

**Nitrates Action Programme  
MALTA**

*May 2010*

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## **Executive Summary**

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This Nitrates Action Programme contains the second Action Programme for Malta pursuant to Article 10 and Annex 5 of Council Directive 91/676 of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, referred to as the Nitrates Directive.

The Nitrates Directive was transposed in Maltese legislation under the Environment Protection Act through the Protection of Waters against Pollution Caused by Nitrates from Agricultural Sources Regulations (LN343/01) (amended by LN 233/04 and 426/07) This legislation entered into force on 14 January 2003. The whole of the Maltese Islands were designated a Nitrate Vulnerable Zone (NVZ) through an amendment to Subsidiary Legislation 435.40 of the Laws of Malta effected by virtue of Legal Notice 233 of 2004. The competent authority for the Nitrates Directive is the Malta Environment and Planning Authority (MEPA) however the implementation measures of the Directive are the responsibility of three different entities: MEPA is responsible for overseeing the implementation of the Directive and for monitoring of surface waters whilst the Malta Resources Authority (MRA) is the agency responsible for groundwater monitoring and regulation. The Department of Agriculture under the Ministry for Resources and Rural Affairs (MRRA) is responsible for the implementation of the Code of Good Agriculture Practice (CoGAP) and the Nitrates Action Programme.

Nitrate levels in inland surface waters and groundwaters generally exceed the 50mg/l limit, at times by several orders of magnitude. The monitoring data from the first nitrate reporting cycle do not show significant nutrient enrichment in coastal areas. The annual average nitrate concentration generally did not exceed 10mg/l and levels in excess of 50mg/l were measured intermittently in winter in only a few inlets. Surface run-off and coastal developments and infrastructure (e.g. sewage overflows) are likely sources of nitrate pollution in such enclosed areas. A key milestone in the implementation of the Nitrates Directive was the development of a Code of Good Agriculture Practice for Malta. The CoGAP was adopted in 2004 and covers all aspects of agriculture production. A dissemination campaign among farmers was carried out during 2005-06 in which a number of seminars on the effective implementation of the Code were delivered. Other dissemination and training initiatives included one-to-one meetings with the farming community and the distribution of information brochures.

The CoGAP includes measures that directly address the implementation of the Nitrates Directive and it is these measures that constituted the first Nitrates Action Programme for the period from 2004-2007, which is the first reporting cycle for Malta following EU accession. The CoGAP

measures relating to the Nitrates Directive were implemented through the Rural Development Plan for 2004-2006 and in the current RDP (2007-2013).

## 1. Introduction

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### 1.1 General Background information on Malta and Nitrate Pollution

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The Maltese Archipelago consists mainly of three inhabited islands, Malta, Gozo, and Comino having a total surface area 315.59 km<sup>2</sup>. Figures published by the National Statistics Office report a total population amounting to 412,277 in 2008 with an average growth rate of less than 1000/yr.

Population density in the Maltese islands is amongst the highest in the world, reaching 1298 inh/km<sup>2</sup> distributed rather unevenly over the territory. Projections show steady growth of the local population up to 2025 and a gradual decline reaching around 400,000 by 2050<sup>1</sup>. Agriculture accounts for 1.62% of GDP<sup>2</sup> and the utilised agricultural land occupies around 10,000 Ha or around 30%<sup>3</sup> of the whole territory. By and large, farming activity has become more intense following EU accession, resulting in a substantial increase of irrigated land over the last five years. These figures are only meant to provide a perspective of the pressure for water resources in a Mediterranean island scenario.

Malta suffers from chronic water scarcity on account of its dry Mediterranean climate. There are no rivers of economic importance and groundwater is the only natural water resource available today. It sustains agriculture entirely and around half of the drinking water supply.

The Art 5 report, required by the Water Framework Directive 2000/60/EC (WFD) reported 13 out of 15 groundwater bodies in Malta and Gozo are heavily polluted by nitrates. It has been scientifically confirmed that nitrate pollution of groundwater is primarily derived from agricultural practices.

In Malta the spatial pattern of soil types is very intricate, both in semi-natural and agricultural areas and different soil types often occur within a single field or within a distance of few meters. The landscapes of the Maltese Islands may be grouped into two main categories: (i) semi-natural landscapes, where very little evidence of man's activities can be recognised; and (ii) man-made landscapes where the influence of man can be identified in the widespread terracing of sloping land and the creation of made ground through the movement of large quantities of soil material and

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<sup>1</sup> Demographic Review (NSO) November 2008.

<sup>2</sup> National Statistics Office News Release 043/2010.

<sup>3</sup> Farm sector survey (NSO) 2007

deposition on rock or rock rubble. The semi-natural landscapes comprise bare sea cliffs, garigue, marsh, woodland, Blue Clay slopes, Blue Clay spring line, and blown sand. The man-made landscapes may be divided into moderate or steep terraces on Blue Clay, shallow, moderate or steep terraces on Coralline limestone, shallow, moderate or steep terraces on Globigerina limestone, valley fill and terraced blown sand. The seven major soil reference groups in Malta are Calcisols, Leptosols, Vertisols, Luvisols, Cambisols, Regosols and Arenosols. In Malta, soils are slightly and moderately alkaline, with a pH between 7.3 and 8.5 (MAL SIS, 2004).

## **1.2 Background on Nitrates Directive and its implementation in Malta**

The Nitrates Directive (Council of the European Communities, 1991) has the general purpose of reducing water pollution caused or induced by nitrates from agricultural sources and preventing further such pollution" (Art.1). A threshold nitrate concentration of 50 mg/l is set as the maximum permissible level, and the Directive limits applications of livestock manure to land to 170 kg N/ha/yr.

### **1.2.1 Waters addressed by the Directive**

Waters referred to by the Nitrates Directive include all waters: surface, ground, transitional and coastal waters.

Surface waters include all freshwaters, in particular those that are used or intended for the abstraction of drinking water and could contain nitrates that exceed the 50mg/l. Groundwaters include waters that contain or could contain more than 50mg/l nitrates.

The Directive also covers natural watercourses, standing waters, transitional waters, coastal and marine waters which are found to be eutrophic or which, in the near future may become eutrophic if preventive action is not taken.

The Nitrates Directive defines waters which are polluted or are liable to pollution as:-

- **surface freshwaters**, in particular those used for the abstraction of drinking water, which contain or could contain, if preventative action is not taken, nitrate concentrations greater than 50 mg/l.
- **groundwaters** which contain or could contain, if preventative action is not taken, nitrate concentrations greater than 50 mg/l

- **natural freshwater lakes, or other freshwater bodies, estuaries, coastal waters and marine waters** which are found to be eutrophic or in the near future may become eutrophic if preventative action is not taken.

A judgment of the ECJ in June 2002 clarified that eutrophic waters must be addressed under the Nitrates Directive even where the eutrophication is caused mainly by phosphorus rather than nitrates from agricultural sources (Case C-258/00, Commission v France).

Eutrophication is the enrichment of waters by excessive inputs of nutrients such as nitrogen or phosphorus compounds, causing accelerated growth of algae and higher forms of plant life, resulting in an undesirable disturbance to the balance of organisms present and to the quality of the water concerned.

### **1.2.2 Nitrates Vulnerable Zones & Whole Territory approach**

The Nitrates Directive provides two options for designation within Article 3: to designate separate zones or announce the whole national territory as vulnerable to nitrate pollution. The aim of designating Nitrate Vulnerable Zones is to identify land sites and consequentially coastal areas where the discharge of an excess of nitrates could cause environmental degradation. Existing EU Member States have adopted different strategies for designation of the vulnerable zones.

In a 2001 report<sup>4</sup> on nitrate pollution in ground waters, it was highlighted that all groundwater across the islands is very vulnerable to nitrate pollution and remedial action is required. The report suggested that all of Malta is a nitrate vulnerable zone.

An amendment to Subsidiary Legislation 435.40 of the Laws of Malta effected by virtue of Legal Notice 233 of 2004 added a new Annex VI to the legislation and designated the whole of Malta as a Nitrates Vulnerable Zone.

### **1.3 National Legislation & related Regulations**

The Nitrates directive was transposed under the Environment Protection Act<sup>5</sup> Subsidiary Legislation 435.40 as Legal Notice 343 of 2001 (as subsequently amended by Legal Notices 233 of

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<sup>4</sup> Cranfield Report

2004 and 436 of 2007) and entitled “Protection of Waters against Pollution caused by Nitrates from Agricultural Sources Regulations”. This legislation came into force January 14, 2003.

The competent authority for the Nitrates Directive is the Malta Environment and Planning Authority (MEPA) whilst competency for the implementation of the Code of Good Agricultural Practice (COGAP) and the Nitrates Action Programme, falls on the Department of Agriculture under the present Ministry for Resources and Rural Affairs (MRRA).

## **1.4 Implementation to date**

The implementation of the Nitrates Directive in Malta from accession to date is summarised in the reporting document required by Article 10 of the Directive and submitted to the EU in 2008. This was the first such reporting obligation for Malta that covered the period from 2004 – 2007. During this time, the implementation of the Nitrates Directive was tied to the formulation and implementation of the Code of Good Agricultural Practice and the first national action programme. A first assessment of the level of contamination by nitrates in all waters was also carried out as required by the Directive. The results of this assessment revealed a very significant level of contamination in all waters, except for open coastal waters.

More recently, a study of nitrate contamination in groundwater in Malta has confirmed that groundwater resources are most at risk from nitrate contamination derived from agricultural sources. It is expected that the results of the surface and groundwater monitoring networks established under the Water Framework Directive will continue to inform the implementation of the current National Action Programme.

### **1.4.1 The development of a Code of Good Agricultural Practice**

In 2006, the Ministry for Resources and Environment developed a Code of Good Agricultural practice (CoGAP) that covers all aspects of agriculture production including (i) animal husbandry and manure handling, (ii) fertilization practices, (iii) irrigation practices, (iv) plant protection practices and (v) field practice. Codes (measures) are grouped in four classes, of which, three are mandatory and one voluntary.

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<sup>5</sup> Chapter 435 of Laws of Malta.

The Codes related to the Nitrates Directive are grouped on their own. Though classified as “mandatory”, these measures can be only implemented once the Action Programme is brought into force.

As at today, only 50% of farm holdings are subject to the monitoring and enforcement procedures, required by Cross-Compliance regulations related to the Nitrates Directive.

The Ministry for Resources and Rural Affairs (MRRA, previously the Ministry of Rural Affairs and the Environment, MRAE) organized several CoGAP training seminars for farmers during 2005 - 2006. The meetings were held in three main regions of the island (north, central and south) in order to capture the whole farming community. Other dissemination activities and one-to-one meetings were organised with the farming community and brochures were distributed.

Meetings were also held with stakeholders other than those coming from the farming community. Meetings, for instance, were held with the National Research and Development Centre and Chamber of Architects in order to describe the way livestock farms should be restructured to meet the requirements of both the Nitrates and Animal Welfare Directives. The Malta Standards Authority also organised courses to educate the public in the utilisation and application of pesticides.

#### **1.4.2 Development of the first Nitrates Directive National Action Programme**

Article 6.4.a of LN 343/2001 which transposes the Nitrates Directive, makes reference to the measures which Action Programme must contain, including:

- a) periods of land application of fertilizers,
- b) storage requirements for animal manure,
- c) limitations on the application of fertilizers to land.

The measures in the CoGAP that refer to the implementation of the Nitrates Directive refer to the following:

##### **i. Measures relating to periods when the land application of certain types of fertilisers is prohibited**

The Nitrates Action Programme set a prohibition on the application of livestock manure during the rainy season (from 15 October - 15 March).

#### ii. Measures relating to capacity of storage vessels for livestock manure

Manure must be stored in leak-proof covered storage clamps connected to a cesspit and the cesspits must be leak-proof and covered. The minimum storage capacity for solid manure must be sufficient to cover the closed period. Cesspits must have sufficient capacity to collect all urine and washings for at least 15 days. Solid manure must be stored in covered clamps from October 15 – March 15. Field storage of solid manure is allowed during the dry season if the dry matter content is at least 30%.

The producer (and contractor, if one is employed) is also obliged to keep records of slurry and manure transports and disposal, including dates, quantities and final destination.

The amount of livestock manure that can be applied to land is also limited by the nitrogen content, i.e. 210 kg N/Ha for the first four years of the action programme (2004-2008) and 170 kg N/ha thereafter.

