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Red John Pumped Storage Hydro Scheme

Appendix 10.5 Surface Water Management Plan

ILI (Highlands PSH) Ltd

November 2018

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	November 2018	Submission	CA	Catherine Anderson	Associate Director

Distribution List

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1 Introduction

1.1 Background

1.1.1 This Outline Surface Water Management Plan (SWMP) sets out the proposals for the management of construction Site runoff (e.g. surface water or groundwater dewatering) and works affecting water bodies during construction of the Development.

1.1.2 The Development is located in the Highland region of Scotland, approximately 14 kilometres (km) south-west of Inverness, and is centred on national grid reference (NGR) NH 60169 33087. The extent of the Development Site is shown on Figure 1.2: The Development Site. The environmental and social features within the red line boundary and surrounding the Development are shown on Figure 2.1: The Surrounding Environment (EIA Report Volume 3).

1.1.3 During the construction phase there is the potential for adverse effects on the water environment from Site runoff contaminated by excessive fine sediments (including the potential wash out of fine sediment from temporary spoil storage, embankments, and access tracks), and which may also smoother habitats and physically impact aquatic organisms, chemical spillages, and physical changes to water bodies as a consequence of:

- Path and watercourses diversions;
- Dewatering and abstraction operations associated with the cofferdam in Loch Ness at the Tailpond Inlet / Outlet Structure;
- Works directly within water bodies (including the construction of a temporary Cofferdam and Jetty, when equipment and materials are brought to the site via the Caledonian Canal and Loch Ness);
- Excavation and crushing of excavated materials;
- Vegetation clearance;
- Works to realignment the C1064 local road;
- Construction of Temporary and Permanent Access Tracks;
- Excavation of tunnel portals and tunnelling of the Waterways, Access and Construction tunnels;
- Earthworks, construction of the Embankment and Landscape Embankment and the creation of temporary material storage; and
- Other general construction activities (e.g. stripping of vegetation, movement of plant and possible batching of concrete etc.).

1.1.4 This document sets out the purpose of the Outline SWMP before providing a summary of the baseline environment, the mitigation to be implemented during construction, monitoring proposals, and an action plan in the event of a pollution incident.

1.2 Purpose of the Outline Surface Water Management Plan

1.2.1 The purpose of this Outline SWMP is to detail the water management principles and procedures throughout the construction period of the Development.

1.2.2 The Outline SWMP and the future full SWMP will ensure that the requirements of relevant environmental legislation, the requirements of the EIA Report, and any conditions of

environmental permits or other permissions / licences are complied with during construction. It shall be the responsibility of the Applicant to ensure the Development is executed in a manner that demonstrates its commitment to the care and protection of the water and aquatic environment.

1.2.3 This Outline SWMP has been developed by the Applicant. The finalised SWMP will be implemented by the Contractor upon the award of the contract. The Contractor will set out the site ad scheme specific measures to control, manage and treat construction site runoff, reduce the risk from chemical spillages, and how a pollution incident will be responded to in keeping with this Outline SWMP. Further changes may be required following determination of the Section 36 application process and following applications for any secondary or associated consents. However, any environmental protection measures will be in keeping with the objectives, requirements and mitigation measures set out in this Outline SWMP, including how clean and dirty water will be kept separate, how fine sediment will be trapped and removed from construction run-off, and how spillages will be managed. The Construction Contractor will also have a duty of care to those who benefit from Private Water Supplies.

1.2.4 Overall, the Construction Contractor will implement this plan and in doing so will need to ensure that:

1.2.5 The Outline SWMP is implemented in accordance with the Outline Construction Environmental Management Plan (CEMP) and Emergency Control Plan; and

1.2.6 The SWMP is a live document and will be reviewed regularly and under each of the specific circumstances set out later in this plan.

1.3 Existing Watercourses and Baseline Water Environment

1.3.1 The Development Site is situated between the River Ness and River Nairn water catchment areas. The Site lies on Ashie Moor, a ridge of land between Loch Ness to the northwest, Loch Duntelchaig to the southwest (including the connected small Loch nan Geadas basin and the upstream Loch Ceo Glais), and Loch Ashie to the northeast. In the southeast of the site, there are two small lochs, Loch na Curra and Lochan an Eoin Ruadha. Details about topography and land uses are covered in Chapter 2: Project Description (EIA Report Volume 2).

1.3.2 Descriptions of the watercourses affected by the Development are illustrated on Volume 3 Figure 10.2 and 10.3 (please also refer to Chapter 10: Water Environment for further detail).

