PHM Consulting
Civil - Structural - Environmental

Mixed Use Development

Pa Healy Road, Limerick

CONSTRUCTION ENVIRONMENTAL & WASTE MANAGEMENT PLAN

September 2021

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Construction Environmental & Waste Management Plan

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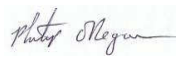
05/11/2021	Third	Rev B	P. O'Regan		

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Contents

1.0 INTRODUCTION

1.1 Brief

PHM Consulting have been engaged by Revington Developments Ltd. (applicant) to prepare an Outline Construction Environmental Management Plan (Outline CEWMP) for a proposed Mixed Use development on lands located at Pa Healy Road, Limerick for the purpose of a planning application to An Bord Pleanala.

This Outline CEWMP defines the project specific environmental measures that are to be put in place and procedures to be followed for the scope of construction works, both permanent and temporary, for the envisaged project. This Outline CEWMP also incorporates the proposed Waste Management measures and Best Management Practices to be adopted by the eventual Main Contractor and all Sub-contractors during the Construction Phase of the development. Please note this Outline CEWMP is produced as part of the planning application. It is intended that this will be updated to include more site specific information once a Construction Management Team (CMT) is appointed.

The planning application comprises of a mixed use development on a circa 4 ha site with vehicular access points from Pa Healy Road. The development will consist of:

(A) Demolition of existing 800m^2 warehouse building on site.

(B) Block 1 – Student accommodation building of 8,238m^2 stepped from three to six storeys, with ground floor café of 144.60m^2 and 3 no. retail units facing onto Pa Healy road of 86.59m^2 each, with 9 no. two bedroom, 37 no. three bedroom, and 15 no. four bedroom student apartments, totalling 189 bed spaces, ancillary laundry, refuse and enclosed communal courtyard with landscaping and bicycle storage;

(C) Block 2 - A residential apartment building of 6,013.25m^2 with nine storeys and two penthouse storeys, total eleven storeys containing 10 no. studio, 1 no. one bedroom and 52 no. two-bedroom apartments;

(D) Block 3 – A residential apartment building of 8,107.10m^2 with six storeys and two penthouse storeys, total eight storeys containing 16 no. studio, 9 no. one bedroom, and 63 no. two-bedroom apartments;

(E) Block 4 – A residential apartment building of 3,869.18m^2 with six storeys and one penthouse storey, total seven storeys containing 7 no. studio, 13 no. one bedroom and 25 no. two-bedroom apartments;

(F) Block 5 – A residential apartment building of 5,849.40m^2 with six storey and one penthouse storey total seven storeys containing 14 no. studio, 15 no. one bedroom and 37 no. two-bedroom apartments;

(G) Block 6 a residential apartment building of 3,869.18m^2 with six storeys and one penthouse storey, total seven storeys containing 7 no. studio, 13 no. one bedroom and 25 no. two-bedroom apartments;

(H) Block 7 a residential apartment building of 4,962m^2 with five storeys and one penthouse storey, total six storeys containing 12 no. studio, 13 no. one bedroom and 31 no. two-bedroom apartments;

(I) Community facilities building of 1,336.90m^2 and three storeys with creche, café, management offices and common accommodation for use by apartment dwellers;

(J) 18 no. Executive Houses – Consisting of 2 no. detached four-bedroom houses of 194.62m2 each and 16 no. terraced four-bedroom houses of 177.82m2 each, with off street parking to front separate from communal parking;

(K) 145 Car parking spaces throughout the development and 420 secured bicycle parking spaces throughout the development;

(L) Ancillary works comprising; new vehicular entrance onto Pa Healy Road, pedestrian and cycle links to Pa Healy road, Park road and City Canal, bin storage for all developments adjacent to all entrances, New public park of 0.5ha along city canal, communal open space and communal roof gardens for all apartments, all ancillary drainage, civil and landscape works, public lighting within estate and Electricity Sub-station to rear of Block 1.

The site is located at 158793E, 157504N IGR. Existing ground levels range from 4.75m to 6.50m above ordnance datum (AOD) Malin.

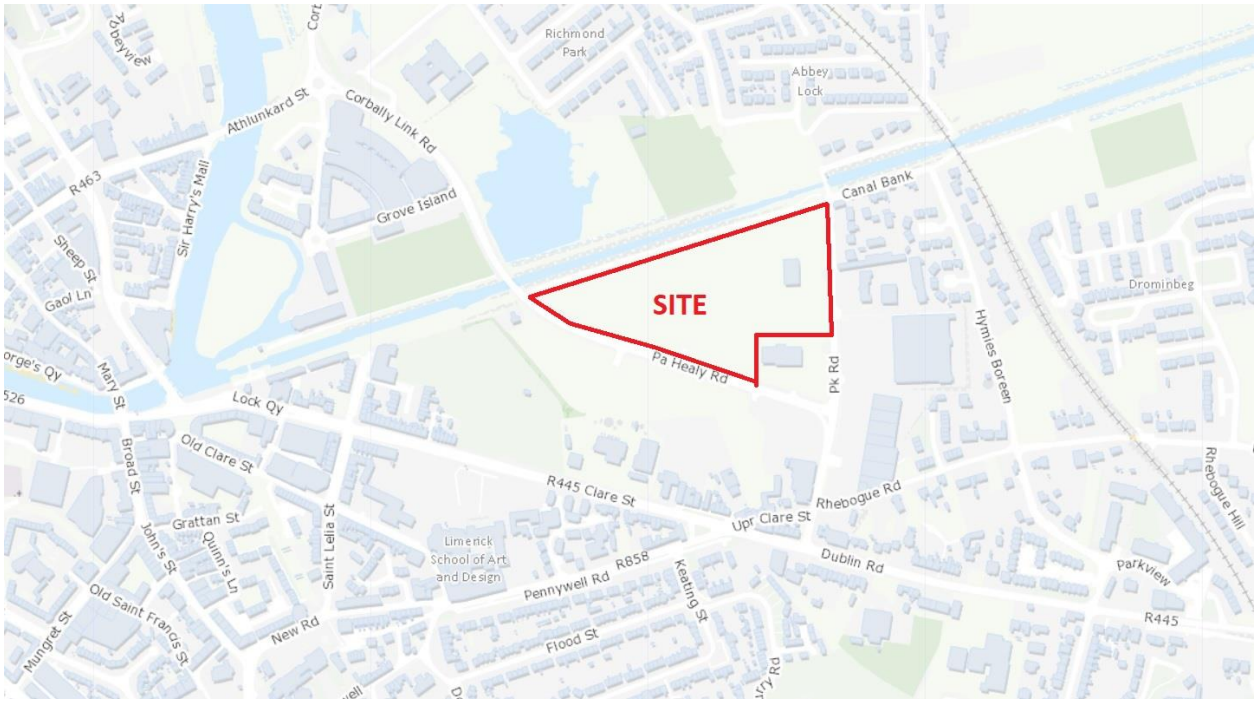

Fig 1 - Site Location Map

1.3 Scope of the Outline CEWMP

The Outline CEWMP defines the approach to environmental management and the waste management at the site during the construction phase. Compliance with the Outline CEWMP, the procedures, work practices and controls will be mandatory and must be adhered to by all personnel and contractors employed on the construction phase of the project.