#### iii. Measures relating to the limitation of land application of fertilisers

The Action Programme prohibited the application of fertilisers to water saturated soils and to soils in flood-prone areas. A minimum distance from watercourses and from the shoreline was specified for the application of mineral and organic fertilisers. Finally, fertilisers cannot be applied in sloping land, unless they are incorporated immediately after application.

The programme contained measures that specify procedures for the application of mineral and organic fertilisers to ensure rate and uniformity of spreading. The application of untreated sewage sludge to the fields is prohibited.

A fertilisation plan is required for the application of mineral and organic fertilisers including livestock manure with the aim of achieving nutrient balance. The Action Programme also states that fertilisers must be applied close to sowing and recommends splitting of fertiliser whenever possible.

#### iv. Other measures

The Nitrates Action Programme requires farmers to keep records of manure transports and purchases of all types of mineral, organic fertilisers and livestock manures.

### **1.4.3 Implementation of the Water Framework Directive (WFD)**

#### Development of a Monitoring Programme under the WFD

It is expected that the results of the coastal and groundwater monitoring programmes developed under the Water Framework Directive, will greatly enhance our understanding of nitrate contamination and eutrophication. The results obtained from these monitoring networks, will support the Nitrates Directive and will provide useful data to establish trends in vulnerable areas.

#### Development of a programme of measures

In drawing up the First Water Catchment Management Plan of the Maltese Islands, basic measures emanating from the Nitrates Directive have been included in the programme of measures developed to achieve good water status for all waters. These measures have been discussed and consulted on by key stakeholders including the agricultural sector.

### **1.4.4 Revision of the Action Programme**

#### **Problems encountered in the implementation of the first Nitrates Action Programme**

The practical implementation of the first Nitrates Action Programme encountered several problems. It was evident that some measures were not practical and very hard to implement. Some farmers found it difficult to implement the Action Programme for economic reasons. The principal concerns of livestock breeders have been the costs of infrastructural changes required to implement the Action Program when compared to the small size of the farms. In the arable sector, most problems arise because of the peculiar nature of the sector in Malta, where it is usual for farmers to grow various crops in one year. Hence farmers were obliged to have fertilisation plans for each crop which translated to additional costs and practical problems.

#### **1.4 Key issues to address in the development of the second National Nitrates Action Programme**

Animal husbandry has benefited from EU aid. In recent years farmers restructured their facilities and markedly improved structures intended for the storage of manure. These improvements augur well to address the nitrate problem. Nonetheless, Malta has, as yet, no regulation in force to limit the application of fertilizers to land as prescribed in section 3 Annex III of the Directive. Amongst

other parameters and simply put, the Directive requires these limitations to take into account the levels of Nitrates present in the soil and in irrigation water, to determine any additional fertilizer which may be required to supplement the uptake by the crop, without any leaching to groundwater. Furthermore the measures are to be applied by each farm and livestock unit, and the permissible amounts of fertilizer should be conducive towards the achievement of the 50mg/l threshold. Action has to be taken, therefore, at the level of all individual holdings in Malta and Gozo, and it will involve, amongst others, the identification of N contributions from soil and irrigation water. A considerable deployment of trained technicians to undertake the necessary fieldwork and testing, is therefore anticipated.

Currently, only those holdings applying for EU subsidies (around 50% of the total) are subject to the monitoring and enforcement procedures, required by Cross-Compliance regulations. Annex I gives the nitrates standards applicable under cross compliance. Furthermore only around 7% of the qualifying holdings, are today selected for compliance checking and control. Such monitoring practices have to be improved if progress with nitrate reduction is meant to be achieved on a wider national scale.

In the arable sector, the findings of the controls indicated that most farmers were compliant with the standards related to good management practices, including the non-application of fertilisers to water saturated soils, water courses and sloping ground and conformity with the procedure for uniformity of spreading of fertilisers.

The non-compliance with the obligations related to crop requirement limitations. Maintenance of records by farmers is often overlooked due to the lack of response to training and education of the farmers. Fertiliser plans are often available for the holding, however in the majority of the cases they are not followed. The first Nitrates Action Programme did not contain requirements obliging farmers to keep records on fertiliser use on farm. This created problems during the verification of compliance with fertiliser application rates recommended in the fertiliser plan.

Non-compliance with the standards by livestock breeders is mainly related to insufficient and inappropriate manure storage facilities. Although the cost of infrastructure related to these requirements is high, where large farms are concerned non-compliance was mainly related to issues concerning planning/development permits. In the case of small farms, non-compliance was often due to economic reasons.

The first Nitrates Action Programme included requirements for the maintenance of records of manure transport by livestock breeders. However, these were of little use during cross-compliance checking, since there is no database to assist cross-checks with records concerning usage by arable farmers.

The emphasis on the implementation of the second Nitrates Action Programme shall be the prevention of future pollution with nitrates by agriculture, particularly on reduction of nitrogen fertilisers and the elimination of pollution from the “hot spots”.

It is important for the revised Nitrates Action Programme to take into consideration these concerns and provide practical measures to overcome the difficulties encountered in its implementation; for example, specific measures and training to aid farmers to be able to fulfil their obligations on record keeping.

The second Action Programme will be codified in Maltese subsidiary legislation by virtue of a Legal Notice and will reflect the legal obligations that are to be applied to all farm holdings. This second Action Programme has been harmonised with regulatory measures to ensure alignment with the requirements of the Nitrates Directive and synergies with other related directives.

## 2.0 Assessment of Nitrate levels in Malta

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### 2.1 Nitrate pollution in surface waters

#### Monitoring water quality

The coastal and inland surface nitrates monitoring programme commenced in 2005 and continued intermittently through 2008. A total of 26 coastal and 12 inland surface water monitoring stations were selected. The selection of coastal sites reflected current knowledge of agricultural land use and practices, as well as topographical information. The distribution of the stations at intervals along the shoreline provided a representative sample of the coastal waters of the Maltese Islands, and also took into consideration the monitoring of bathing water quality.

#### (i) Coastal Waters

The results of the Nitrates Directive monitoring program 2006/8 showed a predominantly low nitrate concentration (<10mg/l annual average) in most coastal areas. The annual average nitrate concentration was between 10-25mg/l in only about 10% of the coastal stations monitored. Winter averages exceeded 25 mg/l in just two stations; in one of these stations the recorded levels exceeded 50 mg/l. Both these monitoring stations were located at the landward side of a relatively deep inlet/bay that receives significant land run-off.

The results obtained from the nitrate monitoring program are consistent with past reports and analysis using satellite remote sensing, which have indicated that eutrophication is limited in time and to specific inlets and bays around the Islands. Moderate eutrophic conditions have in fact been reported to occur in the harbour regions (mainly in Marsamxett, the Grand Harbour and Marsaxlokk). Sewage contamination is suspected to be the major culprit in these areas and not agriculture.

Indeed, the extent of the contribution of agriculture to nutrient pollution in coastal waters is not known. To date only one study<sup>6</sup> was carried out in an attempt to understand the significance of nutrient loadings resulting from land runoff in Maltese coastal waters. This study indicated that surface runoff from diffuse sources may be considered to be significant. Even so, nutrient loads from land runoff cannot be attributed solely to agricultural sources. Apart from agricultural and

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<sup>6</sup> Tabone Adami, E, 2001. GIS-based modelling of nutrient transfers from land to coastal waters for understanding eutrophication patterns. A thesis submitted for the degree of Doctor of Philosophy, Darwin College, Cambridge, April 2001.

animal husbandry practices, the release of untreated sewage and the overflowing of the sewerage network has been identified as a major contributor to high nutrient loads in sheltered bays and harbours around the Islands.

(ii) Inland surface waters

The results of the nitrate monitoring program showed that agriculture has a greater contribution to nitrate contamination of inland surface waters due to the intensive agricultural practices particularly where these water bodies are directly dependent on discharge from springs. In effect nitrate levels in the ten inland surface waters and transitional waters exceed the 50mg/l limit in many of the water bodies monitored..

Inland surface waters in Malta are very small bodies of water that cannot be compared with the perennial rivers and lakes in other countries. These water bodies are instead extremely small and occur seasonally as very small pools of water with a very low flows and small dimensions. Such water bodies are not used for drinking purposes and their sole importance is ecological in that they host several endemic species.

All surface waters monitored under the Nitrates Directive are also Special Areas of Conservation (SAC) designated under the Habitats Directive. In 2005, these water bodies were also designated as water bodies under the Water Framework Directive (WFD).

It has to be stressed that none of the inland surface water bodies in Malta are sources of drinking water. Indeed, their primary importance is their ecological value. Habitats and biota in practically all of these water bodies include rare, threatened and/or endemic species all of which are of prime conservation importance. It is clear that these water bodies in each category (rivers, lakes, transitional waters) are quite disparate and in almost all cases only have a few common features. Furthermore, there exists a great deal of uncertainty as to what the natural range of variability is and in some cases, no data whatsoever. Based on what is known it is evident that these bodies are very dynamic and change character with time of year, sometimes to extreme levels.

It is therefore difficult to assess the significance and the impacts of the recorded levels of nitrates in these waters, particularly in relation to the biodiversity they support without further data.

## 2.2 Nitrate content of Groundwater

The Water Framework Directive (WFD) requires Member States (MS) to achieve Good Groundwater Status by 2015. The WFD adopted the ‘groundwater quality standard’ of the Nitrates Directive, requiring MS to achieve nitrate levels below **50mg/l** in all bodies of groundwater.

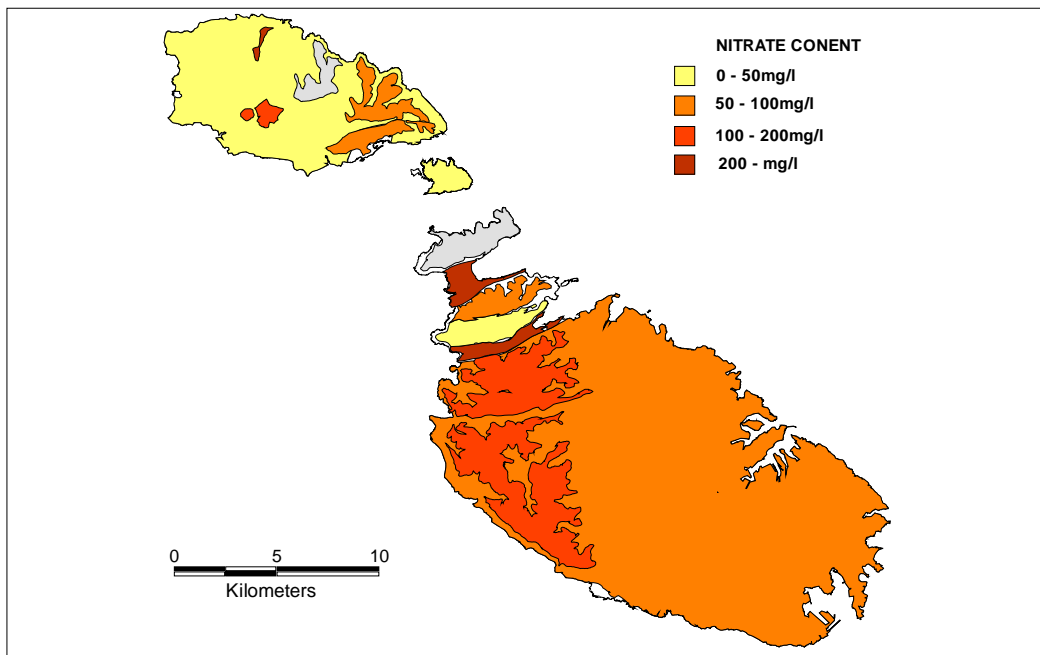
As part of the WFD implementation process, in 2008, the MRA undertook a detailed monitoring programme, of the quality of all groundwater bodies in the Maltese Islands. The main aim of this monitoring programme was to analyse the qualitative status of these bodies of groundwater in relation to the qualitative requirements of the WFD and thus identify those parameters for which more detailed monitoring is required.

