MMB
MOTT MACDONALD
BENTLEY

Operational Technical Management Plan

Llyn Celyn Discharge Consent

August 2024

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Operational Technical Management Plan

Llyn Celyn Discharge Consent

August 2024

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
P01	August 24	K Doyle	H Leyshon J Marshallsea	M J McAree	Management Plan for Discharge Consent

Document reference: ST36 | P01 |

Contents

1 Introduction

1.1 Purpose and Scope

This Operating Technique Management Plan (OTMP) has been written to support discharge consent Ref: PAN-026364. This discharge consent has been sought by Mott MacDonald Bentley (MMB) from Natural Resources Wales (NRW) in relation to the construction of a new spillway at Llyn Celyn Reservoir. The discharge consent is needed to permit the discharge of treated surface water runoff back to surface water. This is required due to increased runoff during periods of intense rainfall throughout the construction period. A Gel Flocculate which bonds with the sediment in the surface run-off, is required to minimise sediments being introduced to surface water. This has triggered the need for a discharge permit.

This document will provide an outline of the methodology and the controls in place, to prevent harm to the wider environment during operations. The OTMP will be updated throughout the duration of the works as required.

Due to significant and prolonged rainfall events during the reservoir safety construction works at Llyn Celyn (required under the ambit of the Reservoirs Act 1975), enhanced silt removal from surface water runoff is required. This OTMP is required to manage the mitigation associated with the discharge consent.

This document must be adhered to.

1.2 Scheme Description

The proposed works are being undertaken at Llyn Celyn reservoir, which is owned and operated by Welsh Water (DCWW). The site is located in a rural area, (NGR: SH 88011 39984). The proposed development involves the construction of an auxiliary spillway, catchwater channel and below ground flow measurement chamber, the reconfiguration of the existing car park and the diversion of a below ground high voltage cable, including landscape and ecological mitigation measures.

In addition, during the construction phase, a range of enabling works are proposed, including the provision of haul roads, materials storage/set down areas, localised road improvements, site compound and welfare facilities and vehicle parking.

1.3 Key Contacts

The following table outlines key personnel involved in the project and their contact details.

Table 1.1: Key Contacts.

	Role	Name	Contact Telephone
Welsh Water	Project Manager	Karen Morris	Numbers not included in external issue due to data protection.
MMB	Contract Manager	John Hughes	
MMB	Site Manager	Dafydd Hughes	
MMB	Works Manager	Mark Blythen	
MMB	Environmental Coordinator	Kay Morris	
MMB	SHEQ Manager	Tim Williams	
MMB	SHEQ Advisor	James Marshallsea	
MMB	Ecological Clerk of Works	Elliott Hughes	

	Role	Name	Contact Telephone
MM	Landscape Clerk of Works	Oliver Judge	
MMB	Design Lead	Greg Cornelius	
MMB	Project Leader	Simon Golds	
Frog Environmental	Technical Director	Leela O'Dea	

1.4 Environmental Audits and Environmental Incidents

SHEQ audits will be undertaken by the SHEQ Advisor/Manager or their appointed person every 90 days to monitor compliance with the OTMP as well as the Construction Environmental Management Plan (CEMP) and Contract Management Plan (CMP).

Updates to the OTMP will be coordinated by the Environmental Advisor/Specialist and issued to relevant parties.

Should an environmental incident occur, all associated works must stop and any source of pollutants contained immediately, following procedures in the Pollution Prevention Plan and CMP. The SHEQ Advisor and Environmental Advisor should be contacted immediately, and the incident reported to the appropriate authorities.

2 Treatment Outline Process

To facilitate the construction of the new spillway, a proportion of the site has been temporarily stripped of vegetation. Given the topography at the site and the presence of Afon Dyfrdwy and Llyn Tegid, there is a risk that silt laden surface run off could cause harm to surface water receptors. To prevent such harm, surface water will be captured and treated at two locations.

- Downstream of the main working area at the crest of the dam; and
- At the bottom of the site, adjacent to the storage area and access road.

The treatment at the two locations is discussed in Sections 2.1 and 2.2.

Treatment will be primarily through the use of settlement lagoons and gel flocculant. The catchment areas of the lagoons can be found in Table 2 below.

Table 2. Catchment area of Settlement Lagoons

Catchment	Area (m2)
Downstream of main working area	7500
Bottom of site adjacent to storage area/access road	4800

2.1 Treatment 1 – Downstream of main working area (crest of dam)

The following process will be adopted for the upper part of the works, which is located downstream of the main working area.

1. A silt capture channel, lined with an impermeable liner and containing check dams constructed of sandbags and silt capture mats, will direct the rainfall to the settlement lagoons. Within this silt capture channel, the Gel Flocculant 494 and Gel Flocculant 360 (henceforth known as gel floc) chemical treatment supplied by Frog Environmental Ltd. will be installed. This will begin the treatment of the sediment within the water as it enters the settlement lagoons.
2. Two lagoons have been created at this stage of the treatment process. The first lagoon has been split into three sections, sandbag baffles through which interconnecting pipework has been installed. These will be placed to provide time for the gel floc to work, and for the silt to drop out of the flow.
3. The water will then flow into a smaller lagoon. Once through this system the water flows through silt filtration socks which are located over silt capture mats, which will discharge over ground. At this stage hay bales and silt netting will also be utilised to capture any remaining silt.
4. The water will then be discharged to the grassy bank and will eventually the discharged surface water will make its way down gradient to the river below.

2.2 Treatment 2 – Bottom of site adjacent to storage area/access road

The second silt filtration system is appropriate for the smaller catchment

1. Water will be channelled from the catchment area into the settlement lagoon where the gel floc will be located.
2. The water will then run through a silt capture channel which will be lined with an impermeable liner and contains check dams constructed of sandbags and silt capture mats.

3. The water will then be discharged into the river.

2.3 Settlement Lagoons

As discussed in Sections 2.1 and 2.2, there are multiple sediment lagoons on site to manage silt run off and prevent silt pollution within the river. The settlement lagoons have been designed with reference to GPP6, and are not designed to receive pumped flows; rather the surface run off will be channelled into the lagoons to then be treated. Please note the lagoons will not be lined due to potential damage to the lining during silt removal activities.

It is envisaged that the lagoons will receive flows of typically 1600l/min. However, they have been designed to accommodate the flows from a 4-inch pump at 2500l/min equivalent as in line with GPP6, to account for higher rainfall levels.

Following the completion of works, the lagoons will be backfilled and reinstated. Please see 'Section 2.5 – Disposal of Gel Flocculant Retained Silt' for disposal method.

2.4 Water Quality

The discharge quality under the above typical flows will not exceed 60mg/l suspended silt as advised by Frog Environmental who have worked with us to design the treatment process. This is below the Statutory default permit standard for suspended solids of 100mg/l.

This will be measured using a turbidity meter. Please see 'Section 4: Monitoring Programme'.

