Operating Technique Aims

The aim of the operating technique for the Llanberis WwTW is to strive to achieve an effluent quality of 0.2 mg/l annual average as per the WFD AMP6 obligation.

First Stage P removal

The first stage of the P removal process at Llanberis will be through chemical pre-precipitation and post-precipitation. This will be through the addition of Ferric Sulphate into static mixing systems prior to both the primary tanks and the humus settlement tanks as shown in the process diagram below.

Dosing of Ferric Sulphate will usually be achieved through an automatic control system which controls the amount of chemical added to achieve the removal required. There are 5 automated modes of dosing available in the control system, all based on industry standard methods:

Mode 1: Fixed Rate Dosing

Mode 2: Inlet Flow Proportional Profile Dosing

Mode 3: Diurnal P Load and Flow Profile

Mode 4: Diurnal Profile Dosing

Mode 5: Feed Back Control Dosing.

In the event of a problem on site with the control system, the ferric dosing will default to a fixed dosing set point and an alarm will be raised for that pump where the individual flow meter fails. If the final effluent monitors fail then the ferric dose rate shall be controlled on flow pacing only.

To ensure pH of the process is maintained to optimal performance levels, alkalinity control through the addition of sodium hydroxide prior to both primary ferric dosing point and into contact tank prior to Blue Pro filters as shown in the process diagram below.

Second Stage P removal

After the humus settlement stage, flow up to 28 l/s will be passed through 2 No. Blue Pro^{R} filters from Blue Water Technologies. The filters are continuous backwash gravity sand filters utilising reactive filtration. The 2 No. filters will work Duty / Duty with minimum flow to individual filters of 4.5 l/s. One filter will run till 9 l/s when 2 filters will operate with equal flow. The chemical addition, which is needed for the surface adsorption to the media, will be controlled by using flow proportional dose rate to incoming flow rate to the filters.

Post the 2 No. Blue Pro^{R} filters, the flow will pass through 4 No. Gravity sand filters for final polishing. Flows over 28 l/s will pass through the Gravity sand filter stage only. This layout is to ensure a second filtration stage after the novel technology should any issues arise. This layout could be changed with some extra work to have the Blue ProR filters after the tertiary Gravity sand filters in the future once operational robustness is proved.

Operational optimisation

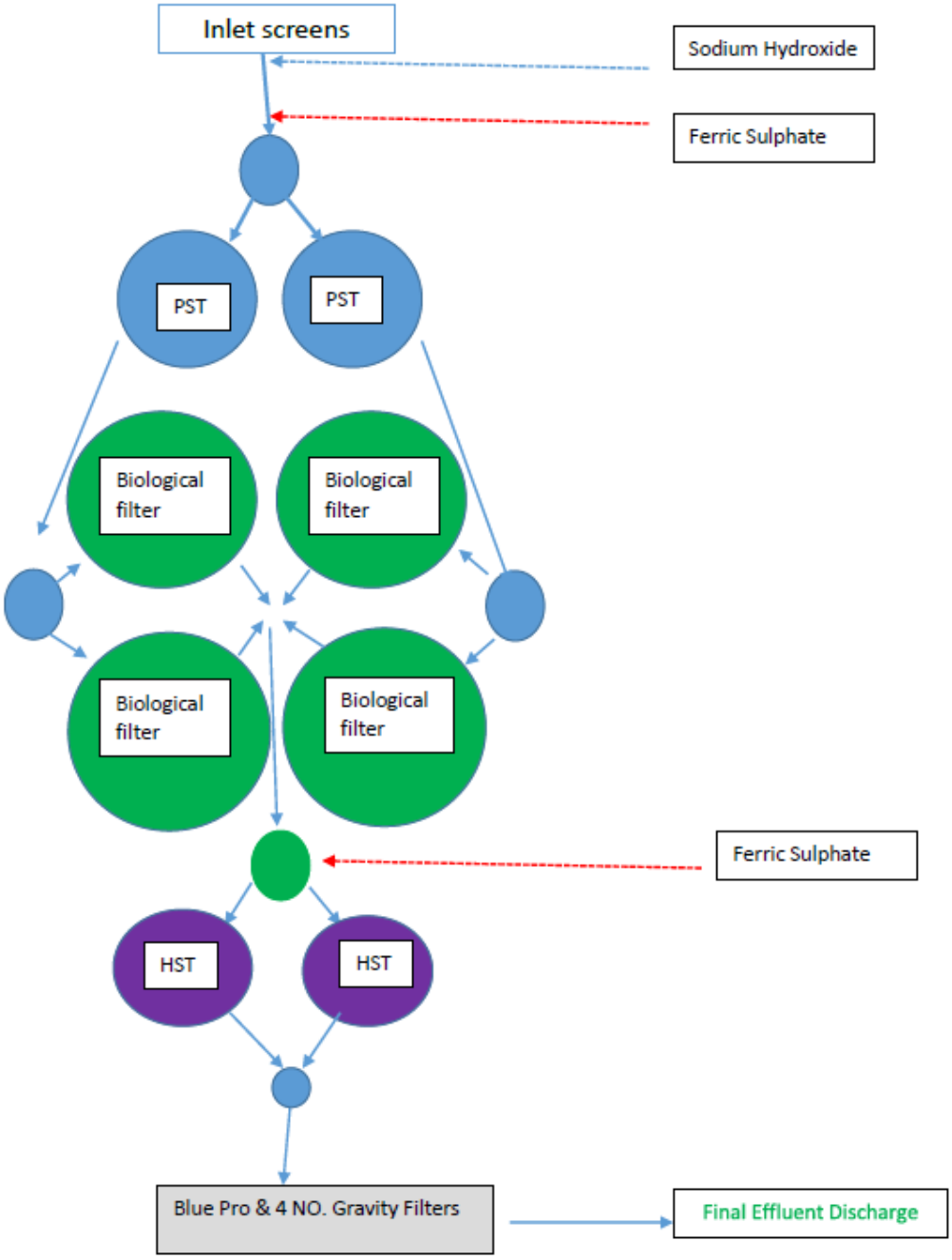
The BluePro technology, as specified by the technology provider and supported by 2 week pilot study work, will reduce TP levels across the technology by up to 90%. E.g. If secondary treatment effluent from the humus tanks is 1 mg/l TP in average flow conditions, the effluent from the Blue Pro will be reduced to 0.1 mg/l on average. As the technology is new and has not been run for a long period under all flow conditions, a second stage of tertiary filtration is in operation (Dynasand filters) as a back-up process whilst we prove the reliability

