4. Key challenges for the management of Jersey's water environment

This section summarises the key challenges for managing the water environment in Jersey as informed by a combination of: the predominant land use on the Island (section **Error! Reference source not found.**); expert judgement from local water quality specialists; known water environment pressures for example pollution incidents and location of certain risk factors; experience drawn from the implementation of the IWMP process elsewhere; known sector pressures; and the outputs from the classification results described previously (section 3).

It is a pressure assessment and not an impact assessment and simply identifies the range of activities occurring on the Island and the types of pressures these are known to exert on the water environment.

The key challenges are structured under eight categories. The categories can both affect the status of the water environment – i.e. **act as 'pressures'** - but also could be affected by other pressures on the water environment – i.e. **be 'receptors'**. One example of this for instance is water supply which acts both as a pressure on the water environment (through impounding reservoirs and removing water resource from the environment through abstraction for drinking water supply) and a receptor (being impacted upon by pressures such as nitrate and pesticide pollution).

For simplicity, and to understand the challenges in relation to the sectors involved, the key challenges for Jersey have been categorised as follows:

- **Water supply**
- **Wastewater management**
- **Industry**
- **The rural environment**
- **The urban environment**
- **Tourism and recreation**
- **Physical modifications and changes to the natural flow and level of water courses**
- **Invasive non-native species**

The following sections look at each of the individual categories in turn and how they can affect the status of the water environment by acting as a pressure and also, where relevant and appropriate, where a category is acting as a receptor..

Balancing pressures and receptors with key components of water use on the Island is in itself a key challenge for the IWMP.

4.1 Water supply

Water supply is a key issue for Jersey to address through the IWMP, where a steadily growing population needs to be served with water supplies of a suitable standard for human consumption taken from an already carefully balanced resource.

Water supply can act as both a pressure on the water environment and a receptor. There are two key components to water supply: water **quantity** and water **quality**. Both are key challenges for the Island's resources and each has the potential to affect the other; for example pressure on water quantity from abstraction can then exacerbate any existing quality issues (for instance by reducing dilution capacity in streams) and this can then result in restricted options to mitigate quality issues, such as the ability to blend

water supplies containing high nitrate concentrations to bring down the levels to those acceptable for drinking water supply. Quantity and quality are considered in the following sections.

4.1.1 Water supply as a pressure

In the context of water supply, quantity is a key pressure both on surface waters (through mainly public water supply sourced from the Island's streams) and on groundwaters (mainly through private water supplies via boreholes). These uses are considered separately below.

Public water supply
Water supply is a key pressure on Jersey's Water environment. Jersey Water, the Island's sole public water supplier, are responsible for supplying 90% of the Island's domestic population.

In 2013 Jersey Water supplied 7,047 million litres of water to approximately 38,000 homes and businesses from two water treatment works. 95% of the Company's water comes from surface water supplies (streams and online reservoirs) with the remaining 5% pumped from groundwater supplies. The Company operates six water supply reservoirs, located in four of the Island's major catchments. (Table 1). These are supported by a number of abstractions (the locations of which are shown in **Error! Reference source not found.** and Figure 1).

At full capacity, the reservoirs hold enough water for approximately 3 months of supply (2,687 million litres). In case of emergencies and to meet future demand pressures, a reverse osmosis desalination plant is located at La Rosiere on the south-west coast of the Island which, at full capacity, produces 6,000 cubic metres of fresh water per day (25-30% of normal daily demand) (Jersey Water 2009).

A system of raw water transfers operates between the reservoirs so that water can be balanced across the Island either as and when a reservoir becomes full, if demand dictates or even if there is a quality issue in one reservoir that requires additional blending and dilution prior to supply. None of the water from the catchwaters enters the supply system directly; it is stored and used to assist with water quality issues when needed.

Table 1: Jersey Water's sources

Jersey Water's Source type	Name
Reservoirs	Millbrook (0.036 M m^3)
	Val de la Mare (0.908 M m^3)
	Dannemarche (0.109 M m^3)
	Grands Vaux (0.227 M m^3)
	Handois (0.204 M m^3)
	Queen's Valley (1.135 M m^3)
Catchwaters	Fern Valley
	Greve de Lecq
	Les Mouriers
	Little Tesson
	Tesson Tanks
	Pont Marquet
	St Catherine's
	Vallee des Vaux
Groundwater	St Ouen's
Desalination	La Rosiere Reverse Osmosis

The Jersey Water Resource Management Plan (WRMP) (Jersey Water, 2009) uses a 25 year planning horizon for managing the Island's water resources. It sets out the current situation of drinking water supply capacity and demand and considers future scenarios and the effect these may have on water supply.

The current WRMP forecasts an 11% reduction in water supply and 15% increase in water demand by 2032. This is predicted to result in a shortfall of 6.5 Ml/d by 2032 during a 1 in 50 year drought. As part of the WRMP process, Jersey Water are required to consider options to address this projected shortfall in supply demand balance; these options could place further pressure on the water environment in the future.

Private Water Supply

As mentioned previously Jersey Water is the sole supplier of mains water in Jersey and provides potable water supplies to meet the domestic requirements of about 90% of the Island's population. The remaining 10% of the population are supplied from private abstractions predominantly from boreholes and wells.

As part of this study, an analysis of recent groundwater abstraction licences and registrations was undertaken, which estimated that approximately 551,724 m^3 per annum is abstracted from groundwater for domestic water supply. This equates to approximately 26% of the total groundwater abstracted on the Island. A further 387,250 m^3 per annum, or approximately 18% of total groundwater abstracted, is drawn from private boreholes in order to supply businesses on the Island.

Sourcing enough water to supply a growing population on a small island is difficult; doing so whilst not only protecting but also enhancing the water environment is going to be a key challenge for the IWMP and key stakeholders such as Jersey Water and the agricultural sector to tackle. The future risk from climate change and changing rainfall patterns to water supply could further add to the pressure on the water environment in the future.

4.1.2 Pressures acting on water supply - water supply as a receptor

The status assessment of Jersey's surface and groundwaters (Section 3) combined the available surface and groundwater monitoring data in order to assess the current status of the Island's water bodies with respect to water quality. This status assessment has confirmed the already-known and well documented issues concerning nitrates on the Island, with more than 80% of stream catchment water bodies failing to achieve Good status for the nitrate and six of the eight WMA's classified as 'at risk' for pesticides... The groundwater assessment also highlighted this pressure from nitrates and pesticides.

The European Community (EC) drinking water limit for nitrate is set at 50 milligrams of nitrate per litre (mg NO_3 l^{-1}); which is also reflected in the Water (Jersey) Law 1972 as amended in 2004. This means that the Maximum Allowable Concentration (MAC) for nitrates in the water supply on Jersey is 50 mg NO_3 l^{-1}. For several decades now, the nitrate concentrations in water abstracted for human consumption has exceeded these limits for at least some of the year in most years. The situation could be worse during the wetter months of the year and when rainfall is particularly intense, as the problem is closely linked to run off and leaching from land in upstream catchments (this is currently being investigated by Department of Environment).

As a consequence of the high levels of nitrate in source waters, the Company applies and receives from the Minister for Planning and Environment a dispensation under the Water Law, and has done since 2004 when 'wholesomeness' was first defined in Jersey. This dispensation has allowed 33% of samples in any one year to exceed the 50 mg/l limit (but be no greater than 70 mg/l) in the Drinking Water supply.

During the consultation on the 2009 dispensation Health Protection (Health and Social Services Department) agreed to the dispensation but advised that they would not continue to support this dispensation unless steps were taken to tackle catchment inputs of Nitrogen.

In August 2012 Health Protection agreed to support another dispensation on the condition that the maximum level in supply under the derogation was reduced from 70mg/l nitrate to 65mg/l. The latest dispensation runs from January 2014 to December 2016 under revised conditions, which are for any year:

a) Regulatory samples must not exceed the maximum allowable concentration (50mg/l) for six months of the calendar year;
b) No regulatory sample shall exceed 65 mg/l;
c) No more than 15% of regulatory samples shall exceed 55 mg/l; and
d) No more than 33% of regulatory samples shall fail to satisfy the formula [nitrate]/50 + [nitrite]/3 < 1, where the square brackets signify the concentrations in mg/l for nitrate (NO3) and nitrite (NO2) respectively.