2.5 Disposal of Gel Flocculant Retained Silt

The silt retained in the settlement lagoons and silt capture channels will be removed, stored, and disposed of appropriately. This process will be subject to waste classification testing.

2.6 Concrete

Concrete wash is not relevant within this discharge and has therefore not been included within this management plan.

3 Environmental Risk Assessment

Environmental Aspect	Environmental Impact	Risk Level	Control Measures	Residual Risk
Fuel/chemical spillage	Pollution of existing watercourses and ground	High	• Works to comply with Operational Safety Standard (OSS) 113 Managing and using Hazardous Substances-Rev A and Operational Environment Standard (OES) 003 Pollution Prevention. • A spill kit to be available on site at all times to deal with any accidental spillages of fuel, oil or other pollutants. • Any spillages must be reported to the Site Foreman/Site Manager. • Site Manager to produce emergency response plan. This will be printed and displayed in the site office. • Fuel will only be stored in the site compound area in correctly constructed tanks and containers. These will be kept closed and locked when not in use. • All re-fuelling will be carried out at a designated location over a Plant Nappies • Plant Nappies to be available within stores for storing plant. • Gas oil to be stored in double bunded tanks. • Petrol to be carried in approved containers and no more than 5 gallon per vehicle at any one time. • Small plant to be fuelled in designated areas. • Implementation of pollution prevention guidelines (NRW) during construction.	Medium
Wildlife	Disturbance of wildlife and their habitats	High	• Review pre-ecological surveys and identify breeding and nesting seasons and avoid work in this period if possible. • ECoW will be in place to ensure that no reptiles will be harmed during the excavation of the settlement lagoons. • Treatment process (incl. settlement lagoons and silt netting) will be sited away from any known badger setts and will not sever any commuting routes.	Medium

			• Minimise disturbing activities in areas where susceptible species have been identified. • For emergencies or identification of protected species - Stop work, make safe and Inform MMB Ecologist.	
Pollution of River	Water pollution	Medium	• All discharges to have daily visual checks, to check for siltation, oils and olfactory evidence of contamination. A turbidity and pH test to be taken twice daily. Please refer to 'Section 4.1: Daily Monitoring & Sampling' for further information. • All onsite staff to receive TBT on dewatering activity and how to stop operation in the event of a visual non-compliance.	Low
Spillage of silts and soils into the water courses.	Water Pollution	Medium	• A filter strip of vegetation will be maintained around each of the lagoons and the watercourses. • All surface runoff to be directed into the lagoons. • Silt netting to be used where there is a recognised pathway between source of exposed soil and water course / site drainage. • Stockpile all soils and materials (imported and site won) **away from water courses and site drainage (at least 10m);** • Ensure that all waste is stored securely and is **at least 10m away from water courses.** • Identify and protect all site drainage and water courses **In the event of a release of silt:** • Stop work immediately and prevent any more material being split. • Place straw bales, silt fencing etc. adjacent to water course to help control sediment immediately. • Limit the spread of silt using straw bales downstream of the spillage. Small spillages will settle out at the straw bale. Large plumes may need a specialist clean-up operation. • ****Specialist contractors to be contacted to remove the contamination*** *** • Report the incident– consultation with a member of the SHEQ team will be required if the incident is Cat 1-3). Regulator to be advised in the event of a significant incident.	Low

Run off from roadways	Water Pollution	Medium	• Use of suitable vehicle wheel wash to prevent generation of excessive silt on roadways. • Employ road sweepers as required to remove excessive silt from roadways. • Install silt netting along artificial roadways if excessive run off is likely.	Low
Turbidity test failure	Water discolouration	High	• If turbidity test fails, further mitigations to be installed and seek advice from site supervisor and SHEQ Advisor.	Low
pH test failure	pH not within normal limit	High	• If pH test fails, discharge to be stopped and seek advice from site supervisor	Low
General Housekeeping	Potential spills to ground of surface water as a result of poor housekeeping.	High	• Ensure good housekeeping standards are maintained on site. • Good spill protection on site in the event of a spill. Machines to use biodegradable oil. • Fuelling operations to be undertaken in designated fuel zone, which is a minimum of 10m away from the point of discharge.	Low

4 Monitoring Program

Silt management is an iterative process that requires regular checking and maintenance to ensure that the mitigation is meeting the site needs and that there is no detriment to water quality at the final discharge point. Therefore, the effectiveness of the mitigation will be monitored daily by the JNB site manager or a competent delegated person (see section 5.1) to safeguard against pollution events as construction progresses. Inspections from Frog Environmental will also take place to ensure that the system is performing as designed (Section 5.2). Specialist advise will be provided when needed both from the SHEQ team and Frog Environmental Ltd.

It is also acknowledged that silt management must evolve as construction progresses; as such any adaption or variation will be suitably assessed to determine the impact to the water environment. This will include the review of written documentation, implementation of the documentation and evaluation of the site condition. Should internal audits raise any issues or non-conformance with this document they will be addressed immediately within the audit. Where not possible, an action will be raised with the Environmental Specialist.

4.1 Daily Monitoring & Sampling

The JNB site manager or a competent delegated person shall inspect the operations once daily, during periods of heavy rainfall, and where safe to do so, this will be increased where necessary to ensure the treatment process is working effectively and efficiently. The checks will take place at multiple points across the system including the silt capture channels, settlement lagoons and the discharge points of each system (Downstream of the main working area at the crest of the dam; and at the bottom of the site, adjacent to the storage area and access road.). The checks will be undertaken to ensure that water is not escaping the system, as well as the monitoring parameters set out in Table 3. The checks will be undertaken prior to works commencing. Monitoring will include a visual and physical testing of the water. The parameters are as follows:

Table 3. Daily Monitoring Parameters

Parameter	Measurement	Range	Method
Weather	Visual	Sun | Rain	Observation
Discharge from site	Visual	Yes | No	Observation
Water Clarity	Visual	Clear | Cloudy | Silty	Observation
Hydrocarbons	Visual	Sheen	Observation
Dissolved Oxygen	Visual	Fish in distress?	Observation
Turbidity	NTU	0-100	Turbidity Meter
TSS	Mg/l	0-60	Correlation
pH	pH	6-9	pH Meter

The data will be recorded on a form such as Figure 1 below, and will be kept for the duration of the project. This will include space to monitor each of the three monitoring points. All records will be kept for review by the Environmental Advisor and will be maintained within the Environmental File.

Daily Monitoring Template Example

	Date	Time	What are the weather conditions? (e.g. Sun/Rain)	Settlement Pond condition (Silt level – Low/Medium/High)	Visual Appearance (e.g. clear, cloudy, muddy)	Any visual Oils? (Y/N)	Any strange smells? (Y/N)	Dissolved Oxygen (Are the Fish in Distress? Y/N)	Turbidity Reading (0-100)	TSS (Mg/l - reading of 60mg/l or higher will stop activity)	pH level (anything outside 6-9 will stop activity)	Person monitoring	Signature
Mon AM													

Figure 1. Example of Daily Monitoring Template

4.2 Exceedance of Parameters

If there are any exceedances of the parameters outlined in Table 3, during the monitoring, , then the test will be repeated. If the second test returns a result that also exceeds the parameters, the water will be tested, and the underlying cause will be investigated, further mitigations will be implemented where necessary. If this test is within normal limits and proven not to be the source of elevated results, then discharge can recommence. If the water is found to be the source of the issue, then the discharge will need to cease until appropriate mitigation measures have been put into place to remove the source of pollution. Any anomalies or elevated results will need to be discussed with relevant parties both on and offsite (Site team & SHEQ team).