Groundwater Body Code	Groundwater Body Name	Number of Monitoring Stations	Mean Nitrate Content (mg/l)
MT001	Malta Mean Sea Level	15	73.9
MT002	Rabat-Dingli Perched	5	137.3
MT003	Mġarr-Wardiġa Perched	1	139
MT005	Pwales Coastal	1	364.6
MT006	Miżieb Mean Sea Level	1	34.1
MT008	Mellieħa Perched	1	91.8
MT009	Mellieħa Coastal	1	335.4
MT010	Marfa Coastal	1	n/a <sup>7</sup>
MT012	Comino Mean Sea Level	1	35.9
MT013	Gozo Mean Sea Level	6	49.4
MT014	Għajnsielem Perched	1	99.9
MT015	Nadur Perched	1	88.4
MT016	Xagħra Perched	1	215.2
MT017	Żebbuġ Perched	1	315.9
MT018	Victoria-Kerċem Perched	2	133.5

**Table 1: Mean Nitrate Content in the groundwater bodies of the Maltese Water Catchment District**

<sup>7</sup> Monitoring results for the Marfa Coastal groundwater body will be available shortly, however this groundwater bodies is expected to have a high nitrate content, in excess of the qualitative standard.

The results of this monitoring programme (table 1) confirmed that ten groundwater bodies have high nitrate levels, in excess of the EU quality standard. These include the Malta Mean Sea Level system, which is by far the most important water body in the islands. Furthermore, three groundwater bodies have nitrate levels exceeding by more than six-times the quality standard. Only three water bodies were identified as having nitrate levels below the quality standard, of which the mean nitrate levels of the Gozo Sea Level system are quite close to the quality standard. This groundwater body should be therefore considered as being at risk of failing to achieve ‘good status’ in 2015. A schematic picture of the nitrate content of groundwater is shown in figure 1



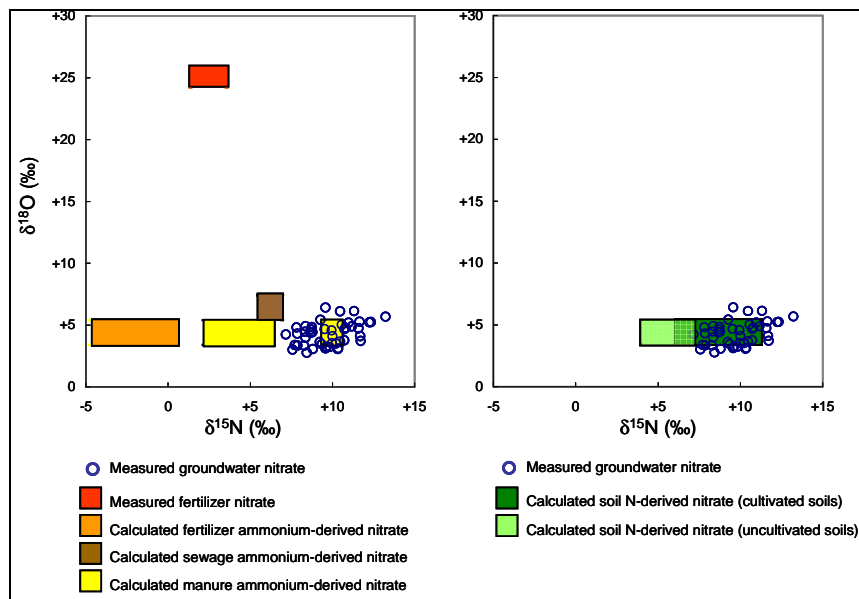
**Figure 1: Schematic representation of the mean nitrate content of the groundwater bodies in the Maltese Islands.**

### 2.3 Sources of Nitrate Pollution

In 2008, the Malta Resources Authority, through ‘Technical Assistance’ funds from the Rural Development Plan for Malta, commissioned a qualitative investigation of all groundwater bodies in Malta and Gozo with the aim of obtaining scientific evidence to identify sources of nitrate pollution in groundwater. This study which was carried out by the British Geological Survey involved the identification of the ‘isotopic signature’<sup>8</sup> of the various potential sources of nitrate pollution present in the Maltese islands and their correlation with the prevailing signature of the nitrate present in the underlying groundwaters.

<sup>8</sup> The ‘isotopic signature’ is the ratio of the stable isotopes of Nitrogen and Oxygen in the Nitrate ion.

In the Maltse islands, the main potential sources of nitrate contamination were expected to include, prior to this study, direct sources such as leakages from the sewer network, leakages from animal husbandry farms, direct leaching of artificial fertilizers and also indirect sources such as the application of fertilizers to land. Analysis for the stable isotopes of oxygen and nitrogen in the nitrate ion were conducted on a number of samples of all these pollution sources and on samples of groundwater lifted from individual aquifers



**Figure 2: Summary of  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$  in nitrate in groundwater and various potential nitrate sources**

(source: BGS report)

The results of the project (figure 2) indicated that sewage-derived nitrate is not a major contributor to high nitrates in groundwater whereas the leaching of nitrate from cultivated soils is likely to be the most important source of nitrate contamination, although derivation from animal wastes could not be discounted. The isotope data do not rule out inorganic fertilizers and/or animal wastes as the original source of the nitrogen. The data are compatible with a process whereby nitrogen from inorganic fertilizers and/or animal wastes is assimilated into the soil organic nitrogen pool, and takes on the isotopic composition of this pool during the cycling of nitrogen attendant on cultivation, before nitrification and leaching to the underlying groundwater.

Another key finding of the study has been the confirmation of the long residence times in the saturated zone of the MSL aquifers. This has important implications for any relationship between present-day activities and groundwater concentration and it would appear unrealistic that a clear

pattern could be anticipated. The lack of widespread rapid pathways from the surface to the water table as deduced from microbiological evidence suggest that a major part of infiltration may occur by relatively slow flow through the aquifer matrix. The travel time for nitrate from the surface to an abstraction point could thus be several decades at some sites.

Hence nitrate stored within the pores of rock formations will act as a secondary source for a long period even if surface applications were to cease completely. It is unlikely, therefore, that new codes of practice would actually lead to significant improvements in the nitrate content of groundwater within the next two decades owing to the slow movement of porewaters through the unsaturated zone.

## **2.4 Gross Nitrogen Balance for Malta**

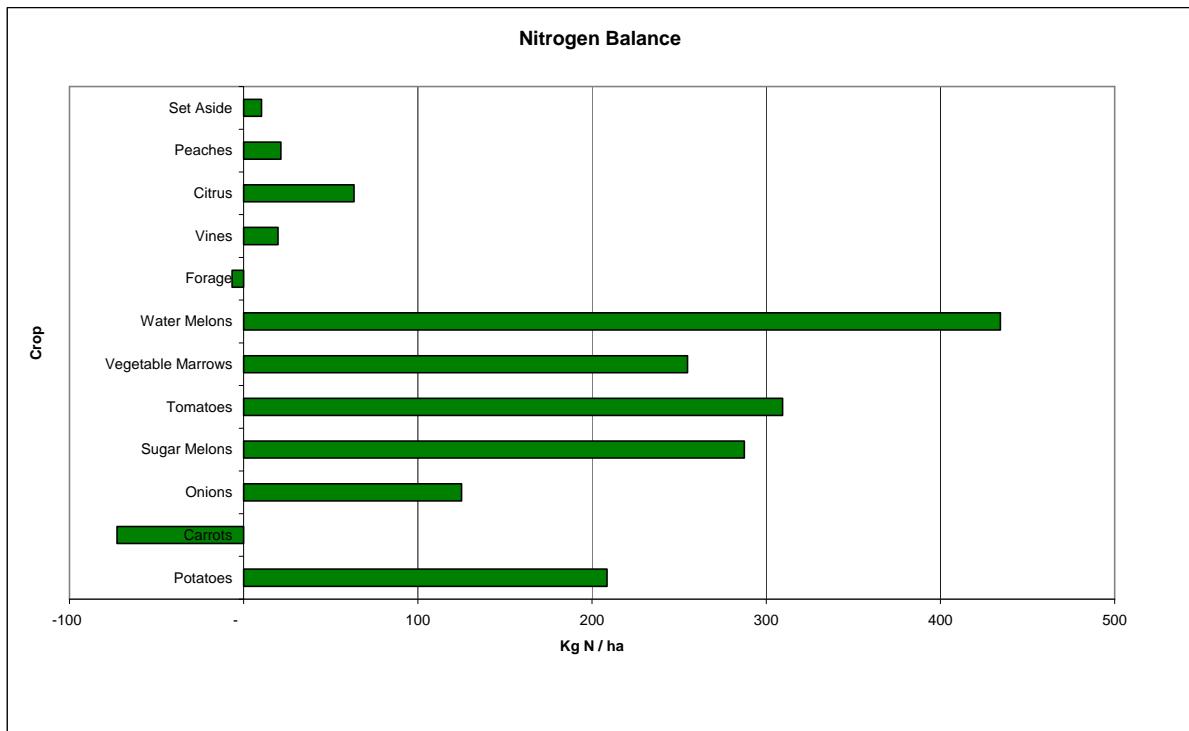
The gross nutrient balance for nitrogen provides an indication of potential water pollution and identifies those agricultural areas and systems with very high nitrogen loadings. The indicator estimates the potential surplus of nitrogen on agricultural land. This is done by calculating the balance between nitrogen added to an agricultural system and nitrogen removed from the system per hectare of agricultural land. As the indicator integrates the most important agricultural parameters with regard to potential nitrogen surplus it is currently the best available measure for nutrient leaching risk.

The Gross Nitrogen Balance (GNB) for Malta as reported by the National Statistics Office<sup>9</sup> is 117 Kg N / ha. The median of the GNB (kg/ha) in Europe amounts to 47 kg/N per hectare, with the highest GNB in the Netherlands with 220 kg/N per hectare to the lowest in Greece with a GNB of 12 kg/N per hectare. Malta, at 117 kg/N per hectare, is approximately two and a half times as much as the median of the gross nitrogen balances within the Member States (NSO, 2008).

Information from the fertiliser survey as part of the calculation of the Gross Nutrient Balance indicate that nearly all the crops are over-fertilised with nitrogen. The results of the study also indicate that the crops which are highly over-fertilised with nitrogen are vegetable crops, with high irrigation requirements.

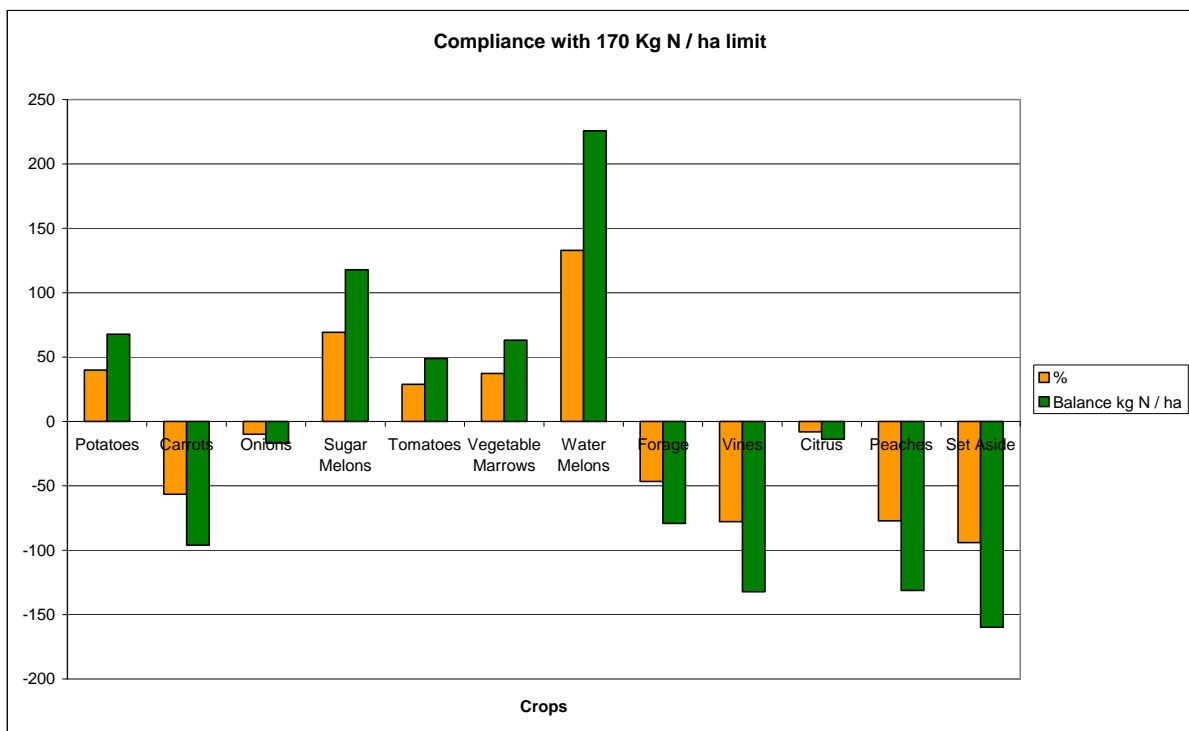
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<sup>9</sup> Gross Nitrogen Balance for Malta 2007, National Statistics Office 2008.