Table 2: Uses of the dispensation for nitrate

Year	Number of dispensation uses
2007	19
2008	0
2009	23
2010	23
2011	30
2012	0
2013	22

Different treatment options have been considered, such as blending and Reverse Osmosis (RO). Although RO this can remove nitrates effectively, it is energy intensive, loses 10% of water through the process and produces highly concentrated nitrate waste which would need disposing of on the Island. A more sustainable option being considered is tackling nitrate pollution at source through action in the agricultural sector. Nitrate pressures from this source are discussed in the Rural Environment pressures section to follow.

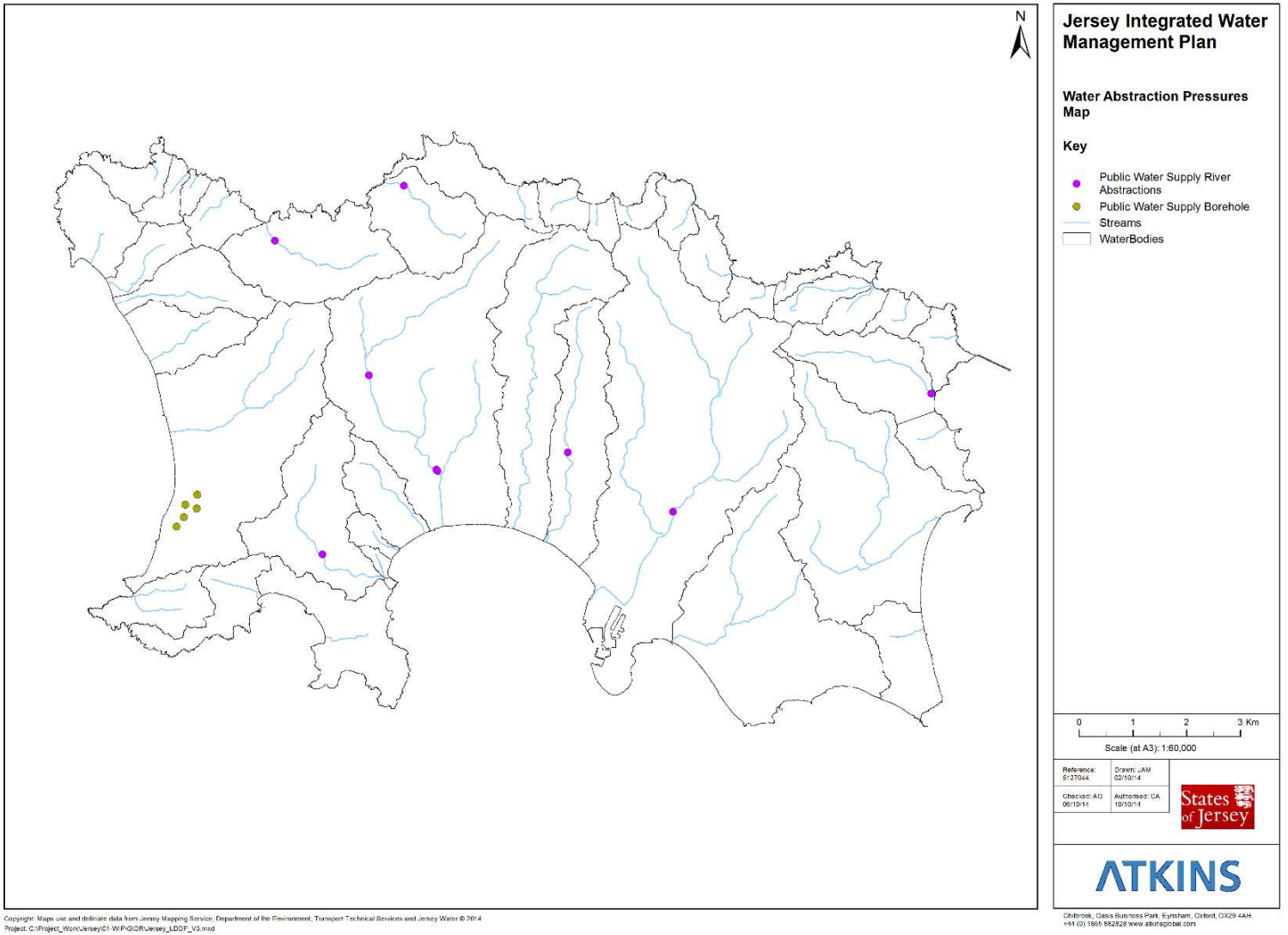


Figure 1: Key water abstraction pressures in Jersey

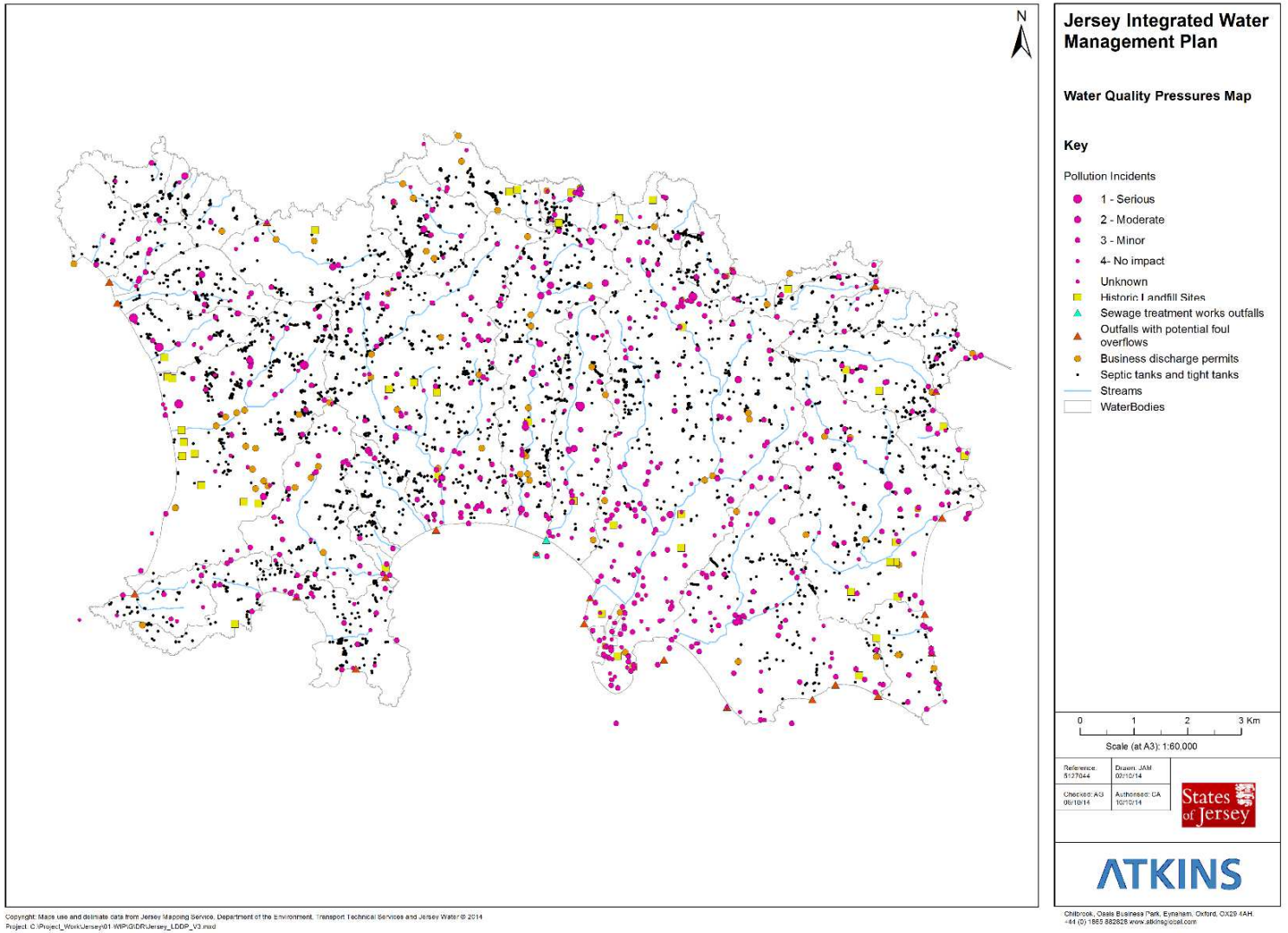


Figure 2: Some key water quality pressures on Jersey

4.2 Wastewater management

Wastewater management on Jersey differs between urban and rural areas and each pose different risks to the water environment.