If the turbidity level of the water meets or exceeds 60mg/l, further mitigations will be installed. This could include but is not limited to; a review of the gel floc to see if more would be beneficial during periods of extended rainfall, and/or the installation of additional silt capture equipment. If visual checks are displayed as cloudy or muddy, then extra turbidity readings should be taken, and any contributing activities stopped if elevated readings are recorded.

If the pH level of the water drops below 6 or exceeds 9, it will need to be re-tested. If it still outside of the set-out parameters, then works will need to stop and further mitigations will need to be installed and a review of on-site chemical use will be undertaken. If this is the case, please contact the environmental advisor.

Any visual deficiencies are to be reported to site management and activities will need to stop until the issues have been resolved.

4.3 Supplier monitoring

Frog Environmental Ltd. to attend site to verify that the system is achieving the desired outcomes at least 4 times during the system operating period.

4.4 Pollution Event

If a pollution event is deemed to have occurred, then the Regulator will be notified of the event, as required, and remediation measures undertaken. Please refer to ‘Section 5: Environmental Incident Reporting’ for further information.

5 Environmental Incident Reporting

5.1 Incident Reporting Process

If an incident occurs onsite, the Rule of 2 should be followed (Figure 2). Within 2 hours of the incident the Welsh Water (DCWW) Project Manager, the site Safety Advisor and the SHEQ Advisor need to be informed of the pollution event. Within 2 days an initial report must be completed and sent to the WW Project Manager, the Safety Advisor and the SHEQ Advisor, along with relevant photos, mitigation and a root cause analysis. Within 2 weeks the full investigation should have taken place and the report must be issued to the relevant parties for review.

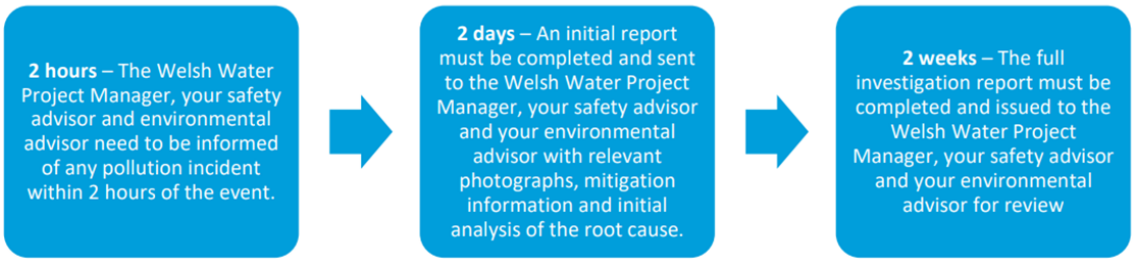

Figure 2. Rule of 2

The following flow diagram (figure 3) shows the process from a spill event to the review of the report and next steps following the spill. This will be adhered to as part of the site emergency response plan.

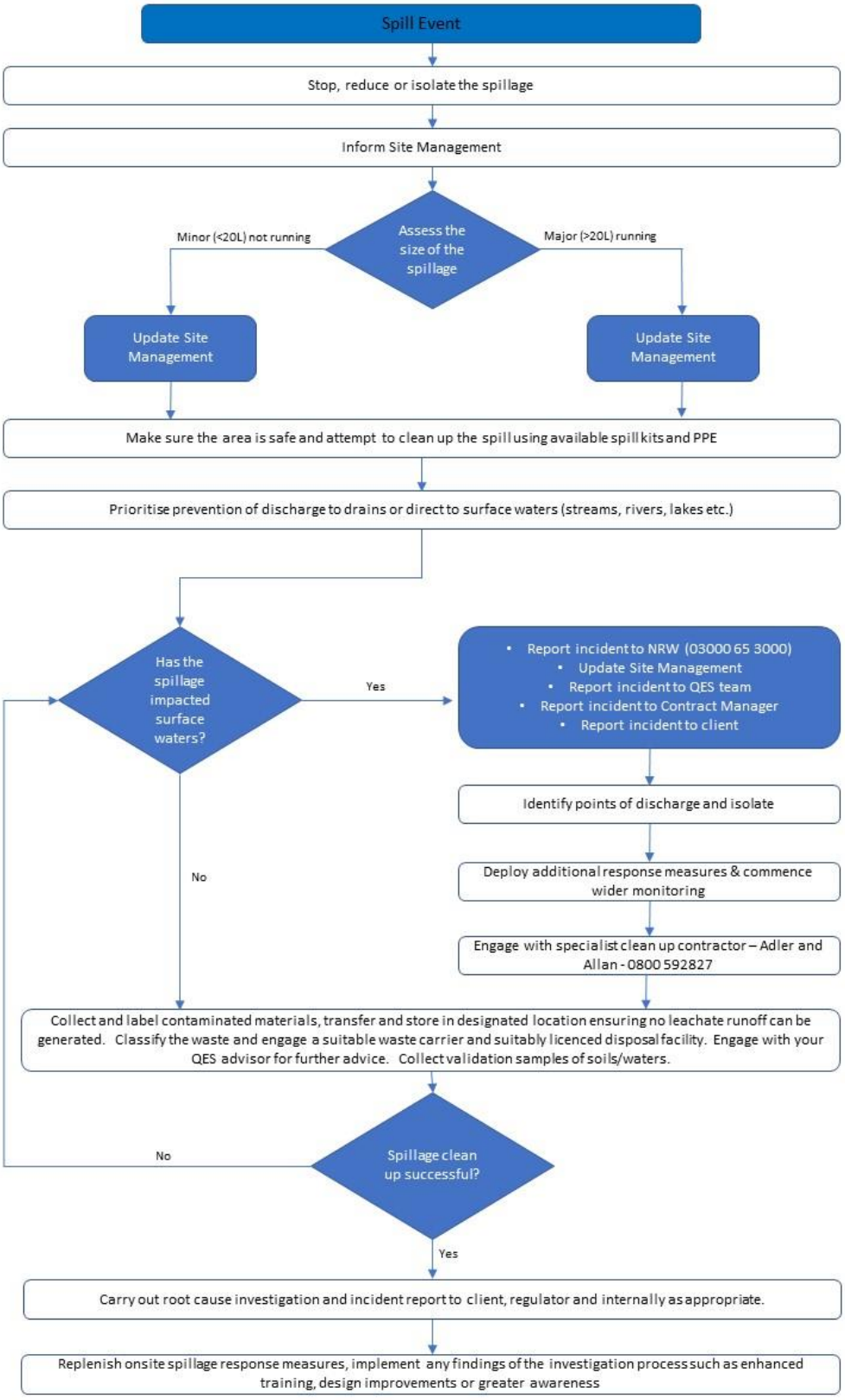

Figure 3. Spill Event Action Plan

5.2 Pollution Prevention Control Measure Inspections

Weekly inspections of the additional critical control measures (outside of treatment method outlined in 'Section 2: Treatment Outline Process') will be carried out and recorded in the site diary. During periods of prolonged or heavy rainfall these inspections will be undertaken more frequently with any required maintenance carried out and recorded as appropriate. These control measures include:

- All silt netting surrounding work areas and stockpiles:
- Silt socks and silt mats at points of discharge including visual inspection of the surface water runoff quality:
- Spill kits – within the work area, plant, refuelling area and in the site compound:
- Stored stocks of hay bales and emergency spill kits.