This Outline CEWMP seeks to:

1. Provide a basis for achieving and implementing the construction related mitigation measures identified in the various reports accompanying this application as listed below.

2. Comply with all relevant conditions attached to the Planning Permission.

3. Promote best environmental on-site practices for the duration of the construction phase.

The CEWMP is considered a 'live' document and as such will be reviewed on a regular basis. Updates to the CEWMP may be necessary due to any changes in environmental management practices and/or contractors. As explained in more detail in the later sections, the procedures agreed in this CEWMP will be audited regularly throughout the construction phase to ensure compliance.

The CEWMP is to be read in conjunction with the Civil Engineering Report.

The CEWMP has been prepared in consultation with the:

- SLR – Appropriate Assessment Screening Report
- SLR – Ecological Impact Assessment Report
- SLR - Natura Impact Statement
- SLR – Tree Survey Report
- Precision – Asbestos R&D Survey Report
- RW Nowlan – EIA Screening Statement
- Verdé – Phase 2 Environmental Due Diligence Report

with particular reference to Mitigation of Potential Impacts on Qualifying Interests.

1.4 Project Roles & Responsibilities

The assigned environmental roles and responsibilities for the relevant project personnel are detailed below:

1.4.1 Construction Director

The Construction Director will have an overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The principal duties and responsibilities of this position will include:

- Overall responsibility for the development and implementation of the CEWMP;
- Allocating resources to ensure the implementation of the CEWMP;
- Participates in the management review of the CEWMP for suitability, adequateness and effectiveness; and

- Sets the focus of environmental policy, objectives and targets for the Contractor.

1.4.2 Construction Manager

The Construction Manager is directly responsible to the Construction Director for the successful execution of the project. The principal duties and responsibilities of this position will include:

- To report to the Construction Director on the on-going performance/implementation of the CEWMP;
- To discharge his/her responsibilities as outlined in the CEWMP; and
- To support and augment the CMT (Construction Management Team) through the provision of adequate resources and facilities in the implementation of the CEWMP.

1.4.3 Environmental Officer

The Construction Management Team Environmental Officer will be responsible for, but not limited to, the following activities:

- Ensuring that the requirements of the CEWMP are developed and environmental system elements (including procedures, method statements and work instructions) are implemented and adhered to with respect to environmental requirements;
- Reviewing the Environmental responsibilities of other managed Contractors in scoping their work and during Contract execution;
- Ensuring that Environmental management systems are further developed, implemented and maintained;
- Providing advice, guidance, instruction and training in all Environmental matters to the senior leadership team and where applicable to sub-contractors and the supply chain;
- Carrying out environmental audits and inspections;
- Preparing in conjunction with the site teams environmental plans, and other associated site documents;
- Participating in site meetings, report on environmental risks, trends and recommend constructive actions towards continuous improvements;
- Investigating, recording and reporting on any issues as they may arise, ensuring root causes are identified and corrective actions are implemented as necessary;
- Developing mitigation plans to off-set future risk where identified.

1.4.4 Project Environmental Consultant

The Project Environmental Consultant will be responsible for, but not limited to, the following activities:

- Review of the CEWMP, environmental control plans, supporting procedures;
- Advise site management (including, but not limited to, the site Construction/Commissioning Manager) on environmental matters;
- Carry out environmental health inspections (data logging (noise, water, dust, etc.)) where necessary;
- Generate reports as required to show environmental data trends and incidents;

- Ensure adherence to the specific measures listed in the Planning Conditions and in the Natura Impact Statement (NIS) Mitigation Measures;
- Advise upon the production of written method statements and site environmental rules and on the arrangements to bring these to the attention of the workforce;
- Investigate incidents of significant, potential or actual environmental damage, ensure corrective actions are carried out and recommend means to prevent recurrence; and
- Be responsible for maintaining all environmental related documentation.

The appointed Consultant must have as a minimum qualification equivalent to a Bachelor's or Master's Degree in Environmental Engineering, Environmental Science, or Environmental Studies.

1.4.5 Project Archaeologist

The Project Archaeologist will report to the Environmental Officer and is responsible for advising on all archaeological monitoring activities, conducting watching briefs and distributing information relevant to monitoring. The responsibilities and duties of the Project Archaeologist will include the following;

- Monitor all ground disturbance works associated with the construction of the development;
- Ensure the appropriate course of action is taken in the event that archaeological material is discovered during the works;
- Liaison with the CMT throughout the construction phase of the project; and
- Liaison with the Department Applications Unit, National Monuments Service, Department of Arts, Heritage and Gaeltacht and the Limerick City and County Council archaeologist as required.

1.4.6 Project Ecologist

The Project Ecologist will report to the Environmental Officer and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the project. The appointed Ecologist will need a degree in ecology or a related subject. Have a specific ecology related postgraduate qualification covering conservation biology, marine biology, zoology and environmental science. The responsibilities and duties of the Project Ecologist will include the following;

- Provision of specialist input and supervision, where necessary, of construction activities in relation to habitats and species;
- Provision of specialist advice on ecological monitoring, and conduct surveys, monitoring and site inspections as set out in the Nutura Impact Statement and An Bord Pleanala Planning Conditions; and
- Liaison with the National Parks and Wildlife Service (NPWS), as required.

1.4.7 Project Communications Officer

The Project Communications Officer is responsible for conducting all public liaison associated with the construction phase of the project. The responsibilities and duties of the Project Communications Officer include the following;

- Responding to any concerns or complaints raised by the public in relation to the construction phase of the project;
- To liaise with the Environmental Officer on community concerns relating to the environment;
- Ensure the Environmental Officer is informed of any complaints relating to the environment; and
- Keep the public informed of project progress and any construction activities that may cause inconvenience to the local community.

1.4.8 Site Supervisors

CMT Site Supervisors are required to:

- Read, understand and implement the CEWMP;
- Know the broad requirements of the relevant law in environmental matters and take whatever action is necessary to achieve compliance. Where necessary seek the advice of the CMT Environmental Officer;
- Ensure that environmental matters are taken into account when considering Contractors' construction methods and materials at all stages;
- Be aware of any potential environmental risks relating to the site, plant or materials to be used on the premises and bring these to the notice of the appropriate management;
- Ensure plant suggested is environmentally suited to the task in hand;
- Co-ordinate environmental planning of CMT activities to comply with environmental authorities requirements and with minimum risk to the environment. Give Contractors precise instructions as to their responsibility to ensure correct working methods where risk of environmental damage exists;
- Where appropriate, ensure Contractors method statements include correct waste disposal methods;
- Be aware of any potential environmental risks relating to the Contractors and bring these to the notice of the appropriate management; and
- Ensure materials/waste register is completed.

1.4.9 Site Personnel

All Contractors, and other site personnel, on the project will adhere to the following principal duties and responsibilities:

- To co-operate fully with the CMT and the Environmental Officer in the implementation and development of the CEWMP at the site;
- To conduct all their activities in a manner consistent with regulatory and best environmental practice;
- To participate fully in the environmental training programme and provide management with any necessary feedback to ensure effective environmental management at the site; and

- Adhere fully to the requirements of the site environmental rules.

