

WATER REPORTS

BY WDEA 8TH JULY 1999

**JERSEY GROUND WATER
REPORT AND FINDINGS BY THE WATER DIVINERS AND ENGINEERS ASSOCIATION.**

INTRODUCTION

When the British Geological Survey issued their first report on Jersey's Water supplies those local people familiar with the subject were so astounded that some got together to investigate and challenge the BGS statements. Those originally involved in the Water Diviners and Engineers Group (we believe the word association to be more appropriate) were:-

Gerard Baudains, 35 years experience in mechanical engineering and longer in farming in Jersey. Water diver.

Mr. W Taverner, engineer. Surveyed the Queen's Road site prior to building Power Station, 50 plus years experience water divining in Jersey.

Mr. G Langlois, retired civil engineer, 50 years experience water divining in Jersey.

Mr. W de la Haye, well driller and water diver, 30 years experience drilling in Jersey, latterly in France also.

Between us we believe we have a considerable pool of local knowledge of geology and underground water supplies. We have attended meetings at the Howard Davis Farm with members from Agriculture and Fisheries, Public Services, and BGS on several occasions; we have attended various other meetings; we have undertaken water divining research specifically for this debate; we have studied the BGS water reports and compared that information with our own data. We have compared present day water levels in the wells at the JEC with those taken in 1936 by Mr. W Taverner. We have visited Les Ecrehos and Les Minquiers to investigate subterranean water supplies. We have pumped out, investigated and taken samples of water from the seven hundred year old well on Les Ecrehos. Two of our members regularly water divine in France for well drilling purposes. We believe our knowledge and data is worthy of serious consideration. In studying the BGS water reports we have noted inaccuracies and omissions. We have employed, at our own expense, an independent UK expert to review the findings of BGS. In general we have done as much research as we felt possible considering the voluntary and unpaid nature of our work.

REVIEW OF THE BGS WATER REPORTS BY THE WATER DIVINERS AND ENGINEERS ASSOCIATION (JERSEY)

Book 1, (technical report WD/91/15).

We would point out that our comments relate mainly to quantity with only general references to quality. Clearly we do not have the resources available to BGS or Public Services in terms of either manpower or finance to pursue the latter issue. At a cost of £80 each clearly we were unable to procure more than half a dozen water sample analyses. We do note, however, that the micro biological and organic analyses by BGS were not done independently but in house. It is interesting to note in the January 1991 first report preface that in the list of 'credits' there is not one local water diviner or well driller, the people most likely to have knowledge of Jersey's ground water.

Also the original BGS team working on the project were students staying at Les Quennevais camp site who, at one stage, were unable to measure the depth of water in a bore hole. Perhaps this accounts for some of the early data being unreliable. The most alarming feature of the first water report is its reliance on guess work. For example, in the executive summary we have - *"the soil moisture deficit analysis suggests that the island's theoretical renewable resource is approximately"*. In the next sentence - *"estimated total abstraction is about 70% of this figure"*. The next sentence - *"this high percentage indicates that over pumping is already occurring and eroding base flow"*.

We note with dismay the frequency with which theory and estimation is extrapolated into figures which are then used as hard fact.

We find the penultimate paragraph on the first page of the executive summary curious in that it suggests that overpumping of St Ouen's sand aquifer will not occur because of the head of fresh water sustaining the saline interface whilst further on BGS argue the opposite for the area of St Clement. Presumably as the JNWCo pump this aquifer their careful monitoring has allayed BGS's fears.

In paragraph 6 of the executive summary it states that there are declining water levels in the aquifer above.

"The water table is declining permanently in some areas as full recovery cannot occur during the winter rains". We challenge BGS to prove that water levels are declining. With regard to the last paragraph of the introduction on page 1, BGS state that - *"Jersey ground water resources are replenished by direct rainfall over the island; none derives from underground flow from recharged elsewhere"*.

The WDEA firmly believe that our underground water supplies come to us from France. France lies 15 miles to the East of Jersey and the sea between us is shallow. A few thousand years ago we were joined to France. Our water divining (remember water diviners cannot locate still water, only flowing water) has proved that the flow of water under Jersey travels generally in an East/West direction, flowing through the faults in the rock. The underground stream feeding the Fort Regent Well has been divined East as far as Brickfield Lane in St Saviour and several streams have been divined in the southern part of St Clement. (See note 1 and page 8 of Report 1).

It would not be unusual for water to travel 15 miles or more in a stream under ground. Because rising sea levels and erosion now mean there is seawater between us and France, that is no reason to suspect the flow of underground streams has been curtailed, although it may account, possibly, for the tiny amount of saline intrusion that exists in some areas of St Clement. (See note 2).

BGS's reports hinge on the assumption that:-

- 1) Jersey's water supplies originated solely from rainfall on the island.
- 2) That the amount abstracted is equal to or exceeds the rainwater that infiltrates Jersey's rock.

Whilst BGS state that water flow is principally from the high ground at Les Platons to other parts of the island, they also point out on page 8 of report 1, that the main fault trend is West/East, and that there is also a West/South/West trend.

On page 20 we note that - *"long term bore hole water level hydrographs are not available for the bedrock"*.