1.3.3 The following surface water bodies have been identified within the Development boundary or are immediate downstream receptors and are shown in Figure 10.1, 10.2 and 10.3 of the EIA (Volume 2: Chapter 10):

Table 1.1 Water Body Receptors and their Importance

Water Body	Baseline Summary	Water Quality Importance	Hydro-morphology Importance
Loch Ness	This waterbody is considered to be an oligotrophic loch that is at Good Ecological Status under the WFD. It is also important for salmon and other important fish species migration as well as supporting water supply, flow along the Caledonian Canal and recreation activities at a regional scale. There is a designated bathing water at Dores. The loch supports commercial fish farming, bottled water, and other hydroelectric power generating installations. The loch also has very important cultural and historical significance.	Very High	High
Loch Ashie	This waterbody is at Bad Ecological Potential under the WFD, but has an objective to increase this to Good by 2027. It is a Drinking Water Protected Area (DWPA).	Very High	Not applicable
Loch Duntelchaig	This waterbody is at Good Ecological Potential under the WFD and is considered a DrWPA. It is also important for recreation at a local level.	Very High	Not applicable
Loch na Geadas, Loch na Curra, Lochan an Eoin Ruadha	These small lochs are not designated under the WFD and there is no water quality data, although they appear to be humic rich. They may support local fish populations and possibly have some significance in terms of local recreational fishing.	Medium	Not applicable
Pond 7	This waterbody is of small scale, shallow and sedimented, plus there is limited or no known or potential socio-economic uses or amenity value.	Low	Medium
Loch Ceo Glais, Feith Ghlas watercourse	These watercourses are located upstream of the Proposed Development and will not be affected, and thus are not considered any further	Not applicable	Not applicable
Big Burn	Big Burn is at High Ecological Status under the WFD and flows into Loch Ashie, which is a storage loch for potable water supply within a DrWPA, and is therefore considered to be of very high importance for water quality. Despite there being only a poorly defined channel, Big Burn may be contributing to water supply storage in Loch Ashie and thus for hydromorphology the importance is High.	Very High	High (hydrology effects only)
Allt a' Mhinisteir Allt Dailinn, Allt'a Chnvic Chonaisg Allt a' Chruineachd and watercourses S1-S11 on Figure 10.1	Watercourses are generally small and predominantly have stable morphology (step pool, bedrock and cascade) with steep gradients. There are some areas where impacts of forestry or farming activities are seen including excess nutrients and sedimentation (poaching of banks by livestock), culverting, widening and straightening. Flows are not thought to be impacted by abstraction and water quality is generally good. They are not classified under WFD but flow to Loch Ness which is classified. None of these watercourses are covered by any wildlife designations. A precautionary medium importance has been attributed to these water bodies.	Medium	Medium
The Inverness Groundwater Body (ID: 150670)	The SEPA website confirms that the Overall Condition, the Water Quality and the Water Flows and Levels are all classified as Good in 2014. The projected condition for each criteria is also Good for 2021 and 2027	High	Not applicable
Private Water Supplies (summarised in Appendix 10.3)	Private water supplies, sourced from groundwater or surface water (springs or surface water bodies). Stated uses include drinking, stock watering and general non-potable.	High	Not applicable
GWDTEs	Areas of blanket sphagnum bog are present on Ashie Moor on either side of the C1064 road in the south of the Development area, and areas of flush and spring are present in the north of the Development area in the vicinity of Clune Wood.	Medium	Not applicable

2 Relevant Guidance Documents

2.1.1 As of the 17 December 2015 all Pollution Prevention Guidance (PPG) Documents published by the UK environment agencies were withdrawn (Ref 13). A new series of Guidance for Pollution Prevention (GPP) is in development, which provides updated good practice guidance to the UK. While this is not regulatory guidance in England where the UK government website outlines regulatory requirements, it remains a useful resource for best practice. The following relevant GPPs have been released in 2018 and should be considered as good practice:

- GPP 2: Above ground oil storage;
- GPP 5: Works and maintenance in or near water for construction or maintenance works near, in, or over water;
- GPP 8: Safe storage and disposal of used oils;
- GPP 13: Vehicle washing and cleaning;
- GPP 19: Vehicles: Service and Repair;
- GPP 21: Pollution Incident Response Plans; and
- GPP22 Dealing with Spills.