1.5 Project Environmental Policy

The Applicant recognises and seeks to minimise the impacts of its business on the environment. The appointed Main Contractor will be committed to:

- Carrying out the Project in full compliance with all applicable environmental regulations and to other requirements to which we subscribe.
- Implementing good environmental practice as part of designs, e.g. carry out design reviews, risk assessments, etc. on the relevant project.
- Preventing pollution from activities through a system of operational controls that include written instructions and staff training appropriate to the environmental requirements of their work.
- Continually improving Project environmental performance by setting objectives and targets and implementing them through an environmental programme.
- Informing all project employees about Environmental Policy and explaining what they should do to protect the environment.
- Implementing this Policy through the successful operation of the CEWMP.

This policy will be reviewed periodically, taking into account current and potential future business issues.

1.6 Keeping of Records

The Construction Manager will ensure that fully detailed records are maintained of any 'incident / event' likely to cause non-compliance and / or harm to the environment. Environmental Incidents/Near Miss Reports are reported and recorded.

Complaints and Follow up Actions on the construction site will be managed by the CMT and contractors will ensure that all complaints are recorded according to CMT requirements.

Each contractor will be responsible for ensuring that a full record and copy of all Safety Data Sheets (SDS) pertaining to their works is kept on file and up to date in their site offices. Contractors will also retain a duplicate copy of all SDSs held by the contractors.

The CMT will be responsible for monitoring the movement and treatment of all waste during the construction phase of the project. Monitoring will be carried out by the Site Supervisor who will record the nature, quantities and off-site destination of wastes.

1.7 Monitoring, Audits and Inspections

Periodic inspections by the CMT will address environmental issues including dust, litter, noise, traffic, surface water, waste management and general housekeeping.

An Environmental Health Inspection Audit of the construction site will be carried out by the appointed Environmental Consultant. Environmental aspects of this audit will be documented. The frequency of these audits (weekly / monthly / other) will be based on the nature of contractor activity.

1.8 Non Conformance and Corrective and Preventative Action

Corrective Action Requests (CARs) will be issued to ensure that prompt action is agreed and committed to, with a view to the effective resolution of any deviations from the CEWMP requirements or any environmental issues.

CARs may be raised as a result of:

- An internal or external communication;
- An internal audit;
- A regulatory audit or inspection;
- A suggestion for improvement;
- An incident or potential incident.

All corrective action requests will be numbered and logged.

2.0 SITE BACKGROUND

Details of the site physical setting are outlined below. Information on the site location, hydrology, geology, hydrogeology of the area has been obtained from records held by the:

- Geological Survey of Ireland (www.gsi.ie),
- Environmental Protection Agency (www.epa.ie),
- Ordnance Survey of Ireland (www.osi.ie) and on-line resources of
- Department of Environment, Community and Local Government (www.myplan.ie).

The site is triangular in shape and is bounded to the North by the City Canal, to the south by the Pa Healy Road (built in 2007) and to the east by Park Road. On the northern bank of the Canal there is an open wetland which is an area designated as a Special Area of Conservation by the National Parks and Wildlife Services – Site Code 002165 – Lower River Shannon SAC.

2.1 Topography

An electronic topographical survey of the site has been carried out for the purpose of the preparation of the design of the roads and infrastructure of this proposed development. All surveyed information has been tied into National Grid Reference system and Ordnance Survey Malin.

The lands are currently undeveloped and unused. In the mid to late 1990's the site was filled with various construction and demolition material. The site is bounded to the north by the City Canal, to the south by the Pa Healy Road and Park Road to the east. The site is vacant apart from a single industrial building (c.530 sq m plan area) located to the east.

2.2 Geology

The GSI describes the subsoils underlying the site as Made Ground with marine/estuarine silts and clays located in the north western corner.

According to GSI data, the majority of the site is located on top of undifferentiated limestones. The southwest corner of the site is underlain by volcanoclastic rocks among limestones.

2.3 Hydrogeology

According to GSI data, the bedrock aquifer underlying the majority of the site is classified as Lm, Locally Important aquifer which is generally moderately productive. The maximum recharge capacity of such an aquifer is 200mm/year.

The GSI classification of the bedrock aquifer beneath the majority of the site is described as having a vulnerability rating of (L) Low. This suggests that bedrock will not be encountered in the first 10m BGL. The eastern boundary has a vulnerability rating of (M) Moderate. This suggests that bedrock will not be encountered in the first 10m BGL in this area also.

2.4 Ground Investigation

As part of the preparation of the scheme design a site investigation was undertaken by Verdé Environmental Consultants.

The principal findings of their investigation included:

Fifteen trial pits were excavated across the site. Trial pits were excavated to a maximum depth of 3.5m BGL. The trial pits were located across the site to give a spatial representation of the shallow subsurface soils.

The general ground conditions encountered from the trial pits excavated on site comprised of brown silty top soil to a maximum depth of 0.3m BGL underlain by made ground comprising brown, light brown or brownish-grey sandy, clay or clayey sand & gravel with an abundance of demolition concrete, frequent red brick fragment and occasional limestone cobbles, metal and glass fragments to the maximum depth of 3.1m BGL. The thickness of manmade deposits was greater in the trial pits located in the central and western portions of the site.

These anthropogenic deposits were underlain by natural soils comprising dark grey or black peaty clay or peat, light brown clayey gravelly sand with large limestone cobbles and boulders and light brown or brownish-grey sandy clay to a maximum depth of 3.4m. Bedrock was not encountered during trial pitting on site.

During trial pit excavation entries of shallow groundwater were observed in the man-made deposits and natural sand and clay at depths between 0.7 and 2.8m BGL. Volumes of encountered shallow groundwater were significant in some locations.

Four groundwater monitoring wells were drilled. All four wells were installed as permanent groundwater monitoring wells in the limestone bedrock aquifer. Each of the wells was completed with a 50mm diameter standpipe to a maximum depth of 10.8m BGL with a slotted screen installed in the bottom 0.55-1.0 metres to capture the groundwater present in the bedrock aquifer.

The general ground conditions encountered during drilling the monitoring wells comprised man made deposits of grey gravels and cobbles with some addition of concrete and red brick fragments to a maximum depth 4.0m BGL. The made ground deposits were underlain by brown peaty clay followed by light grey or brownish-grey silty clay to a maximum depth of 8.8m BGL. Weathered, grey limestone bedrock was encountered during drilling at depths between 6.2m and 8.7m BGL.

Small groundwater strikes were observed during drilling in the overburden at depths between 2.5 and 3.5m BGL and on the interface between the overburden and the bedrock or in the bedrock at the depths between 6.2 and 10.2m BGL.

A summary of encountered physical conditions of the soil during the drilling works is as follows:

- A hydrocarbon sheen, mild hydrocarbon odour and PID readings of 2.9ppm were observed in sandy clay fill in trial pit TP-102 at depths between 1.5 and 2.0m BGL. The same soil strata also contained fragments of metal panels and old car parts;

- A small fragment roof tile potentially containing ACM was present in sandy clay fill in Trail pit TP-103 at a depth between 0.2 and 1.4m BGL;

- A chemical odour, but no elevated PID readings, were noted in sandy clay made ground in the almost entire soil profile of TP-105;

- Moderate hydrocarbon odours and a PID reading of 30.9ppm were observed in the sandy gravel fill at the depth between 1.4 and 3.1m BGL in TP-108. Natural sandy clay soils beneath the fill were observed to be only mildly impacted by hydrocarbons. The PID reading for the natural ground was 1.3ppm;

- An ammoniacal type odour and no elevated PID readings was present in sandy, gravelly clay fill in TP-110 at the depth of 2.4m BGL.