Mains sewerage serves the key urban areas with wastewater facilities, which are administered by the Jersey Transport and Technical Service (TTS) who treat wastewater for the majority of the Island's population via one main wastewater treatment facility ('Bellozanne') on the southern side of the Island and a smaller satellite plant at Bonne Nuit. Treatment processes at Bellozanne include primary settlement, biological treatment by the activated sludge process, and ultra violet disinfection prior to discharge into St Aubin's Bay. In recent years TTS have been unable to meet the nutrient standards set by their discharge permit of 10 mg/l (the standard set in the EU Urban Waste Water Treatment Directive), with annual averages of total nitrogen ranging from between 22 – 39 mg/l from 2009 to 2013. Wastewater can contribute sources of pollutants to the water environment; in this case the coastal waters around the Island. This may include many of the pollutants affecting the status of the water body, such as nitrates, phosphates, dangerous substances and specific pollutants. In response to growing population pressures and the need to ensure adherence with environmental standards, there is currently a plan to replace Bellozanne which should help relieve the pressure from this facility. This new plant also has the potential to help to reduce pressure on the nutrient loading in St Aubin's Bay and any corresponding ecological impacts.

Aside from the mains wastewater network, it is thought that approximately 10% of the Island's households, mainly in the rural areas, are served by private systems such as septic tank and soak-away systems, private package treatment plants and tight tanks. There is a potential risk that, when poorly placed in relation to a water course, or when inappropriately managed, private wastewater systems can contribute to water pollution in surface waters and groundwaters, for example nitrates, phosphates, microbial loading and metals from seepage of sewage effluent. In 2012 it was estimated that domestic wastewater contributes 24% of total reported pollution incidences; although the extent of these incidences in relation to the rural sewerage systems is not separated (the 24% includes urban sewerage pollution incidences). A study carried out by the University of Plymouth (2001) in the Val de la Mare catchment indicated that domestic land occupied 6% of the catchment area but contributed an estimated 10% of the total nitrogen load, predominantly from Septic tanks and soakaways. It is clear that wastewater management in the rural sector remains a risk to the water environment.

4.3 Industry

Jersey does not have a strong industrial past or present; there are no large or widespread manufacturing industries on the island; this is reflected in the chemical classification results with a lack of failures against industrial contaminants in the catchment and coastal waters.

Industrial processes on a smaller scale can, however, exert pressure on the water environment if they are unregulated, utilising key substances of concern or if they are present in large numbers on the Island that collectively could have an effect. It is currently estimated that chemical / industrial pollution is responsible for 7% of reported pollution incidences on the Island (States of Jersey 2012). Furthermore, the future of industry on the Island is not known and could change with the economic climate. As such, industry is still considered a key challenge to the water environment both today, and into the future.

Coastal fisheries and aquaculture

This industry is important to Island life; in 2012 the value of the shellfish and wetfish combined catch was estimated at just over £6million. In terms of environmental quality, the industry can be considered as both a receptor and a pressure.

- **Fisheries and aquaculture as a receptor:** Good water quality is key to the health of fish and shellfish stocks in the surrounding coastal waters, and this in turn is heavily reliant on careful management of

freshwaters draining into the coastal waters. Key concerns for near shore fishing industries can include contributions of faecal matter to the coastal waters (which could arise from inappropriate wastewater management or poor farm manure management for example) and elevated levels of nutrients (similarly from rural run off from agricultural land as well as urban discharges) that can cause algal blooms in the coastal zone, smothering of the shore with algal mats and then subsequent risk of de-oxygenation.

- **Fisheries and aquaculture as a pressure:** The industry can also act as a pressure on the water environment through increased boat activity and pollution, destructive fishing practices and general over fishing.

The land-based activities exerting potential pressure on coastal water quality will therefore need to be carefully managed to ensure that the fisheries and aquaculture industry is sustained into the future. Much work is already underway through existing Department of Environment work programmes, however the IWMP will bring renewed focus to integration between land management and coastal water quality to help achieve this. Alongside this, the IWMP will help existing initiatives designed to address fisheries and aquaculture as a pressure, for example by identifying Priority Protection Areas with specific measures to protect coastal habitats and species such as Seagrass beds.

Mineral extraction

Currently the only minerals actively worked on the Island are sand and stone, with extraction taking place at several sites on land and in the coastal zone. With respect to private groundwater abstractions, three mineral extraction sites are registered with the States of Jersey and currently comprise a large proportion of the estimated groundwater abstraction. An analysis undertaken of recent abstraction records shows that abstraction from groundwater to support dewatering activities constitutes an estimated 29% of total groundwater abstraction (approximately 627,287 m^3 per year). This is undertaken within three Water Management Areas (WMA2 La Haule and St Peter's Valley; WMA5 Northwest; and WMA7 St Ouen and West) where dewatering from extraction activities comprises 56%, 76% and 31% of the total (licensed / registered) annual water use within those WMAs respectively, in each case being the single biggest user of water within the WMA. This is therefore considered a key pressure in these WMAs.

Manufacturing industry

There are no major manufacturing industries based on the island and this pressure is not considered a key issue for Jersey. There are no discharge consents granted for manufacturing industries.

Construction industry

This industry accounts for 6.5% of the Gross Value Added (GVA)[1] (States of Jersey, 2011) and with population projections steadily rising, this industry will continue to operate for some time. Pressures on the water environment from this industry can include inputs of silt and soil from de-watering activities and construction site run off; there is also a risk of chemical spills. It is currently estimated that construction activities are the cause of 1% of reported pollution incidences on the Island; however it is not clear whether this is due to the controls on construction activities, the locality of construction (typically centred around existing conurbations) or to a lower level of reporting of incidences. As there is increased need for housing, urbanisation could extend beyond current towns and villages which could mean streams are diverted or culverted, subject to the necessary permissions, causing future deterioration in water body status.

Contaminated land

This pressure could contribute chemical, metal and hydrocarbon seepage and run off from brown-field sites with previous industrial uses. Further pressure exists from the historical landfill sites on the Island. Jersey also has a historic issue with car disposal which could contribute pockets of oil, metal and hydrocarbon pollution in certain areas, especially where connectivity to water courses is high, although these locations

[1] This can be seen as the sum of profits of businesses and earnings of employees (States of Jersey, 2013).

are not widely recorded. In 2012 it was estimated that 1% of reported pollution incidences are related to contaminated land (States of Jersey, 2012).

Aviation industry

Although generally well-managed, airports can be a source of pollution from chemicals – for example from de-icing activities and fire retardants. These can cause contamination of water courses through run off and contamination of groundwaters through seepage. Jersey airport has a historical pollution incident related to fire retardant and the resulting high levels of PFOS are still visible in the groundwater monitoring data. De-icing activities do occur regularly at the airport although there are facilities on site to collect and treat the first flush of any significant runway de-icing event.

Car industry

There are no major car manufacturing facilities on the Island; however collectively the car industry (servicing and cleaning facilities for example) can pose a risk to the environment. As an example, poorly operated and maintained commercial car washes can pose risks through improper collection and disposal of wash water either in commercial car washes or through car-park based “no water” type enterprises. This can contribute sediment, nutrients and chemicals to the water environment through disposal into surface water drains, overland run off and groundwater seepage. Other risks are present from the car industry, such as oil spills from servicing centres and solvent spills from car bodywork facilities.

Examples of the industrial pressures discussed here can principally affect the status of Jersey’s waters through impacts on water quality. In some cases widespread low-level ‘bad practice’ type issues can collectively grow into a chronic water quality issue; in other cases, a single incident can cause an acute water quality problem that are longer lasting. It is therefore important to understand industrial processes and risks on the Island and manage them appropriately through the IWMP.

4.4 The rural environment

Pollution from the rural environment can be widespread in nature, with sources of pollution ranging from small hamlets and individual houses and farms to widespread Island-specific agricultural practice. In this way, rural pollution can be considered both point source (emitted from a specific location or activity, for example an individual oil spill) or it can be diffuse in nature (for example surface water run-off from a large area of land). It is not limited to the agricultural sector but can include housing, rural road networks and small scale businesses.