**Figure 3: Nitrogen Balance in selected crops**

Figure 3 above shows the excess of Nitrogen fertilisation in the crops under study. The figure illustrates deviations from the crops' optimal nitrogen requirements (at mark 0 on the graph). For example in the case of Water Melons, the application of nitrogen fertiliser exceeds 400kg N/ha of the crops' optimal requirement.



**Figure 4: Compliance with 170kg/ha threshold**

Data from the fertilisers survey also indicates that the limit of  $170 \text{ kg N ha}^{-1} \text{ yr}^{-1}$  stipulated in article 5 of the Nitrate Directive is being exceeded in almost all fields cultivated with irrigated vegetable crops. In certain cases the limits are exceeded by more than 100% (Figure 4). The findings of the survey show that over-application of nitrogen and non-compliance with the  $170 \text{ kg N ha}^{-1} \text{ yr}^{-1}$  is a serious problem on irrigated land.

Figure 4 above illustrates the Nitrogen fertilisation from organic sources in excess of the limit of  $170 \text{ kg N ha}^{-1} \text{ yr}^{-1}$  in the crops under study, both as a percentage and in Kg N/ha. The figure illustrates deviations from this limit (at mark 0 on the graph). For example in the case of Water Melons, the application of nitrogen fertiliser exceeds 100% of the limit, equivalent to an excess over  $200 \text{ kg N/ha/yr}$ .

### 3.0 – Nitrates Action Measures

In this Chapter each measure aimed at reducing Nitrates pollution is marked as para. (a), the rationale for such measure is marked as para. (b) while the implementation and control for such measure is marked as para (c).

<b>3.1</b>	<b>Periods when land application of fertilisers is prohibited</b>
3.1(a)(i)	The land application of organic fertiliser to any land shall not be permitted between 15 October in any year and 15 March of the following year.
3.2(a)(ii)	The land application of inorganic fertiliser to any land and open fields shall not be permitted between 15 October in any year and 15 March of the following year.
<b>3.2</b>	<b>Requirements as to the manner of land application of fertiliser</b>
3.2(a)(i)	The land application of organic fertiliser shall not be permitted when: <ul style="list-style-type: none"> <li>▪ the land is steeply sloping, taking into account factors such as proximity to watercourses, soil condition, ground cover and rainfall or there is a significant risk of causing water pollution, unless incorporated immediately after application;</li> <li>▪ the land is located or in a manner which would make it likely that the nitrogen fertiliser will directly enter a watercourse or water contained in any underground strata;</li> </ul>
3.2 (a) (ii)	The land application of slurry shall not be permitted.
3.2 (a) (iii)	Organic or Inorganic fertilisers shall not be applied; <ul style="list-style-type: none"> <li>• to any type of fresh water courses;</li> <li>• within a minimum distance of 5m from natural water courses;</li> <li>• within 5m from springs, galleries, boreholes and karst features;</li> <li>• within 50m any borehole used for public water supply;</li> <li>• within 100m from the coast.</li> </ul>
3.2 (a) (iv)	All types of mineral and organic fertilisers shall be distributed uniformly on the field and shall be incorporated into the soil as soon as possible.
<b>3.3</b>	<b>Measures governing the limits on land application of fertilisers</b>
3.3 (a) (i)	Application of inorganic and organic fertilisers shall be based on fertilisation planning taking into consideration the balance between the foreseeable nitrogen requirements of the crops and the nitrogen supply to the crops from the soil, water and from fertilisation in accordance with Schedule I.
3.3 (a) (ii)	Inorganic and organic fertilisers shall be applied close to sowing and splitting of fertiliser application is recommended whenever possible.
3.3 (a) (iii)	The amount of “total nitrogen” applied from livestock manure, including excreta by animals themselves, shall not exceed 170 kg N/ha per year (Schedule II).
<b>3.4</b>	<b>Storage facilities for livestock manure</b>
3.4 (a) (i)	The capacity of storage facilities for livestock manure of a holding shall be sufficient and adequate to provide for the storage of all the livestock manure which is likely to require storage between the 15 <sup>th</sup> October to 15 <sup>th</sup> of March.

3.4 (a) (ii)	Manure shall be stored in a leak-proof, covered storage clamp which is connected to a cesspit.
3.4 (a) (iii)	The Cesspits must be leak-proof, covered and must be sufficient to collect all urine and washings for at least 15 days.
3.4 (a) (iv)	Cesspits and manure clamps shall be certified for tightness (leak-proof) by a warranted architect, every five years or following any structural works within the holding or in its immediate vicinity.
<b>3.5</b>	<b>Manner of storage and location of farmyard manure storage</b>
3.5 (a) (i)	Farmyard manure may be stored in the field where land application will take place subject to a maximum limit of 120 days between 16 <sup>th</sup> of March to 14 <sup>th</sup> of October if the dry matter content is at least 30%.
3.5 (a) (ii)	Where stored in a field, farmyard manure must not be stored in the same location of the field in consecutive years, shall be stored in a compact heap and such heaps must not be placed within: <ul style="list-style-type: none"> <li>• 20m from water courses</li> <li>• 50m around a borehole, spring or well</li> <li>• 100m from any borehole used for a public water supply</li> <li>• 100m from the coast</li> </ul>
<b>3.6</b>	<b>Measures related to Land Management Practices</b>
3.6 (a) (i)	Crop rotation shall be practised where necessary.
3.6 (a) (ii)	Farm holdings with an area >1 ha and under intensive irrigated cultivation shall have a Nutrient Management Plan.
<b>3.7</b>	<b>Measures related to Farm Management Practices</b>
3.7 (a)	All animal holdings and animal passageways shall be suitably covered
<b>4.1</b>	<b>Records on the Use of Fertilisers</b>
4.1 (a)	Users of organic and/or inorganic fertilisers shall be registered with the competent authority responsible for nitrates.
<b>4.2</b>	<b>Nutrient Management Course</b>
4.2 (a)	Users of organic or inorganic fertilisers shall be required to attend a compulsory course on the use of fertilisers.
<b>4.3</b>	<b>Farm Records</b>
4.3 (a)	Records shall be kept on every holding and shall be available for inspection.
<b>4.4</b>	<b>Control of Sales / Movement of Fertilisers</b>
4.4 (a) (i)	All sales and purchases of organic and inorganic fertilisers shall be notified to the competent authority responsible for Nitrates
4.4 (a) (ii)	All importers, distributors and resellers of fertilisers shall be registered with the competent authority

### **3.1 Periods when land application of fertilisers is prohibited**

**3.1 (a) (i) Organic Fertiliser:** The land application of organic fertiliser to any land shall not be permitted between 15 October in any year and 15 March of the following year.

Organic fertilisers including farm yard manure shall not be applied to open fields during the period 15 October and 15 March.

**3.1 (a) (ii) Inorganic Fertiliser:** The land application of inorganic fertiliser to any land and open fields shall not be permitted between 15 October in any year and 15 March of the following year.

Provided that inorganic fertilisation may be permitted in the event of demonstrable crop requirement which has been notified by the farmer to the Nitrate Control Unit.

**3.1 (b)** Nitrate leaching is higher in the winter period. Most of the rainfall in Malta falls between October and March, with the highest average rainfall falling between November and January.

**3.1 (c)** Verification of compliance shall be made by administrative checks through the National Nitrate Database, verification of Farm Records and on-the-spot checks in the field and on-the-spot checks in the field and storage facilities.

### **3.2 Requirements as to the manner of land application of fertiliser**

**3.2 (a) (i).** The land application of organic fertiliser shall not be permitted when:

- the land is steeply sloping, taking into account factors such as proximity to watercourses, soil condition, ground cover and rainfall or there is a significant risk of causing water pollution, unless incorporated immediately after application;
- the land is located or in a manner which would make it likely that the nitrogen fertiliser will directly enter a watercourse or water contained in any underground strata;

**3.2 (a) (ii)** The land application of slurry shall not be permitted.

**3.2 (a) (iii)** Organic or Inorganic fertilisers shall not be applied;

- to any type of fresh water courses;
- within a minimum distance of 5m from natural water courses;
- within 5m from springs, galleries, boreholes and karst features;
- within 50m any borehole used for public water supply;
- within 100m from the coast.

**3.2 (a) (iv)** All types of mineral and organic fertilisers shall be distributed uniformly on the field and shall be incorporated into the soil as soon as possible.

**3.2 (b)** The risk of Nutrient losses through surface runoff is increased with the intensity of precipitation. The degree and the length of the slope are two essential features of the topography in relation to runoff. Runoff is increased when the inclination of the land is higher than 5%. However for the scope of the Nitrate Directive it is recommended that Action Programmes shall establish slopes of 7% as a maximum slope for the application of fertilisers. The close proximity to natural water courses, springs and boreholes to land where application of nitrogenous fertilisers is practiced, increase the risk of contamination.

**3.2 (c)** Nitrogenous fertiliser including (organic manure and mineral fertilisers) shall not be applied to any type of fresh water courses, on land that is steeply sloping, taking into account factors such as proximity to waterways, soil condition, ground cover and rainfall, when there is a significant risk of causing water pollution unless incorporated immediately after application, within a minimum distance from natural water courses, springs, boreholes and the coast.

Application of nitrogenous fertilisers shall not be carried out where the land is located or in a manner which would make it likely that the nitrogen fertiliser will directly enter a waterway or water contained in any underground strata. All types of mineral and organic fertilisers shall be distributed uniformly on the field and shall be incorporated into the soil within 24 hours.

Verification of compliance shall be made by administrative checks through on-the-spot checks in the field to check visually for residues of fertiliser and where necessary by conducting soil analysis.

### **3.3 Measures governing the limits on land application of fertilisers**

**3.3 (a) (i)** Application of inorganic and organic fertilisers shall be based on fertilisation planning taking into consideration the balance between the foreseeable nitrogen requirements of the crops and the nitrogen supply to the crops from the soil, water and from fertilisation in accordance with Annex II.

**3.3 (a) (ii)** Inorganic and organic fertilisers shall be applied close to sowing and splitting of fertiliser application is recommended whenever possible.

**3.3 (a) (iii)** The amount of “total nitrogen” applied from livestock manure, including excreta by animals themselves, shall not exceed 170 kg N/ha per year (Annex III).

**3.3 (b)** The amount of nitrate that is leached depends on the amount of nitrate that is present in the soil, the amount that is mineralised and the amount of drainage. Application of nitrogen in excess then what is required by the crop, will increase the concentration of nutrients in the soil and consequently increase the nutrient loading and leaching.

Fertiliser application shall be timed to achieve maximum plant uptake, thereby reducing losses of nutrient to the environment. Ideal timing will be affected by the solubility (mobility) of the nutrient or fertiliser used, crop stage and rate of growth (and therefore its nutrient demand) and the nutrient fixing capability of the soil. Consideration should be given also to the amount of rainfall and/or irrigation experienced or expected.

Applying fertiliser long before the plant will take up the nutrient exposes the nutrient to potential loss. It is especially important to apply highly mobile nutrients at times when plants are actively growing to avoid losses to the environment between application and plant uptake, and thus to maximise the return on the investment.

**3.3 (c)** Fertiliser application (organic and mineral) shall be based on a fertiliser plan, indicating the crop nutrient requirement, the nutrient available in the soil and irrigation water, and the additional nutrients to be supplied from organic manure and from mineral fertilisers, if any. An example of how to calculate the nutrient balance is given in Annex IV. The supply of nitrogen from livestock manure including excreta by the animals themselves must not exceed 170 kg N/ha per year. The maximum land application of solid organic manure at any one time shall be that indicated in schedule 1. The fertiliser plan shall provide recommendations on the proper timing of the applications of fertilisers. A fertiliser plan shall be drawn for all the crops cultivated collectively on an area of more than 200m<sup>2</sup>. However, in this case the farmer shall still base the application of fertilisers in accordance with the limits stipulated in the regulations.