Paragraph 2.3 on page 19 shows how little research has been done. *"These features may only be dilated sufficiently for ground water flow to take place near surface because of the pressure of overburden. All the main water bearing strata in Jersey are therefore shallow, generally within the uppermost 10 to 40 metres"*.

We have consistently argued that there are deep water flows under Jersey. It only took an hour trawling through well drillers data to discover 50 bore holes where underground streams were first struck by the drill at depths below 50 metres, some below 90 metres. (see note 4)

Despite giving a list of these to Mr. R Calverwell of Public Services, the existence of this deep water continues to be denied.

On page 25 of report 1. The paragraphs 1 - 5 are a typical example BGS's conversion of guesswork into fact.

Paragraph 1. Assume.

Paragraph 2. Assume.

Paragraph 3. Say.

Paragraph 4. Let sample represent.

Paragraph 5. Estimated.

Page 26. The estimated annual take represents approximately 70% of the available resource. A percentage which leaves little scope for weaker supplies in dry years.....

Again, guesswork becomes hard fact.

On page 27 one has to query why Jersey's estimated annual infiltration is a third to a quarter of that of the other examples. Again we have estimated annual infiltration and percentage extraction of theoretical renewable resource.

We note in table 14 on page 48 that Jersey's rainwater is especially high in chlorine and NA, (presumably due to marine effects on rainwater).

We are also pleased to note that on page 49 that it is stated - *"some waters in the south and southeast are derived from up welling from deeper oxygen poor sources"*.

This is precisely the deeper pressurised ground water which the WDEA would like investigated.

We also note with interest the last paragraph on page 61.

Page 73, section 6.1. We believe that the first paragraph clearly demonstrates that BGS have confined themselves to studying what we call surface water - the water which has soaked into the ground and which is not detectable by water diviners. Such water is shallow, probably polluted and a well or borehole relying on this source will suffer high seasonal fluctuations, possibly drying up in periods of drought.

This fact is emphasised in the third paragraph where it states - *"most ground water flow is relatively shallow. Borehole evidence suggests between 10 - 40 metres below ground level"*. Again the deeper flow referred to at the end of this paragraph are the underground streams in which the WDEA are interested. Again in paragraph 4 we have - *"this is compatible with the basic North/South ground water flow hypothesis"*. *"Areas where up welling of deeper flow path waters maybe occurring"* - and in paragraph 5 - *"these are deeper ground waters which may be rising to the surface here rather than along the south coast of the island"*.

BGS having outlined the fact two layers of water exist - the underground streams (*"deeper flow paths"*) as BGS call them, and the surface water, then fail to investigate this important source.

In section 6.2 BGS then launch into - *"the whole bedrock aquifer system is at risk"* *"The available groundwater resources on Jersey are under attack from two separate directions, over exploitation and pollution. The theoretical renewable resource"*. *"The renewable resource is divided between estimated abstraction by pumping"*.

Again, we have unsupported statements and guesswork.

On page 75 paragraph 2, - *"However there are many reports throughout the summers of '89 and '90 of boreholes and wells drying up which were previously thought to be reliable"*. The WDEA are not aware of any boreholes or wells drying up unless:-

- 1) They were originally sunk into the surface water (see previous notes) or
- 2) The borehole has failed for mechanical reasons, e.g. the pump has failed and can't be pulled out because the liner has collapsed.

It is interesting to note given BGS's alarming statements about saline intrusion that in paragraph 8 of page 75 there is the sentence - *"over pumping cannot, therefore, promote wide spread invasion of the aquifers by marine water"*.

This is but one of several contradictions in these water reports.

We would certainly agree with the first sentence of paragraph 5 on page 77 - *"the main need in the future is for reliable data"*. Higher up the first paragraph of Section 6.1 - *"except the sand aquifer at St Ouen's, the ground water resources of the island are being overpumped and are not wholly replenish in a normal recharged year."* We would like to know on what evidence BGS make this astounding statement.

Groundwater & Wells by Johnson; outlines the sort of information which is required to determine whether or not a water resource is being overpumped. The method is to note water levels at a similar time each year, and to compare these levels with those of ensuing years. One would need to make a table of water levels over twenty years to get reliable information. If the trend is steadily downwards then it is being overpumped. If the levels are constant or rising then there is no problem. In any case nothing is urgent. One would have years, maybe even decades, to act once a declining water table is noted. We therefore cannot agree with BGS's suggestion that immediate action is necessary, especially in view of the fact that Jersey's water table is not declining. Indeed there is evidence to the contrary.

Analysis of Report 2 (WD/92/22).

With reference to the preface, the last sentence states that the hydrogeological map of Jersey is now available. We previously asked that this be withdrawn as we consider it to be grossly misleading. The areas designated as saline intrusion and the profile of the water table have no correlation with our data.

In the executive summary, paragraph 2, we would stress that we have no confidence in a computer ground water model as the conclusions are only as good as the information put in. With Jersey's extremely complicated geology, with rain water soaking into the surface, with up welling ground water, with streams running out to sea both on the surface and underneath with exchanges between ground water, surface water, reservoirs and the JNWCo water supply, we fail to see how it could be possible to get information sufficiently correct to make computer modeling a useful exercise.

