Remediation Working Plan (Addendum 26/11/2019)

Introduction

VertaseFLI are to undertake remediation works in North Wales. The site has a groundwater LNAPL plume issue and works to remediate the site will entail abstraction of total fluids, pump and treat and discharge to ground of treated water.

Three approvals are required from Natural Resources Wales (NRW) by VertaseFLI prior to commencement of work, these being:

- Abstraction Licence (NRW Ref: PAN-007571);
- Mobile Plant Permit Deployment (NRW Ref: PAN-007570); and
- Discharge Permit (NRW Ref: PAN-007572).

This document has been compiled to address a request for further information (Natural Resources Wales to VertaseFLI on 26th November 2019), in relation to the application for a Discharge Permit (NRW Ref: PAN-007572).

A Remediation Working Plan (the principle document of the Mobile Plant Deployment application) was included in the Discharge application for information (albeit without appendices). This document is an addendum to the Remediation Working Plan for the purposes of satisfying the information required by the Water Quality / Permitting team.

This document addresses the following clarifications requested:

- The discharge is to ground via an infiltration system, therefore any numeric limits we set on a permit will relate to the 'minimum reporting values (MRV's)' for hazardous substances. Please can you confirm the discharge will contain levels below the MRV's for the hazardous substances benzene, toluene and xylene?
- Will the proposed remediation technique ensure for the duration of the discharge that these limits we be able to be met?
- Please can you provide a sampling/monitoring routine which specifically outlines how you will ensure there will be no detections of hazardous substances above the MRV's throughout the duration of the project?
- If a detection of any substance above the MRV is found what mitigation will be in place to ensure no hazardous substances are discharged?
- Can you confirm that the infiltration system in place will ensure there is no discharge of liquid effluent directly to groundwater?

The Water Treatment Plant

Drawings 1828_01 and 1828_03 (Appendix A) show the site layout and groundwater treatment process respectively.

Total fluids will be delivered to the water treatment plant by way of pneumatic top loader pumps.

The total design treatment capacity for the groundwater treatment system is 150m3/day or 6.25m3/hr.

The system is intended to comprise of the following elements, subject to detailed design and safety review:

- 20ft plant room container comprising control panel, backwash & transfer pumps, pneumatic pumps' manifolds and dosing pump, if required;
- Oil/water/silt separator (OWSS);
- LNAPL holding tank (to HSG176);
- 3m3 sand filter;
- Two 2m3 carbon vessels (for water treatment installed in series);
- 5m3 backwash/dirty tank;
- 10m3 discharge tank/backwash clean tank; and
- Two flow meters, one positioned at manifold outlet and one positioned on effluent discharge outlet.

The estimate of volume of free-phase hydrocarbon (which will primarily be dealt with by the oil / water separator) is 25m^3, very much as a worst case.

The groundwater analysis suggests dissolved phase loadings will be limited and total hydrocarbon concentrations will be below 5mg/l in the liquid phase waste stream. On this basis, mass recovery rates in dissolved phase will be under 1kg per day and the liquid phase carbon will therefore have a lifespan of several months. However, this assumes that free product will be 100% removed by the separators and some sheen could pass through which will increase the loading.

VertaseFLI will be notified of system operating conditions via a PLC & modem in the control panel. This allows will allow the plant to run 'unsupervised'.

The system will be designed to be "fail safe" and will have undergone thorough mechanical and process engineering risk assessment prior to mobilisation. Regular maintenance and inspection will ensure that the system remains safe during ongoing operation. The system will be equipped so that if parts of the system fail it will shut down and text VertaseFLI.

Primarily shut-downs are triggered either through pressure loss, high / low level switches being activated or motor failure / abnormal switching conditions. Other typical triggers would be electrical supply problems (surge or cut-out). The system will be designed so that it cannot re-start independently without direct supervision. Additionally, internal and external emergency stop switches will be installed so that anyone on site can shut the system down in an emergency.

All equipment will be installed in accordance with the manufacturer's guidance documentation. The remediation system will comply with all relevant codes and standards including the Machinery Directive 2006, as well as comply with DSEAR guidance and codes of practice.

The compressed air distribution system has been designed in compliance with the Pressure Equipment Regulations 1999 (PER) and the Pressure Systems Safety Regulations 2000 (PSSR). VertaseFLI will ensure that the installation follows the regulations.