2.1.2 Where new GPPs are yet to be published, previous PPGs may still provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. They are referred to in this document alongside other current guidance and in the context of the Development and site specific mitigation measures. Construction phase operations would be carried out in accordance with guidance contained within the Environment Agency PPG, including (Ref 14):

- General Guide to the Prevention of Pollution: PPG1;
- Use and Design of Oil Separators in Surface Water Drainage Systems: PPG3;
- Working at Construction and Demolition Sites: PPG6;
- Control of Spillages and Fire Fighting Runoff: PPG18; and
- Storage and Handling of Drums and Intermediate Bulk Containers: PPG26.
- Additional good practice guidance for mitigation to protect the water environment can be found in the following key Construction Industry Research and Information Association (CIRIA) documents:
- C741 (2015, 4th Edition) Environmental good practice on site guide (Ref 15);
- C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice (Ref 16);
- C624 (2004) Development and flood risk - Guidance for the construction industry (Ref 17);
- C522 (2001) Sustainable Urban Drainage Systems - Design manual for England and Wales (Ref 18);
- C523 (2001) Sustainable Urban Drainage Systems - Best practice manual for England, Scotland, Wales and Northern Ireland (Ref 19);

- C741 (2015) Environmental Good Practice on Site (Ref 20);
- C648 (2006) Control of Water Pollution from Linear Construction (Ref 21); and
- C532 (2001) Control of water pollution from construction sites - Guidance for consultants and contractors (Ref 22).

2.1.3 The Scottish Government has published the Sewers for Scotland Manual" (3rd Edition, Scottish Water 2015) (Ref 23) and Planning Advice Notes (PANs) to provide national guidance on various topics and SEPA has also produced a number of guidance documents covering a range of environmental issues that are relevant to this impact assessment. Those documents relevant to the water environment are listed below (Ref 24):

- PAN 51 - Planning, Environmental Protection and Regulation (Revised 2006);
- PAN 61 - Planning and Sustainable Urban Drainage Systems (2001);
- PAN 79 - Water and Drainage (2006);
- SEPA Policy No. 19 - Groundwater Protection Policy for Scotland (2009;
- SEPA Interim Position Statement on Planning and Flooding (2009);
- SEPA Engineering Activities in The Water Environment: Good Practice Guide - River Crossings (Second edition, 2010);
- SEPA Land Use Planning System SEPA Guidance Note 31, 'Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems' (2017);
- SEPA Technical Flood Risk Guidance for Stakeholders (Version 10, 2018); and
- Sewers for Scotland Manual" (3rd Edition, Scottish Water 2015).

2.1.4 SEPA has also published the following documents to support the implementation of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (Ref 25):

- WAT-PS-06-02: Culverting of Watercourses (2015);
- WAT-SG-78: Sediment Management Authorisation (2012);
- WAT-PS-07-03: Engineering in Artificial Inland Surface Waters (2013);
- WAT-RM-02: Regulation of Licence-level Engineering Activities (2017);
- WAT-SG-86: Registration Rules for Exposed Sediment Removal WAT-SG-93: Guidance for Transport Infrastructure Projects (to follow) (2016);
- WAT-SG-23 Good Practice Guide - Bank Protection (2008);
- WAT-SG-25: Good Practice Guide - River Crossings (2010);
- WAT-SG-26: Good Practice Guide - Sediment Management (2010);
- WAT-SG-28: Good Practice Guide - Intakes and Outfalls; (2008);
- WAT-SG-29: Good Practice Guide - Construction Methods (2009); and
- WAT-SG-44: Good Practice Guide - Riparian Vegetation Management (2009).

3 Surface Water Management Plan

3.1 Prior to Construction

Monitoring

3.1.1 In advance of any construction works, a programme of pre-construction water quality monitoring will be required to augment existing data and to provide a robust baseline against which changes in water quality during construction works can be compared. This monitoring should include regular monthly (as a minimum) visits to all watercourses and major water bodies that could be impacted by the Development for the collection of visual and olfactory observation, in situ monitoring and water samples for laboratory analysis.

3.1.2 In advance of any construction works, a programme of pre-construction water quality monitoring would be required to augment existing data and to provide a robust baseline against which changes in water quality during construction works can be compared. The extent and duration of this will be confirmed by the Construction Contractor in conjunction with THC and other consultees, but is likely to be consist of a minimum of 3 months pre-construction.

3.1.3 After completion of the pre-construction monitoring, the Construction Contractor shall prepare a Water Quality Baseline Report that will be issued to SEPA and THC in advance of construction works commencing on site.

3.1.4 The existence of PWS must be confirmed by the Contractor to identify potential pollution sources for these supplies and the need for any further monitoring if required.

Permissions

3.1.5 The Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended in 2013 (Ref 4), and more commonly known as the Controlled Activity Regulations (CAR) -, apply regulatory controls over activities which may affect Scotland's water environment, including further amendments. How these regulations apply to the Development and where CAR licences may be required are described in the Outline CEMP (see Appendix 3.1 in Volume 5).

