What is Agricultural pollution?

http://www.naturegrid.org.uk/rivers/gt%20stour%20case%20study-pages/plln-frm.html

A wide range of contaminants can reach the river either via groundwater or through drainage ditches, including artificial fertilizer residues, insecticides, herbicides, pesticides and farmyard waste, all of which are potentially very harmful. Accidental milk spillage from dairies is a serious contaminant.

Undiluted animal manure (slurry) is one hundred times more concentrated than domestic sewage, and can carry a parasite, Cryptosporidium, which is difficult to detect. Silage liquor (from fermented wet grass) is even stronger than slurry, with a low pH and very high BOD (Biological Oxygen Demand). With a low pH, silage liquor can be highly corrosive; it can attack synthetic materials, causing damage to storage equipment, and leading to accidental spillage.

Milk spillage, silage liquor, cattle and pig slurry; these are all examples of point source pollution. Diffuse source pollution from agricultural fertilizers is more difficult to trace, monitor and control. High nitrate concentrations are found in groundwater and may reach 50mg/litre (the EU Directive limit). In ditches and river courses, nutrient pollution from fertilizers causes eutrophication. This is worse in winter, after autumn ploughing has released a surge of nitrates; winter rainfall is heavier increasing runoff and leaching, and there is lower plant uptake. Phytoplankton and algae thrive in the nutrient-rich water. Normally, blue-green algae are very important in the river ecosystem, photosynthesising sunlight energy, and liberating oxygen into the water. In large numbers, however, algae can become excessive, discolouring the water, giving an unpleasant smell and robbing the water of valuable oxygen as bacteria work overtime feeding on dead algae remains. Blue-green algae can also produce toxins, which kill wildlife, cause skin rashes, and cause pains and stomach upsets.

Eutrophication is thus depriving the river of oxygen (called "oxygen debt"). As algae dominate and turn the water green, the growth of other water plants is suppressed; these die first, disrupting the food chain. Death of invertebrates and fish follow on, and their dead remains in turn lead to excess bacterial activity during decomposition, reducing oxygen levels still further. Water with high BOD figures are badly polluted, lower figures are better.

Consider the following BOD values of typical pollutants :

Silage liquor: up to 80,000 mg/litre	Vegetable washings 500-3000 mg/litre
Cattle slurry: up to 20,000 mg/litre	Liquid sewage sludge: 20,000 mg/litre
Pig slurry: up to 30,000 mg/litre	Domestic sewage: 300-400 mg/litre
Milk: 140,000 mg/litre	Treated sewage: 20-60 mg/litre

Milk is therefore one of the worst pollutants to that could enter the river system with a biological oxygen demand of 140,000 mg/litre.

Where is there arable farmland in the Great Stour Valley?

Intensive cereal and field vegetable cropping occurs on the Great Stour valley sides, using the more fertile and better-drained loam soils of the Chalk and river terraces.

Grazing marshes occur on the wetter clay and peat soils of the floodplain

How does arable agricultural pollution affect the river on a local scale?

There are high concentrations of nitrates in the local groundwater, especially to the north-east of Canterbury (in the Thanet area). This is a Nitrate Vulnerable Zone (NVZ), where pollution levels exceed 50 mg/litre. The EU Drinking Water Directive set this limit for safe nitrate levels in 1980. In 1991, the EU issued another Nitrate Directive which required countries to identify NVZs where excessive nitrate pollution came from agricultural sources. Thanet is one of 68 NVZs in the UK. Locally, farming intensity is not as high as in Thanet, but eutrophication is bad in some of the marsh dykes (Stour Marshes).

Excessive demand for water (farmers are licensed by the Environment Agency to abstract water directly from the river for spray irrigation) can result in low flows, reducing the dilution capacity of the river; this is worse in summer, and particularly in drought years. This is known as a dilution effect, i.e. concentration increases as flow decreases. In wet winters however, prolonged and heavy rainfall may result in organic pollution incidents, with increased runoff from fertilized fields and accidental overflow from slurry pits. This is known as a pumping effect, i.e. concentration increases as flow increases, flushing chemicals off the fields and farmyards. These two responses seem to work in opposite directions, making the evaluation of diffuse pollution quite difficult.

How can we try to prevent agricultural pollution?

The Ministry of Agriculture, Food and Fisheries - MAFF (now called The Ministry of Environment, Food and Rural Affairs -MEFRA) produced in 1991 a "Code of Good Agricultural Practice" for farmers giving detailed advice on the treating, storing and applying of animal livestock waste, the disposal of dirty water, fertilizers, fuel oil, sheep dip, pesticides, nitrates, disposal of animal carcasses, etc. With EA advice also, local farmers all have to produce a Farm Waste Management Plan to comply with pollution control regulations. Some examples of good practice are:

- reducing ploughing in the autumn
- delaying the ploughing in of crop residues
- reducing the amount of fertilizers, manure and sewage sludge applied
- sowing autumn crops early
- sowing cover crops in winter to avoid bare ground
- careful management of disposal of farm waste
- Set-aside regulations will also have the beneficial effect of reducing intensity of farming in the local area, and thus lowering nitrate levels.

What about orchards?

Fruit farming locally forms part of the North Kent Fruit Belt. Orchards, small fruits and hops are all grown in this area, taking advantage of the lighter sandy soils of the

Tertiary rocks,
sandwiched
between the
heavier clay soils
to the north and
the Chalk loams
to the south,
(see geology.)

Are there pollution threats from orchards?

The potential threat to water pollution comes from the intensive use of pesticides. 'Pesticide' is a general term which includes herbicides, fungicides and insecticides. They are widely used for weed control in agriculture, but also on roadsides and railway embankments. Spray drift from pesticide application can enter water courses if orchards are located too close to the river. The main threat however comes, not from spraying, but from poor storage and accidental spillage, as a result of which pesticides may get into, and contaminate, the groundwater.

Pesticides are persistent in the food chain, since the chemicals involved are non-degradable; they are said to 'bioaccumulate' in the food chain. Organochlorides are found to cause changes in the sexual and reproductive characteristics of wildlife. Top carnivores (in the river, fish) are especially affected. Since pesticides are found in very low concentrations in water, their detection and measurement is complex and expensive. The maximum admissible concentration (MAC) is extremely small - 100 ng/litre or 1 part in 10,000,000 for any one individual substance, but 500 ng/litre for total pesticide residues.

How does orchard pollution affect the river on a local scale?

Spray application has never been a problem locally. Triazines and Drins are representative groups of pesticide compounds, minute traces of which have been detected in the Great Stour.

The following traces of pesticides were recorded in the river at
Bretts Bailey Bridge (GR 187602) on June 4th 1999:

Endosulphan 2.2
Malathion 15.0
HCH 7.4
DDT 2.3
Drins 2.5
Triazines 48.1
Tributyltin 4.0
Fenitrothion 8.0

It can be seen that this is well within the EU Directive of 500 ng/l and thus poses no threat to water supplies. There were no recorded failures in this category of water pollution in the period 1995-1997. It is interesting to note that certain banned substances are still detectable. The Water Act (1989) lists these pesticides which are now banned in the UK including DDT, Dieldrin, Fenitrothion, Malathion, Endosulphan, etc. Their presence in the river is testimony to their persistence, clearly pre-dating the 1989 ban.

TOTAL 89.5
ng/l

How can we try to prevent orchard pollution?

Local farmers follow the MAFF "Code of Good Agricultural Practice" and are required to produce a "Farm Waste Management Plan" for the Environment Agency. See arable section on prevention of pollution for more details. Correct spraying techniques have to be observed, under safe weather conditions.