In Jersey, the main sources of water pollution from the rural environment include:

Rural road run off

Deposits on roads from normal rural traffic activity can include metals, hydrocarbons, sediment and salts in winter months. These deposits can build up and then be washed away in surface water, ending up in small streams and affecting water quality. On higher rural ground to the north of the Island, this can result in pollutants running off into water supply reservoirs. It can also result in pollutants being channelled straight into the sea. The nature of the rural road network in places can serve to channel run off to the southern side of the Island; many main roads run from the higher ground in the north down the valleys to the coastline on the south of the Island. Many of these roads are set lower in the landscape compared with the adjacent fields and are often constrained by walls at each edge. This can serve to channel run off into streams and the coastal waters. This is likely to be a particular risk for St Aubin’s Bay coastal water which receives the majority of the Island’s catchment surface water run-off.

Non-mains wastewater systems

As discussed previously, approximately 10% of the Island’s population, mainly in the rural areas, are served by private systems such as septic tank and soak-away systems, private package treatment plants

and tight tanks. These facilities, when managed incorrectly can pose a risk to water quality in surface waters and groundwaters.

Pollution incidents such as oil spills

This is a key issue on the Island, particularly in rural areas where many of the houses are served with oil-powered heating. It is estimated that pollution incidents involving oil spills account for over 50% of the total reported incidents of pollution on the Island (49 oil pollution incidents were reported in 2012).

Much work has been undertaken by the States of Jersey in the last few years to encourage people to report any oil spills so that they can be managed appropriately, thus reducing the risk to the water environment. This has resulted in an increase in reported incidences since 2011. The Oil Care Group has also resulted in Industry guidelines for oil deliveries and changes to building control regulations in respect of underground pipework.

Agriculture

This is considered to be a key pressure on water quality in the Island, with over half the surface area being given over to cultivation. The link between land use, specifically intensive cultivation, and high nitrate concentrations in surface and groundwater in Jersey has been conclusively demonstrated in a number of studies[2].

Agriculture has also been reported as the cause of 7% of reported pollution incidences (2012) and has been the subject of numerous debates and studies into the widespread nitrates problem on the Island; as such this sector is explored in more detail here.

4.4.1 Agriculture on Jersey

Approximately 67 km^2 of the Island is farmed (57% of the total Island area), with an average farm size of just 0.1 km^2 (approximately 56 vergees). This average is made up of many small farms and a handful of large farms. The Agricultural Statistics Report (States of Jersey, 2012) sets out the following key characteristics in relation to the Jersey agricultural sector:

In the arable sector:

- Nearly 5% of the farmed land is not cultivated.
- Just over 4% of the farmed land is irrigated.
- Potatoes are the biggest crop by land area, with 49% of the farmed land given over to the Jersey Royal (nearly half of the Jersey Royal area is grown under polythene). A further 1% of the farmed area grows other potatoes.
- 6% of the farmed area is used to grow outdoor fruit and vegetable crops[3].
- 2% of the potato, fruit and vegetable crops are grown organically.

[2] The Nitrate and Pesticide Working Party Report in 1996; the Centre for Research into Environment and Health (CREH) report 'Stream Water Quality on the Island of Jersey' in 1997; British Geological Survey annual and summary reports prepared for the Public Services Dept, 1990-2000; and the Plymouth University final report entitled 'Nitrates and Phosphates in Jersey Surface Waters' of October 2001. Foster, IDL, Ilbury BW and Hinton MA, Agriculture and Water Quality: A Preliminary examination of the Jersey nitrate problem. Applied Geography (1989), 9, 95-113.

[3] Outdoor fruit and vegetables include: beans, Brussel sprouts, cauliflower, courgette, lettuce, onions, leeks, parsley, spring greens, tomatoes, soft fruit and strawberries

- Nearly 3% of the farmed area is used to grow flowers; dominated by Narcissus.
- 5% of agricultural land is grown for cereals.
- The area measurements of these are given in Table 3 below.

In the livestock sector:

- The Jersey cow dominates the livestock sector, mostly providing Jersey milk although there is a beef herd of approximately 300 animals (2012).
- There are over 25,000 poultry on the Island, mostly egg laying hens. It is thought this market is growing, having increased 34% from 2011 to 2012 as a result of EC restrictions on battery hen conditions driving the market for free range egg supply.
- Although there were only 20 registered goats in 2012, it is also thought this could increase in the future as goat milk and meat is increasing in popularity on the Island.
- There are 796 equines (24 donkeys with the rest being horses and ponies). These are mostly recreational riding animals.

Table 3: Jersey agricultural character (Source, Jersey Agricultural Statistics (2012))

Agricultural characteristic	2012 agricultural statistic
Whole island	64,612 vergees (116.2km^2)
Agricultural land	37,004 vergees (66.6 km^2)
Average size of holding	70 vergees (0.13 km^2)
Agricultural land not cultivated	1,734 vergees (3.12 km^2)
Area of irrigated agricultural land	1,613 vergees (2.90 km^2)
Jersey Royal potatoes	17,992 vergees (32.4km^2) (of which 9880 vg (17.8km^2) are under polythene)
Total potatoes	18,670 vergees (33.6 km^2)
Other outdoor fruit & vegetables	2,096 vergees (3.8 km^2)
Outdoor flowers	1,005 vergees (1.8 km^2)
Glasshouse	162 vergees (0.29 km^2)
Polytunnel	97 vergees (0.17 km^2)
Cereals	1770 vergees (3.18 km^2)
Cattle	5,152 cows – (of which 309 are beef)
Poultry	25,418 (mostly egg laying hens)
Goats	20 goats
Pigs	452 pigs
Sheep	1,074 sheep
Equines	796 horses and donkeys
Farm labour: full time	635 people
Farm labour: part time	188 people
Seasonal farm labour	837 people

Key pressures from the types of arable farming on Jersey include the use of nitrate, phosphate and ammonia fertilisers, application of pesticides to land, sediment degradation and mobilisation, soil compaction issues and issues with manure management and accidental slurry spills. Some of these pressures are point source in nature (a single or easily identifiable incident in space and time) and others are diffuse in nature (more widespread low level incidences which cumulatively throughout the catchment escalate into an issue).

Point sources of pollution from agriculture can arise from incidences such as accidental spillages of oil, pesticides, fertilisers or other chemicals, poor storage of farm waste and slurries / dirty water or even dumping of waste produce such as potatoes and tomatoes. If farm manure or other waste materials with a high biological oxygen demand (BOD) such as milk are spilled and it makes its way into a nearby water course then this causes sharp decrease in the amount of oxygen in the water, which can affect, or even kill, aquatic organism communities. Depending on the scale and location of the spill, these substances can also contaminate groundwater sources through infiltration. Point source inputs are mostly from accidental spillages or leaks, tend to be easy to spot and report, and if managed appropriately are normally containable provided they're not directly into the watercourse or borehole. In 2012 it was estimated that 7% of reported pollution incidences came from agriculture; mostly point source incidences.

Diffuse sources of pollution from agriculture (or indeed from any sector) are harder to identify and manage. Being diffuse in nature, it is more difficult to pinpoint the exact source of the pollution and the activity causing the problem; the cause could be from one instance of inappropriate land management somewhere in the catchment, or it can be a cumulative effect of widespread agricultural practice over a larger area. Diffuse pollution can include nutrients, pesticides, faecal matter and soil/sediment washing off the agricultural land and into water courses.

Whatever the precise source and pathway, diffuse pollution can cause failures of drinking water standards in surface waters, for example nitrates and pesticides, and therefore disrupt drinking water supplies. As well as this, excess nutrients can cause prolific growth of algal or bacterial populations and result in algal blooms (as have been seen in both inland waters and the coastal waters of St Aubin's Bay over the years) and possibly subsequent impact on ecology. Diffuse pollution can also cause a failure in the standard of Bathing Waters, for example as a result of agricultural faecal matter making its way through surface water drains and into the sea.

Nitrates

In Jersey, the key focus of agricultural pollution to date has been on nitrates specifically because of the issues the Island has with achieving the safe drinking water standards. Aside from human health concerns, the nitrate classifications undertaken as part of this IWMP have also shown that the standards for nitrates are not being achieved in the majority of surface and groundwater bodies; nitrates are therefore also a key environmental water quality concern preventing good status (see sections **Error! Reference source not found.** and **Error! Reference source not found.**. for stream and groundwater classifications respectively).