3.2 During Construction

Training

3.2.1 All Site staff will attend a Tool Box Talk on the risks to the water environment from construction site runoff and chemical spillages and the proposed measures set out in this Outline SWMP.

3.2.2 The Tool Box Talk will be given by a suitably qualified person (i.e. an environmental professional, the Environmental Manager or Environmental Clerk of Works).

3.2.3 Construction workers shall not be authorised to work on Site until they have received this Tool Box Talk.

3.2.4 Technical notes shall be provided to all staff and put up on notice boards in relevant locations.

General Measures

3.2.5 Mitigation measures can be considered as source control (i.e. to prevent fine sediment laden runoff forming and to treat contaminated runoff close to where it forms), barriers and conveyance measures

(i.e. to prevent site runoff draining uncontrolled into water bodies and to direct and treat it on route to storage areas), and storage and final treatment areas (i.e. where water is stored on site and treated to the required quality prior to it being discharged from the site).

3.2.6 In any construction site temporary drainage system and treatment management scheme, it is typical for a combination of construction SuDS or proprietary measures to be used. Measures are often used in series to make maximum use of available space and to ensure adequate removal of fine sediment prior to any discharge being made from the site (e.g. runoff may be initially stored in a small storage lagoon before being pumped via settlement tanks or lamella clarifiers to final treatment storage areas). Examples of proprietary treatment devices can be found on the Siltbuster website: http://www.siltbuster.com/construction/products/clarifiers.

3.2.7 Information on the type of measures that could be implemented with reference to good practice guidance C648 Control of Water Pollution from Linear Construction Projects - Technical Guidance (CIRIA, 2006). The specific treatment train will be determined by the Contractor and will be adapted throughout the works depending on the need and circumstances at any given time. However, measures that may be used include:

- Drainage cut-off ditches with check dams and/ or sediment traps;
- Silt fences, sand bags and straw bales;
- Earth bunds and settlement lagoons;
- Settlement tanks, Lamella Clarifiers, and skips in series filled with clean aggregate or straw bales;
- The use of silt curtains, coffer dams or similar, and temporary dams (e.g. using sand bags, straw bales and geotextiles) for works in water; and
- Baffle pads or other measures to dissipate flow energy on any temporary outfalls to water bodies.

Construction Site establishment and General Earthworks

3.2.8 During the pre-construction works, temporary measures to control runoff draining from the construction Site will be implemented, and then managed and adapted by the Construction Contractor accordingly as the works progress.

3.2.9 The proposed temporary drainage system will be developed in tandem with the detailed design and construction method statement prepared by the Construction Contractor. However, this will be consistent with the objectives and treatment requirements of this plan. The following measures are expected to be used to manage surface water:

- Pre-construction drainage would be installed to intercept the existing land drainage system and divert water away from the working area;
- Vehicle traffic to be limited to major path routes across the site to prevent soil compaction and associated increase in surface water runoff;
- Sustainable drainage systems (SuDS) to be used to ensure no increase in runoff rates or volumes from the construction sites and compound area (e.g. compound car park) to surrounding land drainage ditches and to manage surface water flood risk. Subject to consent, the SuDS would discharge to the local watercourses, ditches or to ground within the Site boundaries.

3.2.10 Runoff from the Site would not be allowed into any waterbody. It would only be allowed to be discharged directly into any watercourse under a CAR licence from SEPA and following the necessary attenuation and treatment using a variety of measures alone or in combination including:

- Identification of all land drains and their sealing using purpose built covers or sand bags;
- Sediment barriers such as silt fences, straw bales and earth bunds (used and positioned in appropriate locations);
- Construction SuDS;
- Proprietary treatment measures (e.g. Lamella Clarifiers); and
- Temporary storage areas (e.g. settlement lagoons, tanks and skips in series).

3.2.11 The arrangements of such drainage infrastructure would be prepared during the detailed design and, as appropriate, agreed with SEPA prior to the commencement of construction. The above measures would ensure that any sediment (including any adsorbed pollutants) carried in suspension in the surface water runoff from the site would have settled out to an acceptable level before it can be discharged to receiving watercourses under an environmental permit from SEPA. The Construction Contractor will agree with SEPA acceptable suspended sediment limits in runoff discharged from the site.

3.2.12 All earthworks will be undertaken in accordance with BS6031:1981 Code of Practice for Earth Works (Ref 5). Land disturbance will be kept to a minimum and disturbed areas will be stabilised as soon as possible after construction by seeding with grass, using geotextile covers or other suitable means.

