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HORN CRAG QUARRY

FISHBECK, NEAR SILSDEN

WATER SUPPLY

**HAISTE INTERNATIONAL LIMITED**



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R E P O R T

Horn Crag Quarry, Fishbeck, Near Silsden

Water Supply

1. Introduction

1.1. A visit and inspection of the site was carried out and discussions were held with representatives of the Quarry owners and the supply users and other interested parties to establish, as far as possible, the existing situation and define the problems affecting the supply.

1.2. We have also held informal discussions with representatives of the Yorkshire Water Authority and the Bradford Metropolitan District Council concerning their past involvement with the problem and future measures which may be taken.

2. Existing Conditions

2.1. Our inspection at the site took place on 26th April, during a spell of dry weather. At the time of the inspection of the source, water was flowing at about a quarter capacity of the 100 mm diameter inlet pipe into the first of the two chambers at the head of the supply line. Prior to our visit, the stone slab covers to the first chamber had been removed to facilitate inspection. The cast iron cover to the second chamber was removed during our visit.

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- 2.2. The visual appearance of the water in the chambers, at the time of the visit, was clear.
- 2.3. Copies of the Quarry owners' proposals in respect of future quarrying operations were handed to us at the time of the visit, and we inspected the area of current activity as well as the remainder of the land which may be affected by possible future activities.
- 2.4. We then visited each of the properties served from the existing supply at the Quarry, together with two other adjacent properties (The Bungalow and Low Cringles Farm) which have independent supplies.
- 2.5. We were informed that all four properties taking water from the Quarry supply were currently importing drinking water in containers or using commercially bottled water for drinking; other uses continued with the Quarry supply.
- 2.6. Monitoring of the water quality is undertaken by the Bradford MDC Directorate of Housing and Environmental Health through their Keighley office. Recent samples had indicated that the quality of the water was such as to be unfit for drinking due to the high bacterial content. We have also seen samples containing significant amounts of settleable solids.
- 2.7. Clearly, irrespective of the causes of pollution, the existing supply is unsatisfactory and measures must be taken to improve the situation. We have considered two broad possibilities; the improvement of the existing supply and the possible alternative supplies available.

### 3. Improvements to the Existing Supply

- 3.1. According to the information we have been given, the supply reacts within a short period of time to rainfall, such that flows into the tanks can vary from a mere trickle in dry spells to a full-bore flow in wet weather; with consequent flooding out of the chambers due to an inadequate overflow arrangement. Connection to surface water sources as well as underground sources is therefore likely, and protection against pollution of surface run-off in the area surrounding the supply is essential.

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- 3.2. This means that improvements to the existing conditions in the area adjacent to the existing chambers must be made, and we consider that the following measures should be undertaken :
- 3.2.1. The provision of a proper watertight inspection cover to both chambers and the raising of the chamber walls to prevent direct ingress of surface run-off.
- 3.2.2. An increase in overflow capacity.
- 3.2.3. Fencing off to prevent access by animals.
- 3.2.4. Re-grading, removal of rubbish, topsoiling and seeding of the area with grass-seed (or alternatively turfing).
- 3.3. Further protection to the supply should be afforded by restricting activities in the area draining to the former Quarry pond, which has now been filled in. Whilst there is no absolute evidence of a connection between the former pond and the source of supply, we believe that it is very likely, bearing in mind the heavily fissured nature of the rock in the area, that passage of water between the former pond and the supply takes place. Thus, rainfall on the area can ultimately seep via the pond to the supply with little or no effective intermediate filtration.
- 3.4. The filling of the pond in itself was not necessarily inappropriate, although the method of filling has probably led to an initial increase in solids levels and turbulence within the water contained in the pond. Over a period of time, the fill will consolidate and may ultimately form a reasonable filtering medium, but until consolidation has been completed, there are always likely to be occasions when some displacement of soil within the fill takes place and further turbulence is caused.
- 3.5. Improvements could be made by increasing the impermeability of the surface above the pond and forming it to falls, such that drainage could be led off and away from the vicinity of the pond or the supply chambers. This would also help to avoid problems which might be caused, for example, by an accidental spillage of oil or fuel from plant travelling over the area. Exclusion of animals from the area draining to the pond is also desirable.

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- 3.6. Desirable as they are, the above measures are likely to be effective over a longer term. To achieve immediate improvements in supply quality, we consider that filters should be fitted to the supply. The type of filter we consider appropriate is that manufactured by British Berkefeld (part of the Portals Water Treatment Group) which is effective in removing harmful bacteria as well as particulate matter.
- 3.7. There are, however, some maintenance requirements with filters, particularly when the amount of iron in solution in the water supply is relatively high, as in this instance.
- 3.8. To establish how effective the filter will be, we would recommend that, initially, a small filter to provide safe drinking water only is fitted at one tap on each house (probably the kitchen tap). The performance of the filter should be monitored over an extended period, sufficient to cover a complete cycle of variations in supply conditions.
- 3.9. Should the filter be successful, then a larger installation, capable of serving all the water needs of each property, could be considered. This may take the form of a single large filter to serve all the properties; or units situated within each property, depending upon a detailed engineering survey.
- 3.10. Due to the head needed to operate the larger filters, it would not be possible to site the single large filter at the Quarry. Instead, a new chamber should be constructed on the supply line, downhill from the Quarry, preferably adjacent to the road for easy access for maintenance. The chamber may be largely underground, depending upon the depth of the supply pipe.
- 3.11. We estimate that the costs (excluding VAT) associated with the provision of filters will be as follows :
- 3.11.1. For the small unit to be fitted at the sink :  
Approximately £100 per unit (subject to individual costs of plumbing).  
The filter cartridges (replaceable) cost £10 each.