Referring to our previous statement about obtaining water levels over a long period of time, the fourth paragraph on page 1 of the introduction is interesting in that it states - *"direct measurement of representative of ground water levels has proved very difficult due to interference from pumping. The likelihood is that ground water levels and ground water storage are at a low ebb"*.

We believe it is unscientific to draw a conclusion such as this having admitted that measurement is proving difficult.

Again the last paragraph on page 2, *"theoretical renewable underground water..... is approximatelytotal abstraction of ground water may amount these estimates suggest that overpumping may already be established.....if this is the case historical data are not available to substantiate this assertion"*.

We are amazed that what is purported to be a scientific document contains so much estimation and supposition.

On page 4 *"(some coastal areas are susceptible to seawater ingress)"*.

We know of several boreholes within feet of the sea wall along the south east corner of Jersey and yet these are not pumping seawater but are used for drinking and garden irrigation. We note the last sentence - *"groundwaters are in any case rich in chlorine due to the marine environment of the prevailing westerly winds"* and suggest this negates the overpumping theory. Could not the salinity referred to earlier be caused by either Jersey's salt laden rainwater or the possibility of the sea interfacing with underground streams to the east of Jersey as outlined in the beginning of our report?

Referring to our previous comments on the computer model employed by BGS we would draw attention to the third paragraph on page 6 - *"uncertainties in both hydraulic conductivity and recharge lead to multiple solutions for the water balance which no model can handle satisfactorily"*.

We reiterate that we have no confidence in a computer model being able to generate useful or meaningful information in relation to Jersey's underground water supplies. The fact that section 2.3.3 on page 10 states that the base of the aquifer has been arbitrarily set to 40 metres below topographic level whereas we argue that most of Jersey's water flows below this level and merely reinforces our argument.

Groundwater resources page 23 - *"data have now been collected over a time base of two years"*.

Referring to our earlier comments twenty years would be needed to give a meaningful outline with 10 years being perhaps the minimum to gain a useful impression. Two years is quite useless.

Section 3.2 - *"statistically the limited monitoring information indicates neither rise or fall in water table and evidence must be sought elsewhere to establish if the water table is declining"*. No evidence of declining water table but a suggestion that BGS are hoping to find somewhere where it is.

Paragraph 2 - *"this data set shows little change in fifty years"*. So where is the declining water table with which BGS are so concerned?

"Two wells completed in 76 show a decline in water level to the present day. This decline probably reflects pumping rather than any a real decline in water level". "The water table is for the most part relatively stable with time even during the current relatively dry period".

Need we say more?

The last paragraph of section 3.2 on page 25. We would advise that the demand for new boreholes to replace existing sources that have failed are due to mechanical failure, not to wells drying up as is suggested in the last sentence.

On page 40, section 3.7 - (the groundwater balance) - *"given a low rain fall year there is likely to be an overdraft given a wet year there may be a surplus"*. This is a typical if but or maybe followed closely by the statement - *"there is little room for further development of the groundwater"*.

Page 47 in view of the statement in the last paragraph we believe that this particular statistic should be left out of calculations as it causes an unnatural distortion. It is admitted that this is a contaminated supply.

Page 57, section 4.5 (seawater intrusion) - *"the seawater component was identified in the St Clement area as only 1% or less"*. Are BGS overstating the problem elsewhere? Also the previous sentence suggests that seawater may be drawn into a borehole by pumping but earlier in our report we have outlined the case where continued pumping reduces saline. We refer to our earlier comments on salt laden rainwater and possible sea/groundwater interchange to the east of Jersey.

We note the last sentence on page 61 - *"the Jersey groundwaters were probably recharged a few years to a few decades ago"*.

Again on page 63 we have the statement - *"boreholes and wells are reportedly drying up with each succeeding winter", or "and in the southeast where seawater is intruding the aquifer....."*. These statements (which we challenge) are then used as a basis for paragraph 3 - *"these failures to the groundwater system are signs that the water balance is now critical"*.

We would suggest once again profound statements are being made without scientific basis.

Section 5.3 on page 65 - *"however the potential imbalance between resource potential and demand can now be restated with confidence"*.

The WDEA asks how.

WATER REPORT NO 3.

In the executive summary we note in paragraph 2 - *"the likelihood of a groundwater deficit is indicated by a probable underestimate of potential evaporation, underestimate of groundwater abstraction*". What sort of science is this?

"However, it is still difficult to monitor water levels that are independent of local pumping and fixed head regimes, and long term change in water level is not apparent at many sites". So data is unreliable and water table constant.

In paragraph 4 - *"groundwater flow is predominately from North to South"* - we challenge this theory.

In the last paragraph - *"Jersey groundwaters still apparently remain at relatively little risk from contamination by pesticides"*. In other sections they warn us that our water is at risk from pesticides.

Introduction page 1, - *"intensive agriculture and horticulture throughout the island has polluted much of the water resource which has now elevated nitrogen concentration".* Where is the proof?

Last paragraph - *"accumulating evidence suggests that the resource is being over exploited and the abstraction levels are ultimately unsustainable"*. What evidence?