Measures to Intercept and Treat Suspended Fine Sediments

3.2.13 Mitigation measures relevant to controlling surface runoff, where there would be exposed soils, excavations, storage of top soil and other aggregate materials would include

- Scheduling construction activities to minimise the area and period of time that soil would be exposed, particularly during wetter periods;
- Construction areas would be demarcated from the rest of the site so as to minimise the disturbance of land not required for development;
- Installation of cut-off drains around the working areas to intercept surface runoff and divert it around the working areas;
- Existing land drains are to be identified and covered or protected by sand bags;
- Minimising the stockpiling of materials and locating essential stockpiles as far away as possible from watercourses;
- Movement of construction vehicles and plant would be strictly controlled to minimise the potential for soil compaction and erosion;
- Exposed soils should be re-seeded to mitigate bare earth exposure and habitat loss as soon as possible. Rock rolls should be underlain by geotextile to prevent erosion of earth beneath the stone (which could also compromise the integrity of the armouring);
- All mitigation measures would be subject to design and approval by construction managers for health and safety and environment, and by appropriate regulators for environmental impacts;
- The rate of discharges to the watercourses of construction site runoff will be at a controlled rate agreed in advance with SEPA/THC and with appropriate measures to dissipate the flow energy;
- All access roads or purpose built haul roads shall be kept free of mud by the use of a road sweeper, and if deemed required by the Construction Contractor, a vehicle wheel wash facility on the main accesses to the Site.

3.2.14 In practice, the application of these measures will be a continuously adaptive process in response to site specific constraints and changing needs on site. For example, different types and levels of

treatment of fine sediment in runoff may occur depending on the time of year, the location of the works, and the nature of works being undertaken at that point in time. It is therefore not appropriate to be entirely descriptive at this stage, but to focus on the range of measures that the Construction Contractor can deploy to provide the necessary water environment protection.

Measures to reduce the risk of chemical spillages

3.2.15 Mitigation measures to reduce the risk of a chemical spillage include:

- Plant and machinery will be inspected before use to ensure clean and fit for operation on site;
- All static plant or mobile plants parked for prolonged periods (e.g. overnight) will be fitted with 'plant nappies' or drip trays, which will be checked regularly and emptied if required by the Construction Contractor in to the bunded waste oil containers;
- All mobile plant will carry Spill Kits with other Spill Kits placed in seal containers and key locations close to watercourses (when there are works nearby). Spill Kits are to be checked daily and replaced immediately after use;
- All staff working on site to be trained in the use of Spill Kits;
- Fuel oil to be stored in the secure Construction Compounds on an impermeable surface and within a self bunded container (capacity of the bund must be 110% the maximum oil storage);
- Refuelling of mobile plant to be undertaken in the Construction Compound on an impermeable surface only;
- Drilling fluids and additives (if used) will be stored appropriately in bunded tanks holding 110% of its capacity. Any waste or used drilling fluid will be stored and tankered away off-site;
- Other liquid chemicals to be used on site to be stored within a secure container;
- No equipment or materials other than those used for flow control (but excluding pumps and pipes) are to be left in the channel outside of working hours;
- Where possible pre-fabricated concrete structures are to be used. Where this is not possible and wet concrete pours are to be made, extreme care is to be taken when delivering the concrete to the site and during the operation. Frameworks should be secure and fixed tightly to reduce egress of concrete. Measures to catch any spillage are to be provided and removed before water is allowed back into the working area;
- Implementation of site working practices to minimise the risk of concrete spillages. In particular, specific concrete wash out facilities are to be provided away from any watercourse (minimum 20 m), on flat land and operated to ensure no spillage of wet concrete to ground (e.g. by use of geotextiles, skips); and
- The construction site and construction compound should be kept secure at all times to prevent vandalism and anti-social behaviour that could lead to a pollution incident.

Working In and Over Water

3.2.16 Mitigation measures specific to works in and over water bodies includes:

- All works in Loch Ness and other watercourse channels (including works to the banks only that maybe largely carried out from the bank) will be undertaken in a dry working area. This will require the Construction Contractor to set up a silt curtain and coffer dam in Loch Ness, and potentially over-pump or flume or create temporary dams using straw bales, sand bags, geotextiles and pumping equipment in smaller watercourse. The Contractor should ensure that there are more than adequate pumps and pipes on site for the flows anticipated.