The nitrogen application standards shall be based on scientific fertilisation recommendations and crop requirements and indicate what doses are the best from an agronomic and economic point of view. Fertiliser plans shall be compiled by Agronomist or Technical Advisors recognised by the Competent Authority responsible for the Nitrate use in Agriculture.

Verification of compliance shall primarily be carried out through administrative checks through the National Nitrate Database and the Land Registry, supported by other checks as required. The system shall identify risk farmers by detecting the over utilisation of organic and mineral fertilisers. On-the-spot checks shall be used to verify that application of fertiliser is being based on a fertiliser plan issued by a recognised advisor and that proper Farm Records are being maintained.

### **3.4 Storage facilities for livestock manure**

**3.4 (a) (i)** The capacity of storage facilities for livestock manure of a holding shall be sufficient and adequate to provide for the storage of all the livestock manure which is likely to require storage between the 15th October to 15th of March.

**3.4 (a) (ii)** Manure shall be stored in a leak-proof, covered storage clamp which is connected to a cesspit.

**3.4 (a) (iii)** The Cesspits must be leak-proof, covered and must be sufficient to collect all urine and washings for at least 15 days.

**3.4 (a) (iv)** Cesspits and manure clamps shall be certified for tightness (leak-proof) by a warranted architect, every five years or following any structural works within the holding or in its immediate vicinity.

**3.4 (b)** Responsible storage is necessary to protect the local environment from the harmful affects that ‘run off’ from manure can have if it is allowed to enter watercourses or ground water. Storage allows the nutrients in the manure to be applied to crop-land at appropriate times in the growing cycle. Storage also allows the manure to be held when its application is prohibited.

Covering of the manure clamp prevents the input of rainwater and the production of wet manure and foul water, thus decreasing the possibility of pollution. Manure clamps shall be rendered leak-proof with a concrete base to avoid leaching that can cause pollution to the surroundings and the underground water. Cesspits shall be leak proof to avoid nutrient losses.

**3.4 (c)** The storage facilities for livestock manure of a holding shall be sufficient to store all the livestock manure produced on the farm between the 15<sup>th</sup> October to 15<sup>th</sup> of March. The livestock manure storage capacity of a holding, shall be calculated by taking into account the following farming practices:

- The number, type and age of animals present on the farm;
- the quantity of farmyard manure produced;
- any solids removed from slurry other than pig slurry by means of a slurry separator;
- any additional storage available off the holding including any agreement with another holding;
- any valid contract the holding has with a manure processing facility.

Calculation of the need for storage capacity shall be carried out in accordance with annex V.

Manure or slurry shall not be stored underneath the animals but shall be kept outside in a proper leak proof manure clamp and/or cesspit. Manure clamps shall be covered and built with three rendered high walls with the least possible surface: volume ratio. The floor of the manure clamp shall have a high gradient slope in order to facilitate the separation and collection of fluids which discharge into a cesspit for the collection of fluid. This shall not apply to the rearing of ovines and caprines reared on deep-litter systems.

Mechanical separation should be considered on large cattle farms to reduce the storage capacity required for the solid phase. The manure clamp and the cesspit shall be certified as being leak proof by a warranted architect.

Verification of compliance is carried out through administrative cross-checks with the National Livestock Database and the National Nitrate Database, supported by any other checks as may be required. The quantity of manure produced on each farm can be calculated by the NND through information from the NLD. During cross-checks the quantity of manure produced on the farm compared to the available storage capacity. On-the-spot checks serve to verify that manure produced is actually being stored in the manure clamp, that the storage facilities comply with regulations and that there are no losses of nutrients to the environment.

### **3.5 Manner of storage and location of farmyard manure storage**

**3.5 (a) (i)** Farmyard manure may be stored in the field where land application will take place subject to a maximum limit of 120 days between 16<sup>th</sup> of March to 14<sup>th</sup> of October if the dry matter content is at least 30%.

**3.5 (a) (ii)** Where stored in a field, farmyard manure must not be stored in the same location of the field in consecutive years, shall be stored in a compact heap and such heaps must not be placed within:

- 20m from water courses;
- 50m around a borehole, spring or well;
- 100m from any borehole used for a public water supply;

- 100m from the coast.

**3.5 (b)** Manure can be considered a contaminant if it comes into contact with surface or groundwater, therefore it shall be appropriately located during temporary storage in open fields. Rainfall can cause effluent discharge from manure stored outside and may pose a contamination threat to surface and ground water.

**3.5 (c)** The storage of farmyard manure in the field is permitted only for a maximum limit of 120 days during the period 16<sup>th</sup> of March to 14<sup>th</sup> of October, however the dry matter content of the manure shall be at least 30%. Farmyard manure shall not be stored in the same location of the field in consecutive years and shall be contained in a heap and at a distance from water courses, boreholes, springs, wells and the coast.

Verification of compliance shall be made through on-the-spot checks to ensure that farmyard manure is not stored in open fields during the close period (15<sup>th</sup> of October to 15<sup>th</sup> March). Via on-the-spot checks inspectors can ascertain, that when manure is stored outside, the minimum distances specified in the regulations are being respected and that only manure with > 30% dry matter content is temporary stored in fields.

### **3.6 Measures related to Land Management Practices**

**3.6 (a) (i)** Crop rotation must shall be practised where necessary.

**3.6 (a) (ii)** Farm holdings with an area >1 ha and under intensive irrigated cultivation shall have a Nutrient Management Plan.

**3.6 (b)** Legumes leave a lot of available nitrogen in the soil, which may be lost if there is no crop to take it up. Cover crops and crops with high nitrogen requirements reduce the concentrations of nutrients in the soil and reduce nitrate leaching during the rainy period.

A Nutrient Management Plan (NMP) is a written plan that describes how the major plant nutrients will be managed. The nutrient management plan aims to optimise production and maximise profit value from nutrient inputs while avoiding or minimising adverse effects on the environment.

**3.6 (c)** Land managers shall make and keep a cropping plan of their holding. Crop rotation must be practiced taking into consideration the nutrient requirement of the crops.

Irrigated crops tend to be over fertilised with nitrogen, farms with a holding size of >1 ha shall prepare a Nutrient Management Plan (NMP) for their holding within 2 years from the publication of the second National Action Programme. The NMP shall describe how the major plant nutrients (nitrogen, phosphorus and potassium) will be managed. The NMP shall cover all the area management by the land user and shall be issued by registered agronomists.

The NMP must:

- ensure that nutrient management meets all legal requirements,
- include a nutrient budget which compares nutrient inputs from all sources with all nutrient outputs,
- achieve desired changes in nutrient levels and production (e.g. increasing soil fertility from a poor base to support a higher stock carrying capacity; altering soil nutrient status to suit future crops),
- minimise the cost of supplying nutrients and avoids wasted spending on unnecessary or unused nutrients,
- minimise the risk of damage to the environment;
- consider the land manager's personal objectives.

A template of a NMP is given in Annex VI.

Verification of compliance shall be made via field inspections to verify that farmers are maintaining a cropping plan of their holding and are practicing crop rotation. The availability and compliance with the Nutrient Management Plan is verified through physical checks.

### **3.7 Measures related to Farm Management Practices**

**3.7 (a)** All animal holdings and animal passageways shall be suitably covered.

**3.7 (b)** Covering reduces the amount of foul water generated that would have to be collected and stored. Covering prevents environmental pollution of nearby sea, valleys or underground water and reduce air pollution to the minimum.

**3.5 (c)** Animal housing and animal passage ways shall be constructed in a way to ensure that runoff of foul water is intercepted and collected in a leak-proof cesspit

Verification of compliance shall be made through on-the-spot checks to ensure that farmyard building is compliant with the required standards and that there is no discharge of foul water from the farm.

## **4.0 – Record-Keeping and Compliance Monitoring**

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In this Chapter each action, aimed at helping the farmer control the application of nitrogen fertiliser and assisting the compliance with the measures contained in chapter 3, is marked as para. (a), the rationale for such measure is marked as para. (b) and the implementation and control for such measure is marked as para (c).

### **4.1 Records on the Use of Fertilisers**

**4.1 (a)** Users of organic and/or inorganic fertilisers shall be registered with the competent authority responsible for nitrates.

**4.1 (b)** Registration of users provides better control on the use of such fertilisers.

**4.1 (c)** The Competent Authority responsible for Nitrates shall keep a register of land users and the farm holdings making use of fertilisers. Use of fertilisers shall only be permitted to registered users. Sales or deliveries of organic manure shall be covered by receipts or delivery notes.

Compliance monitoring shall be carried out through administrative cross-checks with the National Nitrate Database.

### **4.2 Nutrient Management Course**

**4.2 (a)** Users of organic or inorganic fertilisers shall be required to attend a compulsory course on the use of fertilisers.

**4.2 (b)** Given that excess application of fertilisers is mainly related to the lack of knowledge and education of the farmer, training shall be obligatory.

**4.2 (c)** Farmers shall be obliged to attend a course on the use of fertilisers approved by the Competent Authority.

The Competent Authority shall be notified about the attendance of the course and shall issue certification to each farmer in this regard. Absence of such certification shall prohibit the farmer in question from using or purchasing fertilisers.

Verification of compliance is made through cross checks with the National Nitrate Database.

### **4.3 Farm Records**

**4.3 (a)** Records shall be kept on every holding and shall be available for inspection.

**4.3 (b)** Records provide information on the management of the farm holdings, the usage of inorganic and organic fertilisers as well as compliance with the required standards. A good system of record-keeping can help ensure that land application of manure efficiently uses the manure's fertilizer nutrients while protecting groundwater and surface water. Also, good records are evidence of good management.

**4.3 (c)** Records shall be kept so as to allow the following information to be ascertained on an annual basis: -

- the land user for the calendar year in question;
- the total agricultural area including the size and location of each field;
- the cropping regimes and their individual areas;
- the number of livestock kept on the holding, their species and type, and the length of time for which they were kept on the holding;
- the capacity of livestock manure storage, and where applicable the details of rented storage, farmyard manure production, manure separation, the details of any rental or contractual agreement;
- the quantity of each type of nitrogen fertiliser moved on or off the holding, the amount of each type of fertiliser applied, the nutrient content of the chemical fertiliser, the location where used,

- the date of movement of organic manure, the name and address of the consignee, the consignor and any third party transporter of the manure;

Records shall be prepared for every holding, for each calendar year by the 30<sup>th</sup> October of the following year and shall be retained for a period of 5 years from that date. Invoices, receipts and delivery notes shall also be retained. Farm records shall match information recorded in the NND. Templates of farm records are presented in annex VII.

Verification of compliance shall be made through on-the-spot checks to ensure that records are being maintained and are cross checked with the National Nitrate Database.

#### **4.4 Control of Sales and Movement of Fertilisers**

**4.4 (a) (i)** All sales and purchases of organic and inorganic fertilisers shall be notified to the competent Authority responsible for Nitrates.

**4.4 (a) (ii)** All importers, distributors and resellers of fertilisers shall be registered with the competent authority.

**4.4 (b)** Registration and monitoring of sales and purchases of organic and inorganic fertilisers provide a more effective control on the use of nitrogenous fertilisers.

**4.4 (c)** Sales or movement of livestock manure from farms shall be notified to the Competent Authority responsible for Nitrates by the producer, not later than the 30 October of every year. Sales of chemical fertilisers shall be recorded and notified to the Competent Authority responsible for Nitrates by not later than the 30 October of every year. Importation of chemical and/or organic fertilisers by land users shall be notified to the competent Authority by not later than the 30 October of every year.

Compliance monitoring shall be made through administrative cross checks with the National Nitrate Database.



## **5. Enforcement of the National Action Programme**

### **5.1 Functions, Powers and Duties of the Competent Authority**

The Department of Agriculture shall be the Competent Authority responsible for the implementation, monitoring and enforcement of the Nitrate Action Programme (NAP). The Department shall also be responsible for the dissemination of the obligations arising from the NAP to the farming and Agro-industry and reporting on the implementation of the NAP.

The Competent Authority shall set up a Nitrates Action Unit with the necessary administrative infrastructure for the implementation of the Nitrates Action Programme. It should have sufficient human, financial and other resources (access to national databases) to be able to meet its obligations. In particular, human resources are likely to have the most fundamental impact on the ability to operate an effective NAP.