The next sentence reads - *"the likelihood of a groundwater deficit has been calculated using a limited island wide data set supplemented by statistically generated data"*.

This sounds suspiciously like guesswork to us.

The last sentence - *"this study will allow precise quantification of the groundwater balance in the catchment with a more accurate estimate of the available groundwater resource or theoretical renewable resource for the whole island"*. This is entering the realms of fantasy.

First paragraph, page 2 - *"the island is formed of Precambrian and Cambro Ordovician rocks which have not been glaciated and are weathered with a shallow aquifer perhaps forty metres thick"*.

It is important to remember this forty metres is an arbitrary figure plucked from the air to enable a modflow exercise to take place. It is not true and we are not aware of any research research having been done to quantify this statement.

We have been advised that the MODFLOW computer modelling mentioned in paragraph 4 is unreliable for the granite type of geology found in Jersey.

Page 4, first paragraph - *"continued decline in water levelGrouville spring"*.

In September 93, Gosselin's well was reported as never being higher; this well is quite close.

Second paragraph - *"to date, attempts to use such equipment to acquire meaningful data have failed"*.

Our comment, - so how can fundamental conclusions and statements be made when BGS admit they have no meaningful data on water levels, although further on in the third paragraph - *"it was noted that there was apparently little real change in water levels between 1943 and the present day"*.

So water levels are static as we state with confidence.

These water reports are full of contradiction. Interestingly the diagram on page 6 shows water levels rising from the year 1990 to 1992.

On page 7 we are amazed that paragraph 3 and paragraph 2.3 (the groundwater balance - a revision) should be included in what purports to be a scientific report.

The second sentence of paragraph 2.3 reads - "the theoretical renewable resource was estimated to be 4500 to 6700 x 10³ M³/A in the year 2 report and baseflow was determined as 2100 x 10³ M³/A. Total groundwater abstraction is estimated above at 3500 x 10³ M³/A."

We submit that this paragraph, like much of BGS's statement, is an exercise in extrapolation of theory and guess work.

Page 9 (paragraph 3), we notice that it is admitted that a collapsing water table does not exist. The statement that low lying coastal areas are still susceptible to exhaustion and saline intrusion we would disagree with.

Paragraph 4 requires careful study. It is stated that "*the forty metres thickness of aquifer may be an overestimate*". Also - "*this trial and error by the drillers on the island*". We are aware that some well drillers drill in hope more than expectation and as such give the industry a bad name. We are only interested in boreholes which have been professionally sunk into a water divined underground stream. The rest of the sentence reads - "*that yields in greater depths beneath the water table are marginal and the effective island wide aquifer thickness may only be 25 metres*". Our data proves that the yields from greater depths are substantial and the 25 metre statement is unsustainable in the light of the well driller's records. See note (4).

Page 47, the last paragraph, we noticed that the groundwater model of Robins and Smedly suggests that groundwater flows predominately from the North to the South. Do they have any evidence?

Page 49, paragraph 2 - "*depth of the unsaturated zone is usually only a few metres typically between 2 and 5 metres*". Add these figures to the 25 metres previously stated and you have depths from surface to bottom of aquifer of 30 metres. This is absurd.

Page 51(B). It is our understanding that a typical leakage factor for sewers is 20%. If that is so then a considerable amount of nitrogen must be reaching soil and underground water from the public sewerage system.

Page 67, table 14. We invite people to study this six year survey of pesticide results. This clearly shows there is not a problem with pesticide pollution of island water supplies.

In the list of recommendations on page 68 we totally disagree with paragraph 5, indeed the first sentence should be turned on its head.
We agree entirely with paragraph 8 on page 68.

**REVIEW OF WATER REPORT NO 4.
TECHNICAL REPORT WD/94/53**

In **Background**, page 1, it states, *"There is no reworking of data, the conclusions reported earlier in the Year 3 Report (Robins & Others, 1993) remain extent"*.

The Trinity catchment study page 2, we have no comment apart from the fact that we do not believe that the area can be used to extrapolate data for the whole of the island as is suggested in paragraph 1.

On page 6, paragraph 4.1. *"The bedrock aquifer is a shallow fractured aquifer which underlines the whole of the island"*. We dispute this.

"Depth to water is only a few metres beneath much of the island and increasing to 10 to 30 metres beneath high elevation coastal areas". Disputed again.

At the bottom of page 6, *"boreholes have been drilled up to 84 metres"* etc.

They have been drilled a lot deeper than that and again the deep groundwater circulation they referred to but do not investigate is in fact the quality abundant supply which the WDEA have been trying to prove the existence of for years. *"For the most part groundwater flow is shallow"* is incorrect.

The first paragraph on page 7, North of St Ouens Bay there is no groundwater of any consequence, there is a borehole of approximately 500 feet deep near the Lobster Pot which is dry but it is interesting to note the same paragraph includes the words *"seawater intrusion is not a significant problem"*. The last paragraph of 4.1 on page 7 proves that BGS have done no research into the possibility of freshwater reaching us from the continent.