It should be noted that agriculture is not the only source of nitrates on the Island; other minor sources are also contributing to the problem - for example urban, transportation and the water industry.. However, as agricultural land occupies over 50% of the Island's area, and as agriculture is accepted as a key water management pressure throughout Europe, it is considered to pose a significant challenge to water management on the Island and it will need to be further addressed through implementation of the IWMP.

The link between diffuse pollution from agriculture and high nitrate concentrations in surface and ground waters in Jersey has been the subject of numerous studies over the years (Foster, 1989; CREH, 1996; Plymouth 2001; and BGS, 1998) and is not repeated here.

Further work has been undertaken by the States of Jersey Department of the Environment which indicates a strong relationship between the island-wide area cultivated for potatoes, the head of cattle and the nitrate levels in streams and groundwaters; the results of this work are presented in Figure 3 below.

The DoE data analysis shown here extend from 1980 to 2014 and show the measured nitrate levels in water bodies, the farmed area and the head of cattle on the Island throughout this time. Some pre-processing of data has been undertaken for this figure to select data points from specific years where there were <12 nitrate data records, interpolate nitrate data between records within the year, take account of WMA area (weighting) and then sum the data from all WMAs to calculate the mean nitrate level of each year shown.

The pattern of the farmed area dataset is reflected in the rise and fall of the nitrate levels. A rise in farmed area appears to be shortly followed by an increase in nitrate levels within 1-2 years; similarly when the farmed area falls (such as in 2007) the nitrate levels follow suit after a lag period of approximately 4 years

(this possible time lag is receiving further investigation by Department of Environment). The same pattern is not seen in the data for head of cattle.

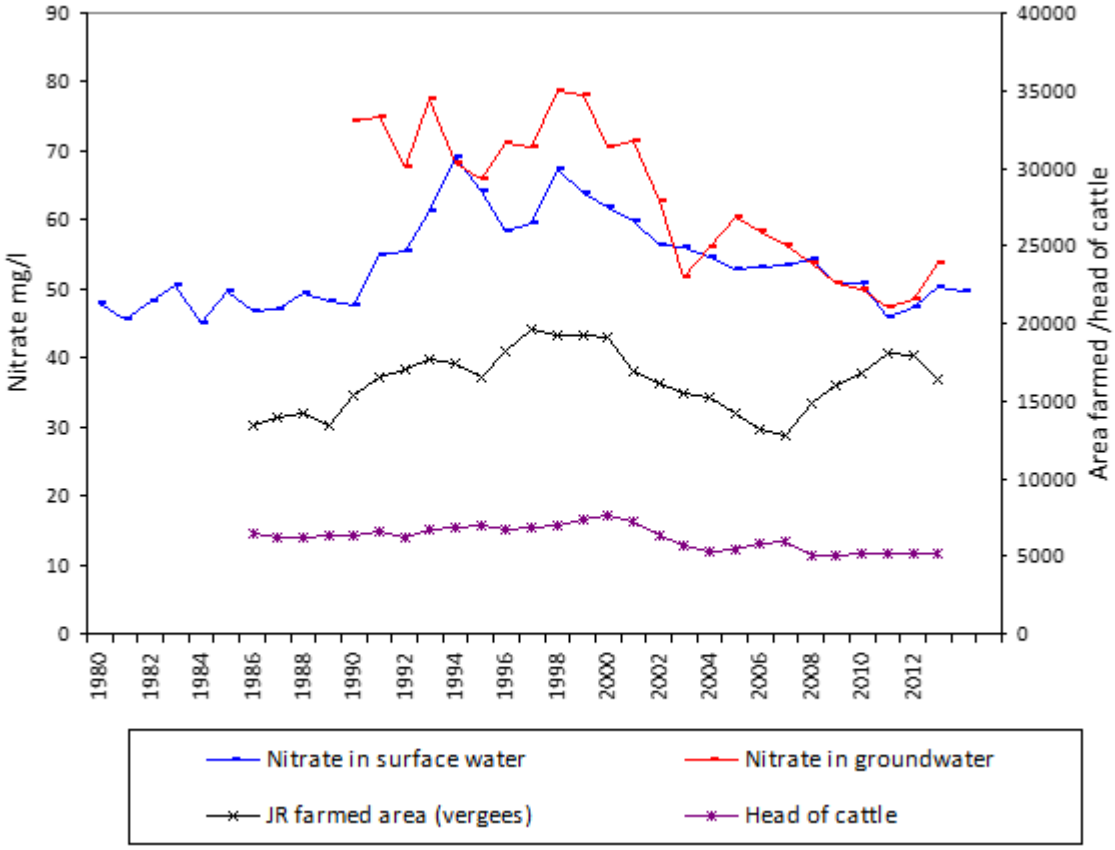


Figure 3: Annual average nitrate level (as NO_3) for Jersey surface and groundwater, showing weighted method by Water Management Area, 1980-2014 (to August 2014 only).
(source: States of Jersey)

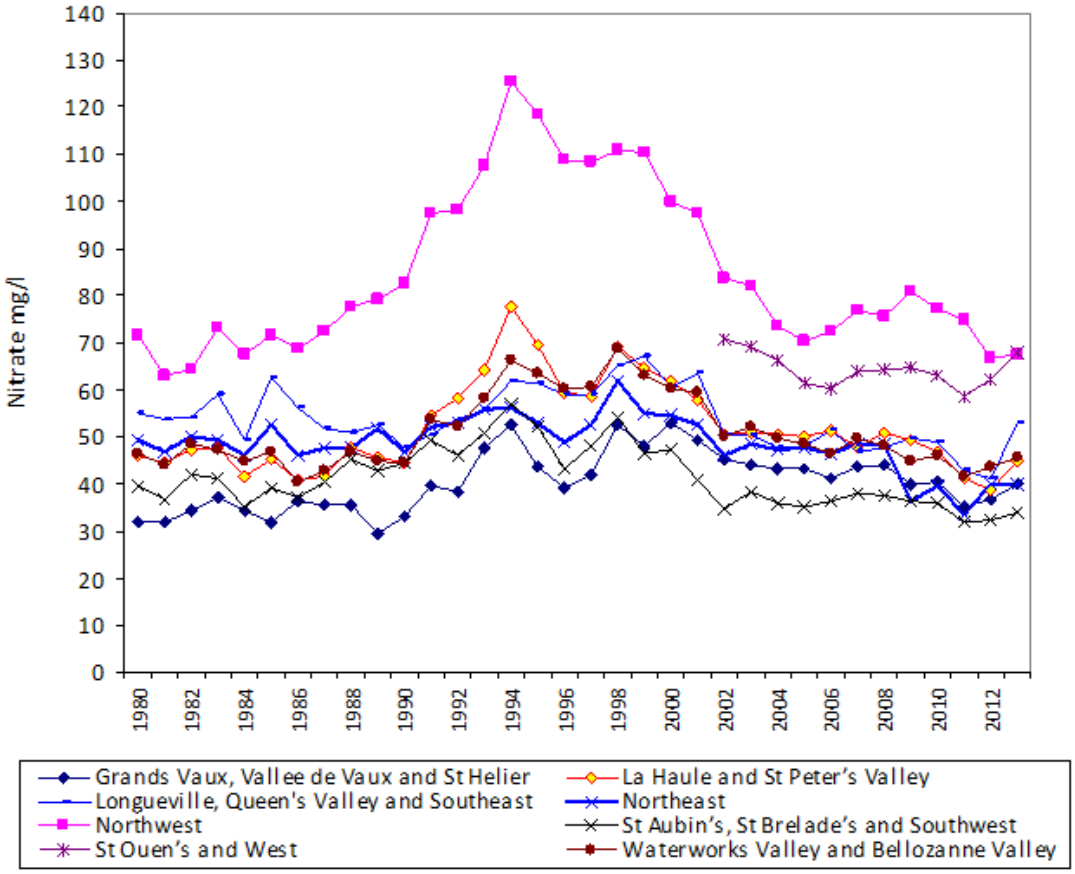


Figure 4: Historical nitrate monitoring records for the WMAs

When these nitrate data are displayed separately at WMA level (Figure 4), it is clear that all WMAs follow the same approximate pattern of nitrate peaks and dips; however some WMAs show higher levels overall than others, for instance Northwest has the highest nitrate levels consistently, and Grands Vaux, Vallee de Vaux and St Helier and St Aubin's St Brelade and Southwest both show the lowest nitrate levels (the latter consistently lowest since 1998).

