameters not covered by the existing government issued guidance.

These guidance documents were used to construct a classification system that would provide guidance on disposal options. The six point classification system is summarised in Table 2. The classification system focuses on contamination issues and their potential environmental significance in disposal. It does not address nutrient content and physical characteristics such as grain size or refuse content.

The stretch by stretch allocation of waterway to each Class was subsequently presented in map format to provide local managers with a guide to sediment quality on waterways in their charge and to provide a basis for discussion with the Waste Regulation Authorities on individual site licences.

The system was designed to indicate the likely disposal route for planning purposes. It is

Class	Disposal Option	Basis of Limits
1	May be disposed of to agricultural land regardless of concentrations in receiving land.	Complies with lower levels of permissible concentrations of potentially toxic elements in soil after application of sewage sludge (DoE, 1987)
2	May be disposed of to agricultural land but may require assessment of concentrations in receiving land.	Complies with upper levels of permissible concentrations of potentially toxic elements in soil after application of sewage sludge (DoE 1989)
3	May be disposed of to towing path and areas of public access regardless of concentrations in receiving land.	Complies with all DoE Interdepartmental Committee of Redevelopment of Contaminated Land [ICRCL0] trigger concentrations (DoE, 1987)
4	May be disposed of to towing path and	Complies with majority of ICRCL trigger

	areas of public access but may require technical support to gain regulatory authority agreement.	concentrations, but within upper levels of permissible concentrations in soil after sludge application (DoE, 1987)
5	May be disposed of to British Waterways owned landfill site without further treatment.	Exceeds ICRCL trigger concentrations (DoE, 1987)
6	May require disposal to a commercial site, possible with specialist facilities. Further analysis may be required.	Exceeds ICRCL trigger concentrations, has Kelly rating [Kelly (1979) as amended by British Waterways] greater than 1.5 or one parameter falling within Kelly [Kelly (1979) as amended by British Waterways] "Unusually Heavily Contaminated" criteria

therefore a guide for the operational manager. In order to substantiate a selected disposal route further sampling is often required to complete the local detailed picture of sediment quality, and to satisfy the requirements of the Waste Regulation Authorities. Further detail may also be required to meet local circumstances where for example the range of disposal options is restricted by location or site specific considerations.

3.1.2 Sediment Quantity

Cross sections were taken every 50 m throughout the majority of the network to establish the existing profile of waterway bed. This was set against a standard profile and the volume of material to be removed to achieve the standard was calculated.

The work was completed by contractors who carried out simple depth measurements across the channel at 2 m intervals on wide canals and 1 m intervals on narrow canals. On river navigations acoustic sensors were used for survey. The measurements were completed during the same period as the qualitative sediment sampling. The data was provided on computer disk. At the end of this exercise it was possible to use computer aided design packages to estimate the quantity of material that had to be removed to achieve profiles to match required standards.

3.1.3 Planned Disposal

The knowledge of the quantity of sediment to be removed and the likely disposal route enable the waterway managers to plan dredging requirements and disposal routes in line with the new regulatory controls.

Deposit of materials onto adjacent banks either owned by British Waterways or a neighbouring landowner is the normal route where the material is clean. In rural areas dredgings are often spread onto agricultural land by agreement with the farmer. Where there is no adjacent land, options include disposal to a commercial landfill or land purchase to establish a new British Waterways landfill disposal site. Long term costs and liabilities are a major consideration in determining whether British waterways should own a disposal site. In urban

areas the disposal route may be to commercial sites, or to a British Waterways owned site.

3.2 Cost Reduction

3.2.1 Water Content

One of the most difficult aspects of dredging disposal is the high water content of dredgings in the as-dug condition. The water content results in difficulties in transport and disposal and brings associated extra costs.

High water content causes cost to spiral at every stage of the disposal process.