The Nitrates Action Unit shall enhance the national Knowledge Base by:

- Undertaking studies on manure quality, soil nitrogen content; plant protection alternatives;
- Building and managing a soil monitoring surveillance network and collaborate with the MRA and MEPA regarding groundwater quality monitoring in order to synergise findings of both monitoring networks;
- Maintaining a database for monitoring changes in agriculture in terms of farm holdings, manure application, soil and manure analysis.

### **5.2 National Nitrate Database (NND)**

The Competent Authority shall maintain a national nitrate database containing the following data;

- Registered land users making use of fertilisers;
- Attendance to obligatory training;

- Information about the holdings pertaining to the land users (link with the LPIS);
- Information about livestock farms buildings, manure storage facilities and including a link with the National Livestock Database;
- Information about the land management practices;
- Information about the landscape, soil types, water sources and water courses;
- Information about the sales and movements of livestock manure;
- Data about the sales and purchases of chemical fertilisers;
- Information on checks conducted by other authorities;
- Findings of monitoring and controls;
- List of Advisors and technical experts;
- List of manure transporters.

The database will provide an integrated collection of data consolidated into a common pool, for the organization, storage, management and retrieval of information. The NND shall play an important role in the management of the Nitrates Action Programme. The system shall provide for an effective monitoring and control and shall be used to perform the following controls;

- Identification of non registered users;
- Detecting land users who exceeds the limits of manure applications;
- Detecting livestock farms who does not have sufficient manure storage facilities;
- Assisting in the verification of compliance in;
  - respect of the close period;
  - respecting the minimum distance established for the storage of manure;
  - respecting the application of fertilisers / manures on sloping land;
  - correctness of farm records;
  - quality of fertiliser plans and nutrient management plans;
  - respecting land management practices;

- respect of manner of land application of nitrogen fertiliser;

### **5.3 Enforcement**

The enforcement authority for the purpose of compliance with the Nitrates Action Programme shall be the Department of Agriculture or any other entity authorised by the Department. The inspection programme conducted by the Paying Agency for the verification of compliance with the NAP as part of the cross-compliance checks shall be taken into consideration.

The enforcement of good agricultural practices depends on an ongoing monitoring programme whereby the actual implementation of measures is assessed by a team of field officers and/or farm inspectors. These officers would be responsible for receipt of notifications, administration of the National Nitrate Database, collecting data and keeping records relating to fertiliser and manure management, identify risk farmers or/and land users, conduct inspections, suggesting remedial action to enforce measures in action programmes on an individual farm basis and propose the application of fines and legal actions.

**5.3.1** Administrative controls are required to verify farmer submissions of records regarding slurry and manure transports and disposal including dates, quantities and their final destination; to that proper records of inorganic fertiliser and livestock manure purchases are being maintained; to verify compliance with periods when land application of nitrogen fertiliser is prohibited, to identify risk farmers which make overutilization of fertilisers and those exceeding the maximum farm stocking rates, to verify that all farmers are registered and that all sales and purchases are notified to the competent authority.

All administrative controls shall be carried out by a Nitrate Control Unit specifically set up under the Agriculture Department, other than the present Control Unit within the Paying Agency that deals with the controls of EU funds including the respect to cross compliance.

**5.3.2** Field controls shall be carried out on the basis of a random and risk-based sample. Farms with higher environmental risks shall be monitored more intensively. The classification into risk groups will be based in part on the size of the farm holding, the type of animals on the farm, the use of chemical and organic fertilisers, the agricultural practices, the nature and the location of the

holding. The National Nitrate Database will play a key role in the identification of risk holdings. Large livestock farms, holdings which make use of a large amount of fertilisers, holdings that are located on sloping land and/or have soils with a potential of flooding and are close to water resources shall be considered farms with a relatively high risk.

### **5.3.3. Enforcement Notice**

Where the competent authority is of the opinion that a land user / livestock breeder / retailer is in breach or is likely to be in breach of the regulations in such circumstances which make it likely that the breach will continue or be repeated, the competent authority shall issue an enforcement notice.

The enforcement notice shall state:

- the required actions to be taken by the land user / livestock breeder / retailer upon whom it is served, which may be considered appropriate to remedy, or to prevent the continuation or repetition of, any contravention to which the notice relates;
- the period within which any such requirement is to be complied with; and
- inform the land user / livestock breeder / retailer on whom the notice is served of their right to appeal.

Depending on the nature of the non-compliance, the period for compliance stated in the notice as shall be reasonable for the circumstances and shall not in any case be less than 28 days.

An enforcement notice may be appealed and such an appeal shall suspend the period of compliance.

The competent authority may at any time;

- withdraw the notice;
- extend the period for compliance;
- with the consent of the person on whom the notice is served, modify the requirement of the notice.

## 5.4 Offences

The measures contained in the second Nitrates Action Programme shall be reflected in national legislation. In this way, all agricultural businesses regardless of their size, type of livestock or species of animal shall be obliged to comply with the standards of the National Action Programme. However, the way in which farms are required to make their reports and the intensity of inspection will differ according to their risk profile, so as to keep the administrative burden on farmers and the government's implementation costs as low as possible. This will also make it possible to employ the available inspection capacity as efficiently as possible.

The legislation codifying the measures contained in the Nitrates Action Programme shall make the non-compliance with the standards and obligations of the National Action Programme an offence and subject to legal proceeding and penalties.

The non-compliance with the measures of the NAP shall be enforced through the issuing of a warning, followed by punitive sanctions according to the severity of the breach. Penalties will take the form of a combination of administrative fines and criminal justice, with the emphasis on the application of administrative fines. Criminal prosecutions should be reserved for very serious infringements and for fraud.

## **6.0 – Assessment of National Action Programme**

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### **6.1 Assessing effectiveness of the Nitrates Action Programme**

**6.1.1.** Monitoring programmes shall be set up to assess the effectiveness of the second Nitrates Action Programme through administrative controls on the basis of the data sent to competent authority and cross-checks with other relevant databases as well as physical inspections on the farms themselves.

**6.1.2** Water quality monitoring programmes shall be set up to monitor both surface waters and groundwaters. These programmes have already been designed in accordance with the Water Framework Directive. These are presented in depth in the next section (section 6.2.)

### **6.2 General monitoring programme**

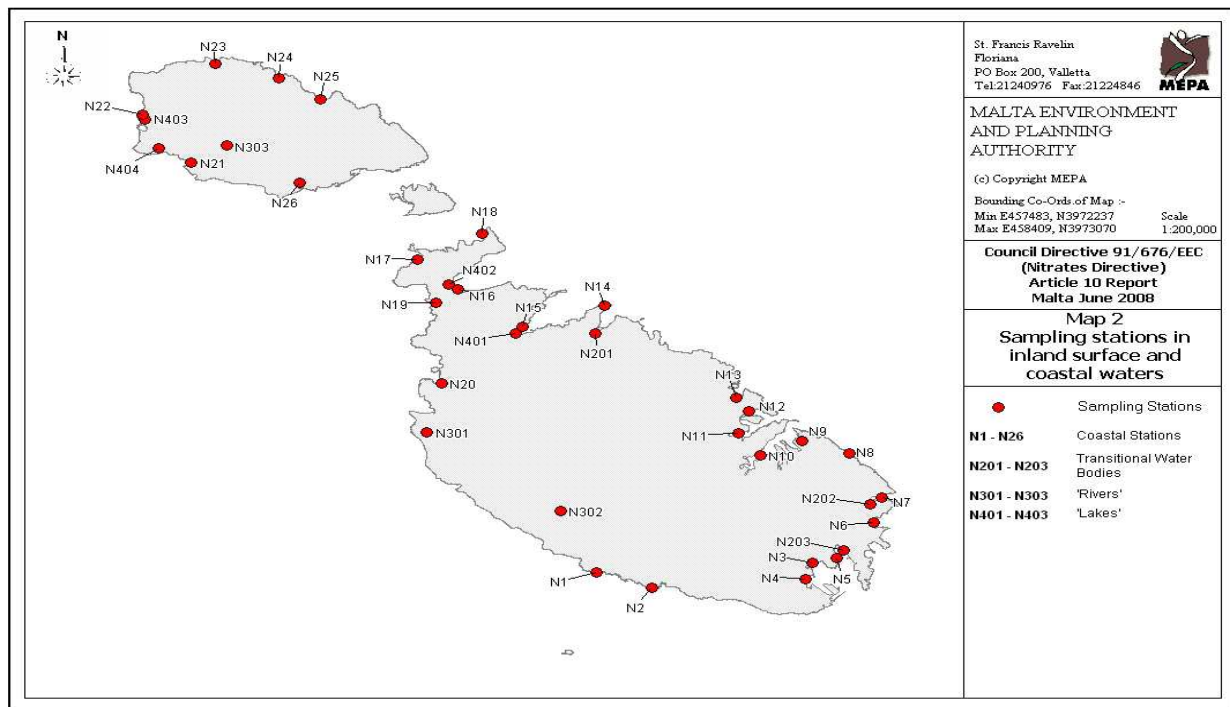
The competent authority shall draw up and implement monitoring programmes to assess the effectiveness of the Nitrates Action Programme.

#### **6.2.1 Monitoring of surface waters<sup>10</sup>**

The monitoring programme for surface coastal waters will build on the monitoring of the first cycle (see Figure 5 below) and the monitoring programs of the Water Framework Directive (WFD). A baseline survey of physical, chemical and biological parameters of coastal and selected inland waters will be launched in 2010 and is funded through the ERDF program. The data collected will help to develop assessment methods for surface waters within the context of both the Nitrates Directive and the WFD.

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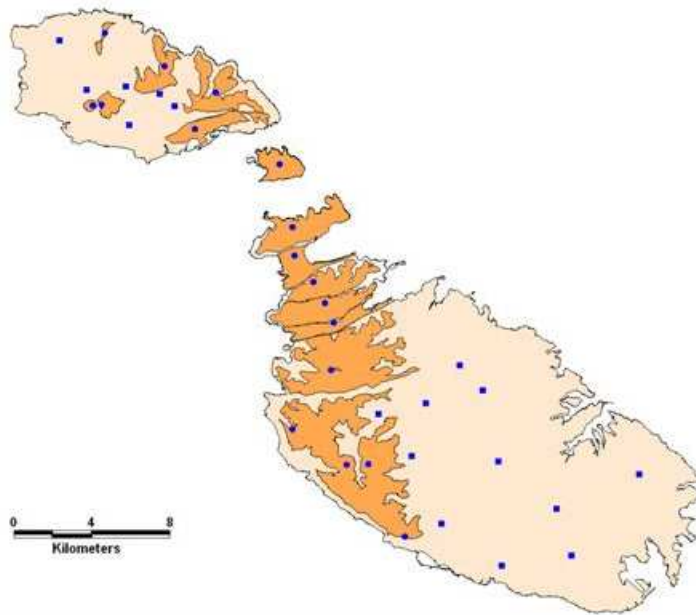
<sup>10</sup> Surface waters comprise inland freshwater streams and pools, transitional waters and coastal surface waters.



**Figure 5: Sampling Stations for inland, coastal and transitional water bodies during 2006-2008**

### 6.2.2 Monitoring ground waters

Article 8 of the Water Framework Directive (WFD) requires the establishment of “surveillance” and “operational” monitoring programmes. These monitoring programmes are intended to provide the necessary information to enable the Article 4 environmental objectives to be met, in particular the assessment of groundwater quantitative status, chemical status and the identification of significant, long-term trends in natural conditions and trends resulting from human activity in groundwater bodies. The programme foresees the gathering of qualitative data at regular intervals. Nitrates in groundwater will be monitored every six months in all groundwater bodies. The groundwater network is shown graphically in Figure 6 below:



**Figure 6: Water Framework Directive Groundwater monitoring network**

### **6.3 Localised monitoring of waters in higher-risk areas (drinking water protected areas)**

Monitoring for nitrates in groundwater shall also be undertaken in all abstraction stations utilised for the abstraction of water intended for human consumption in Malta, on a monthly basis. Such monitoring, concerns the two main groundwater bodies in the island (Malta Mean Sea Level and Gozo Mean Sea Level) as well as the smaller Mgarr-Wardija and Mizieb groundwater bodies.

Data generated from this groundwater monitoring programme will be utilised to supplement, when required, data from the WFD monitoring networks.

### **6.4 Monitoring impact of Nitrates Action Programme measures at farm level**

The Department of Agriculture shall be responsible for the assessment of the effectiveness of the action programme. The development of the National Nitrate Database will play a key role in the assessment of the effectiveness of the action programme. In addition a monitoring programme will be implemented, related to the effectiveness of the action programmes in terms of improving agricultural practice.