- For small areas of work within watercourse it may be possible to isolate an area of the bed using sand bags and straw bales.
- Works to the banks may also be undertaken on scaffolding. However, scaffolding should be lifted from the channel at the end of the working shift and any temporary dams created by straw bales or sand bags partially breached to ensure the full channel is available for flows;
- The Contractor should undertake all works in accordance with an Pollution Prevention Plan and ensure that this include measures for removing staff and equipment from the channel when high flows are expected;
- If temporary crossings are installed for construction purposes that are not open span, then impermeable and over-long culvert or flume pipes will be used to prevent the ingress of fine sediment that may infiltrate to the watercourse from material used to form the haul road;
- An oil boom should be positioned across watercourses to which work is undertaken downstream of the works and monitored on a daily basis;
- If required, the Construction Contractor should ensure that there is equipment on site for the installation of straw bale dams across the watercourses downstream of the works to trap fine sediments. However, this measure is only likely to be necessary if it is not possible to work in the dry or for in channel works that are required for longer periods and which may experience periodic periods of higher flows that are redirected along the main channel than via the pumped system; and
- Scaffolding or debris netting should be installed across the channel prior to the removal of any masonry walls etc. Any masonry material that falls into the watercourses or Loch should be removed by the Construction Contractor.

Use of Wet Cement and Wet Concrete

3.2.17 Construction Compounds will be constructed with a mixture of imported material and material generated from other construction activities such as Headpond works. The compounds are anticipated to be unsealed in nature and will be either floated (over peat) or built into the hillside depending on the site conditions and anticipated loads. Where on-site concrete batching facilities are provided they will be operated under the conditions of the appropriate authorisation, at least 50 m from a waterbody and provided with an isolated surface water drainage system linked to a storage facility, which can be pumped out by a specialist Contractor for disposal at a suitably licenced waste facility.

3.2.18 Cement and wet concrete will be prevented from entering any water bodies. Designated areas shall be set out for the purpose of concrete batching and concrete wash out and care shall be taken to ensure these are sited away from sensitive receptors such as water bodies and land drains. Where this is required it should be done on impermeable hard standing away from watercourses (minimum 20 m on flat land and further or sloping ground subject to site specific risk assessment).

3.2.19 If concrete wash out areas are shallow excavations they will be lined by a suitable geotextile membrane to prevent infiltration to groundwater.

3.2.20 The washing out of any concrete mixer and associated chute, tools or equipment will be carried out in a designated area away from drains and watercourses / bodies. Delivery drivers will be made aware of the requirement on arrival at site. Wash down activities will take place in designated areas consisting of impermeable and contained wash out lagoons.

Management of groundwater ingress to underground structures

3.2.21 The Construction Contractor will aim to stem any uncontrolled water ingress into waterways, the Power Cavern and Access Tunnels using a combination of sprayed concrete and/or other forms of lining as appropriate. A significant amount of the construction will be at great depth, where the amount of fracturing will reduce and so inflow will reduce also.

3.2.22 The Headpond will be concrete lined and this is because the system needs to be kept 'closed' to prevent further spread of invasive species. The amount of interaction with underlying groundwater body will be minimal. Although no springs have been found in this area, if during construction a water ingress to the head pond area is discovered, the possible installation of a granular fill beneath the lining may be required.

Temporary drainage management associated with compound set ups

Foul water

3.2.23 The main compound will have temporary accommodation and welfare facilities for up to workers. It is expected that a suitably sized storage tank will be provided that would be periodically pumped out by a specialist contractor so that the water could be disposed of at a suitably licenced waste facility. These will be located at an appropriate distance from sensitive receptors such watercourses or residential properties.

3.2.24 Prior to construction, the Construction Contractor will prepare the arrangements for welfare provision and will be responsible for the maintenance of the facilities throughout the life of the project. Waste water facilities will be arranged with appropriate sewerage provisions included within these facilities and all necessary consents obtained from THC and SEPA.

Surface water

3.2.25 Any surface flows from compound areas that could be contaminated (e.g. adjacent to fuel stores) should pass through suitable attenuation and treatment measures prior to discharging to any watercourse under a licence from the SEPA, such as SuDS or an oil separator, or otherwise pumped out for off-site disposal and a suitably licenced waste facility.

3.2.26 Static plant such as pumps and generators will be placed on drip trays wherever practicable to prevent leaking materials, from contaminating the ground or surface waters. Facilities for washing plant and equipment contaminated with concrete or other chemicals will also be provided to prevent pollution of surface water and groundwater. If on-site batching facilities are required they will be operated under the conditions of the appropriate authorisation.

Monitoring

3.2.27 During construction further water quality monitoring will be undertaken to ensure that mitigation measures are operating as planned and preventing pollution. The purpose of the monitoring programme would also be to ensure that should pollution occur it is identified as quickly as possible and appropriate action is taken in line with the Emergency Response Plan. Although regular site visits to all water bodies that may be affected should be continued (as in the pre-construction monitoring), it is expected that daily observations by the Environmental Management / Environmental Clerk of Works would be carried out while works are ongoing that may cause impact, together with ad hoc sampling as required or in response to signs of pollution (e.g. as part of an investigation).