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3.11.2. Larger individual units for each household :  
Approximately £300 plus plumbing costs. (Note that if pressure is low, a small pump may also be required in addition).

3.11.3. Single large unit serving all properties :  
Approximately £1,200 basic cost, plus fitting and construction of small chamber ..... say £1,800.  
(Cost of small pump in addition, if required.)

(As an alternative to 3.11.3.; a complete unit filter with an integral pump and pressure vessel would cost approximately the same, but requires an electricity supply.)

3.12. Maintenance for the filters consists of regularly checking the filter cartridges for accumulation of deposits and brushing clean. When the cartridge wears down to a specified size it must be replaced. It is not possible to state how long a cartridge may last as this depends upon individual circumstances. The larger units require similar maintenance and the replacement of cartridges.

3.13. We understand that the manufacturers of the filters may offer a hire service to establish the effectiveness of the system prior to purchase. If this offer is available, the trial could be carried out at relatively little expense.

3.14. We would emphasise that however effective a filter system is, protection of the source of the supply in accordance with our recommendations in 3.2. to 3.6. above is essential if continuous safe water is to be made available.

#### 4. Alternative Supplies

4.1. Essentially there are two alternatives; a mains supply from the Yorkshire Water Authority; or an independent borehole supply. Both would be reliable and provide safe long-term facilities.

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#### 4.2. Mains Supply

4.2.1. We understand from the Water Authority that the cost of a mains supply would be approximately £54,000, plus the cost of individual house connections and plumbing.

4.2.2. There is the possibility that the mains supply could be extended, for example to serve the Caravan Park, in which case the cost per property might reduce. However, the cost would still be substantial.

#### 4.3. Borehole Supply

4.3.1. There would be no difficulty in principle in installing a borehole to provide an adequate supply, although this would, of course, be subject to obtaining the necessary licence from the Water Authority.

4.3.2. The precise location for the best supply could be determined from a geological survey, but the field between 'The Bungalow' and 'Red Garth' would seem to be one possibility.

4.3.3. A supply of electricity would be required for the pumping plant and some form of treatment for the borehole water (such as the type of filter detailed in section 3, for example) may be necessary, subject to sampling the actual supply.

4.3.4. The estimated cost of the borehole would vary with depth, which could only be established following a geological survey and test pumping. However, the order of cost would be approximately £6,000 for an uncased borehole 150 mm (6 inches) in diameter and 61 m (200 feet) in depth. To this must be added the cost of providing electricity to whichever site was selected, plus the cost of connecting pipework.

#### 5. Causes of Pollution

5.1. In order to establish precisely the cause of pollution, we feel that it would be essential to use tracer to establish the path of water into supply. Whatever tracer is used, disruption of the supply for a period

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of some weeks would occur whilst all signs of the tracer were washed through the system. The tracer should also be used during rainfall to establish the pattern of contributing overland flow; thus little or no notice could be given.

5.2. Thus, a satisfactory alternative supply for the period of the tests, which could be extensive, would have to be provided.

5.3. Before further investigations into a tracer system are made, we would suggest that the supply users are consulted to re-confirm their requirement for the causes of pollution to be established.

6. Observations and Recommendations

6.1. During our visit to the site, we inspected the supply arrangements at the Bungalow, which abstracts from a piped source in the adjacent field. We are concerned that the cover to the supply tank is not watertight, and that access to the area surrounding the supply is open to animals, etc.

6.2. The amount of inflow at the time of our visit was very low.

6.3. In view of the high level of risk to the supply, we would advise that a secondary supply, connected either to the Quarry source or to the selected alternative, should be made; and that the area adjacent to the supply should be fenced off and better protected.

6.4. During the course of our investigations, the Water Authority have pointed out that, as any supply to more than one dwelling requires their consent, an application in respect of the Quarry supply should be made at the earliest possible time. The application should be jointly from each user, and will be assessed on a quantitative (rather than qualitative) basis.

6.5. We would recommend that :

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6.5.1. Protection works to the existing quarry source are carried out. (Sections 3.2. to 3.5. inclusive.)


6.5.2. A trial using small filters mounted at sinks is carried out. If the trial is successful :

6.5.3. A single large filter (if feasible) or individual large filters are installed.

If the trial is unsuccessful :

6.5.4. A borehole supply is implemented.

6.6. Should you require further advice, we will be happy to provide it.

A handwritten signature in black ink, appearing to be 'A. J. ...', is centered on the page.

for HAISTE INTERNATIONAL LIMITED