A summary of encountered physical conditions of the groundwater during trial pitting and drilling works is as follows:

- Shallow groundwater entries were observed in 12 of 15 excavated trial pits;

- Groundwater was present in all four monitoring wells;

- A hydrocarbon sheen was observed in the groundwater entering TP-107

- No free product in the form of LNAPL or DNAPL and no hydrocarbon sheen were observed in the remaining trial pit water strikes or any of the monitoring wells.

2.5 Soil and Water Assessment

The results of the soil analysis are summarised below:

Metals

All metals were below the relevant GACs for all land use categories with the exception of Beryllium and Lead.

Very slightly elevated Beryllium (1.8mg/kg) concentrations were reported in the deeper natural soils obtained from trial pit TP-108B at 3.1-3.4mbgl. The recorded concentrations exceeded both Residential HP and Residential GAC of 1.7mg/kg. Concentrations Beryllium in the made ground soils sampled in this trial pits at the depth between 1.4 and 3.1m BGL did not exceed any of the relevant standards.

Very elevated concentrations of Lead (6,371mg/kg) were reported in TP-110 in the made ground sample taken from between 2.4 and 2.8mbgl. This concentration exceeds all available GAC standards.

Speculated Total Petroleum Hydrocarbons (TPH-CWG)

Low concentrations of hydrocarbon were reported in 12 of 15 excavated trial pits; however, the majority of the hydrocarbon concentrations were reported below all GAC standards.

Elevated concentrations of hydrocarbons were reported in the soil sample TP-108A obtained from made ground taken between 1.4 and 3.1m BGL. The concentration exceeded Residential HP and Residential GACs. Hydrocarbon concentrations in a deeper sample taken from this trial pit at the depth between 3.1-3.4m BGL, although being slightly elevated, did not exceed any of the GAC standards. In both cases, encountered TPH contamination was interpreted by the analytical laboratory as degraded diesel.

In the soil sample TP-115 an elevated concentration of Benzo(b)fluoranthene of 3,549µg/kg was reported which exceeded the Residential HP GAC standard. The concentrations of Benzo(a)pyrene

(4,330µg/kg) were also elevated above both the Residential and Residential HP GAC standards. An exceedance of Dibenzo(ah)anthracene was also reported in the sample from TP-115 with a concentration of 768µg/kg. This concentration exceeds all available GAC standards including residential, commercial and public open spaces GAC.

Free asbestos fibres were present in 12 of 15 excavated trial pit locations on site. The laboratory identified the fibres mainly as Chrysotile and Crocidolite and quantified as less than 0.1%. Further specialist testing is recommended to confirm these results.

The results of the groundwater analysis are summarised below:

Elevated Barium was reported in groundwater samples obtained from all four monitoring wells and ranged between 104µg/l in MW-101 and 1215µg/l in MW104 exceeding the IGV standard.

The following Contamination Pathways have been identified for the site:

- Vertical migration of dissolved-phase contamination from made ground and slightly contaminated natural subsoil into shallow groundwater beneath the site;
- Lateral migration of contamination in groundwater at shallow depth;
- Direct contact with shallow soils (ingestion, inhalation and dermal exposure);
- Inhalation of potential asbestos fibres;
- VOC migration into future site buildings and other confined spaces;
- Permeation of contaminates through plastic water mains.

The following receptors have been identified for the site:

- Human health – on site workers (development stage of the project), future site occupiers and maintenance workers.
- Limestone bedrock aquifer beneath the site.
- Park Canal – The canal is an engineered feature lined with impermeable barrier to prevent escape of the water. In addition, the site and the canal are buffered by a deep drainage ditch. Both the site and canal are not considered to be hydrologically connected; therefore The Park Canal is deemed not to be a plausible environmental receptor.

2.6 Verdé Recommendations

Following on from the above the Recommendations proposed include:

- Localised hotspots of Lead, TPH and PAH contamination on site require further investigation of lateral and vertical extent. However, based on the review of the current results the contamination issues can be managed by capping with a suitable layer of clean soils to act as a barrier to receptors.

- Presence of asbestos fibres in soils on site requires further delineation and quantification. This also can be potentially resolved by importing of clean soils and capping off the existing soil surfaces.

2.7 Flora & Fauna

There will be on-going monitoring of wildlife in the vicinity of the construction site by the Project Ecologist and any unusual species, new species or habitats will be reported immediately to the Construction Manager and Environmental Officer.

Where unexpected ecological habitats are uncovered the habitats protection protocol will be adhered to by site contractors as advised by the Project Ecologist.

Protection Protocol: This protocol is designed to ensure that ALL persons working on the construction site are fully aware of their legal obligations under the Wildlife Act 1976, as amended.

SI 39 of 1976, The Wildlife Act, as amended SI 38 of 2000, affords protection to a range of wildlife in Ireland including wild birds, animals and plants. Whilst this project is expected to receive permission to proceed from relevant Authorities, this does not override certain laws that prevent wilful harm to protected species. What is protected that may be found in the Project Area?

- All wild birds and their eggs, nests and young, with the exception of certain species, are protected under the Wildlife Acts.
- Certain animals including all Bat and Otter species.

Whilst no bat roosts were found, there is a chance that bats could occupy roosts prior to the commencement of works. If bats are found during site clearance, works will cease and the National Parks and Wildlife Service (NPWS) will be contacted to avoid an offence being committed by disturbing a bat roost. Works will be suspended if bats are found to avoid further risk of direct harm to bats.

3.0 OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

3.1 Construction Activities

This section describes the main activities involved in the construction of the proposed development. As the proposed development is located on a filled site with an existing industrial structure, there is demolition works associated with the project, primarily the demolition of the single industrial building c.530 sq m.

3.2 Construction Schedule

The construction period for the development is expected to last 3-5 years. The development is proposed to be phased as per Fig 2. On completion of each phase, the incomplete area of the site will be adequately fenced off to prevent unauthorised access. Appropriate signage will also be erected. The proposed development will involve the following activities:

- Installation of site offices, welfare facilities, Covid-19 sanitisation stations and one-way pedestrian routing.
- Site clearance in stages.
- Importation of granular capping material.
- Construction of construction access roads and on-site staff parking in areas where these roads, car parks can later be developed as permanent roads, car parks in line with the development design.
- Retention and protection of existing boundaries on site.
- Development of Blocks as per Phasing Plan.
- Development of a network of roads, drainage, water supply, services, pathways, play areas and landscaped areas within the site.

It is expected that the construction of the proposed development will commence in 2022, subject to planning and other approvals. It is envisaged that the construction activities will be completed in 2027.