Although nitrates remains a priority because of the implications on drinking water standards, the focus of the IWMP extends beyond the nitrates issue and further considers other diffuse agricultural pollutants such as phosphorus, ammonia, sediment, pesticides and faecal matter (all of which can also be contributed to by other sectors such as urban and industry).

Other nutrients, such as phosphorus and ammonia

Although not specific to the agricultural sector (like nitrates, it can also be emitted from the urban environment) we do know that some types of farming and agricultural practices can give rise to phosphate losses from land, either from animal manure or from phosphate fertilisers for example. Phosphorous can bind to sediment, become mobilised in later run off events or through animal 'poaching' activities (trampling of stream banks) and cause a subsequent rise in stream phosphate levels. Too much of this nutrient can cause excessive algal growth in streams and ponds which in turn can affect the ecology of water and how it is used for drinking water supplies. Similarly, ammonia from manure and fertilisers is toxic and can be harmful to the aquatic ecology.

Phosphorus is known to be a key pressure on the Island; soil samples taken across the Island illustrate that Phosphate indices in agricultural soils are generally very high, with P soil indices typically of 4 and above, with indices of 8 also seen (Figure 5).

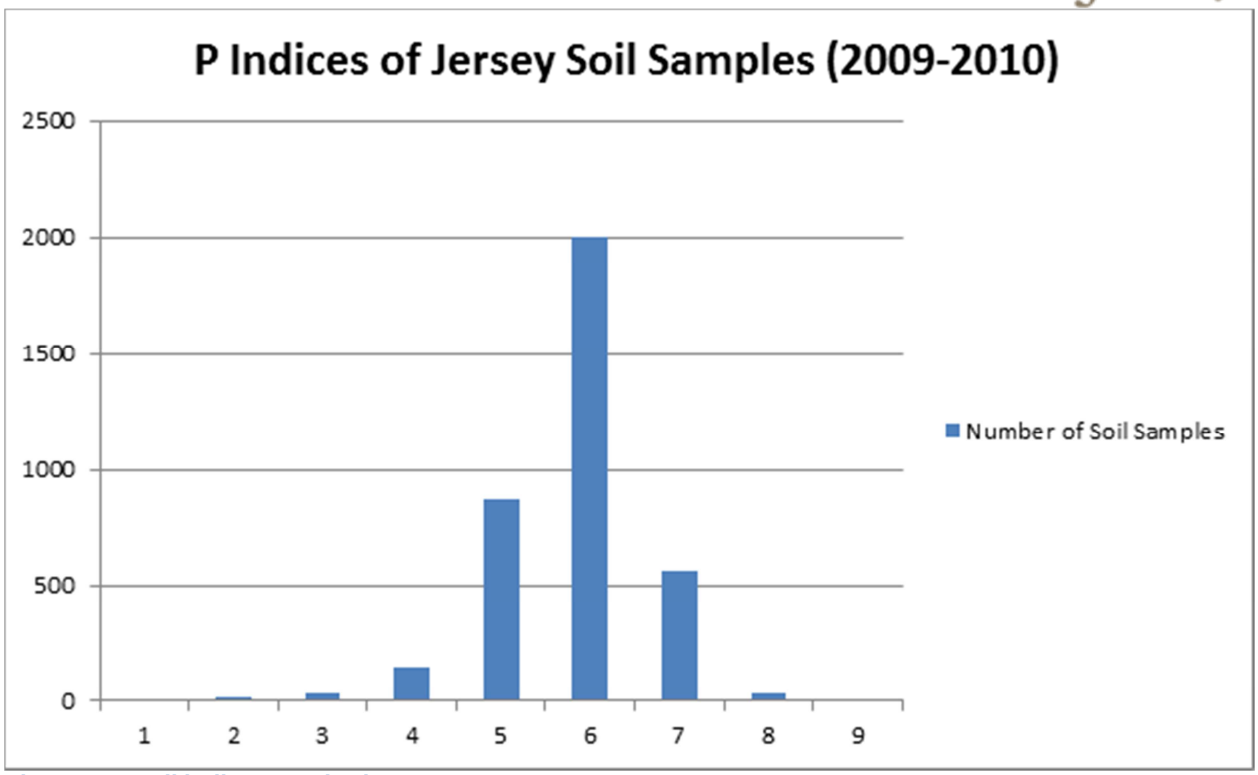


Figure 5: P soil indices monitoring.

(Source: Department of Environment)

The available water sampling data analysis through the Diffuse Water Pollution Project also indicates that phosphorus levels in local waters may well be in excess of those required (University of Stirling[1], 2012). The classifications undertaken as part of this IWMP also assigned a Moderate status classification for phosphorus; however this was assigned a low confidence rating due to limited data. Further monitoring should be carried out through the IWMP to provide clarity on this issue.

Sediment

Sediment can become a particular issue with certain types of farming practice, particular soil types and landscape gradient – a key risk for Jersey with the steep cotil farming character.

Farming practices that break down the soil structure, making it unstable, or otherwise disrupt the top layer of soil (e.g. cultivating steep slopes, early ploughing, leaving land bare over winter, wet harvesting of maize), particularly during wetter months, can mobilise fine sediment into run off pathways. This sediment can smother the aquatic ecology such as plants and invertebrates and can also serve to transport other pollutants into the streams (e.g. phosphorus, which readily binds to sediment particles, other chemicals and faecal contaminants from manure). Sediment can also increase the burden on water treatment for supply and reduce the effectiveness of drainage systems because of local siltation issues. Further impacts can also include the loss of productive soils for farming.

[1] Diffuse Pollution Project - Evaluation of Surface Water Chemistry Data, Final Report. University of Stirling, Van Niekerk, M, 2012

Pesticides can make their way into surface waters and can also infiltrate through the soil into groundwaters both through point source incidents (spillages, incorrect disposal and misapplication) and diffuse sources (misapplication, drift). Even a small amount of pesticide in a water source can render water supplies unfit for human consumption – the drinking water limit is 0.01ug/l. This is a minute amount and very hard to envisage, but here are some equivalents : 1 second in 320 years, 1p in £100 million, a grain of wheat in 390 tonnes, 1 baked bean in twenty one million cans of baked beans.[4]

Pesticide contamination of water is a particularly serious concern for an Island so heavily reliant on surface waters for public supply and groundwaters for private water supply in areas where there is no mains supply. These chemicals can also cause damage to ecosystems and aquatic assemblages.

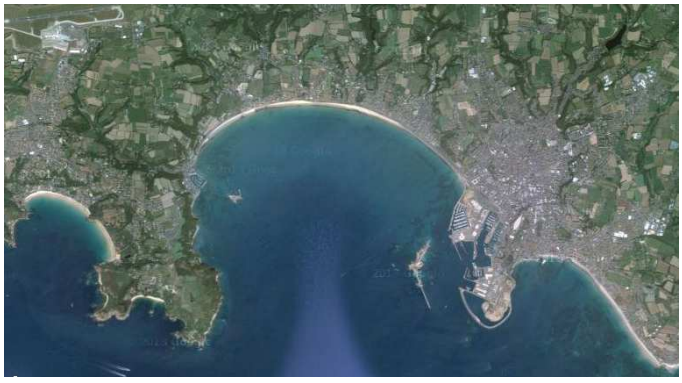
Action is already being taken by the agricultural sector to reduce its impact on the environment. 73.8% of the agricultural area claims either **Single Area Payment or Quality Milk Payment** and as such are required to abide with the Water Code and Animal Welfare Codes. The **agri-environment scheme** continues to be made use of and further work has being done to protect the Island's waterways through the **Diffuse Pollution Project** and the provision of information, training and advice. Membership of assured produce schemes has also had a part to play.

Although there have been indications that nitrate levels have been reducing in recent years the water quality problems on the Island remain. There is an ongoing need for the agricultural sector, as custodians of such a large proportion of Jersey's natural environment, take further action alongside other sectors in order to improve environmental performance in all of these parameters.

4.5 The urban environment

Although the Island is predominantly rural, approximately 24% of the island area is considered to be urban. There are large urban centres on the southern side of the Island; St Helier is the main town, with the larger urbanised areas of Red Houses / Quennevais and Five Oaks. Extending along the southern and eastern coastlines, there are a considerable number of smaller residential clusters and inland, urban areas include villages such as St Aubin, St Peter, St Ouen, St Mary, St John Maufant and Gorey.

