Guernsey Airport Groundwater Improvement

new drainage system and additional pollution control measures ensure a greater level of protection for the island's water supply

by Laurent Wallis

Guernsey Airport caters for roughly one million travellers every year. In 2012 work began on an £80m programme of essential maintenance and improvements which will equip the airfield to service the island for the next 30 years. Known as the Airport2040 Project, work includes resurfacing of the existing runway, extension of the safety areas, reconstruction of the concrete apron areas and installation of airfield ground lighting and navigational aids. An environmental requirement of the Airport 2040 development necessitates a new drainage system and additional pollution control measures to afford a greater level of protection for the island's water supply.

Filtered water & backwash water tanks - Courtesy of Trant Construction Ltd

Project need

The new plant will treat surface and groundwater from the international airfield, before entering the Beau Valley stream to the north of the airport boundary, and help filter out traces of a toxic chemical previously used in firefighting foam known as perfluorooctane sulfonate (PFOS).

Production of PFOS began to be phased out in 2000 and now concentrations in finished and semi-finished products must not exceed 10mg/kg. The operation of the treatment plant was required under waste license to allow removal of 7,000 cubic metres of soil contaminated with PFOS; affected soil was sealed inside a container and covered with a mound of earth.

Design summary

The scheme is designed to filter flows of up to 20l/s by diverting these from the Lovers Leap outfall up to the filtration plant where it passes first through the anthracite filters and then through the granulated activated carbon filters before returning by gravity back to Lovers Leap and discharged to the stream.

Key partners

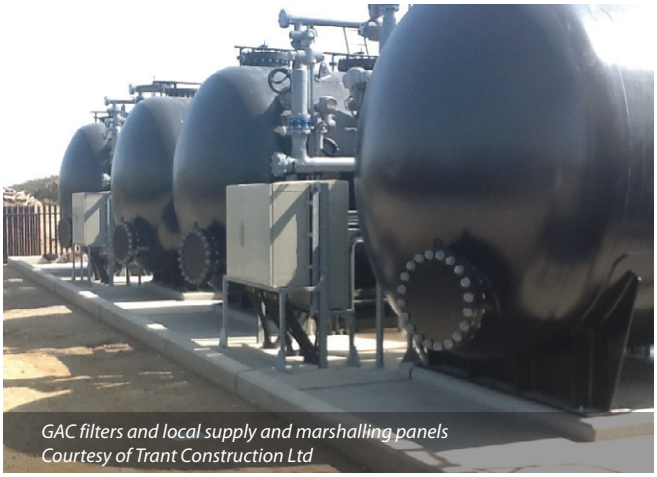
- ARCADIS UK were responsible for the project management and overall design.
- Trant Construction undertook the detailed design for the anthracite pressure filters, granulated activated carbon, process, electrical and ICA. Trant Construction also undertook the civil engineering, mechanical engineering, electrical installation and commissioning.
- Trant Systems Electrical (TSE) designed, manufactured, installed and commissioned the new motor control centre (MCC) and the treatment control panel (TCP). TSE also developed the functional design specification and process software.

Project delivery

A site compound was first established encompassing Lovers Leap and a section of the Airport Fire Training Ground, which was assigned landside status for ease of construction activities. Key factors in project delivery were providing Guernsey Airport with:


GAC filters & central pipework runs - Courtesy of Trant Construction Ltd


GAC filters and local supply and marshalling panels
Courtesy of Trant Construction Ltd


GAC filters and local supply and marshalling panels
Courtesy of Trant Construction Ltd


Microfibre bag filter system pumps - Courtesy of Trant Construction Ltd

- Project flexibility: If things did go wrong at the works there was nowhere else to take the sludge for processing.
- Continued equipment supplier support, post-contract completion: The States of Guernsey expects and requires the same level of response from suppliers as if on the UK mainland.
- Continued process support, post-contract completion.

The two main areas of works comprised (i) the Lovers Leap area and (ii) the process slab area.

Lovers Leap diversion chamber and pumping station: A 3m deep reinforced concrete weir diversion chamber was constructed to divert up to 20l/s to the 7m deep submersible pumping station. Both were constructed in a small valley with gradients up to 1:4. These presented difficulties that required experienced site personnel with excellent health and safety awareness. The gradient required that a working platform be constructed for the 24-tonne excavator prior to works taking place. Face protection of the excavation was achieved by using close sheeting and manhole frames.