Water Treatment

Levels of benzene, toluene and xylene have been extensively investigated as detailed in the ERM report: Project Neo Deeside: Summary of Investigations 1999 – 2016 of 3rd February 2017. Analysis of these three BTEX types have been undertaken at a range of limits of detection including at, and lower than, DEFRA's / EA's minimum reporting values (MRVs).

Benzene and toluene have never been detected in any of the groundwater samples recovered and therefore there is absolute confidence that the discharge water will always be below the MRV's for these chemicals.

Xylenes have been detected in the groundwater above the MRVs, but at relatively low levels in a limited number of boreholes during the series of investigations undertaken.

Not taking into account samples associated with free-product (to be removed by oil/water separation) maximum results have been: 118ug/l in BH201, 65ug/l in BH203, 7ug/l in BH406 and 4ug/l in HP03. Throughout the site, throughout the investigations, xylene levels, other than those mentioned are seen to be at levels of non-detect or <MRV.

Water will not be removed from single areas during the remediation such that these levels (118/ug/l, 65ug/l etc…) will not be received at the water treatment plant; levels will be significantly lower. The quality of the discharge water will additionally improved by the use of carbon filtration.

The use of activated carbon in the pump and treat process will ensure that all hydrocarbons (sVOCs / VOCs (including xylenes)) in the discharge are below the MRVs for the duration of the remediation / discharge event.

Carbon Filtration

Oil-water separation techniques are long established, as are the use of activated carbon for the removal of hydrocarbons from aqueous streams.

Activated carbon is a well-established technology and has a proven track record of use in a wide variety of applications, notably in directly relevant fields of, water treatment and remediation.

The sorption of compounds onto activated carbon differs according to whether the contaminant is being sorbed from the vapour or aqueous phase and with concentration. This can be modelled through use of the Freundlich equation and isotherms across a range of concentrations through experimentally derived data for each contaminant and grade of carbon. For example, TCE will load at 10 mg/m3 at approximately 11.5 wt%. Many isotherms are regarded as commercially sensitive by manufacturers, but we have obtained permission from CPL to provide one for sorption of TCE in the aqueous phase to illustrate what an isotherm looks like and the point above. See Figure 1.

The proposed method of replacing activated carbon would be to swap the vessels with fresh ones. This means it would be straightforward to replace with increased capacity vessels to manage the frequency of change outs required.

The method of change out is shown in Figure 2. below.

Weekly water sampling will be undertaken before, between and after the carbon pods, during commissioning and initial operational phases to establish that the system is working as intended. Sampling will then be undertaken (in the same location) in line with the maintenance regime with declining inlet concentrations as the remediation progresses.

Sampling for hazardous substances, at a limit of detection at or below the MRV, will be undertaken. Should breakthrough occur (hazardous substances detected at, or greater than the MRV) after the first carbon pod, swap-out will be undertaken.

This will ensure there will be no detections of hazardous substances above the MRV's throughout the duration of the project at the point of discharge. The sampling, post 2nd carbon pod, will confirm this.

The presence of the second carbon pod should be considered as the insurance or mitigation in place to ensure no hazardous substances are discharged.

Figure 1. Isotherm for TCE (Aqueous Phase)