The plan proposed for the monitoring and evaluation of the action programme consists of

- collection of baseline data;
- implementation of the Nitrates Action Programme measures,

- collection of data over the monitoring period and
- evaluation of the effectiveness of change in indicators of farm management practices by comparison of baseline data, targets levels and limits with collected data after implementation.

An important output from the monitoring programme will be the ability to identify which action programme measures are effective, and which measures might need modification to achieve the objectives of the Directive.

## **6.5 Monitoring Programme**

There will be two components to the monitoring and evaluation of the Action Programme. The first is based on information specifically generated for the purpose of the evaluation process and on available national indicators and statistics. The second involves comprehensive monitoring and evaluation programmes in selected agricultural areas. The output of these two monitoring programmes in conjunction with the water quality monitoring data will meet the Commission's reporting guidelines for evaluating the temporal trends in aquatic environment and agricultural practice

### **6.5.1 National Indicators and Statistics**

There are two important national surveys in relation to provision of national indicators for the monitoring programme. These are the farm structure survey and the fertiliser use survey both conducted by the National Statistics Office.

### **6.5.2 Detailed Studies in Specific Areas**

There is a need for an additional study over and above the national monitoring and evaluation programmes to assess the action programme. A programme based on localised agricultural areas is proposed to address this need. Studies of agricultural areas shall include different types of landscapes consisting of steeply sloping ground, different soil types, various agricultural activities and farming systems. The selection of relevant agricultural areas will be undertaken in consultation with the Malta Resources Authority and the Malta Environment and Planning Authority. The objective of the monitoring and evaluation programme is to provide scientific evidence of the efficacy of the Action Programme. The results of the study will be compared with monitoring data groundwater quality.

Farm management and attitudinal indicators including:

- Farm Practices – soil fertility levels, land use patterns, fertiliser and manure management (spreading times, rates and locations); fertiliser & concentrate use, outputs, nutrient balances, farmyard surveys, buffer zone areas, farm financial surveys.
- Behavioural studies – attitudinal surveys.

The specific studies which encompass a combination of landscapes/agricultural practice, offer a unique opportunity to generate information that can be used to evaluate the efficacy of the Nitrates Action Programme measures. In so doing, where targets are not being achieved the necessary adjustments can be recommended.

Behavioural studies among the farming communities will assist in improving the understanding of the factors which are determining the farmer's understanding of and responses to the controls of nutrient loss from agriculture to water. The output from these studies will assist in developing better approaches to and improving the focus of the technology transfer strategies.

## **7.0 – Implementation of the National Action Programme**

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Malta's compliance with the Nitrate Directive necessitates adequate resources to implement the measures contained in the Nitrates Action Programme, including:

- a) Harmonisation of the Nitrates Action Programme with the regulatory measures required under Annex 3 of LN343/2001.
- b) Enforcement of measures required by the Nitrates Action Programme, on all holdings in Malta and Gozo
- c) Setting up proper testing capability for soil and water (in-house or out-sourced).
- d) Training of field technicians to implement action on the ground.
- e) Monitoring of Nitrate levels.
- f) Educational, Training and Advisory Programmes to support the farming community.
- g) Data collection.

### **7.1 Investment and funding**

#### **7.1.1 Investment for the Upgrading of Agricultural Holdings**

The Ministry for Resources and Rural Affairs will be providing financial support under the Rural Development Programme 2007 – 2013 for the upgrading of agricultural holdings under measure M121 (Modernisation of Agriculture holdings) with a budget of approximately €19 million.

#### **7.1.2 Funds for Training, Information and Diffusion of Knowledge.**

Funds are also made available for technical assistance through measure M114 (Use of Farm Advisory Service) and measure M111 Training, Information and Diffusion of Knowledge, with a total budget of approximately €2 million.

### **7.2 Setting up of Nitrates Action Unit within the Department of Agriculture**

The successful implementation of the Nitrates Action Programme will depend largely on the efficiency of the Nitrates Action Unit in monitoring and controlling agricultural holdings' compliance with the Nitrates Action Programme.

The Nitrates Action Unit should be **initially** composed of:

**Manager/Principal Agricultural Officer** – The Manager / PAO will be responsible for the monitoring of the implementation of the Nitrates Action Programme by the Nitrates Action Unit and also monitoring any changes needed to be carried out in the Unit or the Programme in order to reach the objectives of the Nitrates Directive;

**Senior Agricultural Officer** - will liaise between the Manager / PAO and the agricultural officers/controllers etc;

**4 Agricultural Officers** – These officers will initially work on an extensive information campaign regarding the obligations of farmers and the action needed to comply with such obligations. The information/educational campaigns will not only focus on the obligations farmers have to abide to but will also focus on agronomic practices. These practices should help farmers satisfy the requirements of the Nitrates Action Programme while maintaining with the least possible negative economic impact. Once the Nitrates Action Programme is fully operational, the number of Agricultural Officers should increase to 8 in order for the Unit to be able to carry out the necessary on-the-spot controls.

**2 Executive Officers** –the executive officers will be responsible for inputting data regarding the use of fertilisers, transport of manure etc. by farmers, issuing reports or enforcement notices and licences from the Nitrates database.

**1 system operator** – this officer will play a key role in the setting up and maintenance of an effective IT system i.e. the Nitrates Database. He will be responsible for ensuring that the Database and its related software reflects the needs of the Nitrates Action Unit.

### **7.3 Database**

In order to be successful in monitoring and controlling the application of the Nitrates Action Programme, and thus the compliance by farmers, it is of utmost importance for the Nitrates Action Unit to be in possession of an efficient database system. Such a database should not only permit an effective control on the implementation of the programme but should also be aimed at reducing the administrative burden.

### **7.3.1 Choosing the right Database system**

Over the past years the MRRA, with the help of EU funds, invested in the build up of the Integrated Administration and Control System (I.A.C.S) within the Paying Agency. The primary role and use of this system is intended for the reception of the EU aid applications for Direct Payments and Rural Development. Such a system already holds a significant amount of information needed by the Nitrates Action Unit for the implementation of the National Action Programme. Moreover the information in this system, regarding the land users and the land use (LPIS), are updated regularly together with the findings of the O.T.S. controls. Such controls, especially those regarding the Cross Compliance, (SMR 4 – Nitrates Directive) will reduce the amount of O.T.S. that the Nitrates Action Unit will have to carry out. On the other hand the Paying Agency should have access for the information and data gathered by the Nitrates Action Unit regarding the compliance of farmers, applying for schemes under pillar I and pillar II, with the Nitrates Directive. Other data which the Nitrates Action Unit will be using in the monitoring and control of the Nitrates Action Programme is that related livestock.

### **7.3.2 Enhancements to be carried out to the current system.**

Chapters 3 and 4 of the Nitrates Action Programme highlights the obligations of the farmer and the responsibilities and duties of the Nitrates Action Unit respectively. The enhancements to be carried out on the system should reflect such obligations, responsibilities and duties mentioned in these chapters. The enhancements should cater for;

- Registered land users making use of fertilisers;
- Attendance to obligatory training;
- Information about the land management practices;
- Information on the land use, i.e. crops being cultivated;
- Information about the landscape, soil types, water sources and water courses;
- Information on the nitrogen content of the parcels;
- Information about the sales and movements of livestock manure;
- Data about the sales and purchases of chemical fertilisers;

- Information on checks conducted by other authorities;
- Findings of monitoring and controls;
- List of Advisors and technical experts;
- List of manure transporters;
- List of authorised retailers of processed organic fertiliser and inorganic fertiliser;
- Forms to be filled by farmers regarding the transport of manure and the application of fertilisers;
- Enforcement notice templates, which will possibly generated/issued automatically by the system upon the identification of any breach or non-compliance;
- The automatically generation of parcel fertiliser plans, per parcel, from the system.

#### **7.4 National Advisory Services**

There is a need to establish a Farm Advisory Service entrusted with the primary task to provide technical support to the farming community. It is intended that the Ministry for Resources and Rural Affairs will set up a Farm Advisory Services to compliment Farm Advisory Services provided by private organisations. The services rendered would promote good agricultural practice as defined in the COGAP but more importantly help farmers in complying with the Nitrates National Action Programme through direct technical support and training.

The Farm Advisory Services shall be made up of a team of experts in the field of agricultural policy and resource management. It is expected that this team would be responsible for the implementation of four main areas:

- I. Development of technical support for the farming community through:
  - Providing support to farmers who voluntarily seek technical assistance;
  - Engaging in farm visits to provide on-site practical support;
- II. Raising farmer awareness on effective farm management and crop production by:
  - Co-ordinating and implementing a nation-wide awareness campaign targeting the farming community with particular attention being given to the promotion of

effective farm management strategies and providing guidance on compliance with the Nitrates Action Programme;

- Organise farmer training courses and sessions and collaborate with the Malta Standards Authority on certification of farmers attending these courses.

## **7.5 Nitrates Action Programme – Dissemination of Information**

The importance of providing guidance on this Nitrates Action Programme is essential. The development and dissemination of a non-technical guidance document shall be prepared and distributed to the farming community and stakeholders and also be made available on the internet. It is expected that the document will explain the requirements of the NAP and provide practical tips on how the measures specified in the NAP should best be implemented. This document will be complemented by the services offered by the Farm Advisory Services. A DVD will be produced to describe the obligations within the Nitrates Action Programme.

## ANNEX I – Cross Compliance Nitrate Standards

Standard	Requirement
B1	Application of mineral and organic fertilisers should be based on a fertilisation planning. Input and output of plant nutrients must be balanced. Mineral nitrogen fertilisers and organic fertilisers must be applied close to sowing. Splitting of fertiliser application is recommended whenever possible.
B2	Livestock manure applied on land should be less than 170kg N/ha.
B3	Purchase of all types of mineral and organic fertilisers should be recorded by the farmer.
Q1	All types of organic and inorganic fertilisers should not be applied between the 15 <sup>th</sup> October and the 15 <sup>th</sup> of March.
Q2	Liquid manure should not be applied to soils with a slope of 10 m/100 m or more.
Q3	Solid manure and mineral fertilisers should not be applied to sloping land unless they are incorporated immediately after application.
Q4	Fertilisers (mineral and organic) should not be applied to water saturated soils and to soils that are likely to be flooded.
Q5	All types of mineral and organic fertilisers should be distributed uniformly on the field.
Q6	Liquid and solid manure should be incorporated into the soil as soon as possible.
Q7	Fertilisers (mineral and organic) should not be applied to any type of fresh water courses.
Q8	A minimum distance of 50 m must be kept from natural water courses and boreholes during fertiliser application.
Q9	Liquid and solid manure should not be applied within 100 m from the coast.
Q10	Field storage of solid manure is possible between 16 <sup>th</sup> of March to 14 <sup>th</sup> of October if the dry matter content is at least 30%.

L1	Livestock farms should have a structure that provides sufficient storage capacity for solid manure be stored in the closed period between 15 <sup>th</sup> October to 15 <sup>th</sup> of March.
L2	Livestock farms should have a capable of collecting all urine and washings for at least 15 days.
L3	Livestock manure should be stored in a covered clamp between 15 <sup>th</sup> October and 15 <sup>th</sup> of March.
L4	Manure should be stored in a leak-proof, covered storage clamp which is connected to a cesspit.
L5	The cesspits must be certified as leak proof by a warranted architect.
L6	Silage should be stored in appropriate leak-proof clamps.
L7	The livestock breeder should keep records of manure transport.
L8	Records of manure transport should contain at least name of contractor, quantity and type of manure, date of delivery and where transported
L9	The minimum storage capacity for solid manure must be sufficient to cover the closed period.