3.2.28 Once construction has commenced the Environmental Clerk of Works will prepare monthly Water Quality Monitoring Reports to be issued to the Construction Contractor and discussed at monthly progress meetings.

3.2.29 It is anticipated that post completion of the works water quality monitoring would continue to verify that the works have been completed without adversely affecting water quality. The monitoring period is to be confirmed.

3.2.30 The Environmental Manager / Environmental Clerk of Works will be responsible for undertaking any investigations required as a consequence of the programme of water quality monitoring. This will include liaison with Environment Agency and THC about the production of Incident and Lessons Learned Reports. These reports will detail actual impacts, describe the outcomes of actions taken, proposals for additional monitoring of affected site and receptors, and potentially changes to method statements, works processes and staff training.

Management of Flood Risk

3.2.31 In addition to the temporary drainage systems as described earlier, construction site works would be carefully managed across the site to avoid increasing any flood risks on site or off site, as well as to prevent pollution of receiving water bodies. The following measures are proposed:

3.2.32 Where construction works do impede on the flood conveyance (e.g. around proposed watercourse crossings) works would be undertaken to ensure water flows are unobstructed and that flood risk does not increase elsewhere;

3.2.33 Where groundwater is encountered suitable de-watering methods would be used to maintain a dry working area, with the water discharged in accordance a CAR licence;

3.2.34 During the construction phase, the Contractor would monitor weather forecasts on a monthly, weekly and daily basis, and plan works accordingly. For example, works in the channel of any watercourse would be avoided or halted (and equipment and materials removed) where high flows or even flooding is forecast;

3.2.35 The Contractor would sign up to SEPA flood warning alerts and describe in the Emergency Response Plan the actions it would take in the event of a possible flood event (based on weather forecasts, flood alerts and observations on site). These actions would be hierarchal meaning that as the risk increases the Contractor would implement more stringent protection measures. This is important to ensure all workers, the construction site and third party land, property and people are adequately protected from flooding during the construction phase;

3.2.36 The Emergency Response Plan would need to be enforced from the first day of construction works through to the end of all works on site, 24 hours per day, seven days per week (i.e. if action is required on non-working days procedures and resources would be available as required by the action plan in the Emergency Response Plan);

3.2.37 The risk from groundwater flooding would need to be managed accordingly through appropriate working practices and with adequate plans and equipment in place for de-watering to ensure safe dry working environments and safe working in confined spaces (such as the provision of escape routes and banksman to monitor works). It is proposed that these measures would be included in a comprehensive groundwater mitigation strategy should be considered at the detailed design stage to mitigate the risk of groundwater flooding during both the construction phase and post-construction.

Pollution Prevention Plan (PPP)

3.2.38 Please refer to the Outline CEMP (Appendix 3.1 in Volume 5) for full details of the Pollution Prevention Plan and how it is proposed to respond to a serious pollution incident occurring on Site.

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Fabric silt fences

These are geotextiles installed in the path of sheet flow runoff to filter out sediment. They are often installed around water bodies, below the toe of a cleared slope or around temporary earth stockpiles. Silt fences detain sediment-laden water and promote settlement and may remove 80-90% sand, 50-80% silty loam, and up to 20% silt-clay loam in runoff (CIRIA 648, 2006).

Baffle pads on temporary discharge

If the rate and energy of temporary discharges are not controlled there is a risk of eroding the bed and banks of the receiving water body. The use of baffle pads on the outfall is one way in which the energy of the outfall can be dispersed to avoid bank and bed erosion.

Straw bales

Like fabric silt fences and sand bags, straw bales are a multipurpose way to manage construction site runoff to prevent untreated ingress to water bodies and to support the filtration of fine particulates from runoff.

Tanker for off-site disposal

Where it has not been possible to adequately treat construction site runoff there remains the option to pump the runoff out to a tanker for disposal off-site at a suitably licensed waste facility.

Earth bunds

These are temporary barriers to conveyance of construction runoff and can be used to create temporary storage lagoons or barriers between construction works and water bodies. Care needed as earth bunds may themselves be a source of fine sediment, although this can be minimised by covering with a suitable geotextile or seeding if they are to be in place for a longer period of time and not part of topsoil storage.

Drainage grips (option to include check dams / sumps)

Drainage grips (otherwise known as cut-off or temporary drains) are temporary drains installed to intercept runoff from slopes above construction works to prevent it entering the site or cleared slopes within the site itself. They are an effective way to temporarily manage surface water runoff and convey flows contaminated with fine sediment to storage and treatment areas. Gravel and straw bale check dams can be created at regular intervals to encourage fine sediments to settle out during conveyance.

