



## GROUND SOURCE



## GEOTECHNICAL EXPLORATION SERVICES

AT DRILCORP, WE HAVE BEEN INVOLVED IN A NUMBER OF PROJECTS WITHIN THE GROWING GROUND SOURCE INDUSTRY. PLANNING POLICIES, SUCH AS THE MERTON RULE, REQUIRE NEW DEVELOPMENTS TO GENERATE AT LEAST 10% OF THEIR ENERGY NEEDS FROM ON-SITE RENEWABLE ENERGY EQUIPMENT IN ORDER TO HELP REDUCE ANNUAL CARBON DIOXIDE (CO<sub>2</sub>) EMISSIONS IN THE BUILT ENVIRONMENT. ONE WAY TO MEET THESE REQUIREMENTS IS TO USE GROUND SOURCE HEATING AND COOLING TECHNIQUES FOR CLIMATE CONTROL WITHIN A BUILDING. THIS CAN BE DONE BY USING OPEN LOOP OR CLOSED LOOP TECHNOLOGY.

### OPEN LOOP

THIS SYSTEM USES GROUNDWATER FROM AQUIFERS BENEATH THE SITE, GENERALLY BY DRILLING TWO BOREHOLES OF WHICH ONE IS USED TO ABSTRACT WATER TO BE PUMPED THROUGH A HEAT EXCHANGER AND THE OTHER, A RECHARGE BOREHOLE, IS USED TO RETURN THE USED PROCESS WATER INTO THE AQUIFER. AS ONE OF THE FOREMOST WATER WELL DRILLING CONTRACTORS IN THE UK, WE ARE IDEALLY SUITED TO HANDLE THESE TYPES OF PROJECTS, PARTICULARLY IN CASES OF LIMITED ACCESS.

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## CLOSED LOOP

CLOSED LOOP SYSTEMS CONSIST OF TWO LENGTHS OF PLASTIC PIPE CONNECTED BY A 'U' BEND. THE PIPES ('U' BEND FIRST) ARE FED INTO A BOREHOLE WHICH IS THEN FULLY GROUTED WITH SPECIAL THERMAL GROUT. THE PIPE IS FILLED WITH LIQUID ANTIFREEZE AND THE ENDS ARE CONNECTED TO A HEAT EXCHANGER (HEAT PUMP). THE HEAT PUMP PUMPS THE LIQUID AROUND THE PIPE AND IT IS WARMED BY SUBSURFACE TEMPERATURES. THE GAINED HEAT IS THEN EXTRACTED BY THE HEAT PUMP AND MULTIPLIED BEFORE BEING USED TO HEAT THE PROPERTY. THE SYSTEM CAN BE USED IN REVERSE FOR COOLING. FOR LARGE INDUSTRIAL PROPERTIES, MANY LOOPS ARE NEEDED AND ARE CONNECTED VIA MANIFOLDS.

## COOLING THE TUBE OPEN LOOP CASE STUDY

DRILCORP IS ONE OF THE MANY PARTNERS WORKING WITH TFL ON THE COOLING THE TUBE PROGRAMME, HAVING SECURED A CONTRACT TO PROVIDE AND TEST FOUR BOREHOLES FOR AN OPEN LOOP GEOTHERMAL COOLING SYSTEM.

GETTING HEAT OUT OF THE LONDON UNDERGROUND (LU) NETWORK IS A HUGE ENGINEERING CHALLENGE AND TFL HAS ESTABLISHED A DEDICATED PROGRAMME TEAM TO PROVIDE SOLUTIONS TO PREVENT TEMPERATURES ON DEEPEST PARTS OF THE NETWORK RISING TO UNACCEPTABLE LEVELS.

THE NEED TO AVOID INCREASING TEMPERATURES ON THE UNDERGROUND SYSTEM IS ACTUALLY THE FLIPSIDE OF TFL'S SUCCESS. SERVICES ARE PLANNED TO INCREASE BY 25%, AND NEW TRAINS, THAT CAN ACCELERATE QUICKER, ARE ON ORDER. BUT MOVING MORE CUSTOMERS AND MORE TRAINS TAKES MORE ENERGY, EVEN WHEN THE BEST OF MODERN TECHNOLOGY IS APPLIED, AND MORE ENERGY CREATES MORE HEAT. AND, CONTROLLING TEMPERATURES IS HARDER THAN EVER BEFORE, BECAUSE THE GROUND AROUND THE TUNNELS HAS HEATED UP OVER THE MANY YEARS SINCE THEY WERE BUILT.