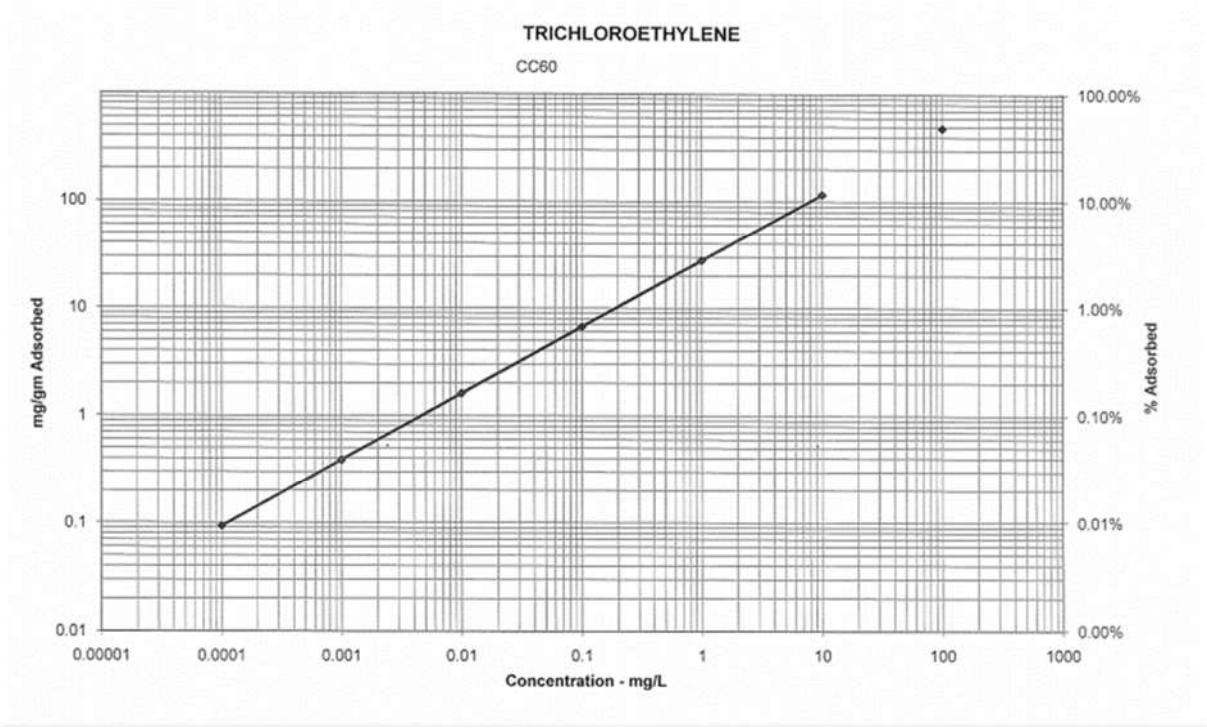
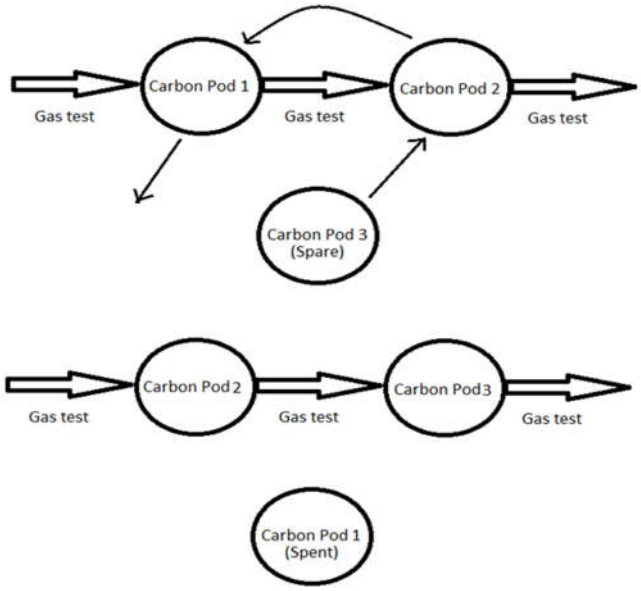


Figure 2. Carbon Swap-Out Procedure



The Discharge Point

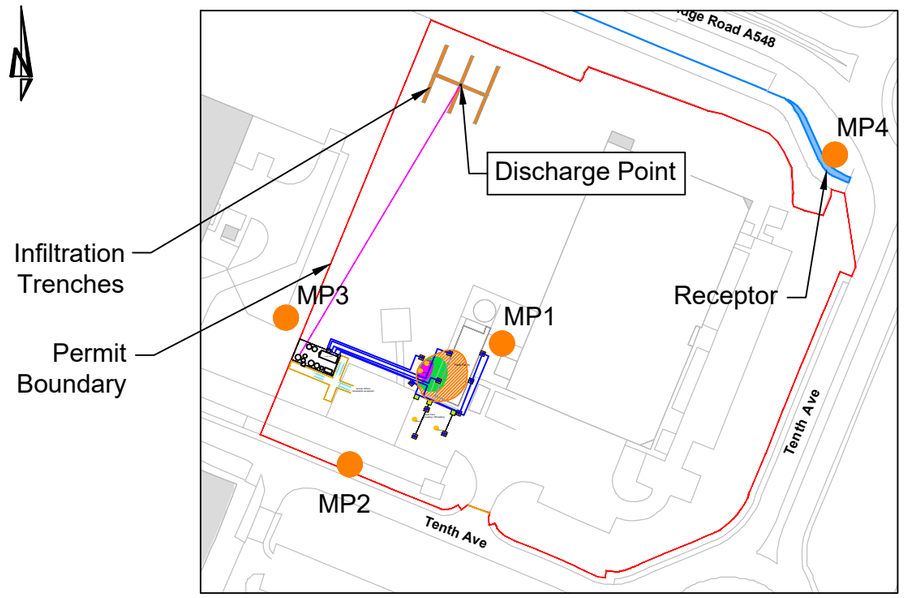
Drawing D1828_01, the 'Indicative Site & Remediation Layout', shows a pipeline from the discharge tank from the discharge point. 50mm id HDPE pipe will carry treated water from the discharge tank to the infiltration system.