On paragraph 4.2, *"large parts of St Clements and Grouville are experiencing saline intrusion"* contradicts the previous paragraph and we would argue that this is not true.

Page 16, paragraph 5.3 the first line probably says it all. *"The absence of reliable of annual island wide groundwater level data precludes the presentation of a detail picture of the movement of water levels over this annual period"*.

We would reiterate that long term monitoring is necessary. The *"graphs"* in the rear of Year Report are fairly useless and that they give the movement over less than one year. What is needed is the water level at the same period of time in succeeding years. These part yearly graphs, unreliable as they are, do not show an indication of a collapsing water table.

Report of the working party on the safeguarding of the water resources of Jersey
(by Public Services Committee March 1992).

This adds nothing to the argument as it merely accepts BGS's findings and draws conclusions from it.

Groundwater resources degradation in Jersey: socio economic impacts and their mitigation (by the British Geological Survey-Technical Report WD/96/8).

It is interesting to note in the summary on Page 13, third paragraph, *"the emergence of mass tourism"*.

Page 1, paragraph 2.1 Really? Regurgitated statements from previous reports (shallow aquifer). This is not true. They state also *"the water levels generally followed a subdued version of the surface topography"*. *"Depths to water is only a few metres beneath much of the island, increasing to 10 to 30 metres per high beneath high elevation coastal areas"*. Of course both these statements are untrue.

The second paragraph under paragraph 2.1. *"sustainable yields from boreholes are small when compared with aquifers in the UK and elsewhere. Typical borehole yield is less than .5 litres per second"*.

This is again wrong. .5 litres per second equates to 400 gallons an hour. If that's the best boreholes in Jersey could do the well drillers wouldn't get paid. Most wells and boreholes give 1000 gallons per hour, quite a lot give 3000 gallons per hour and there are one or two that give 10,000 gallons per hour. So much for BGS's knowledge of borehole flow rates. We know of instances where they have measured flow rates from a defective pump and flow rates from a borehole after the water has gone through a processing plant so in both cases those would not be anywhere near true readings of the borehole output.

Page 3 becomes more interesting, paragraph 2.1.1 *"long term depletion of the groundwater resources is not a significant problem in Jersey the aquifer is thin and has little storage"*. BGS haven't done any investigation that we are aware of to evaluate the thickness of the aquifer. Whilst the well drillers are aware of how to achieve this data they are not aware that BGS has ever asked for it to be done. Indeed, when P.S. engineers have asked for boreholes to be drilled, it has become clear that they have no knowledge of boreholes and thier drilling.

Further down below table 1 we have *"a quick estimate of the groundwater resources can be made by making broad assumptions about the aquifer"* the next sentence *"a rough water balance"*. The next paragraph contains the words *"estimates, extrapolating, indicates, suggesting"*. What sort of science is this?

Page 5, paragraph 2.11. *"In the summary, there appears to be no deficit in the water-balance at present. Current discharges from the groundwater system amounts to between 50% and 100% of the estimated average annual renewable resource. Although the margins of uncelainty in the estimation of abstraction and recharge are large, problems of physically unsustainable use, that is where abstraction exceeds recharge, are probably only significant in the short run during periods of 'drought' and in particular localities, rather than posing a longer term threat for the Island as a whole"*.

This paragraph should be studied carefully.

On page 8 under pesticides they talk about herbicides used in onion and pea cultivation. Where are these crops? In the middle of the same paragraph is *"very few sources analysis had detectable concentrations"* - (of pesticides).

On page 10, top sentence *"the instance of significant pesticide concentrations arising in groundwater has risen considerable in recent years"* and yet elsewhere in the reports out of hundreds of samples tested only about five were positive and all within safety levels, quite apart from the statement shown above!

In the second paragraph, the first line is interesting *"there is little evidence of long term over exploitation and falling water levels in many parts of the island"* also *"long term trends tend to be steady within the interior of the island"*. Next sentence, *"in the coastal margins many boreholes have failed in recent years*". The only failures that the well drillers are aware of are those that have failed from mechanical reasons not for lack of water. The very few that have failed due to lack of water are those that have been sunk into the surface water and not into a underground stream. Unfortunately there are one or two well drillers who do not water divine before drilling.

The last paragraph of 2.2.2 *"when the resource is stressed and water levels are low, less groundwater can be pumped from the existing wells and boreholes, therefore protecting the bulk of the groundwater resources from severe depletion"*.

We would not normally have a comment to make on this except in so far as BGS, by this statement, seem to believe that there is no risk of over exploitation of Jersey's underground water supplies and yet elsewhere in their various water reports over abstraction is the biggest problem that needs immediate legislation!

There are more contradictions in these water reports than in any technical book I have read in the last forty years (G. Baudains).

It is interesting to note figure 8 on page 14, has no data for peas and onions which were so prominent earlier on in this report.

Interestingly on top of page 18 are the words *"tourism in crisis, by contrast with financial services tourism in Jersey has been in marked decline.."* Its interesting to compare this with the third paragraph on page IV *"the emergence of mass tourism"*.

On page 20, whilst not in relation to water quantity again, there is a clear lack of knowledge about farming in Jersey, - such as the statements about large quantities of nitrogen, being often subsidised overuse in the application of chemicals and pesticides requirement of products aimed at niche markets also tend to be high (for which there is no evidence).