Pumps, settlement tanks and lamella clarifiers

Pre-treatment of construction site runoff can be provided by first pumping runoff through a settlement tank. These use gravity to encourage fine particulates to settle out and become trapped at the bottom of the tank. Greater levels of treatment can be achieved by using Lamella Clarifiers that include a series of inclined plates to provide a larger effective settling area for a small footprint. There are a range of products depending on application and flow rates and these can also be deployed in series and with chemical dosing tanks, if required.

Chemical treatments (e.g. use of flocculants)

Flocculation is the process by which negatively charged particulates bind together in the presence of a positively charged flocculent. This solution is typically required when there is limited space for other alternative measures to be effectively implemented. The design of the system, size and dosing rates needs to be carefully considered, and advice and a permit from the EA may be required. Other chemical approaches are also available.

Chemical dosing tanks (for dissolved metals)

Chemical dosing tanks provide a way in which high concentrations of metals in runoff can be precipitated out before the treated water is discharged from the site. Chemical dosing tanks are often containerised to reduce the footprint of the facility, ease of delivery, and reduce the risk of chemical spillage. Residual sludge waste will need to be removed from the site for appropriate disposal at a suitably licensed waste facility.

Sand Bags

Sand bags provide a flexible way to prevent sediment-laden runoff entering a watercourse by creating temporary dams and barriers to runoff. This is most effective on the face of temporary watercourses crossings and short length land depressions where there are preferential flow pathways.

Vegetated buffer zone

Vegetated buffer zones protect water bodies by provided a separation between the water body and the area of construction works and a means by which any overland flows can be treated before it drains to the water body. When planning the works a Contractor should minimise the area of vegetation clearance, especially around water bodies to maintain natural buffer zones.

Temporary settlement lagoon

Temporary settlement lagoons are an effective way to remove suspended fine particulates from construction site runoff by storing water and allowing the fine particulates to settle out. Where high concentrations are expected, a long retention time is required for significant settlement (due to the very fine nature of the sediment), or space is limited, a series of lagoons may be required with intervening gravel weirs, or the use of a flocculent could be considered. The storage required depends on site requirements, character of fine sediment, and the duration of works.

Measure: Primary & Secondary Purpose

MEASURE	SOURCE CONTROL	CONVEYANCE	TREATMENT
Fabric silt fences	●		●
Earth bunds	●	●	
Sand bags	●	●	
Silt curtains	●		
Baffle pads on temporary discharge	●	●	●
Drainage grips		●	●
Vegetated buffer zones			●
Conveyance swales		●	●
Straw bales			●
Pumps, tanks, lamella clarifiers		●	●
Temporary settlement lagoons			●
Skips in series			●
Chemical treatments			●
Tanker for off-site disposal	●	●	●
Chemical dosing tanks			●

● Primary Purpose of Measure

● Secondary Purpose of Measure

Silt Curtains

Floating silt curtains are designed to control and manage sediment flow within standing waters. It consists of a top flotation pocket below which is suspended vertically an impermeable curtain, and then a ballast at set intervals to hold the curtain in place. It is typical for a bespoke curtain to be created for the particular water body (i.e. changes in bathymetry, flow conditions can be taken into account). Similar products exist for use in low river flows, although they are generally less effective than when deployed in calmer water.

Conveyance swale (option to include check dams / sumps)

Similar to drainage grips, conveyance swales provide a way in which construction site runoff can be directed to storage and treatment areas. The wider cross sectional area of a swale when compared to a drain encourages greater settlement of fine particulates. Settlement can be enhanced by the inclusion of check dams and sediment traps, although the build-up of deposited fine material will need to be monitored and regularly cleared out.

Skips in series

Where there are constraints on space that prohibit the use of construction SuDS (i.e. settlement lagoons as described above) an alternative option might be to drain runoff through a series of skips filled with clean aggregate or straw bales to encourage filtration and settlement of suspended fine particulates.

Purpose of Issue

PURPOSE OF ISSUE

Client

Intelligent Land Investments
33 Bothwell Road,
Hamilton.
MI3 0AS.

Project Title

RED JOHN PUMPED STORAGE HYDRO SCHEME

Drawing Title

POTENTIAL FINE SEDIMENT TREATMENT MEASURES

Designed	Drawn	Checked	Approved	Date
TJ	TJ	OT	CA	18/10/18

Internal Project No: 60570241
Suitability:
Scale @ A3: NA
Zone: X

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Drawing Number: Appendix A

Rev: P01

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