Further plant inspections are carried out and recorded daily to identify any leaks or emission defects.

Table 4. Internal Contacts

Internal Contacts		
Contact	**Office Hours**	**Out of Hours**
Site Manager – Dafydd Hughes Works Manager – Mark Blythen	Numbers not included in external issue due to data protection.	Numbers not included in external issue due to data protection.
Contract Manager - John Hughes		
SHEQ Manager/Advisor (Environmental) - Tim Williams / James Marshallsea		
SHEQ Advisor (Health and Safety) – Nigel Bull		

Table 5. External contacts

External Contacts		
Contact	**Office Hours**	**Out of Hours**
Emergency Services (Fire/Police/Ambulance)	999	999
Local Police	101(non-emergency)	101(non-emergency)
Local Hospital/NHS Trust	01745 583910	01745 583910
Environmental Regulator Incident Hotline	0300 065 3000 (NRW)	0300 065 3000 (NRW)
Environmental Regulator Local Contact	TBC	TBC

Local Authority Emergency Planning Department	01766 771000	01766 771000
Floodline	0345 988 1188 (EA)	0345 988 1188 (EA)
Local Water Company/Authority	0800 052 0130 0800 085 3968	0800 052 0130 0800 085 3968
Electricity Company	0800 001 5400	0800 001 5400
Gas Company	0800 111999	0800 111999
Waste Management Contractor	01202 870833	
Specialist Clean Up Contractor JNB Buying Department	0800 592 827	0800 592827
Local residents / business who may be affected by pollution event.	National White Water Centre 01678521083	N/A

6 Chemical Data Sheets

The following documents detail the substances that are being used to aid in the treatment process.

- 494 Safety Data Sheet 2023.
- 360 Safety Data Sheet 2023.
- Llyn Celyn Gel Flocculant Environmental Carry Over Calculations.
- FC4327 JNBentley Settlement Test and Gel Flocculant Validation Report.
- GF-PD-03v2_ Environmental Standards relating to Gel Flocculant Composition.

SAFETY DATA SHEET

Gel Flocculant 494

SECTION 1: IDENTIFICATION OF MIXTURE AND COMPANY

1.1 Product identifier

Gel Flocculant 494

CHEMICAL FAMILY: Polyacrylamide polymer

CAS NUMBER: none identified

CHEMICAL NAME: none identified

1.2 Relevant Identified Uses

Water treatment

1.3 Supplier

Frog Environmental Ltd

Business Contact

The Byre

0345 057 4040

Blackenhall Park

Emergency Contact

Bar Lane

Staffordshire DE13 8AJ

0345 057 4040 (not 24 hours)

24 Hour Emergency Contact

UK National Poisons Information Service: 0344 892 0111

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification

Not classified according to EU regulation 1272/2008 as implemented in The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use) (Amendment etc.) (EU Exit) Regulations 2019.

2.2 Label elements

No labeling required

2.3. Other hazards

No component meets the criteria of a PBT or vPvB substance according to EU regulation 1907/2006 as implemented in The REACH etc. (Amendment etc.) (EU Exit) Regulations 2019 (as amended)

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

There are no components present, within the current knowledge of the supplier that are classified as hazardous to health or the environment and present at concentrations that require reporting in this section.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

General

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid.

Skin

Wash skin with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If irritation occurs get medical attention.

Inhalation

Remove exposed person to fresh air. Seek medical attention if the patient feels unwell.

Eye

Flush eyes with large amounts of water for at least 15 minutes, lifting eyelids to insure complete flushing of surface. Seek medical attention if irritation persists.

Ingestion

Keep at rest. Never give anything by mouth to an unconscious person. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Keep airway clear. Seek medical attention.

4.2. Most important symptoms and effects, both acute and delayed.

Signs and Symptoms of Acute Exposure

Inhalation: vapours, mists or dusts of the product may be irritating to the respiratory system. May irritate mouth, nose, and throat.

Ingestion: May cause irritation of the lining of the stomach.

Skin: Mild to moderate irritation can occur.

Eyes: Can cause mild to moderate irritation.

Chronic Health Effects

Prolonged or repeated contact may cause defatting and drying of the skin. Prolonged or repeated contact may cause discomfort and local redness. No known other chronic effects.

4.3 Indication of any immediate medical attention and special treatment needed.

Treat symptomatically.

SECTION 5: FIRE FIGHTING MEASURES

5.1. Extinguishing Media

Suitable: Use extinguishing media suitable for the surrounding fire..

Unsuitable: None.

5.2. Special hazards arising from the mixture

Hazardous Combustion Products: Carbon and Nitrogen Oxides (CO, CO_2, NO_x)

5.3. Advice for Firefighters

Protective Equipment/Clothing: Wear full protective clothing including positive pressure self-contained breathing apparatus.

Fire Fighting Guidance: Fight large fires from maximum distance or use unmanned hose handlers or monitor nozzles. Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until after fire is out.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear appropriate protective equipment (see section 8). Wet product and aqueous solutions of product are very slippery. Trace amounts of product on smooth surfaces can become extremely slippery when wet.

6.2 Environmental precautions

Prevent entry of concentrated solutions into waterways or sewers.

6.3. Methods and materials for containment and clear up

Sweep or scoop dry material and place in appropriate container. Absorb aqueous solutions with a dry inert material, such as clay, and place in an appropriate waste disposal container. After most of the material has been recovered, clean the area with warm, soapy water.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Normal precautions common to good manufacturing practice should be followed in handling and storage. Open and handle container with care. Keep the containers closed when not in use. Avoid physical damage to blocks. Use appropriate personnel protective equipment (See section 8).. Avoid contact with eyes, skin, and clothing. Do not ingest. After handling, wash hands thoroughly with soap and water.

7.2. Conditions for safe storage, including any incompatibilities.

Store in a cool, dry area. Store in accordance with good industrial practices. Keep away from direct sunlight. Protect against physical damage.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1. Control parameters

None identified.

8.2. Exposure controls

8.2.1. Engineering Controls

No specific measures required

8.2.2. Individual Personal Protection

Eye Safety: glasses are required as a minimum. Use splash goggles or a face shield when eye contact due to splashing is possible.