The fifth paragraph on that page concludes by *"consolidating agriculture holdings the demand for water and agriculture will be concentrated"*.

They seem to have lost sight of the fact that when you buy a field you don't move it next to yours; it stays in the same place, so the water requirements will stay in the same place.

What the reference to cheap immigrant labour in paragraph 4 has to do with water we are not quite sure.

Again in paragraph 5 they are ill informed. *"1989 chemical fertiliser import at 5075 tons, 4050 in 1992."* It then suggests that this does not *"necessarily indicate levels of application since fertiliser can be stored"*.

Clearly they are unaware that if you store fertiliser for a year or so it becomes solid and unusable.

On page 22 top paragraph *"total water consumption in 1993 was 6650 ML"*. How was that figure obtained or guessed?

Figure 14 on page 24 gives a lie to the statement that Jersey is a simple geology.

On page 27 there is an absurd diagram and we would like to know where the river is which is shown in the top of the picture. The remainder of the report seems to be more of a political nature - the only comment we would make would be on page 35 paragraph 5.1. second paragraph.

We have information that high nitrate concentrations may prevent stomach cancer and not cause it.

On page 46, paragraph 7, "Conclusion". It is refreshing to read "*The major water problems of the Island are not, however, primarily quantitative*". So we aren't running out of water after all!

THE JERSEY GROUNDWATER STUDY RESEARCH BGS REPORT RR/98/5

In the executive summary they restate previous comments *"groundwater flow is principally North to South"* - We determine the flow as being from East to West. They state that sustainable borehole yield is about half a litre per second (400 gph) and that the highest known yield is 4 litres per second (3300 gph) whereas we know that (see appended notes on boreholes) even shallow wells will produce more than this and that average borehole yields are more than three times greater than BGS's statement at between 1000/3000 gph and far from 4 litres per second (3300 gph) being exceptional, it is not unusual.

The highest known flow is in fact nearer 10,000 gph, again three times BGS's figure.

They also suggest that *"analysis of borehole hydrograph suggests annual recharge rates lie between 30 and 300 millimetres per year"*. So their suggestion has one thousand percent a corridor - so wide that any calculations based on this would be totally meaningless.

We would also suggest that the BGS's own data contradicts their statement that *"organic pollutants, notably pesticides, are increasingly being detected in groundwater"*.

Interestingly in the introduction on page 1 they state that *"chemical analyses for the public supply boreholes at Mont a La Brune suggests little long term in major ion concentration, including nitrate since 1974"*. The next sentence states *"nevertheless a serious nitrate pollution problem was developing throughout the 1980's"*. Another contradiction?

On page 2 BGS state that the studies have involved in *"three research institutes, two universities and a variety of consultant engineers"*. This gives the impression that a broad spectrum of expertise has been used in these reports. Unfortunately the data from which everything is extrapolated comes from solely one source, a combination of Public Services and BGS.

We noted on page 2, paragraph 1.2.2 that it is recognised that the *"the dominant structural trend in Jersey is East/North East to West/South West"*.

This is a very important statement as it admits that the fissures run in the same direction (East/West) that we know the water flows. As water flows through cracks in the rock and not through solid rock we would suggest this disproves BGS's theory of a North/South underground water flow.

On page 7 it is refreshing to see an acceptance that of the approximately 70 new boreholes drilled each year, half are replacements for defective or dry boreholes.

On page 8, hydrogeology, paragraph 2.1.1. Again boreholes yields are grossly understated. It is suggested that most boreholes yield less than 400 gallons per hour and many less than 80 gallons per hour. This is absurd producing such tiny quantities of water.

They again restate the inaccurate information that *"depth to water table is generally a few metres increasing to 10 - 30 metres beneath higher ground"* (see appendix of borehole notes), although later on in that paragraph they quote *"a few boreholes have encountered useable quantities of groundwater at depths of up to 84 metres below ground surface, and these may penetrate the deeper lines of structural weakness that trend East North/East to West/South West across the island"*. The following sentence suggests that this flow is of relatively limited volume.

We dispute this as it is in fact the principal supply used by boreholes.

Their note 1 is also inaccurate. If we are the Water Diviners referred to in this paragraph, we have never portrayed or suggested that any underground rivers exist under Jersey. The underground streams are not mystical; we believe that these streams come from France but our attempts to investigate this have been frustrated whilst BGS have made no attempt at investigation whatsoever. It would be logical for such water to come from the Pyrenees but of course that would require much more extensive research. We were advised by a UK expert that some water in England was attributed to a flow path from the Pyrenees but we have no knowledge of this and it is peripheral to the present argument.

The reference to the moon being a driving force was made in the nature of a possibility which should be researched. In view of the profound effect that it has on water above ground (we are familiar with a 40 foot rise and fall of tide caused by our moon) it would be interesting to evaluate what effects this may have on underground water.