The infiltration system will consist of three gravel filled trenches fitted with inspection chambers, slotted monitoring wells and high-level floats. The infiltration system will be covered. The discharge pipeline will discharge directly into the centre of the infiltration system allowing water to dissipate over a wide horizontal and lateral extent. A man-hole will be the only way the infiltration system could be accessed.

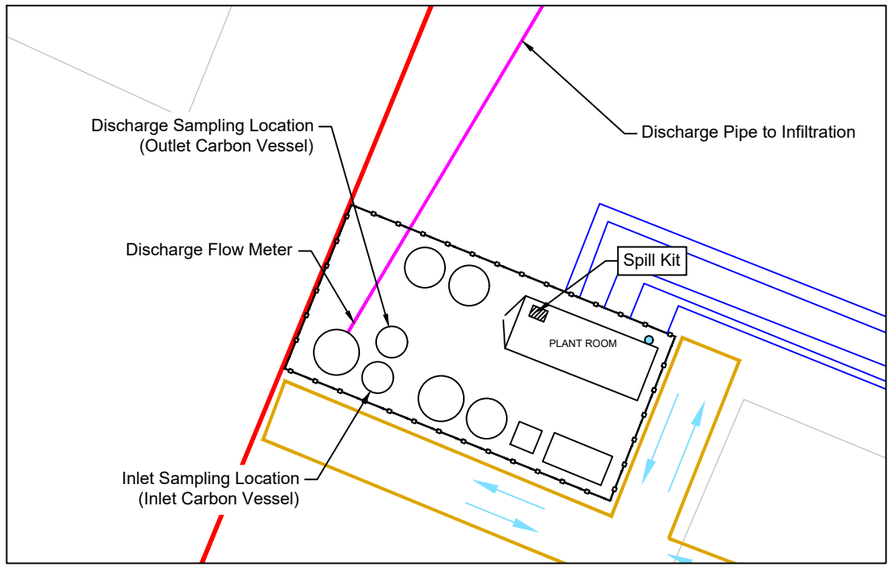
Only water that has passed through the oil/water separator and two carbon filters will be discharged. This will ensure that there will be no direct discharge of liquid effluent (no discharge of untreated effluent) to groundwater.