Skin: Wear nitrile, butyl or Viton® gloves. The specification of glove depends on the work being undertaken; consult manufacturer's recommendations. Breakthrough times >480 mins (thickness ≥0.1 mm). When skin contact is possible for other than the hands, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Protective clothing must be cleaned thoroughly after each use.

Respiratory: No specific measures required.

Thermal: No hazard

Additional Remarks: Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove soiled clothing and wash thoroughly before reuse. Use care in walking on spilled material. Material spilled on hard surfaces can be a serious slipping/falling hazard.

8.2.3. Environmental exposure controls

No specific measures identified for normal handling and use.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Solid

Colour: Yellow to white or off-white

Odor: Slight vinegar odour

Melting Point: > 100 °C

Boiling Point: > 100 °C

Flammability: not flammable

Lower/Upper Flammable Limit: Not applicable

Flash Point: No data available

Auto-Ignition temperature: No data available

Decomposition temperature: No data available

pH: 5-7.5 (concentration dependent)

Viscosity: Not applicable

Solubility (Water): Soluble in water but dissolves very slowly

Partition Coeffecient (KOW): No data available

Vapor Pressure: No data available

Relative density: ~1.1

Vapour density: No data available

Particle characteristics: Not applicable, bulk form

Other information : No relevant data identified

SECTION 10: STABILITY AND REACTIVITY

10.1: Reactivity

No hazardous reactions identified. Does not react with air, water or other common materials

10.2. Chemical Stability

This product is stable

10.3. Possibility of hazardous reactions

None identified. Hazardous polymerization will not occur

10.4. Conditions to Avoid

High temperatures

10.5. Incompatible materials

Oxidising agents. Strong bases may cause the release of ammonia

10.6. Hazardous Decomposition Products

Carbon and nitrogen oxides (CO, CO_2 NO_x)

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on hazard classes

Acute Toxicity: This product is of a low order of acute toxicity. Oral LD50 (Rat) >5000 mg/kg

Skin Irritation: Mild to moderate irritation can occur. Prolonged or repeated contact may cause defatting and drying of the skin

Eye irritation: Transient mild to moderate irritation can occur

Respiratory of skin sensitization: No known effects

Germ cell mutagenicity: No known effects

Carcinogenicity: No known effects

Reproductive toxicity: No known effects

Specific target organ toxicity – single exposure: No known effects

Specific target organ toxicity – repeated exposure: No known effects

Aspiration hazard: not applicable for solids

11.2. Other information

The substance is not expected to have endocrine disrupting properties. No other relevant information identified

SECTION 12: ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Fish (Oncorhynchus mykiss): 96 hr LC_{50}: > 2500 mg/L.

Invertebrates (Daphnia magna): 48 hr EC_{50}: immobility 705 mg/L.

12.2. Persistence and Degradability

Not readily biodegradable but complete mineralization is expected under environmental exposure. Degradation initialization and rate are dependent on UV levels.

12.3. Bioaccumulation potential

The product is not expected to bioaccumulate.

12.4. Mobility in soil

The product is designed to bind to sediment and soil, so it is not expected to suffer from leaching or mobility.

12.5. Results of the PBT assessment

This product does not meet the criteria of a PBT or vPvB substance.

12.6 Endocrine disrupting properties

The substance is not expected to have endocrine disrupting properties

12.7 Other adverse effects

None identified

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods: Dispose of all waste must be in accordance with all applicable national and local health and environmental regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

SECTION 14: TRANSPORT INFORMATION

14.1: UN number: Not applicable. The products is not classified as dangerous for transport.

14.2: UN proper shipping name: The products is not classified as dangerous for transport.

14.3: Transport hazard classes: Not applicable. The products is not classified as dangerous for transport

14.4: Packing group: Not applicable. The products is not classified as dangerous for transport

14.5: Environmental hazards: None identified.

14.6: Special precautions for users: None identified.

14.7. Maritime transport in bulk: Not applicable. The products is not classified as dangerous for transport

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/ legislation specific for the product

EU REACH: All components of this product have been registered with the European Chemicals Agency or are exempt from registration.

U.S. TSCA Inventory Status: All components of this product are either on the Toxic Substances Control Act (TSCA) Inventory List or exempt.

Canadian DSL Inventory Status: All components of this product are either on the Domestic Substances List (DSL), the Non-Domestic Substances List (NDSL) or exempt.

15.2. Chemical Safety Assessment

A chemical safety assessment has not been carried out for this product.

SECTION 16: OTHER INFORMATION

DATE: December 2022: First issue:

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Any information or advice obtained from FEL otherwise than by means of this publication is also given in good faith. However, it remains at all times the responsibility of the customer to ensure that the product is suitable for the particular purpose intended. Conditions of use are beyond our control, and therefore users are responsible for verifying the data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product.

FEL accepts no liability whatsoever (except as otherwise expressly provided by law) arising out of the use of information supplied, the application, adaptation or processing of the products described herein, the use of other materials in lieu of FEL materials or the use of FEL materials in conjunction with such other materials. The information in this safety data sheet relates only to the product designated herein, and does not relate to its use in combination with any other material.

SAFETY DATA SHEET

Gel Flocculant 360

SECTION 1: IDENTIFICATION OF MIXTURE AND COMPANY

1.1 Product identifier

Gel Flocculant 360

CHEMICAL FAMILY: Polyacrylamide/polyacrylate polymer

CAS NUMBER: none identified

CHEMICAL NAME: none identified

1.2 Relevant Identified Uses

Water treatment

1.3 Supplier

Frog Environmental Ltd

Business Contact

The Byre

0345 057 4040

Blackenhall Park

Emergency Contact

Bar Lane

Staffordshire DE13 8AJ

0345 057 4040 (not 24 hours)

24 Hour Emergency Contact

UK National Poisons Information Service: 0344 892 0111

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification

Not classified according to EU regulation 1272/2008 as implemented in The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use) (Amendment etc.) (EU Exit) Regulations 2019.

2.2 Label elements

No labeling required

2.3. Other hazards

No component meets the criteria of a PBT or vPvB substance according to EU regulation 1907/2006 as implemented in The REACH etc. (Amendment etc.) (EU Exit) Regulations 2019 (as amended)

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

There are no components present, within the current knowledge of the supplier that are classified as hazardous to health or the environment and present at concentrations that require reporting in this section.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

General

Take proper precautions to ensure your own health and safety before attempting rescue and providing first aid.

Skin

Wash skin with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If irritation occurs get medical attention.

Inhalation

Remove exposed person to fresh air. Seek medical attention if the patient feels unwell.

Eye

Flush eyes with large amounts of water for at least 15 minutes, lifting eyelids to insure complete flushing of surface. Seek medical attention if irritation persists.

Ingestion

Keep at rest. Never give anything by mouth to an unconscious person. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Keep airway clear. Seek medical attention.