Transport between these urban areas is served by a network of roads. Public transport is limited to buses and taxis; there are no trains in operation on the Island. In 2012, there were an estimated 118,838 cars registered to the Island; this number is the highest recorded since 1980 and the upwards trend has been increasing for at least the last two decades. However, this figure also includes vehicles that are unused or have been disposed of without informing the Driver and Vehicle Standards.



Apart from Bellozanne discharging into the bottom end of the Bellozanne stream catchment there are currently no other consented sewage or industrial effluent discharged directly into Jersey's streams. However pollution can still reaches surface and ground water bodies through diffuse means in urban areas. Diffuse pollution from the urban environment can contribute substances such as suspended solids, some pesticides, poly-aromatic hydrocarbons (PAHs) and metals to the water environment and the specific sources of these contaminants are often hard to pinpoint. These include:

- **Run off from roads and urban public spaces** - contributing for example: chemicals associated with vehicles and subsequent deposits onto road networks including hydrocarbons and metals; salt and antifreeze from cars; sediments from dust, dry earth and road sweepings; faecal matter from

[4] The Voluntary Initiative – www.voluntaryinitiative.org.uk, accessed 15 October 2014

animal fouling of pavements and small urban green spaces; and chemicals, detergents and sediment from transient car washing facilities. These contaminants are easily flushed into nearby water courses and surface water drainage systems by rainfall run off from land, causing a flushing effect and a peak in contaminant loading to surface water bodies and coastal waters. The high concentration of cars on Jersey (the 2011 Census showed the average number of cars / vans per household was 1.5; higher than the UK average at 1.2) could mean that road run off is a key issue on the Island. The nature of the road network in many places facilitates road run off during rainfall events. Many of the main roads on the Island run from higher ground in the north, where rainfall is typically greater, to the low-lying south. Furthermore, roads in many parts of the Island for example in the rural north, are often constrained on either side by walls; this can serve to channel the flow of water and provide quick conveyance of diffuse road pollution during run off events.

- **Pesticides and fertilisers** – used by local authorities and households to treat urban green spaces, parks, gardens, roadside verges, hard standings, golf courses etc.

- **Light industrial / trading estate sources** – this source relates to small trading estates with multiple businesses typically using or storing chemicals. This could for example include small print works, metal workers, small scale industrial cleaners, veterinary facilities, commercial vehicle servicing and car washing etc. Poor management and disposal of the substances used can result in contaminated run off from the hard standings into nearby water courses and surface water drainage systems.

- **Misconnections** – including incorrect plumbing of foul drainage into storm drainage systems, contributing untreated sewage directly to water bodies. Misconnections, although reasonably easy to correct, are often difficult to trace in urban environments.

- **Misuse of drainage systems** – using surface water drainage systems to dispose of unwanted substances instead of undertaking responsible disposal via municipal facilities or sewer (for example disposal of paint, oils, chemicals, car washing water etc.)

- **Historical sediment build up** – sediment from urban sources that has deposited over time in specific locations and which is later re-suspended in run off events, releasing historic contaminants into the waters.

- **Combined Sewerage Overflows** (CSO) – these are designed to overflow into the coastal waters when the capacity of the sewerage system is exceeded, such as during storm events. These discharges are a source of raw sewage into the system, containing solids, faecal contamination, nutrients and other chemicals and metals. There are a number of known CSOs on the Island interspersed along the coastline, mainly on the southern side of the Island.

The review of chemical monitoring data undertaken as part of the classification process showed some evidence of chemical pressures associated with more urban areas. This included several elevated monitoring levels for chlorine, copper and zinc and although the levels reported warrant further investigation, they were not sufficient to fail the water bodies for a chemical assessment.

Nitrates and urban influences

It is understood that urban areas can contribute sources of nitrates to the water environment; nitrate sources are not limited to the agricultural sector. Therefore a further analysis has been undertaken to investigate the nitrates issue in relation to urban areas. Figure 6 below shows the available nitrate monitoring data (nitrate concentrations) alongside the % urban area within the catchment from which the monitoring data is taken. Although this is only a high level analysis, it shows a strong negative link between % urban area versus nitrate concentrations (this relationship is statistically significant with 98% confidence, using a two tailed t test).

As the urban area increases, the general trend of nitrates decreases and the peaks in nitrate monitoring data are not coincident with the highest urban density in a catchment. This observation is supported by the

groundwater assessment, which indicates lower nitrate concentrations in groundwaters in more urbanised areas (Figure 6).

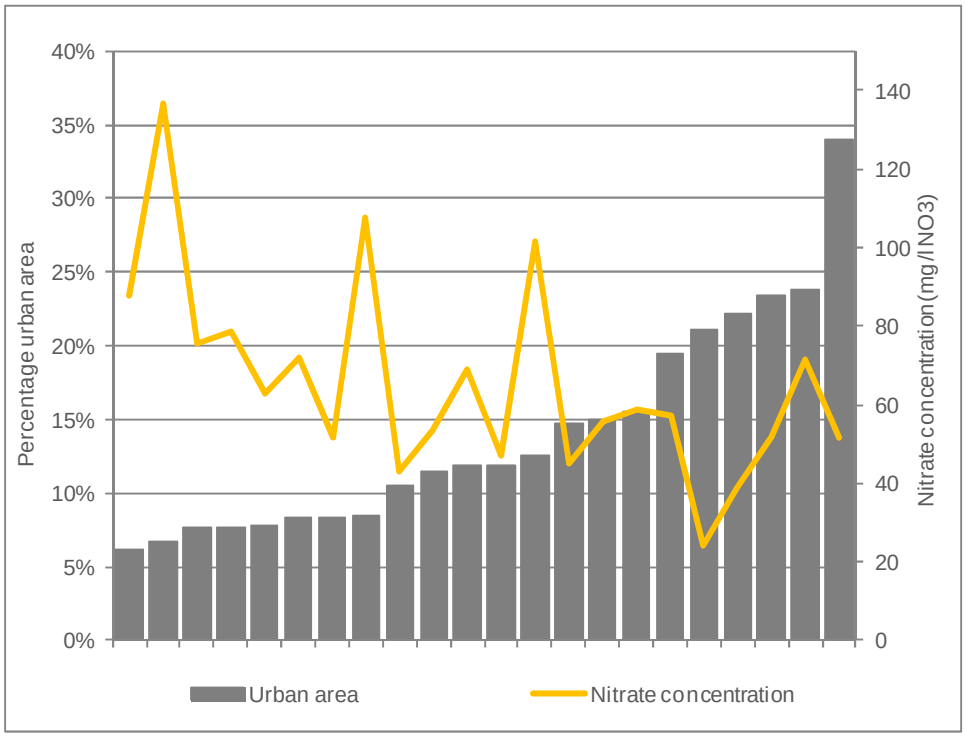


Figure 6: Nitrate monitoring data in relation to % urbanisation in the upstream catchment

4.6 Tourism and recreation

The natural environment of Jersey, and particularly the coastline and surrounding waters, is a strong draw for tourists to the Island; people come to enjoy the natural beauty of the inland areas, as well as the Island's beautiful beaches and coastal waters. However, this seasonal influx of visitors can place additional pressure on the water environment in Jersey.

Jersey has seen a decline in tourism since the late 1990s and between 2011 and 2012 the number of staying leisure visitors decreased by 2%. Despite this, the States of Jersey estimated a total number of 688,300 visitors to the Island in 2012 (which includes holiday makers, business visitors, leisure day visits and visiting yachts).

Aside from the additional water supply needed and wastewater treatment, the tourism industry can place more direct pressures on the Island's water bodies.

People going to the beaches to enjoy the sand and sea can contribute litter pollution to the coastal waters. Horse riding is becoming increasingly popular on the Island and higher activity from horses can place additional pressure on footpaths (with for example additional compaction) and water quality (through manure management and run off).

Yachting visitors to the Island can also contribute to water pollution through

sewage effluent and wastewater discharges from the boats; this can be a particular pressure in summer months and where yachts congregate in popular bays and in marinas.

The IWMP includes coastal waters and as such will seek to address any significant sources of coastal pollution from the tourist industry, alongside land and freshwater based pressures, in the objectives and measures set out.

4.7 Physical modifications and changes to natural flow and level of water courses

The majority of Jersey's streams and ponds have been modified to some degree either with respect to morphology (physical form and function of the stream) or hydrology (water flow and level).