## Annex II: Plant Nutrient Requirements

Crop Type	Yield (t/ha)	Nitrogen Kg N/ha	Phosphorus kg P <sub>2</sub> O <sub>5</sub> /ha	Potassium Kg K <sub>2</sub> O/ha
Carrot	30	90	80	160
Fennel	50	140	80	160
Wheat	5	150	100	100
Barley	5	100	80	80
Oats	4	60	80	60
Maize	10	250	100	120
Sorghum	30	250	100	150
Rape seed	3	100	100	100
Chickpea	2	30	80	80
Broad bean	3	20	80	80
Bean	3	20	80	80
Pea	15	30	80	160
Grass	30	70	100	100
Sulla	15	50	120	120
Potatoes	30	150	120	240
Basil	30	90	50	150
Brussels sprouts	10	110	80	160
Cabbage	30	110	70	160
Chicory	40	130	60	180
Endive	25	90	50	150
Lettuce	30	130	60	180
Leek	30	150	60	180
Parsley	30	80	60	120
Celery	20	160	90	180
Spinach	25	120	50	150
Asparagus	6	90	80	150
Artichoke	30	170	60	180
Broccoli	20	140	90	180
Cauliflower	30	100	70	160
Dill	1	110	80	80
Cucumber	50	180	120	240
Watermelon	50	160	90	180
French bean	30	40	50	100
Eggplant	35	170	80	240
Melon	40	150	100	200
Pepper	40	200	100	300
Tomato	50	130	100	200
Pumpkin	30	130	80	160
Courgettes	26	130	100	200

Garlic	12	150	80	160
Onion	30	120	80	160
Beet	60	160	70	210
Radish	30	40	100	100
Turnip	30	90	80	160
Table grapes	20	180	90	210
Wine grapes	15	110	60	180
Quince	12	90	60	120
Apple	30	130	60	140
Pear	25	160	80	160
Apricot	20	170	70	210
Cherry	20	110	80	80
Almond	10	100	80	80
Peach / Nectarine	30	170	70	210
Plum	20	150	60	180
Orange	25	210	90	210
Lemon	25	200	80	200
Tangerine	25	180	80	180
Grapefruit	30	170	70	160
Olive	3	130	80	160
Fig	10	90	60	120
Pomegranate	10	90	60	120
Strawberry	30	190	100	300
Mulberry	12	120	60	180

#### Annex III: N content in livestock manure

Livestock	N content in manure	Maximum rate of manure to be applied (tons/ ha)*
Cattle	0.56%	30
Pig	1.8g/L	94,000 L
Layer	1.52%	11
Broiler	2.62%	6
Rabbit	0.83%	20
Sheep	0.90%	19

\*Approximate application rates of different manures to comply with 170kg N/ha.

**Annex IV: Example of how to calculate nutrient balance**

**FERTILISER PLAN TEMPLATE**

<b>Name:</b>							
<b>I.D.</b>							
<b>Address:</b>							
<b>Crop Type</b>							
<b>Expected Yield (t/ha)</b>							
<b>Soil Test Data mg/l</b>	<table border="1"> <tr> <td><b>N</b></td> <td><b>P</b></td> <td><b>K</b></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table>	<b>N</b>	<b>P</b>	<b>K</b>			
<b>N</b>	<b>P</b>	<b>K</b>					

		Amount	Plant nutrients			
			N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
Plant nutrient requirement kg/ha	<i>area of field</i>		<i>value</i>	<i>value</i>	<i>value</i>	
Plant nutrients requirement in the given area (kg)			<i>value</i>	<i>value</i>	<i>value</i>	
Nutrient levels in soil						
Nutrients to be applied from irrigation water						
Nutrients to be applied as fertiliser	<i>type of manure</i>		<i>value</i>	<i>value</i>	<i>value</i>	
Type of manure to be applied and the nutrient content in 1 tonne			<i>value</i>	<i>value</i>	<i>value</i>	
Maximum amount of allowable Nitrogen in livestock manure that can be applied in the given area						
Maximum Rate of manure (tonns)		<i>quantity of manure</i>				
Amount of manure required in a given area to satisfy the plant requirements, containing the given nutrients (tonns)		<i>quantity of manure</i>		<i>value</i>	<i>value</i>	<i>value</i>
Ammont of nutrients to be applied from fertilisers				<i>value</i>	<i>value</i>	<i>value</i>
Amount of N fertiliser	<i>fertiliser type</i>	<i>value</i>				
Amount of P fertiliser	<i>fertiliser type</i>	<i>value</i>				

Amount of K fertiliser	<i>fertiliser type</i>	<i>value</i>			
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Prepared by:

\_\_\_\_\_  
Signature

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Date

**Annex V: Calculation of the need for manure / slurry storage capacity**

Animal	Capacity in Days	No of Animals on Farm	Total Volume Manure for Capacity/Head in M <sup>3</sup>	Total Volume in M <sup>3</sup> (CxD)	
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<b>Broilers</b>	15		0.004		Cesspit
	153		0.015		Manure Clamp

<b>Layers</b>	15		0.00106		Cesspit
	153		0.01683		Manure Clamp
In Case of Air Drying	153		0.009792		Manure Clamp
<b>Pullets</b>	15		0.00135		Cesspit
	153		0.00918		Manure Clamp
<b>Total</b>	15				Cesspit
<b>Total</b>	153				Manure Clamp

<b>Rabbits</b>	15		0.04875		Cesspit
(Does)	153		0.11		Manure Clamp

<b>Swine</b>					
<b>Sows</b>					
Lactating	15		0.15		Cesspit
Gestating	15		0.045		Cesspit
Replacement	15		0.045		Cesspit
<b>Boars</b>	15		0.045		Cesspit
<b>Fatteners/Weaners</b>	15		0.06		Cesspit
<b>Total</b>	15				Cesspit
<b>Sows</b>					
Lactating	153		1.16		Manure Clamp
Gestating	153		0.07		Manure Clamp
Replacement	153		0.07		Manure Clamp
<b>Boars</b>	153		0.07		Manure Clamp
<b>Fatteners/Weaners</b>	153		0.07		Manure Clamp
<b>Total</b>	153				Manure Clamp

<b>Ovines and Caprines</b>	15		0.03		Cesspit
	153		0.26		Manure Clamp

<b>Cattle</b>					
<b>Cows</b>					
Lactating + Dry	153		7.36		Manure Clamp
Lactating Only	15		0.9		Cesspit
lactating + Dry with Bedding	153		8		Manure Clamp
In Case of Seperator	15		1.5		Cesspit
	153		1.84		Manure Clamp
<b>Heifers 1-2 Years</b>					
Heifers 1-2 Years + Bulls + Sire	15		0.12		Cesspit
	153		2.88		Manure Clamp
With Bedding	153		3.18		Manure Clamp
In Case of Seperator	15		0.29		Cesspit
	153		0.76		Manure Clamp
<b>Heifers 0-1 Years</b>					
Calves	15		0.18		Cesspit
	153		1.12		Manure Clamp
With Bedding	153		1.24		Manure Clamp
In Case of Seperator	15		0.26		Cesspit
	153		0.28		Manure Clamp
Total	15				Cesspit
Total	153				Manure Clamp

## **ANNEX VI: GUIDELINES FOR A NUTRIENT MANAGEMENT PLAN**

### **Part A: Property details**

This section identifies the property and the people responsible for the Nutrient Management Plan.

- Compile the contact details.
- State the farm areas – total, effective (i.e. in production or fallow in preparation for production; exclude non-productive areas such as pathways, buildings) and irrigated (if any).
- State the irrigation type(s).
- Describe the enterprise types (Horticulture, Arable, Viticulture, Dairy, Swine, etc.).
- Statement of purpose of the plan.

### **Part B: Plan objectives, land management units and environmental risk**

#### Objectives

- Comply with all legal requirements related to nutrient management activities.
- Take all practicable steps to maintain or enhance the quality of the property's water resources.
- Take all practicable steps to ensure that there is an adequate supply of soil nutrients to meet plant needs.
- To take all practicable steps to contain nutrients within the property boundaries.
- Take all practicable steps to minimise the risk of nutrient contamination of any areas of significant vegetation and/or wildlife habitat.
- Undertake a nutrient budget.

If you choose to reject any of these, attach justification (e.g. a farm map showing that there are no areas of significant vegetation or wildlife habitat).

#### Property Management Objectives

- Write any extra objectives the owner or manager chooses to set – e.g. objectives about achieving particular nutrient level targets or objectives about farm practices such as soil testing.

- Identify the 'land management units' (LMU's) for the farm, i.e. areas of the farm that are under similar management and that will respond to management in similar ways. Consider such things as soil types, slope, management activities (e.g. dryland or irrigated, significantly different crop types) and differences in historical management.
- If all of the farm is managed similarly and responds to that management in similar ways, only one LMU is needed.
- Make a brief note distinguishing each LMU in the table and note the area it covers.
- Mark these on a farm map and attach it to the NMP.
- Make a list of farm nutrient management activities and their possible environmental consequences – e.g. nitrogen fertiliser use might lead to contamination of surface or ground water. For each of these, estimate the likelihood of adverse environmental effects and the consequences of such events.
- Consider only the inherent risk caused by the activity and do not discount the risks because good management will overcome it.
- Note any activities that have medium or higher likelihood of adverse environmental effects and/or medium or higher consequences in the table of environmental risks. Identify the LMU's on which these will occur.
- Include comments about the risks identified. For example regional concerns about farm activities.
- Identify the main nutrient management activities that you will address in your planning.
  - N Fertiliser Use
  - P Fertiliser Use
  - Effluent disposal
  - Others

You can add any objectives you like, but be aware that management practices should then reflect these and set out steps to achieve them.

## **Part C: Management guides**

- Describe the management planning for nitrogen fertiliser use, phosphate fertiliser use and dairy effluent application.
- Note the types of applicable fertiliser, application rates and locations where they will be spread (LMU's).
- List any specific requirements your business has about nutrient use or activity.
- List any specific requirements your Council has about this nutrient use or activity. These will include conditions that must be met for the activity to be a 'permitted activity' or conditions imposed as part of any resource consent held by the farm for this nutrient management activity.
- List the best management practices (BMPs) that the farm will use to reduce environmental risks from this activity.
- It is not necessary to adopt all the possible BMPs for a particular risk or activity but the practices chosen need to be suitable for managing the inherent risks identified for the property.
- For each BMP included, note how the manager will check that these are implemented
  - e.g. runoff control noted on a farm map.

### **Doing self-assessment**

- The property manager needs to complete a self-assessment on a yearly basis, checking that the management practices did achieve the objectives set at the beginning.
- Verify achievement of nutrient management activity requirements.
- Verify implementation of each management practice listed at the planning stage.
- Assess the effects of the nutrient management activity overall. Verify that the code specific and property objectives were achieved.
- Assess the achievement of the objectives, whether met and/or were barely achieved or the manager was not satisfied with performance.

- If the objectives are not achieved or partially achieved, then changes in management practice are required. Note the new management practices that will be used, the person responsible for ensuring these are implemented and a deadline for completion or introduction.
- Write in the actual completion date when each new management practice is adopted.
- The person responsible for the NMP (owner or manager) needs to sign off and date the self-assessment.

### **Farm map**

- Check that there is at least one farm map attached, showing the land management units or other distinctions between management areas.
- Extra farm maps can be added, e.g. to show areas receiving particular fertiliser types, to show location of water courses or natural water sources etc.

### **Nutrient budgets and soil test results**

- Check that there is at least one nutrient budget attached for each land management unit, this is particularly relevant where you identified significant environmental risks from nutrient management activities.
- The nutrient budget should use the planned nutrient inputs and the expected production outputs from the area. If several fertiliser options were considered then the nutrient budget should support the final choice.
- Soil test results are important for establishing initial soil nutrient levels for nutrient budgeting.
- Further soil tests are useful checks on trends in soil fertility over time to compare actual changes with those expected and planned.

## ANNEX VII: TEMPLATE FOR RECORDS

### RECORDS FOR LAND OWNERS

Name & Surname

I.D. No.

#### **Cropping Plan**

Parcel Ref. or LMU	Area (ha)	Crop type

#### **Purchase of mineral / organic fertilisers**

Date	Type of organic / mineral fertiliser	Nutrient content	Quantity (kg)	Supplier or ID of consignee

#### **Use of mineral / organic fertilisers**

Date	Type of organic / mineral fertiliser	Nutrient content	Quantity (kg)	Parcel Ref. or LMU

#### *Additional Information*

- Copy of farmer's parcel list
- Invoices / receipts of purchase / delivery notes
- Soil test results

### RECORDS FOR LIVESTOCK BREEDERS

Name & Surname

I.D. No.

#### **Movement of organic manure**

Date	Type	Quantity	I.D. no. of consignor	I.D. of transporter

#### *Additional Information*

- Herd book
- Invoices or receipts of sales / delivery notes
- Contractual agreement of rented storage
- Sketch of manure storage facilities
- Architect certificate of compliance (non leakage)
- Technical information of manure separation equipment