4.2. Most important symptoms and effects, both acute and delayed.

Signs and Symptoms of Acute Exposure

Inhalation: vapours, mists or dusts of the product may be irritating to the respiratory system. May irritate mouth, nose, and throat.

Ingestion: May cause irritation of the lining of the stomach.

Skin: Mild to moderate irritation can occur.

Eyes: Can cause mild to moderate irritation.

Chronic Health Effects

Prolonged or repeated contact may cause defatting and drying of the skin. Prolonged or repeated contact may cause discomfort and local redness. No known other chronic effects.

4.3 Indication of any immediate medical attention and special treatment needed.

Treat symptomatically.

SECTION 5: FIRE FIGHTING MEASURES

5.1. Extinguishing Media

Suitable: Use extinguishing media suitable for the surrounding fire.

Unsuitable: None.

5.2. Special hazards arising from the mixture

Hazardous Combustion Products: Carbon and Nitrogen Oxides (CO, CO2, NOx)

5.3. Advice for Firefighters

Protective Equipment/Clothing: Wear full protective clothing including positive pressure self-contained breathing apparatus.

Fire Fighting Guidance: Fight large fires from maximum distance or use unmanned hose handlers or monitor nozzles. Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until after fire is out.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear appropriate protective equipment (see section 8). Wet product and aqueous solutions of product are very slippery. Trace amounts of product on smooth surfaces can become extremely slippery when wet.

6.2 Environmental precautions

Prevent entry of concentrated solutions into waterways or sewers.

6.3. Methods and materials for containment and clear up

Sweep or scoop dry material and place in appropriate container. Absorb aqueous solutions with a dry inert material, such as clay, and place in an appropriate waste disposal container. After most of the material has been recovered, clean the area with warm, soapy water.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Normal precautions common to good manufacturing practice should be followed in handling and storage. Open and handle container with care. Keep the containers closed when not in use. Avoid physical damage to blocks. Use appropriate personnel protective equipment (See section 8).. Avoid contact with eyes, skin, and clothing. Do not ingest. After handling, wash hands thoroughly with soap and water.

7.2. Conditions for safe storage, including any incompatibilities.

Store in a cool, dry area. Store in accordance with good industrial practices. Keep away from direct sunlight. Protect against physical damage.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1. Control parameters

None identified.

8.2. Exposure controls

8.2.1. Engineering Controls

No specific measures required.

8.2.2. Individual Personal Protection

Eye Safety glasses are required as a minimum. Use splash goggles or a face shield when eye contact due to splashing is possible.

Skin: Wear nitrile, butyl or Viton® gloves. The specification of glove depends on the work being undertaken; consult manufacturer's recommendations. Breakthrough times >480 mins (thickness ≥0.1 mm). When skin contact is possible for other than the hands, protective clothing including gloves, apron, sleeves, boots, head and face protection should be worn. Protective clothing must be cleaned thoroughly after each use.

Respiratory: No specific measures required.

Thermal: No hazard

Additional Remarks: Selection of appropriate personal protective equipment should be based on an evaluation of the performance characteristics of the protective equipment relative to the task(s) to be performed, conditions present, duration of use, and the hazards and/or potential hazards that may be encountered during use. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Use good personal hygiene practices. Wash hands before eating, drinking, smoking, or using toilet facilities. Promptly remove soiled clothing and wash thoroughly before reuse. Use care in walking on spilled material. Material spilled on hard surfaces can be a serious slipping/falling hazard.

8.2.3. Environmental exposure controls

No specific measures identified for normal handling and use.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Solid.

Colour: Green to white or off-white

Odor: Slight vinegar odour.

Melting Point: > 100 °C

Boiling Point: > 100 °C

Flammability: not flammable

Lower/Upper Flammable Limit: Not applicable

Flash Point: No Data Available

Auto-Ignition temperature: No data available

Decomposition temperature: No data available.

pH: 7 (concentration dependent)

Viscosity: Not applicable.

Solubility (Water): Soluble in water but dissolves very slowly.

Partition Coeffecient (KOW): No Data Available.

Vapor Pressure: No data available

Relative density: ~1.1

Vapour density: No data available

Particle characteristics: Not applicable, bulk form

Other information : No relevant data identified

SECTION 10: STABILITY AND REACTIVITY

10.1: Reactivity

No hazardous reactions identified. Does not react with air, water or other common materials.

10.2. Chemical Stability

This product is stable.

10.3. Possibility of hazardous reactions

None identified. Hazardous polymerization will not occur.

10.4. Conditions to Avoid

High temperatures.

10.5. Incompatible materials

Oxidising agents. Strong bases may cause the release of ammonia.

10.6. Hazardous Decomposition Products

Carbon and nitrogen oxides (CO, CO_2 NO_x)

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on hazard classes

Acute Toxicity: This product is of a low order of acute toxicity. Oral LD50 (Rat) >5000 mg/kg

Skin Irritation: Mild to moderate irritation can occur. Prolonged or repeated contact may cause defatting and drying of the skin

Eye irritation: Transient mild to moderate irritation can occur.

Respiratory of skin sensitization: No known effects.

Germ cell mutagenicity: No known effects

Carcinogenicity: No known effects

Reproductive toxicity: No known effects

Specific target organ toxicity – single exposure: No known effects

Specific target organ toxicity – repeated exposure: No known effects

Aspiration hazard: not applicable for solids

11.2. Other information

The substance is not expected to have endocrine disrupting properties. No other relevant information identified.

SECTION 12: ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Fish (Oncorhynchus mykiss): 96 hr LC_{50}: 140- 150 mg/L.

Invertebrates (Daphnia magna): 48 hr EC_{50}: ≥ 125 mg/L.

12.2. Persistence and Degradability

Not readily biodegradable but complete mineralization is expected under environmental exposure. Degradation initialization and rate are dependent on UV levels.

12.3. Bioaccumulation potential

The product is not expected to bioaccumulate.

12.4. Mobility in soil

The product is designed to bind to sediment and soil, so it is not expected to suffer from leaching or mobility.

12.5. Results of the PBT assessment

This product does not meet the criteria of a PBT or vPvB substance.

12.6 Endocrine disrupting properties

The substance is not expected to have endocrine disrupting properties

12.7 Other adverse effects

None identified

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods: Dispose of all waste must be in accordance with all applicable national and local health and environmental regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

SECTION 14: TRANSPORT INFORMATION

14.1: UN number: Not applicable. The products is not classified as dangerous for transport.

14.2: UN proper shipping name: The products is not classified as dangerous for transport.

14.3: Transport hazard classes: Not applicable. The products is not classified as dangerous for transport

14.4: Packing group: Not applicable. The products is not classified as dangerous for transport

14.5: Environmental hazards: None identified.

14.6: Special precautions for users: None identified.

14.7. Maritime transport in bulk: Not applicable. The products is not classified as dangerous for transport

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/ legislation specific for the product

EU REACH: All components of this product have been registered with the European Chemicals Agency or are exempt from registration.

U.S. TSCA Inventory Status: All components of this product are either on the Toxic Substances Control Act (TSCA) Inventory List or exempt.