Altering the morphology of a stream could include a diversion from its natural course or physical modifications such as culveting, cannelising or putting in a small weir, or even removing woodland from the stream banks. These types of changes to the stream and bank shape can prevent the stream connecting to its floodplain and affecting the flood capacity of the stream in higher flows. Modifications to the morphology can also affect the hydrology of a stream by reducing flow and water levels. This can be compounded by other hydrology pressures such as abstraction for agricultural irrigation and drinking water supplies which can reduce not only the water in streams, but in more serious cases it can also lower the water table with more wide ranging effects for the local habitats such as meadows and woodland.

Overall, morphology and hydrology pressures can affect water quality, habitat availability, biological communities, flood capacity and can also serve to reduce the stream's resilience to seasonal extremes of flow. On Jersey, some streams have been impounded for historical uses, such as water mills and for other historical water features. Other modifications undertaken are more contemporary in nature, such as those associated with protecting property and people from flooding events or putting in road networks. There are also ongoing pressures associated with housing development, which often includes works to alter the natural course of a stream.

The coastal environment is also susceptible to physical modification; coastal defences and sea walls serve to reduce connectivity between the sea and the land, reducing habitat availability such as sand dunes; dredging activities and ports and harbours also affect the natural coastline of the Island.

In future, these pressures are likely to increase further as demand for water, property development and urbanisation increases. Although it isn't necessarily reasonable to remove these pressures entirely, some aspects of the pressures could be minimised, for example it may be possible to ensure that future developments do not worsen the extent of modification on key streams, or where they are considered un-modified; this objective will be taken forward for consideration in the IWMP.

4.8 Invasive non-native species

Invasive non-native species of plants and animals are recognised as one of the biggest threats to biodiversity world-wide after habitat loss. Invasive species can often spread vigorously and once established can have very significant impacts on native plants and animals, outcompeting native species for space and food with subsequent damage to local biological communities.

The cost to control non-native invasive species can become prohibitively expensive, and where eradication techniques are not used appropriately, can result in spread of invasion rather than control.

Jersey already has issues with invasive non-native species; some of which are relevant to the IWMP for instance Himalayan Balsam. The States of Jersey (Natural Environment Team) are currently drawing up an invasive species strategy, outlining the known extent of invasive species and a strategy for their control. The IWMP will draw upon this for measures within the final Plan.

4.9 Future trends and risks

In order to manage the Island's water resources sustainably into the future, it is important to consider what the future may present in terms of pressures and risks; these trends can be natural, anthropogenic or even economic.

For example, upward trends in the Island's population will place more pressure on drinking water availability and wastewater treatment; increased urbanisation to house the population may further contribute to diffuse urban pollution; climate change may result in rising water temperatures and more extreme weather events; economic trends may result in a changing agricultural focus of the Island. All these serve to increase uncertainty about the future pressures on the water environment and it's important to have a high level understanding of these when putting together the IWMP so that the potential risks and opportunities these changes pose can be considered.

Trends that are already emerging include:

- A resident population that has steadily increased since the 1970s, with the most rapid growth rate between 2001 and 2011. Population increase is currently 44% natural growth and 56% inward migration and migrants from countries that have recently joined the EU form the largest migrant group entering Jersey.
- Changing agricultural and land management techniques.
- Increasing demand for drinking water, projected to rise further. The Jersey Water 2009 WRMP forecasts an 11% reduction in water supply and 15% increase in water demand by 2032. This projected shortfall is driven by an increase in demand due to population growth, in addition to a reduction in supply due to climate change, with population growth being the most significant influence.
- Increased need for higher capacity wastewater treatment facilities; to this end Transport and Technical Services (TTS) are already investigating expansion of the Bellozanne treatment works to serve the growing population of the Island.

These trends will be considered through the IWMP when assessing the risks to the water environment. Furthermore, there are some key Island development plans that have the potential to be progressed over the lifetime of the IWMP.

Land reclamation

The States of Jersey Island Plan 2011 provides a summary of the history of reclamation of the St Helier foreshore, which has taken place for at least 200 years. Given the competing pressures of ports and harbours, fisheries, aquaculture, agriculture, mineral extraction, industry, housing development, tourism and power generation on coastal land and marine resources, there is potential for further land reclamation to take place over the time period of the IWMP, if considered to be in the Island's urgent strategic interest (States of Jersey, 2008; 2011b). This would result in the loss of ecologically valuable marine habitat.

Regeneration of St. Helier

The town and port of St. Helier is currently a focus for regeneration activity, and several changes are likely to take place over the period of the IWMP. Between 2014 and 2015 works are scheduled to remove a bridge (States of Jersey, 2008; 2011b) and improve several pontoons within St Helier Harbour. Any further development that could affect water status may need to be taken into account within the IWMP.

The States of Jersey Island Plan 2011 states that in the longer-term there may be a need for a new port as the current facilities are ageing and inefficient. Feasibility work has indicated that this could be sited at La Collette, which has significantly deeper water (States of Jersey, 2011b). This could affect water status in the longer-term rather than over the period of the IWMP.

Shipping activity

Any changes in levels of shipping activity could affect the status of coastal water bodies over the period of the IWMP. Almost all freight into and out of Jersey is through the Port of St Helier (States of Jersey, 2011b). Between 2006 and 2016 there was a relatively steady decline in the number of tonnes of freight shipped through St Helier Harbour, from 418,000 tonnes in 2006 to 351,000 tonnes in 2013 (States of Jersey, 2013). The number of sea passengers also declined between 2002 and 2013, from approximately 919,000 in 2002 to 719,000 in 2013. This indicates a declining trend in freight and sea transport activity in the Port of St Helier, which may reduce the pressure on the marine environment. However, by 2018 one of the main aggregate extraction operations on the Island will be wound down (Simon Sand and Gravel Ltd., St. Ouen's Bay) so there may be an increase in the import of sand for the construction industry, according to the States of Jersey Island Plan 2011, which could increase the volume of freight after this point.

Energy generation

Opportunities have been identified for tidal power harvested from Jersey's territorial waters "to make a significant and increasing contribution to the energy requirements and security of the Island for the rest of this century" (2008 report from the Tidal Power Steering Group, referenced in States of Jersey, 2011b). The Island Plan 2011 notes that a significant investigation may be required to establish the optimum locations for potential installations and their long-term viability. It also notes the potential for off-shore wind energy generation in Jersey's waters. There is potential for tidal power prototypes and future permanent tidal and wind schemes in the longer-term to have adverse impacts on the marine environment, although such schemes are unlikely to be approved if impacts are considered to be significant.

5. What can be done?

5.1 Strengthening our understanding of the status of Jersey's waters

It is important to note that this is the first time that the management of water environment has been approached in an integrated way; combining our knowledge base and action plans for the terrestrial, freshwater and marine environment. Existing data have been used to inform this assessment, where possible; however there are some areas where data limitations meant we have not been able to undertake classifications. Throughout the first IWMP process (2015-2020) we will be building upon the existing evidence base by re-visiting our monitoring strategy and investing our monitoring resources based on IWMP priorities. Although this won't directly reduce pollutants in the environment, it will help us target our measures appropriately in the future; investing energy where we have reasonable confidence it will result in a positive environmental outcome.

6. Next steps

6.1.1 Setting objectives and selecting measures

Work to date has focused on collating the appropriate monitoring data on Jersey, using these to understand the key pressures acting on the water environment and to assess the current status of the water bodies. Over the next year, we will be preparing the Draft Integrated Water Management Plan and as part of this we will be:

a) Setting objectives for each water body: assigning a status class we want to reach for each water body, which are most important to focus on first and the target date by which we want to reach this status;
b) Setting out programmes of measures that will be implemented to tackle the key water management issues on Jersey

In assessing the measures that could be used to mitigate some of the key pressures identified in this report, consideration will be given to the technical feasibility, environmental constraints and the cost effectiveness of these measures.

For the Jersey IWMP the approach is likely to draw on that developed in England and Wales for the first and second RBMPs. This used a scoring system for effectiveness together with a database of costs, supplemented with locally-specific cost information, in order to determine the most cost-effective measure combinations that achieve good status for all water bodies. This will be carried out on the scale of the Island as a whole to ensure consistency in the approach used across all water bodies. During preparation of the Draft IWMP we will be consulting closely with the States of Jersey in order to define and refine the approach used.

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