ACEI ENGINEERING EXCELLENCE AWARDS: CIVIL

WINNERS: T.J O'CONNOR & ASSOCIATES, J.B. BARRY & PARTNERS AND ROYAL HASKONINGDHV – RINGSEND WASTEWATER TREATMENT PLANT (WWTP): CAPACITY UPGRADE CONTRACT

Completed CUC with process equipment plinth in foreground

Since 1906, Ringsend Wastewater Treatment Plant (WwTP) has been treating the wastewater of the Greater Dublin Area agglomeration comprising of the geographical area of Dublin City Council and parts of the functional areas of Fingal, South Dublin, Dun Laoghaire Rathdown and Meath County Councils. The original plant was a Primary Treatment facility incorporating the disposition of primary sludge at sea, which continued until 1998.

In 2005 the plant was significantly upgraded to include Secondary Treatment and Sludge Treatment for a nominal/design load of 1.64 million Population Equivalent (PE). The 2010 EPA Discharge Licence for the plant, imposed a Nitrogen (N) and Phosphorous (P) discharge standard of 10 mg/l and 1mg/l respectively, as the receiving Lower Liffey Estuary, was designated a nutrient sensitive waterbody under the Urban Waste Water Treatment Regulations 2001 (S.I. 254 of 2001).

In 2016, Irish Water commissioned T.J O'Connor & Associates, J.B. Barry & Partners and Royal HaskoningDHV (collectively known as the 3JV) as their consultants to design, plan, procure and project manage the overall upgrade of the Ringsend WwTP to comply with the 2010 EPA Discharge Licence and to treat an increased PE of 2.4 million. The innovative Royal HaskoningDHV patented Nereda® Aerobic Granular Sludge (AGS)

process, was procured by Irish Water and "Free Issued" to the Contractors as the chosen treatment process for the Ringsend secondary treatment plant upgrade.

This commissioned work which is ongoing comprises several highly complex upgrades to the plant summarised as follows:

- Capacity Upgrade Contract using Nereda® AGS technology - 400,000 PE new build;
- Existing SBR Conversion to Nereda® AGS technology - 400,000 PE retrofit capacity increase (four contracts);
- SAS Upgrade to increase sludge thickening capacity;
- New P-Fixation facility;
- Sludge Line Enhancement;
- MIC Increase;
- SCADA Upgrade.

The 2022 Award for Excellence in Civil Engineering was specifically for the Capacity Upgrade Contract (CUC).

The following features of the CUC Contract were highlighted for the Award:

Excellent interaction and communication amongst over 250 professionals across multidisciplinary teams within the Client, Irish Water, Consultants and Contractor organisations to successfully deliver a highly complex automated wastewater treatment system in a BIM Common Data Environment.

Selection of the Nereda® process, facilitating treatment capacity over conventional treatment options, within the limited site footprint, eliminating the requirement for the originally planned 9km Long Sea Outfall Tunnel, mitigating its associated risk and cost uncertainties.

The Exemplar / Specimen Design for the CUC consisted of a two-tiered structure configuration to cater for the Client's selected innovative AGS (Nereda ®) process technology and was based on non-linear geotechnical modelling, for which extensive site investigations had been undertaken to provide the appropriate data. This followed on from the approach adopted by T.J. O'Connor & Associates in their design of the existing SBR's which were completed in 2005 and which were six times larger than the CUC. Driven cast-in-situ piles were used on the original SBR's whereas CFA piles were used for the CUC.

Complex design and construction on a piled foundation in poor ground, prone to settling for the 110m x 36m x 20m high Main Reactor Block, subject to the dynamic variable loads associated with the different hydraulic conditions generated by the Nereda® process;

Design and construction of a 110m long x 5m wide Equipment Plinth and associated 110m long x 20m high steel support structure with all elements designed to allow for relative movement in three directions between the plinth and the Main Reactor Block.

Aerial view of overall RGD Wastewater Treatment Plant following CUC completion

Ongoing construction of Lower Deck Reactors

The project also provided for the design and construction of:

- An MCC Building on existing buried structures;
- Nereda® MEICA equipment in 7.5m deep 2-tier reactors;
- Extensive interfaces with the existing live operational plant;
- A highly automated plant controlled by a bespoke Nereda® Controller complete with future connections to the Dublin Regional Telemetry System.

The Contractor chosen to execute the Design Build Operate contract was a joint venture between Veolia Ireland and P.J. Hegarty & Sons (VPJH), appointed as PSDP and PSCS for the project. The chosen Conditions of Contract were FIDIC Gold Book. Monthly programme reports were delivered using Primavera P6 in accordance with Irish Water requirements.

View of Upper Deck Reactor in operation

An RE team of experienced professionals with previous experience of the 2005 Ringsend site was assembled for the execution of this project, comprising of Civil, MEICA and structural professionals. Irish Water PMs maintained an active presence on site for the duration of the construction works. The ER team under the guidance of an experienced PM, comprising of all disciplines across the 3JV, interacted extensively both on site and remotely with all parties in the successful execution of the project. Lessons Learned and Cost Control workshops were a regular feature on the project. Earned Value Management was used to track project expenditure relative to completed work.

Health and Safety was managed on site with all stakeholders adopting a collaborative and inclusive approach to the importance of safety on such a complicated site, resulting in an excellent safety record for the project. HAZOPs and CHAZOPs were executed throughout the project with the aid of 3D Model, providing complete visualisation of the ultimate finished product, comprising almost 3,000 tagged assets.

With up to a maximum of 2,500 l/s of high-quality compliant treated wastewater flowing from the CUC, the successful completion of this project in January 2022 delivers significant benefit to the population of the Greater Dublin Area and the natural environment of the Lower Liffey Estuary for many years to come.