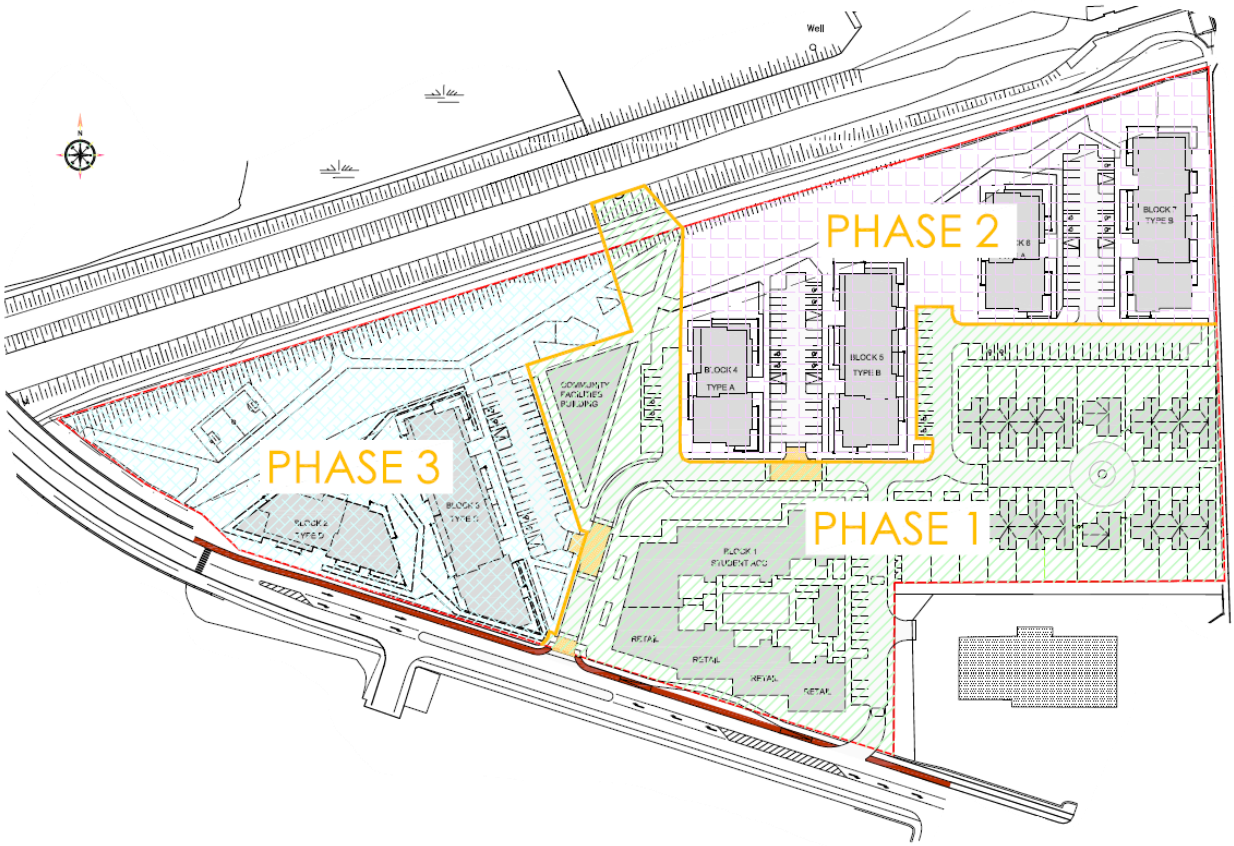

Fig 2 – Phasing Plan

3.3 Method Statement for Construction

A Construction Stage Environmental Management Plan and Safety and Health Plan will be developed by the appointed Main Contractor to include all aspects of the project.

It is anticipated that there will be a single contract to cover all the elements of the proposed development and that the contractor will be required to prepare more detailed CEWMP(s).

The contractor will be required to comply with all of the performance requirements set out in tender documentation including the statutory consent approvals which may be granted by An Bord Pleanala and other statutory consent authorities.

It is the responsibility of the contractor to ensure compliance and to avoid and/or reduce significant adverse effects that have been identified where practicable. Where the contractor diverts from the methodologies and working areas outlined herein and/or defined in the granted planning consent ad associated conditions that may be granted, it would be the responsibility of the contractor to obtain the relevant licences, permits and consents for such changes.

3.4 Housekeeping

The contractor will employ a "good housekeeping" policy at all times. This will include, but not necessarily limited to the following requirement:

- General maintenance of working areas and cleanliness of welfare facilities and storage areas;
- Provision of site layout map showing key areas such as first aid posts, material storage, spill kits, material and waste storage, welfare facilities etc.;
- Maintain all plant, material and equipment required to complete the construction work in good order, clean and tidy;
- Keep construction compounds, access routes and designated parking areas free and clean of excess dirt, rubbish piles, scrap wood, etc. at all times;
- Details of site managers, contact numbers (including out of hours) and public information signs (including warning signs) will be provided at the boundaries of the working areas;
- Provision of adequate welfare facilities for site personnel;
- Installation of appropriate security, lighting, fencing and hoarding at each working area;
- Effective prevention of oil, grease or other objectionable matter being discharged from any working area;
- Provision of appropriate waste management at each working area and regular collections to be arranged;
- Excavated material generated during construction will be reused on site, if deemed acceptable give previously discussed results of site investigation.
- Effective prevention of infestation from pests or vermin including arrangements for regular disposal of food and material attractive to pests will be implemented, if infestation occurs the contractor will take appropriate action to eliminate and prevent further occurrence;

- Maintenance of wheel washing facilities and other contaminant measures as required in each working area;
- No discharge of site run-off or water discharge without agreement of the relevant authorities.
- No discharge of site run-off or water discharge will be acceptable onto public roads or into third party lands.
- Open fires will be prohibited at all times;
- The use of less intrusive noise alarms which meet the safety requirements such as broadband reversing warnings, or proximity sensors to reduce the requirement for traditional reversing alarms;
- Maintenance of public right of way, diversions and entry/exit area around working areas for pedestrians and cyclists where practicable and to achieve inclusive access;
- All loading and unloading of vehicles will take place off the public highway;
- Material handling and/or stockpiling will be appropriately located to minimise exposure to wind;
- Water misting or sprays will be used as required to minimise dust generation during dry or windy periods.

3.5 Site Set-up

3.5.1 Site Security

Given the location of this site and its exposure public areas on all three aspect of the site it will be imperative to provide a robust system of security during the construction phase(s). Security will be the responsibility of the contractor who will provide adequate security to prevent unauthorised entry to or from any working areas. The following measures will form the basis to be used to prevent unauthorised access:

- Install CCTV and alarm system with remote access, two-way communication and cloud based backup storage;
- CCTV and security systems will be sited and directed so that no intrusion into private properties occurs;
- Provide adequate security patrols during out-of-hours and holiday periods;
- Provide a manned access control at the main site access.
- Liaise with local community groups, An Garda Síochána and Limerick City and County Council when setting up security plan.

3.5.2 Site Hoarding

A site boundary in the form of a hoarding will be established around each of the working phases before any significant construction activity commences in that working area. The hoarding will be a minimum

of 2.4m high to provide a secure boundary to what can be a dangerous environment for those that have not received the proper training and are unfamiliar with construction operations.

Site hoarding also performs an important function in relation to minimising nuisance and effect including:

- Noise emissions by providing a buffer;
- Visual impact by screening;
- Dust minimisation.

The erection of hoarding will be of a similar nature to what is carried out on most construction sites. Mounting posts would be set in concrete, with horizontal rails and metal sheeting. Where practicable, hoarding will be retained and re-configured for re-use between working areas as construction progresses.