KEEPING THE TUBE'S CUSTOMERS COOL INVOLVES DEVELOPING NEW TECHNOLOGIES, AS WELL AS MAKING BEST USE OF MORE TRADITIONAL APPROACHES. AND EVERY EFFORT IS BEING MADE TO ENSURE THAT "GREEN" METHODS ARE USED WHEREVER PRACTICABLE.

COOLING THE TUBE WILL USE BOREHOLE COOLING AS A LOW ENERGY AND ENVIRONMENTALLY FRIENDLY SOLUTION FOR ONE UNDERGROUND STATION. THE PROJECT, TO PROVIDE COOLING TO STATION PLATFORMS BY EXTRACTING COOL WATER FROM A DEEP AQUIFER BEGAN IN JANUARY 2009. SPLIT INTO TWO PHASES OF WORKS, PHASE 1 (TWO ABSTRACTION BOREHOLES) IS NOW COMPLETE WITH PHASE 2 (TWO REINJECTION BOREHOLES) PLANNED FOR LATE 2009.

## PHASE 1 WORKS

WORKING TO A VERY TIGHT PROGRAMME, THE DRILLING, DEVELOPMENT AND TESTING OF THE TWO ABSTRACTION BOREHOLES FACED A SERIES OF CHALLENGES AND STRICT STAKEHOLDER REQUIREMENTS DUE TO THE SITE LOCATION IN A BUSY PARK. THE WORK WAS PLANNED TO ENSURE THAT NO DAMAGE WAS CAUSED TO MATURE TREES EITHER ABOVE OR BELOW GROUND LEVEL, AND THE CONSTRUCTION SITE HAD TO BE SHIELDED FROM PUBLIC VIEW WITH MINIMUM NOISE LEVELS DURING WORKING HOURS.

A NUMBER OF SURVEYS WERE UNDERTAKEN TO ENSURE EVERY EVENTUALITY HAD BEEN ASCERTAINED, PREVENTING UNEXPECTED DELAYS ONCE SITE WORKS COMMENCED. AN UNEXPLODED ORDNANCE SURVEY DETERMINED THERE WERE NO UNWELCOME REMAINS FROM WW2 BOMBING RAIDS, WHILE THE ARBORICULTURAL TREE SURVEY ASSESSED THE IMPACT OF THE PROPOSED SITE WORKS ON TREES AND ESTABLISHED A SUITABLE CONSTRUCTION METHODOLOGY.

PROTECTING THE GROUND AREA USED FOR BOREHOLE TESTING WAS PARAMOUNT AND THE COMPOUND WAS COVERED WITH PROTECTIVE ALUMINIUM GROUND COVER PADS TO PREVENT ANY LONG TERM DAMAGE. DUE TO THE RESTRICTED TIMESCALES, THE WORKS WERE CARRIED OUT WITH TWO DRILLING RIGS WORKING SIMULTANEOUSLY. ALL OF THE HEAVY DRILLING EQUIPMENT AND ASSOCIATED PLANT WAS MOBILISED AND WORKS COMPLETED ON SCHEDULE.

EACH BOREHOLE WAS DRILLED, LINED, DEVELOPED, TESTED AND CCTV AND GEOPHYSICAL RECORDS WERE PROVIDED. THE BOREHOLES WERE COMPLETED TO A DEPTH OF 130MTR BELOW GROUND LEVEL, TERMINATING IN THE CHALK AQUIFER WITH AN OPEN HOLE DIAMETER OF 450MM. ON COMPLETION OF THE PHASE 1 WORKS THE PLANT WAS DEMOBILISED, THE GROUND PROTECTION PADS REMOVED AND THE SITE REINSTATED. THE GRASS RECOVERED WITHIN A FEW WEEKS LEAVING LITTLE EVIDENCE OF THE SITE WORKS.

COOLING THE TUBE WERE DELIGHTED WITH PHASE 1 DECLARING THE WORK HAD BEEN COMPLETED 'SUCCESSFULLY, ON TIME AND TO BUDGET'