of the process. In order to ensure the process is running optimally to achieve the removals required, the following will be undertaken:

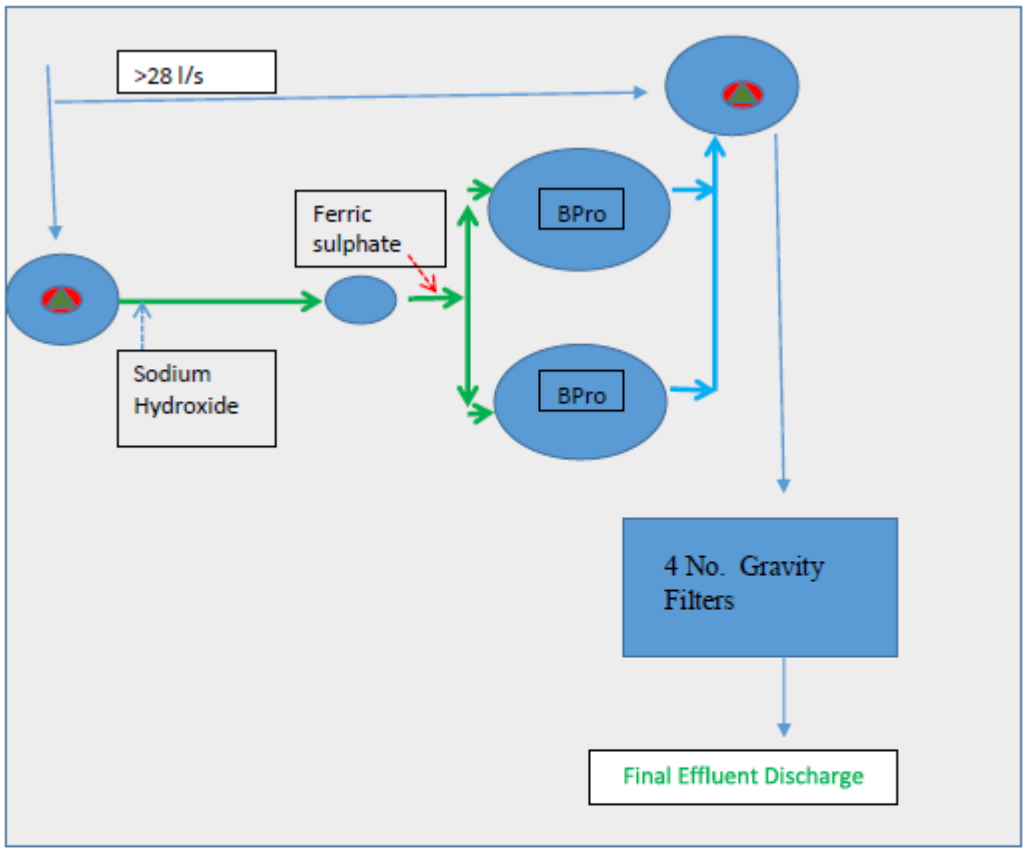
Samples will be taken weekly across the process to ensure the automated control is achieving the optimum results in the first stage P removal process, targeting 1 mg/l Total Phosphorus leaving the humus settlement stage. This will be a manual process undertaken by the Science and Support team. The effluent quality from the secondary process will dictate what the Tertiary Treatment can achieve.

Monitoring of the Blue Pro chemical dosing and process performance will be carried out at the same time to optimise to achieve the 90% removal across the tertiary plant. This will be carried out through sample analysis (TP and pH) and dose rate analysis). This will ensure that the pH through chemical correction and dosing of the iron is balanced which will ensure the adsorptive capacity of the hydrous ferric oxide coating is maximised. This manual checking could be automated once the process is fully established through at least 1 year of analysis.

Process Diagram of Site Process Units and Dosing Points:



Expanded details for Blue Pro and Gravity Filter flow split:



Key Code:

PST = Primary Settlement Tank

HST = Humus Settlement Tank

BPro = Blue Pro Filters

= Distribution chambers/ contact tank

= Pumping station (Blue Pro & Gravity Filters)