The following measures will be applied:

- Maintenance of adequate hoarding to an acceptable condition to prevent unauthorised access to works areas;
- Maintain appropriate sightlines to ensure safety of vehicles and pedestrians;
- Temporary fencing may be used for short term works areas;
- Retain existing walls, fences, hedges and earth banks as far as reasonably practicable;

3.5.3 Site Compound

The site compound will be developed, comprising of offices and welfare facilities for the contractors on site. Temporary works requiring connection for water and sewage will be made to the existing local authority network under connection agreement with Irish Water. The temporary construction compound will include a site office for the construction management team and site facilities for the construction staff. The compound will be serviced with electrical power, water supply and toilet and sanitisation facilities. If not, electrical power will be supplied from a low noise, double bunded diesel generator sited within the compound. If water not sourced from the local network, then water would be delivered to the site by bowser and sewerage/effluent would be stored in designated tanks and removed from site periodically by a licensed waste transport haulier to a Local Authority treatment plant for treatment.

The location of the compound, associated haul roads and main site access point will be determined and agreed with the Local Authority prior to commencement. The compound will be used as a storage area for the various components, fuels and materials required for construction. Any fuels will be stored in self bunded tanks. The compound will be fenced off to ensure site security is maintained. The compound may be situated in an area of future landscaping within the proposed development so as not to interfere with the areas where structures are to be constructed. Any area used will be reinstated in accordance with the grant of planning at the end of the construction period.

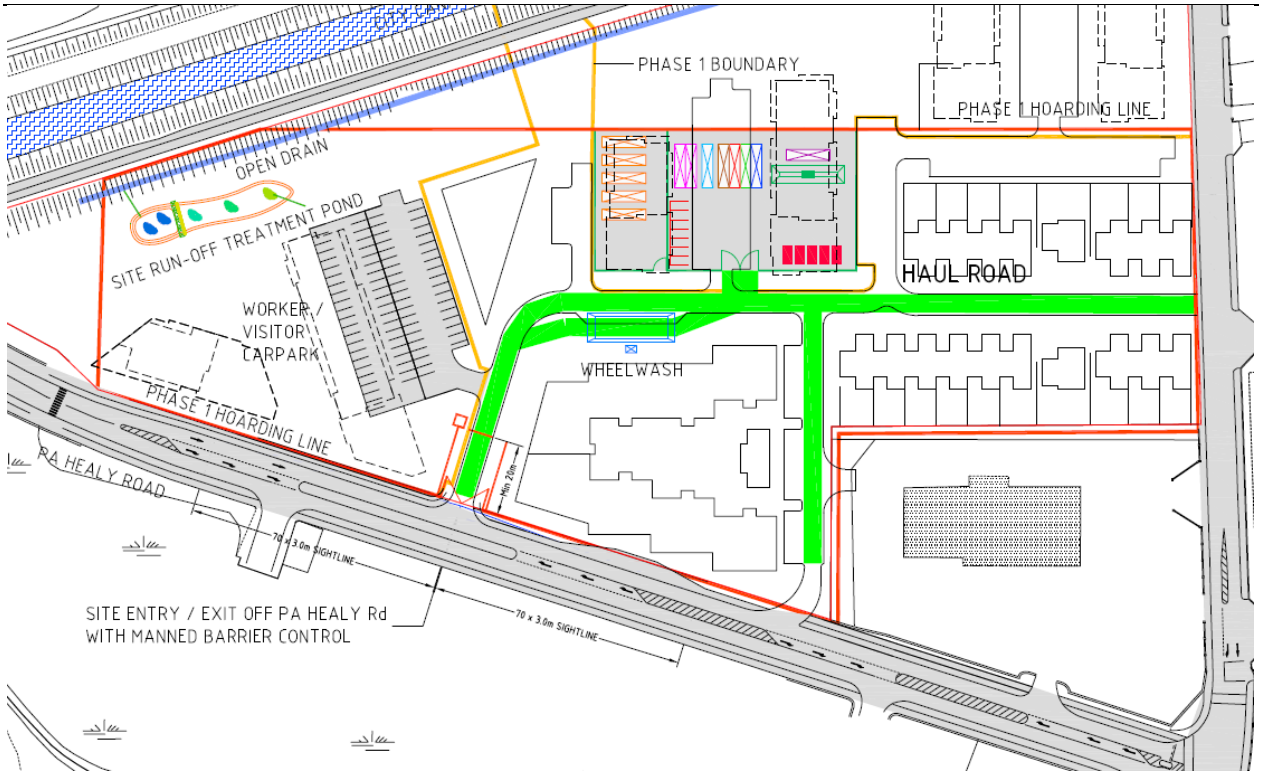

Fig 3 – Phase 1 - Site Set-up

3.5.4 Site Preparation Works

Initially the site will be securely fenced, and a construction compound will be established. Top surface material will be stripped back and either stockpiled on site for pending re-use where feasible in landscaped areas or removed off site to a permitted or licensed facility as part of a recovery operation. This will be done in accordance with all relevant statutory requirements.

Site stripping will be kept to a minimum in line with the phasing plan and the recommendations of the Verdé Environmental Site Investigation Report. A project programme will be developed for each phase of the project taking cognisance of the recommendations of the environmental reports.

- Site clearance not to be undertaken during wet conditions when rainfall of more than 1mm/hr is forecast within the next 24 hour period.
- Erosion and sediment traps to be provided as detailed in Section 4 prior to outfall to the Canal.
- Hydrocarbon separation to be provided for all surface water prior to outfall to the Canal.
- Fuels, Lubricants, hydraulic fluid, solvents and oils to be carefully handled and spill kits provided. All such fluids to be stored in bunded containment to minimum 110% capacity.
- Accidental spillages to be immediately contained and contaminated soil removed from site.
- Waste fluids to be collected and removed from site.
- Dedicated wash down area to be provided for concrete trucks.
- The proposed surface water head wall is to be preformed of precast concrete and to be installed during low water period with no work within/adjacent the Canal to be done within the period October to June.

- A penstock shut-off valve is to be provided on the outfall pipe and located within the site boundary, to be available in the event of an accidental spill of contaminates.

3.5.5 Construction of New Buildings

The development comprises the construction of new Apartment Blocks and houses. In addition to landscaped open green areas, there will be residential play areas for use by residents/public.

All building will be constructed in accordance with current building regulations and certified by an appropriate Architect during and upon construction completion.

3.5.6 Material Sources and Construction Transportation

Construction materials will be sourced locally where possible availability of these materials. This will be based on the necessary constraints of performance, durability and cost. The contractor will be required to implement the following measures in relation to traffic and transportation during construction:

- All trucks entering and exiting the site will be covered with tarpaulin;
- Adequate parking will be provided to avoid queuing at the site entrance and prevent disruption to neighbouring business. Construction vehicles will not be allowed to park on the public road either outside the site or on ant of the approach roads leading to the site;
- All trucks entering the site will be restricted to suitable speed limits and will be directed to the relevant area by the Site Manager;
- Trucks entering the site will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the site will be required to pass through a wheel wash. A lance will be provided to clean down the bodies and sides of the trucks prior to leaving site;
- All site staff including drivers will be required to abide by the normal rules of the road;
- The contractor will prepare a Detailed Construction Traffic Management Plan (CTMP) covering all construction stages that takes into account other potential construction works in the area including the proposed Park Road Bridge and New School;
- The CTMP will include a detailed consultation plan to deal with third party queries from both residents and commercial operators. The CTMP will require agreement with both Limerick City and County Council and An Garda Síochána.