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Gel Flocculant Treatment System: Environmental Calculations

Project: **Llyn Celyn, JN Bentley**

Overview

This sheet provides site specific assurance data for the "carry-over" of key elements to the environment from water treatment using gel flocculant blocks
Calculations are derived from an estimated flow / treatment rate, forecast or known volumes of gel flocculant and compared against a worst case scenario release rate
Worst case degradation rates are known from years of site trials, experience and technical review
Carry over rates are compared to the most relevant Environmental Quality Standards (EQS)
The approach is highly conservative, with worst case scenarios being adopted
Carry Over Rates are prior to dilution within the receiving waterbody, nor do they take account of binding / capture within the subsequent methods of silt capture

Site Data

Number of Gel Flocculant Blocks / Mats in system

Type	No.
360	10
494	10
394	0
398	0
Total	20
Number of Floc Mats in system	10

Flow Rate

Total Discharge Rate (L / min)	1,600
Hours run per day	24
Discharge per day (Litres)	2,304,000
Days until replacement of Blocks	30
Discharge in litres per set of blocks	69,120,000

Aluminium

No. of Gel Flocculant (494)	Forced Mixing Degradation of Blocks in days (Pipe Reactor, typically >80 days)								Passive mixing degradation of blocks in days (drainage ditch/ drain/ culvert					
	10	20	30	40	50	60	70	80	90	100	110	120	130	140
1	0.003	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.007	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
3	0.010	0.005	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4	0.014	0.007	0.005	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
5	0.017	0.009	0.006	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001
6	0.021	0.010	0.007	0.005	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.001
7	0.024	0.012	0.008	0.006	0.005	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002
8	0.027	0.014	0.009	0.007	0.005	0.005	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.002
9	0.031	0.015	0.010	0.008	0.006	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.002	0.002

Acrylamide

No. of Gel Flocculant blocks in	Forced Mixing Degradation of Blocks in days (Pipe Reactor, typically >80 days)								Passive mixing degradation of blocks in days (drainage ditch/ drain/ culvert					
	10	20	30	40	50	60	70	80	90	100	110	120	130	140
20	0.214	0.107	0.071	0.053	0.043	0.036	0.031	0.027	0.024	0.021	0.019	0.018	0.016	0.015

Polyelectrolyte

No. of Gel Flocculant blocks in	Forced Mixing Degradation of Blocks in days (Pipe Reactor, typically >80 days)								Passive mixing degradation of blocks in days (drainage ditch/ drain/ culvert					
	10	20	30	40	50	60	70	80	90	100	110	120	130	140
20	0.881	0.441	0.294	0.220	0.176	0.147	0.126	0.110	0.098	0.088	0.080	0.073	0.068	0.063

Project Specific Comparison: Carry Over Levels v Environmental Quality Standards

Discharge carry over aspect	EQS Value		Standard	Project Discharge Value	% below EQS
Aluminium	0.2	mg/l	Drinking Water Standard	0.011	1649.87%
Acrylamide	0.1	ug/l	Drinking Water Standard	0.071	28.74%
Polyelectrolyte	7.5	mg/l	Waste Water Treatment Standa	0.294	2453.69%



SUMMARY / NOTES:

Terms

The use of flocculants on construction sites requires permission from the environmental regulator.

Proceeding with deployment of a flocculant without regulatory permission is not advised.

Every construction site is different and whilst frog environmental provide site-specific proposals, frog environmental is not 'in control' of the construction site or any portion thereof at any time.

frog environmental do not accept design liability for the efficacy of water treatment systems that are developed in conjunction with the customer.

The quality and quantity of water discharged from site remains the sole responsibility of the customer at all times. Please refer to our full terms and conditions

Settlement Test and Gel Flocculant Validation Report CT-02v5

Frog reference	FC4327
Customer	JNBentley
Site	Llyn Celyn PMF Flood Conveyance, Llandderfel, Y Frongoch, LL23 7NU
Sample	Collected by Nick Stephens
Date	23.04.2024
Lead Author	Leela O'Dea Leela@frogenvironmental.co.uk

Table of Contents

Introduction

Testing has been undertaken on a soil & water sample from the above-mentioned site. The testing process examines the rate of natural separation of solid fraction from water and helps inform the type of silt pollution control measures that may be required during Temporary Works.

frog environmental has a protocol in place that we will first examine the possibilities for treating water without the deployment of flocculants. Only when this avenue has been exhausted through testing and site investigation will frog suggest the use of a flocculant. For more information about the use of flocculants on construction sites, please follow the link: https://www.frogenvironmental.co.uk/pollution-avoidance-and-mitigation/flocculant-use-on-a-construction-site/

If test result show that a flocculant is required, there is a preference for working with the customer to develop gravity fed treatment systems. Gravity fed systems have several distinct advantages over pumped system:

- Reduced energy and carbon footprint
- Reduced fuel costs
- Reduced pump hire costs
- Reduced risk associated with refueling

A limitation of gravity fed treatment systems can be the effective mixing of flocculant with effluent. In these circumstances, forced mixing using a pumped flow of water can improve reaction times and settlement rates. Gravity fed systems are therefore not appropriate for every site.

About Gel Flocculant

Gel Flocculant is an active silt control product applied in slow-release solid gel blocks. It is designed to separate liquid from solid. Gel Flocculant is stored in dehydrated state and only activates on contact with water. There are several different blends of Gel Flocculant frequently used in the UK and settlement testing establishes the most effective blend for the site in question. In some circumstances a combination of 2 different blends of Gel Flocculant may provide the most effective solid separation.

Gel Flocculant products applied in the UK are synthetic anionic polyacrylamides that also have a coagulating function.

For peer reviewed information regarding the safety of Gel Flocculant and its fate in the environment, a literature review is available from frog environmental upon request.

Management calculations to demonstrate the carry-over concentrations of three key substances; Acrylamide, Polyacrylamide Polyelectrolyte (PP) and Aluminium contained in Gel Flocculant are completed

for every project to ensure compliance with relevant Environmental Quality Standards (EQS) for drinking water. These calculations are intentionally conservative and do not account for the factor of the dilution within the receiving waterbody nor any binding to the sediments. It is anticipated that any residual concentrations are present in very small concentrations.

Should there be specific environmental sensitivities, testing for acrylamide and aluminum concentrations in effluent can be undertaken as part of a management system to ensure thresholds are not breached. However, there are no UK laboratory tests available for polyelectrolytes.

Test Process

The aim of testing is to record the natural separation of the solid fraction from water in controlled conditions. The control is tested against different Gel Flocculant blends with reaction times and type of floc produced noted. Where a control shows promise for effective natural settlement this will be recorded in the report and the customer advised of passive silt management interventions.

Once all Gel Flocculant blends have been tested, the most effective blend is photographed and included in the report, with the results of testing from other less effective blends omitted. The control is also photographed for comparison purposes.