Appendix A - Drawings

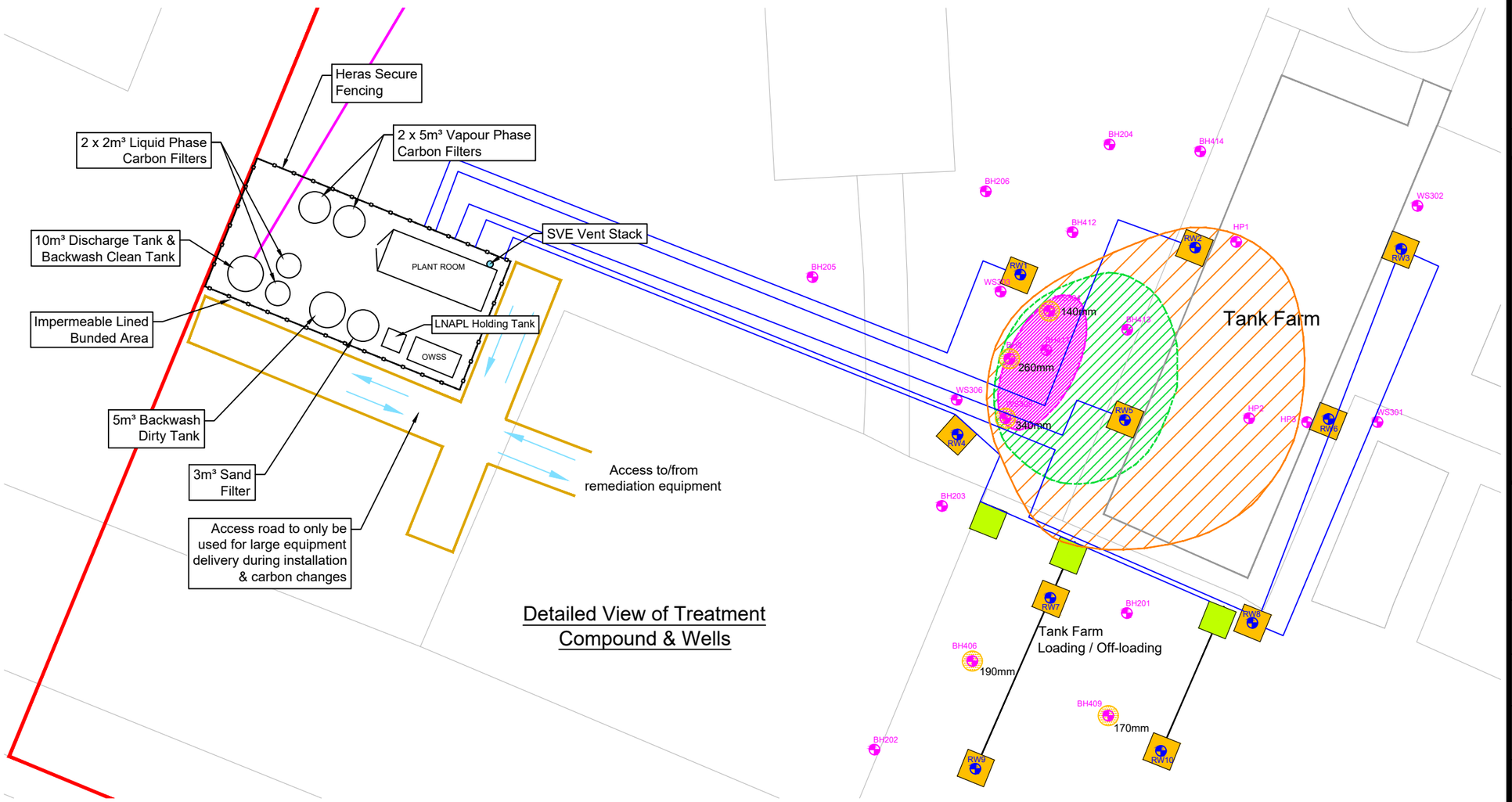
A3



Overview of Site



Enlarged View of Treatment Compound Showing Discharge Information & Spill Kit Location



Detailed View of Treatment Compound & Wells

Legend

- Site Boundary
- Historic well location
- LNAPL present July 2018
- Proposed remediation well location
- Proposed chamber (below ground)
- Proposed junction (below ground)
- Air supply oil/water return (below ground)
- Floating Product Layer (Best Case)
- Floating Product Layer (Likely)
- Dissolve Phase (Worst Case)
- MP4 Monitoring Point Location