  The contractor will appoint a single point of contact to facilitate the communication of the various traffic management plans and the preparation of a project specific website to aid communication would also be beneficial;
- As part of the CTMP a Mobility Management Plan will be prepared to ensure access to the site by sustainable travel modes is encouraged. The following measures will need to be considered within the Mobility Management Plan;
  - 〉 The provision of showers/changing rooms for construction staff;
  - 〉 The provision of cycle parking for staff;
  - 〉 The promotion of car sharing among staff, including van pooling;

〉 The provision of charging points within the site for electric vehicles.

Transportation of material to the site will follow the routes as per the map below:

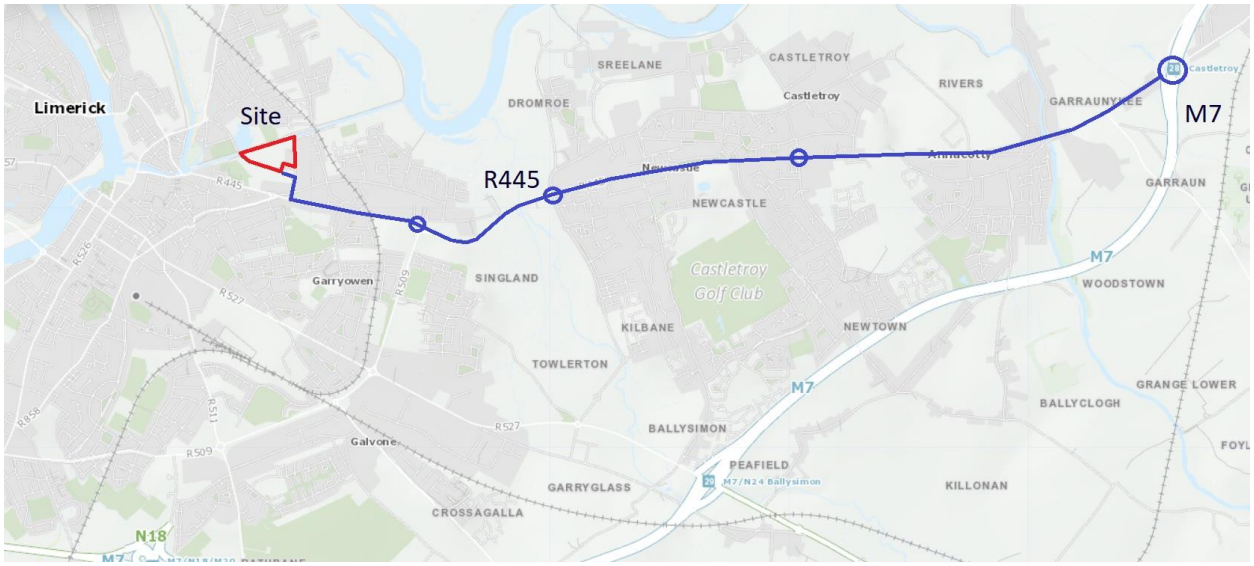

Fig 5 – Access route from East, South and North via M7/R445

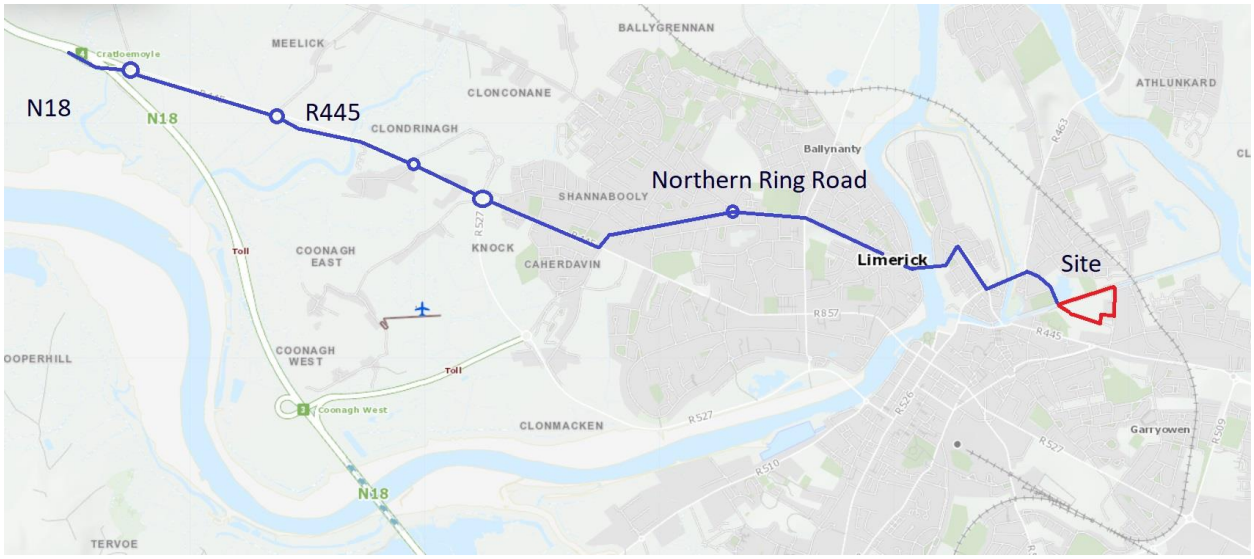

Fig 6 – Access route from West via N18/R445

3.6 Employment and Accommodation

Through the construction phase there will be some variation in the numbers working on site. It is anticipated that approximately 200 construction workers could be employed during the peak construction periods. Temporary office accommodation and other construction facilities will be installed on site for the construction phase. All temporary units will be of a high standard, as a minimum in accordance with statutory regulations.

The co-ordination of people and materials on-site will be one of the key activities throughout the construction phases. A construction management plan will be put in place prior to the commencement of the works. This plan will designate traffic routes, timings and parking arrangements with particular attention paid to Covid-19 working restrictions.

Typical working hours during the construction phase would be envisaged as:

Start Finish

- Monday – Friday 08:00 to 8:00
- Saturday 08:00 to 16:00

Currently, there are no works foreseen outside of normal working hours. The above measures will minimise the impact on surrounding neighbours.

3.7 Construction of Services

3.7.1 Electrical Connections

Power will be required for the construction compound. It is anticipated that power will be required for temporary lighting and temporary signals required during the works. If a connection to the existing network is not available low noise double hooded generators will be used.

3.7.2 Foul Sewer

As part of the new development a new foul water drainage system will be constructed to collect and convey the foul water flow generated by the development. The foul network will consist of 100mm diameter uPVC sewers from individual houses laid to falls of minimum 1:40 to connect to a 225mm uPVC SN8 sewer or as otherwise specified, to be located within the estate roads or open space areas of the development in accordance with Irish Water Code of Practice.

All foul water will discharge to the existing Foul Sewer which runs through the site – Limerick Main Drainage System.

Irish Water has confirmed that the connection of this development to the Irish Water infrastructure is feasible. A Statement of Design Acceptance has also been provided by Irish Water.

3.7.3 Storm Sewer

All surface waters from the development will be conveyed via a gravity collection network and discharged to the Canal at a controlled rate which will assimilate the predevelopment run-off rate in accordance with the current principals of stormwater management and the Greater Dublin Strategic Drainage Study. All surface waters are to be treated for the removal of contaminates such are floating debris, suspended solids and hydrocarbons prior to eventual discharge to the Canal located to the west of the site. Further detailed explanation of the system is contained within the Services Report prepared by PHM Consulting. The storm sewer will consist of a 100mm diameter pipe collection network around each house in accordance with TGD part H discharging to 225mm diameter uPVC sewer or larger under the estate roads or open space areas.