- water that becomes incorporated in the silt as dredged substantially increases the bulk of sediment to be handled and deposited,
- wagons can only be partly filled to provide adequate containment of the material in transit;
- many commercial tips have quotas for wet material imposed by the Waste Regulation Authorities and deposit of wet material frequently attracts premium rates which can be twice those for dry material (Aspinwall, 1992).

As a result of this there were several local initiatives to investigate options to reduce water content.

Thickening Agents

On several occasions in Scotland draining waterways and removing dredgings "dry" has been attempted. Without thickening agents the thixotropic nature of the material has led to problems moving the material over uneven surfaces. This was a particular concern where there was significant contamination.

A variety of thickening agents have been used. Some common materials, such as straw and cement, were ineffective while others, such as sand were relatively expensive. The most cost effective material was mineral waste from a contaminated site. This worked well and had the additional benefit of clearing another contaminated site.

Floating Processing Plant

In Birmingham a plant consisting of a linear motion shaker, mud cleaner with 4 hydrocyclones, a decanting centrifuge and a polymer dosing unit was used. The major problem was screening input for large items of debris. Substantial quantities of wash water were required and this created its own problems on discharge to the waterway. The plant produced solids with a lesser water content than dredgings but the solids were still unacceptable for landfill as they still had a tendency to slump.

3.2.2 Re use Options

Re use options have also been considered both as a commercial venture and to explore options to take the process outside waste regulation. A large body of

work exists on the re-use of coastal and estuarine dredgings, including those from ports. This includes beach recharge as a disposal method for maritime materials (Construction Industry Research and Information Association (CIRIA), 1992). However it would not be cost effective to use inland dredgings to recharge coastal defences because of transport costs and the process would still require licensing by the Ministry of Agriculture Fisheries and Food. Recharge of river beaches and slopes may be possible. However this can be in conflict with flood defence requirements and there is a risk of re deposition in the river channel.

3.2.3 Control of erosion and siltation

Erosion of banks increases the rate of sedimentation and hence the frequency of dredging and the volumes of material for disposal. Work is now under way to look at siltation rates on designated lengths of waterway to quantify the relationship between the method of bank protection and rate of siltation. Early empirical work suggests that improved bank protection will yield substantially reduced rates of siltation and a long term reduction in dredging costs.

4. FURTHER REGULATION

4.1 Waste Management Licensing Regulations 1994

In the second half of 1992 draft documents relating to a further round of regulation of waste were issued. The documents were issued with limited time for consultation. Review of these documents by British Waterways technical staff was a substantial task. It emerged that there were a number of major difficulties. The new waste regulations as drafted would result in substantial additional costs and necessitate fundamental changes to existing practice for which there was no environmental justification.

4.1.1 Single Industry Requirements

The draft regulations appeared to be geared to commercial landfill and concerned with regulating the disposal of mixed waste for which commercial fees were charged. There was no recognition of the requirements for single industry disposal sites, of the type that are common place within the dredging industry. These are frequently located within the operators premises, receive one homogeneous waste source, represent a minimal risk and need minimal regulation. Even where dredged material is contaminated the nature of that contamination is well defined and relatively uniform.

The requirements for management of this type of site are different from the commercial site in terms of the competence of the manager, the potential for biodegradation, leachate and gas production and the need for final cover.

There are other key differences. Commercial sites can have a capacity of 1 million m^3 or more as opposed to the typical British Waterways site of 10,000 m^3 . Patterns of use are also different. Dredging disposal sites may be used intermittently, often only three months every ten years as episodes of dredging take place, whereas commercial sites are usually used intensively throughout

their life. This had cost implications for British waterways operations given the proposed scales of fees and charges.

The draft regulations also reduced the number of disposal options exempt from licensing.

In particular the removal of the exemption to dispose of material to agricultural land was of considerable concern and had wide implications for the land drainage industry

4.1.2 Response to Government

Formal responses to government drew little reaction from the Department of the Environment. This is understandable as British Waterways dredgings are less than 0.5% of the national tonnage of waste produced per annum. The total for all inland dredging generates perhaps 5 million tonnes of waste per annum compared to 35 million tonnes per annum of sewage sludge.