NOTE: **Based on supplied ERM tender drawings**

Rev.	Description	Revised By	Date
	FIRST ISSUE		14-10-19

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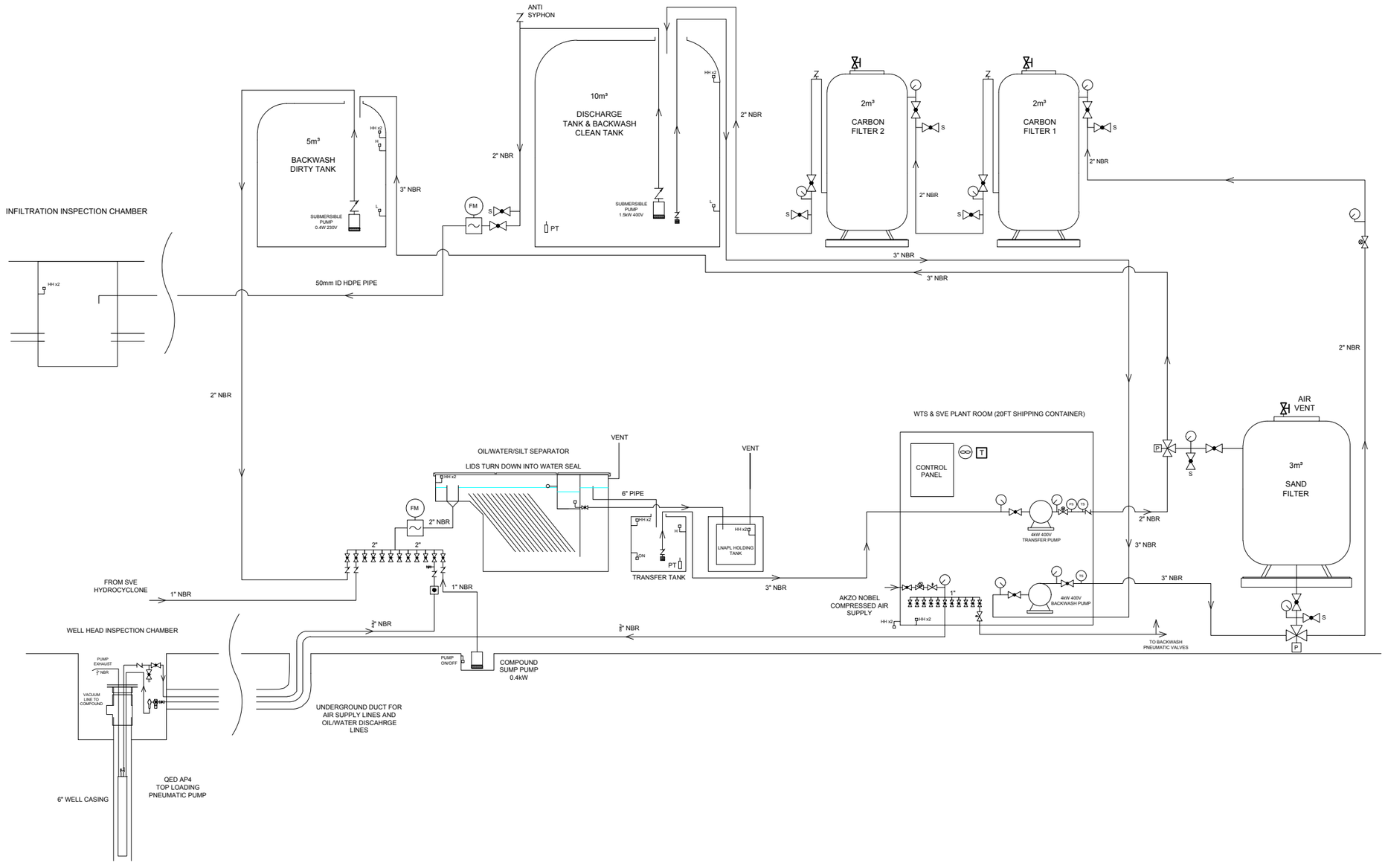
Site Address:
Project NEO - Akzonobel
Deeside Industrial Estate
Deeside, Flintshire
CH5 2UA

Rev: -

Title: Indicative Site & Remediation Layout

Client: ERM

Drawn: MRG	Checked: IB	Approved: JLH
Dwg: D1828_01	Contract: 1828ERM	Scale: NTS



EQUIPMENT LEGEND

A3

- STRAINER AND NON RETURN VALVE
- BALL VALVE
- SAMPLE PORT
- GATE VALVE
- PRESSURE GAUGE
- VACUUM GAUGE
- NON RETURN VALVE
- FLOW METER
- PRESSURE REGULATOR
- SOLENOID VALVE
- 3 WAY PNEUMATIC VALVE
- FILTER REGULATOR WITH PULSE COUNTER
- FLOW INDICATOR
- HIGH LEVEL ALARM FLOAT SWITCH
- HIGH LEVEL FLOAT SWITCH
- LOW LEVEL FLOAT SWITCH
- WALL THERMOSTAT
- TEMPERATURE SWITCH
- PRESSURE SWITCH
- VENTILATION FAN
- PRESSURE TRANSDUCER

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Rev: -

Title: GROUNDWATER ABSTRACTION & WATER TREATMENT SYSTEM P&ID

Client: ERM

Drawn: WM	Checked: HLF	Approved: JLH
Dwg: D1828_02	Contract: 1828ERM	Scale: NTS