In the reference to Fort Regent's well we believe that BGS has misunderstood underground streams (water flowing through fractures in the rock). In the case of the stream feeding the Fort Regent well, it is continually flowing otherwise water diviners would not be able to detect it. There are actually two streams which feed the well and they have been traced back as far as Brickfield Lane (it was not traced further due to a) lack of time, b) the number of branches in the stream creating difficulties in determining the main flow path).

We know of no situation where water is not under pressure when the stream is penetrated, whether by a well or a borehole. Some of these underground streams are running at pressures approaching 200 pounds per square inch (i.e. a 400 foot head of water). The rate of abstraction apportioned to the Fort Regent well is onerous as it is based on the fact that *"24 men working for two hours can with ease pump 800 gallons of water"*; this does not mean more could not be pumped, only what the men could achieve; in other words it is a pumping capacity not a stream flow capacity.

The statement towards the end of paragraph 2.1.1 suggests that intense pumping on boreholes in Grouville Bay area invites saline intrusion.

Our information is that the opposite is the case. ().

The whole thesis of this report seems to be about a "water bubble" - a phrase much in use some years ago. It infers that underneath Jersey lies a saturated sand or rock in which lies water. The WDEA are not interested in these shallow aquifers because, with a few exceptions, they are low yielding and unreliable in times of drought. The WDEA are concerned only with the water flowing through rock fissures; these are the streams that supply all wells and boreholes which have been sunk according to water diviners instructions and are therefore reliable. The depth at which water is to be struck and the quantity available can be determined before drilling; indeed any reputable water well driller will guarantee it.

We believe the fancy equation in paragraph 2.1.5 is irrelevant as it is based on the guesswork and estimation used in previous BGS water reports and furthermore does not take into account many factors, including the possible recharge from the adjacent continental coast.

Page 14 figure 8. If the data is in fact correct, it demonstrates that we do not have a collapsing water table as BGS has suggested elsewhere, but that it is a steady situation. Indeed, in many places the groundwater could not be higher, as many wells or boreholes are either full or overflowing (artesian).

On page 13, last paragraph, BGS admit that any surplus is discharged to the sea at the coast. We notice that they make no comment about the possibility of deeper underground streams discharging into sea further offshore.

It is strange that on page 17, BGS refer to nitrates being low or below detection limits in the South East coastal areas and yet in figure 12 they show one of the highest concentrations as being in the South East corner. Another contradiction?

At the end of page 22 and carried on to the top of page 28 there is the interesting sentence *"in the low lying coastal areas, although there is evidence of higher salinity derived from mixing with a minor proportion of seawater, there is no evidence for increasing salinity resulting from pumping induced saline intrusion"*. Surely this is a variance with BGS's often stated theory that over abstraction is causing saline intrusion?

On page 32 *"total use of groundwater and base flow represents just over half the available annual renewable resource"*. We suggest this sentence is untenable in the light of
a) no research has been done to establish whether the water flowing under Jersey come from France (if the water flows from East to West where does the water in the East of the island come from?) and b) no one can calculate the volume of water available in the rocks under Jersey and c) the apparent acceptance by BGS that little water exists below 25 metres.

The predominant water supply is the deeper "flow paths" to which BGS refer but have not investigated. The volume of water existing under Jersey is not only unquantifiable but the estimates proposed by BGS relate only to the insignificant "surface water" that is both unreliable and unsuitable for well and borehole supplies.

CONCLUSION

The WDEA has no confidence in the data supplied by BGS as it appears to relate mainly to the surface water and not the high volume reliable deeper supplies which they only refer to in passing.

We note with dismay that the majority of BGS's data seemingly hinges on estimates, guesswork and assumption as admitted in their own statements. Compounding this problem has been the reluctance to incorporate leaking water mains, (circa 1 million gallons a day) leaking sewers and soakaway discharge into the recharge figures for Jersey, the dismissal by Public Service personnel of the existence of deep water underground streams (even though some boreholes on these streams are monitored by Public Services) and above all by the absence of any research into the origin of these underground streams.

It is interesting to note in the acknowledgments that they are listed as "field workers, analysts, modellers, agronomists, environmentalists, sociologists, economists, engineers and lawyers as well as hydrologists, hydrogeologists and hydrogeochemists". The well drillers, who for decades have drilled all over the island and have data relating to geology, depths to water, quantity of water, etc, together with water diviners locate the presence of underground streams, have been ignored and at times ridiculed. It therefore comes as a little surprise that the data and conclusions contained in the BGS water reports bear little resemblance to the facts as contained in the well drillers data.

For instance one stream feeding a borehole at La Moye runs at a pressure of around 150 psi, maintaining a head of water of some 300 feet. Every stream penetrated by a borehole is under pressure.

Were the water under Jersey to be lying in a kind of puddle as suggested by BGS then not only would water diviners not be able to locate it, but once water was struck by a well driller it would not rise up the bore. It is our belief that BGS have failed to understand Jersey's geology, failed to undertake proper research and presented as hard facts figures which are mere extrapolations of estimates and guesswork and shrouded it all in scientific gobbledegook with a view to baffling the layman into believing that these reports are scientific documents based on sound scientific research.

We demand that an independent review is made of the BGS reports with a view to establishing their credibility and accuracy and that research is done into the subterranean water flows that exist between here and France, and that the WDEA data is studied and not dismissed as has previously been the case.