The submersible pumping station consists of a wet well including 2 (No.)15kW variable speed duty/standby pumps capable of the designed 20l/s.

Rising main from Lovers Leap and gravity return of filtered water: The rising main from the pumping station was constructed of PE pipe electrofusion weld on site by experienced personnel. The gravity return pipeline was constructed of uPVC plastic.

Pressure filters & GAC filters: Design of the pressure & GAC filters was completed in-house by Trant's clean water specialist design team. Duty/standby pressure filters (anthracite filtration media) were installed to remove solids from the groundwater and protect the GAC (granulated activated carbon filtration media) filters from fouling. Each pressure filter is capable of the 20l/s required to be filtered under the waste license.

4 (No.) GAC filters were installed in two parallel trains filtering 10l/s per train over a 45-minute contact time and are fed by duty standby variable speed pumps. This contact time enables the removal of PFOS from the groundwater. The two trains operated in tandem gives a maximum filtration of 20l/s.

Storage tanks: 5 (No.) GRP storage tanks were installed on the process slab for: (a) GAC feed water; (b) 2 (No.) for filtered water; (c) GAC backwash waste; and (d) wastewater.

Backwash systems: Backwashing of the pressure filters occurs on a differential pressure and time expired basis. Backwash flows are controlled to 10l/s by a modulating valve on the output of duty/assist/standby pumps. The waste from backwashing is passed to the waste storage tank.

Backwash of the GAC filters also occurs on a differential pressure and time expired basis. Backwash flows are controlled to 10l/s by a modulating valve on the output of the duty/assist/standby pumps. As the waste from these backwashes will contain PFOS this is passed to the bag filter feed tank.

Waste system bag filter system: Due to the PFOS removed by the GAC Filters when a backwash of the GAC filters is performed, the bag filters, in series with 100 micron and

3 micron filtration, remove the carbon and therefore the PFOS from the backwash waste. Differential pressure switches indicate when a filter requires removal. The waste from these bags is placed in a covered-lined skip for analysis prior to disposal. The filtered backwash can then be pumped to the foul sewer. A bunded area is provided for washdown, and water from this area is pumped back into the bag filter feed tank to prevent any possible contamination.

MCC & TCP: A 7m-long, 400amp MCC with a standalone UPS-protected treatment control panel was installed. The MCC is fed from a new transformer dedicated to airport equipment. The (form 4 type 2) MCC was located in a purpose-built electrical kiosk.

The MCC was provided with latest generation of Siemens touchscreen HMI and was selected for its superb graphical displays of site status. An ethernet card was included to allow the future installation of the Guernsey Water SCADA system used for island-wide monitoring and control of all pumping stations and treatment works.

Specific points related to the contract

Trant's design team worked closely with ARCADIS UK and Guernsey Airport to ensure that the project remained on schedule and that the particular health and safety and security aspects involved with working on an international airport were adhered to.

Lifting Operations: Advanced notice was required for lifting operations. Low visibility periods are common during the first quarter of the year on Guernsey and due to safety concerns it was necessary to suspend all works in designated areas and postpone lifting operations.

Transportation: Due to Guernsey's small and busy road network it was necessary for larger items of plant and equipment to be brought in along the island's designated heavy goods route prior to 6am and across the airport runway with the assistance of airport operations. Due to the largest crane on the island being 25 tonnes, and the layout of the filter plant, it was necessary to perform a tandem lift for each of the GAC filters.

Communications: Throughout the project Trant remained in close contact with airport operations and the control tower to ensure that sufficient notice was given of any requirements and that any safety concerns they had were dealt with immediately.

Conclusion

Despite a challenging brief, genuine working partnerships, trademark expertise and proven technology has ensured that Guernsey Airport's groundwater quality has been enhanced.

With operational completion on 19 March 2012 and handover on 30 March, the success of the project was achieved through in-house multi-disciplinary teamwork and experienced site staff, with Trant Construction's specialist clean water engineering team leading the way.

Trant worked closely with ARCADIS UK, Guernsey Airport and Guernsey Water to ensure plant operation and all necessary tests were completed in time for the start of the runway improvement contract.

The Editor & Publishers would like to thank Laurent Wallis, Project Manager with Trant Construction Ltd, for providing the above article for publication.