In order to take the matter further two aspects needed to be developed to influence government

- an industry wide response was required to aggregate the interests of all organisations concerned with dredging;
- a measure of independence would be helpful in making a strong case.

The Construction Industry Research and Information Association (CIRIA) was asked to take the matter forward on behalf of the inland dredging industry. They were appointed to consult with the industry and prepare an industry wide commentary to Department of the Environment on the draft regulations. The document was produced in March 1993 and submitted to the Department of the Environment as an industry view

This was successful in that when revised regulations were issued in April 1994 important exemptions were re-introduced. The government was able to use sufficiently flexible wording to cover the majority of the requirements for the inland dredging industry. Their scope for achieving this was however constrained by the requirements of the EC Landfill Directive on which the UK regulations had to be based.

More fundamentally the whole exercise was important in gaining recognition of the requirements of the inland dredging industry, which had previously been overlooked by government. This will be important in the longer term as follow up regulations and guidance take effect on a range of issues such as site environmental monitoring, Special Waste, Landfill Tax and other matters.

4.2 Industry Guidance

It was recognised when the regulations first appeared in 1992 that their interpretation would always be a complex matter. A particular concern for nationally based organisations such as British Waterways was the potential for differing and conflicting interpretation between the County based Waste Regulation whose understanding of the nature of dredging and their

management requirements would vary widely. This could making planning and executing dredging works difficult and bring additional costs.

In the UK the usual route for providing guidance on interpretation of Waste Regulations for both regulator and operator is through Waste Management Papers (WMP) issued by the Department of the Environment. In early discussion with the Department we had discovered that there was no WMP planned for dredgings management, and preparation would not be possible for such a small sector. However the Department were prepared to help with development of guidance by the industry. Indeed this was encouraged as a way forward to develop some standard approaches that would meet the requirements of both operators and the regulatory agencies.

As a second phase CIRIA was therefore commissioned to prepare an expert guidance document on interpretation of the regulations to guide operator and regulator in the disposal of dredgings to land.

Preparation of the document was steered by an industry wide group taken from regulators and operators. Table 3 lists some of the main organisations involved.

**TABLE 3 ORGAN ISATLONS REPRESENTED ON THE CIRIA
STEERING GROUP**

National Association of Waste Regulation Officers
Waste Regulation Authorities
National Rivers Authority, (Flood Defence and Pollution Control),
British Waterways
The Port of London Authority
Manchester Ship Canal Company,
The Broads Authority,
The Association of Drainage Authorities,
National Association of Waste Disposal Contractors
Department of the Environment

The work was carried out by consultants appointed by competitive tender and managed by CIRIA. Some preparatory work was completed before the regulations were published . but work could not begin in earnest until April 1995. The Report is titled 'Guidance on the Disposal of Dredgings to Land". Its full publication is expected in the autumn of 1995. This become the reference document on interpretation of the Waste Management Regulations for the dredging industry.

The report is structured in two parts. The first, Part A, provides guidance on the selection and planning of a disposal method including the legal position, information requirements and application procedures. Part B provides more extensive supporting information to enable the user to apply for a licence or to

register an exemption. By working closely with all parties involved in the disposal of dredgings it has been possible to achieve a document which in practical terms has a status close to a formal WMP.

5. 1995/1 996 DREDGING SCENE

5.1 Concerns

The new regulations have increased complexity which must be handled by operators day to day. Definitions within the regulations are often imprecise. For example there is no absolute definition of what constitutes "agricultural improvement" in relation to the exempt disposal of waste to agricultural land. Whilst this can give flexibility it can also mean that regulators approach the matter by taking the most cautious view. This in turn means that the dredging industry is faced with an increasingly difficult task. The new Guidance provides support but cannot provide the black and white clarity some would like. Clarity could emerge if the definitions were tested in court but this is a costly route with an uncertain outcome and many prefer less risky negotiation with regulators on a site by site basis.