We ask for an independent review because the officers of Public Services are too closely involved with BGS to be able to make unbiased assessments for their Committee.

Appended is a compilation of data relating to depth and flow rates of underground streams, a map of streams divined in the S.E. of Jersey and from the Fort Regent well, together with water depths at the Queen's Road site of the JEC and other relevant information.

1. JEC site
2. SE of Jersey Water Divined
3. Bore hole depths
4. Large volumes
5. Dr Suttons' Letters
6. Fort Well

WATER REPORT

Note 1) A local well some ten feet in diameter was sunk onto an underground stream circa 1950 by Galleon of Guemsey. Upon penetrating the stream the water was found to come in on the East side of the well. The stream runs through the centre of the well East/West.

Deputy Carter when president of Public Services was interested in helping us to further prove this matter by dyeing the centre of three wells on one stream with a view to tracing the dye in either of the other wells. Despite our pressing the issue the matter was never pursued. We are not aware of BGS having done any research into this matter either.

In order to gain further information on the probable flow of water from France to Jersey the WDEA visited both Les Minquiers and Les Ecrehos to determine underground water on these reefs by divining.

We have found water under Les Minquiers, Mr. G Langlois has reported fresh water being available near the Pipettes (only accessible at low water spring tides). A small amount of fresh water is visible on the north side of the Maitre Isle.

On Les Ecrehos there are strong indications of underground flow. There is fresh water again on the surface and there is a seven hundred year old stone built well which we have pumped, examined and had analysed. (See note 3).

Some years ago we offered to drill a borehole on the Ecrehos for research purposes. We are confident that circa 1000 gallons an hour could be pumped continuously from one of the streams flowing (East/West), under this reef. Our attempts to do this have been frustrated.

We believe that to establish that water flows to us from France would make all BGS's estimations of quantity, recharged etc. irrelevant. We are not aware that BGS has done any research either on the Les Minquiers or Les Ecrehos.

Note 2) Saline intrusion.

One would expect were saline intrusion to occur because of an interface between fresh and seawater that continued pumping would exacerbate the problem. This is not the case. One resident of St Clement pumped his borehole continuously for a long period of time () and the salinity declined to zero. Upon switching off his pump for a day or two the salinity was back to its normal level.

The salinity of the well mentioned in Note 1 has not changed since 1950. We believe this strikes out the theory that saline intrusion is caused by overpumping the aquifer. In 1950 there were no deep boreholes; pumping was by surface pump from shallow wells.

Note 3) Well on Les Erehos.

Pollution. Much is made about agriculture being the cause of high nitrate levels in Jersey groundwater. The well on the Les Erehos has a nitrate content of 2400 milligrams per litre; there is no agriculture on Les Ecrehos.

Note 4) Bores between 40/90 metres, without names. (These are confidential well drillers records).

WELLS at J.E.C. Queens Road,
 Comparison of levels,
 1936 by Mr. W. Taverner.
 1993 by Mr. G. Baudains and Mr. A. Dow (J.E.C.)

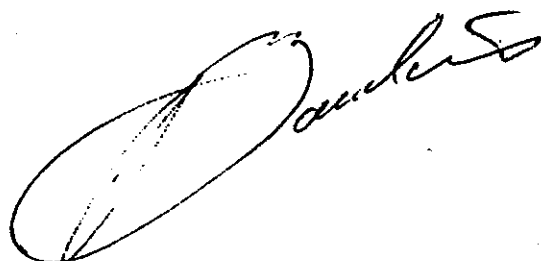
	1936	14-5-1993
North well, (west of queens rd)	-	14.0 ft.
South well, (west of coolers)	18.5 ft.	10.5 ft.
West well, (west of generators)	11.0 ft.	9.3 ft.
East well, (east of la pouquelaye)	8.0 ft.	-

The above figures represent the depth; wellhead to water.

The 1936 figures have been calculated from the data listed below, measured in relation to a datum (the floor of the Merlees diesel generator room) .

	N. Well.	S. Well	W. Well	E. Well
Ground level	-	-3.48'	0.00'	+10.00'
Water level	-	-21.98'	-11.00'	+2.00'
Depth of water	-	20.0'	38.0'	42.0'

G. Baudains,
 Le Bourg Villa,
 St. Clement.
 date May 16th. 1993.



50 Bone. Holes where
water was struck
once below 40 meters.

1990 To Present Day

Some produced water from 90 m'
and beyond, not before this depth

410 FT
305 ..
300 ..
300 ..
300 ..
X 400 ..
240 ..
X 500 ..
460 ..
300 ..
365 ..
300 ..
245 ..
375 ..
240 ..
X 400 ..
325 ..
210 ..
X 400 ..
X 410 ..
292 ..
245 ..
325 ..
325 ..
275 ..
X 400 ..
300 ..
275 ..
270 ..
X 480 ..
X 425 ..
304

295 FT
230 ..
X 410 ..
X 405 ..
208 ..
235 ..
305 ..
310 ..
325 ..
208 ..
X 335 ..
275 ..
275 ..
200 ..
325 ..
355 ..
300 ..
305 ..