Repeated agitation of the same sample gives a good indication for the reaction time required to settle solids from suspension. In each case an NTU reading is taken and shown in the key alongside a photographic record of the test. The level of agitation required for reaction helps to inform a deployment plan.

In some cases, Gel Flocculant will not be effective. Whilst cationic flocculants and liquid products are available, frog environmental do not supply these products for use in ‘open’ applications, such as surface water drainage from construction sites due to the associated environmental risks.

Where products tested by frog environmental are not effective this will be openly discussed with the client and support provided in objectively reviewing alternative pollution control interventions.

Disclaimer

The use of flocculants on site requires permission from the local regulatory authority. Proceeding with deployment of gel flocculant without regulatory permission is not advised.

Whilst frog environmental provide advice on product specification and deployment, frog environmental is not in control of the construction site or any portion of the construction site at any time. frog environmental do not take responsibility for the quality of water discharging from site at any time and do not accept design liability for the efficacy of any water treatment systems that are developed as part of this report. Please refer to our full terms and conditions prior to procurement, as these will form part of any contract for supply of silt control products and services.

Any product specifications, technical drawings, sketches and site plans provided by frog environmental ltd in relation to this report are proposals and should be reviewed and approved by the Permanent Works Designer. All proposals are based on the best available data at the time of quotation.

Testing results are indicative and are reliant on the representative nature of samples. Most silt control systems require an element of fine tuning once installed to operate at optimal levels.

Results

Water Temperature (°C)	**14.4**	**pH**	**9.86**

A. Control vs 30 min Settlement

Turbidity 799 NTU to 743 NTU

B. Control vs 24 hour Settlement

Turbidity 799 NTU to 81 NTU

<table>
<tr>
<td> 

A. Test 1 Control vs WL 494 / 360
(15 seconds agitation plus 30 seconds settlement)</td>
<td> 

B. Test 2 Control vs WL 494 / 360
(further 15 second agitation from Test 1 plus 60 seconds settlement)</td>
</tr>
<tr>
<td>Turbidity
799 NTU to 68 NTU</td>
<td>Turbidity
799 NTU to 24 NTU</td>
</tr>
<tr>
<td> 

C. Test 3 Control vs WL 494 / 360
(further 15 second agitation from Test 2 plus 60 second settlement)</td>
<td></td>
</tr>
<tr>
<td>Turbidity
799 NTU to 9 NTU</td>
<td></td>
</tr>
</table>

Summary of Results

Natural settlement reduced turbidity from 799 NTU to 743 NTU over a period of 30 mins. There was no visible change in turbidity over 2 hours decreasing to 734 NTU. Further settlement over 24 hours provided a reduction in turbidity to 81 NTU.

Testing showed the most effective Gel Flocculant to be WL494 in combination with WL360.

Conclusions and next Steps

Physical settlement is unlikely to achieve clear water. Settlement Testing is a key factor when it comes to assessing the risk of a construction site causing a silt pollution event. However, there are other important factors to consider:

Factor	Why is it important?
Settlement characteristics of particle (defined by Settlement Test)	Defines how the silt particles behaves when in suspension with and without the application of Gel Flocculant
Water Attenuation areas and attenuation design	Attenuation areas slow the flow of water and allow time for silt or floc particles to settle out of suspension. If this can be done without use of flocculant, it should be.
Permitted Total Suspended Solids (TSS) value expressed in mg/l	Notes the quality of water acceptable for discharge.
The flow rate of effluent that requires treatment	Treatment solutions have differing effective treatment rates. Knowing the flow rate helps to come up with the most cost-effective approach.
Proximity and connectivity to watercourse(s)	Where does surface water from your site drain to? It is illegal to cause silt pollution or erosion at the point of discharge.
Knowledge and Experience on site	Skills and knowledge on site can help prevent a silt pollution incident or react quickly to mitigate one
Management Systems	Named roles and responsibilities on site helps a company to respond effectively to an incident.

There are 5 key components to a treatment system using Gel Flocculant:

1. **Mixing:** the mixing of effluent with Gel Flocculant, through passive or forced measures.
2. **Capturing:** trapping flocculated particles, either in attenuation features, Silt Capture Channels or a combination of measures.
3. **Maintenance:** removing accreted silt from attenuation features or Silt Capture Channels
4. **Monitorin**g: testing effluent quality to ensure compliance
5. **Optimise:** refine the system, scaling treatment up or down depending on the season or the risk associated with a specific construction phase

More information on the deployment of Gel Flocculant is available from frog environmental.

To discuss next steps, contact: Leela O'Dea (Leela@frogenvironmental.co.uk)

Acrylamide, Aluminium & Polyelectrolyte Calculations

Gel flocculants have been defined as part of the pollution control. Gel flocculants are synthetic anionic polyacrylamides that also have a coagulating function. Gel flocculant is non-toxic to the aquatic environment and does not bioaccumulate, remaining bound to the sediment until they degrade. Refer to the MSDS.

The next section outlines the environmental standards for the aspects of gel flocculant that are applicable and management calculations to demonstrate protection of the environment – Acrylamide, Polyacrylamide Polyelectrolyte (PP) and Aluminium.

The subsequent section shows the site-specific carry-over calculations for each of the aspects. Whilst all the parameters meet the environmental standards for drinking water quality at the exit of the treatment system it should be borne in mind that this scenario is hugely conservative. This does not account for the factor of the dilution within the receiving waterbody nor any binding to the sediments. Additionally, the gel flocculant can be expected to outlast the conservative estimate of 30 days.

Environmental Standards

The regulator quite rightly requires the assurance that the use of a flocculant will not lead to any undue environmental impact or breach an Environmental Quality Standard. As noted, gel flocculants are anionic; non-toxic to the aquatic environment and do not bioaccumulate, remaining bound to the sediment until they degrade to produce water, carbon dioxide and nitrogen oxide.

The three key elements that require assurance for environmental protection are Polyacrylamide Polyelectrolytes, Acrylamide and Aluminium. These elements are discussed generally as below.

Polyelectrolytes
In Scotland, SEPA controls polyelectrolytes via ***Regulatory Method (WAT-RM-12) "Discharges from Water Treatment Works.*** This process notes that Anionic Polyelectrolytes are preferable (Gel flocculant is Anionic) and that SEPA may consider a numeric discharge consent.

In England and Wales, the Environment Agency and Natural Resources Wales has produced guidance for water companies via: ***Control of chemicals used for dosing at wastewater treatment works.***

This notes an EQS standard *"For anionic and non-ionic polyacrylamide polyelectrolytes, we apply an EQS of 3.5mg/l as a 95-percentile limit in soft acid waters. Soft acid waters are waters with a pH 6 or less, and a total hardness of less than 20mg/l. For waters with a hardness of 20mg/l or more as calcium carbonate, we apply a 95-percentile limit EQS of 7.5mg/l."*

Acrylamide
The Environmental Quality Standard for Acrylamide is the DWI value of 0.1 μg/l.

Aluminium
The Environmental Quality Standards for Aluminium is the DWI value of 0.2mg/l.

mottmacbentley.co.uk