Whilst the range of exemptions has been welcomed by the industry their use can also bring concerns about long term liabilities. All operations carried out under an exemption have to be notified to the WRA (or other relevant body) but this notification does not authorise the activity. It is up to the operator to determine whether the activity falls within the requirements of individual exemptions. There is scope for long term liability and conflict with the Regulatory body at a later stage if they determine that the operation falls outside the requirements. At the present time the waste producer shoulders fully the burden of setting precedent with regard to exemptions.

5.2 Implications and Developing Practice for British Waterways

The new regulations have had, and will continue to have a significant impact on the nature of dredging disposal operations. The costs of site acquisition procurement of licences, environmental monitoring and ultimate surrender of licence are a major disincentive for the historic practice of depositing dredging spoil in small landfill sites.

British Waterways now has about 40 licensed sites. The number is unlikely to increase significantly. Instead numerous exempt disposal routes are being exploited using areas such as towing paths, adjacent banks and disposal to agricultural land. Reuse is being exploited by spreading dredgings on agricultural land and in the case of river dredgings, use as a secondary aggregate.

The focus on exempt disposal has been sharpened by the move toward use of contractors for dredging works. On many occasions the specification for work

includes dredging and disposal. In bidding for the work competitively contractors constantly look for low cost disposal routes and have usefully opened up new options previously not fully exploited. Long term, relationships with these specialist contractors may yield further efficiency savings as they gain confidence and see opportunities for investing in specialist dredging and processing plant.

At a technical level developing knowledge of qualitative aspects of dredgings is also developing with gains in efficiency. For example we now have a clearer picture of the nature of the contamination experienced in canal sediments. Recent work has shown that whilst total levels of contamination can be locally high, extended exposure to water removes the mobile fraction of the contaminants, and the residue is relatively benign. This has an important implication for disposal after dredging.

5.3 Continuing Development

At the present time there are still developments in the regulation and control of waste management.

The Government has published a draft Waste Strategy (DoE, 1995). The Strategy is based on three key objectives for waste management:

- to reduce the amount of waste that society produces;
- to make best use of the waste that is produced; and
- to choose waste management practises which minimise the risks of "immediate and future environmental pollution and harm to human health.

In support of this strategy a Landfill Tax is planned to be introduced from October 1996 with the aim of reducing the amount of waste entering landfill sites by up to 10%. A recent consultation document from the Her Majesty's Customs and Excise advocates an ad volorem tax of between 30 and 50 per cent which is expected to average out at £10/tonne. On the basis that BW dredges approximately 1 million tonnes per annum, this tax could cost British Waterways up to £10 million per annum. If this tax is applied to dredgings disposal, volume reduction through dewatering and control of accretion rates by enhanced bank protection will assume greater importance.

Under the "umbrella" of the Environmental Protection Act 1990 a number of Regulations have been introduced to implement EC Directives. A draft of the latest of these 'The Special Waste Regulations 1995, is currently out for consultation. It will be of interest to see the final form of the Regulations and how they are applied.

In addition it is proposed that the regulators will be unified under the Environmental Agency. There will be a single regulator made up of the previous waste and water regulators. The formation of a single authority should

streamline the regulation of dredgings disposal and ensure greater consistency of approach.

6. CONCLUSIONS

The regulation of dredgings disposal has brought fundamental change to the process of planning and executing dredging works. It has required careful consideration of a wide range of technical and environmental matters and the application of new technical skills within the process of project management. Costs have also increased, but this in turn has resulted in review of disposal options.

Influencing the process of regulation presented practical difficulties but has facilitated an industry wide approach. This has been successful in promoting the interests of the industry across government, and the regulatory agencies. As a result the nature of the business and its operational requirements is now much better understood. The opportunity now exists for longer term collaboration.

The process of regulation is not yet complete, but the mechanisms for dealing with new legislation are now established.

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