All foul and surface water sewers and manholes will be tested for infiltration through air testing and hydraulic testing prior to commissioning, in accordance with Irish Water Code of Practice.

3.7.4 Water Main

A mains water connection will be made to the construction compound for staff welfare facilities and other uses associated with the compound. It is proposed that the watermain connection will be taken from the existing 300mm watermain located on Pa Healy Road at the proposed entrance to the development site.

In order to complete the above connections, the proposed works would be subject to a Construction Management Plan and a Traffic Management Plan, to the satisfaction of Limerick City and County Council and Irish Water. The potable water supply to each building as well as the fire hydrants will be fed from the new water mains that will be constructed within the development.

3.7.5 Surface Water

All surface water shall be treated prior to discharge to receiving waters. Measures to protect surface waters from contamination are outlined in Section 4 of this Plan – Best Management Practices.

As a priority item, a temporary detention basin with an impermeable liner will be constructed early in the construction phase in order to provide the necessary storage of surface waters during periods of heavy rainfall which will provide a mechanism of treatment for the settlement of suspended solids prior to discharge. Discharge will be controlled at a rate not exceeding the natural greenfield run-off rate through the Hydrobrake manhole prior to outfall to the Canal. All discharged waters will be treated for Hydrocarbon removal through a Class 1 Bypass Interceptor. It is envisaged that the detention basin in conjunction with silt screen barriers will provide best mitigation against potential impact on the Canal receiving waters during the construction phase.

In the operational phase of the development all surface water shall discharge to the Canal as per the Engineering Services Report and design, utilising the same Outfall, Hydrobrake and Petrol Interceptor along with trapped road gulleys and attenuation storage being provided through a series of below ground storage systems designed to cater for the 1:30 year critical storm event with allowance for climate change. The complete system of manholes, pipework and attenuation is designed to be impermeable to infiltration from site ground water, in order to eliminate the risk of existing perched groundwater within the site from entering the Canal/Lower Shannon system.

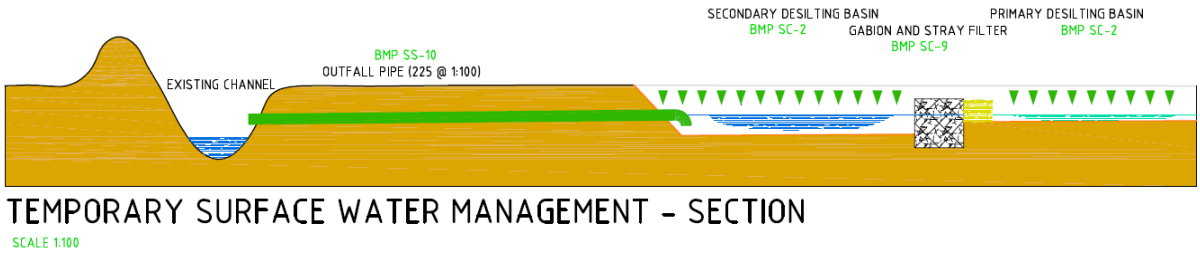

Fig 4 – Section through Detention Basin

3.8 Historic Contamination of Land

The proposed development area is a filled site, and its previous known use was agricultural. During work involving excavation on site, appropriate remediation measures will be employed, in full compliance with all relevant waste legislation given the characterisation of the fill material on site and the presence of contaminates, as outlined in Section 2. Any work of this nature would be carried out in

consultation with the appointed Environmental Consultant, and the Environmental Department of Limerick City and County Council. Refer to previous Section 2 for further information.

3.9 Health and Safety

A combination of hoarding and security fencing will be erected along all boundaries of the site with the purpose of restricting access to the work area for security and health and safety reasons. In accordance with the statutory requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013, a Health and Safety Plan will be prepared.

This will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed and updated as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations. Copies will be held on site for inspection.

Safety on site will be of utmost importance. On appointment of any contractor or subcontractor on site, safety statement, insurances, training records, and risk assessment method statements RAMS, of each contractor will be required prior to any work being undertaken on site. Prior to working on site, each individual will receive a full safety briefing and induction. The main contractor and each sub-contractor will be required to provide safe systems of work, relevant safety equipment to the tasks being undertaken for their employees on site, procedures for compliance with Covid-19 HAS/HSE Guidelines. Safety briefings will be held regularly and prior to any onerous or special task. 'Toolbox talks' will be held weekly to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All workers and visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team. All PPE to be level assessed for its appropriateness for particular tasks.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is put in place.

3.10 Potential Construction Phase Environmental Impacts and Control Measures

3.10.1 Potential Impact and Effects

Upon review of the various environmental reports accompanying this application, the following potential impacts that would typically be expected due to construction and operation of a mixed-use development such as the proposed Canal Bank Development are noise, dust, discharge of pollutants to receiving water and biodiversity loss. The potential impacts and effects on Natura 2000 sites are identified by considering the nature and scale of the proposed development, the location of the proposed development relative to Natura 2000 sites and any landscape or ecological connectivity.

The potential impacts of the development that are considered to have potential to affect the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are as follows:

- Discharge of water to the canal during construction and operation of the development.

- Disturbance of species due to noise and lighting associated with construction and operation of the development.

3.10.2 Construction Phase Control Measures

The construction activities described in Section 3.3 will have a range of effects as described in 3.7.1. This section describes the likely consequences of the works, and outlines the proposed control measures that will minimise negative environmental impacts. The potential construction phase impacts include emissions to air such as dust, noise, vibration and artificial light, construction traffic, and poorly controlled construction waste. Surface water run-off from the site during periods of heavy rainfall, and accidental leaks or spills from construction plant and equipment, have the potential to impact on the quality of soils, surface water and groundwater.

3.10.2.1 Noise Generating Activities

During the construction phase, the potential noise and vibration impacts are associated with site preparation works, foundation construction activities, general construction activities and construction vehicle movements. Similar to any construction site, there is potential for noise generation associated with site clearance and construction activities.

No works will be carried out outside of normal permitted working hours except with prior written authorisation from the local authority.

Principal sources of noise will include:

- Earthworks plant and equipment.
- Construction plant and equipment.
- Construction traffic.

3.10.2.2 Noise Control Measures

With regard to construction activities, reference will be made to BS5228: Noise and Vibration Control on Construction and Open Sites, which offers detailed guidance on the control of noise and vibration from demolition and construction activities to which the Main Contractor will be required to give due regard. In particular, it is proposed that various practices be adopted during construction, including:

- Hours will be limited during which noisy site activities are permitted.
- Channels of communication will be established between the Contractor/Developer, Local Authority and residents.
- A Site Representative will be appointed responsible for matters relating to noise.
- Typical levels of noise will be monitored at the site boundaries close to residential areas.
- The site will be hoarded on all sides (as per Phasing drawing) with a minimum 2.0m high solid timber hoarding.
- Plant will be selected with low inherent potential for the generation of noise.
- All site roads will be kept even so as to mitigate the potential for vibration from lorries and other construction vehicles.

- Barriers will be erected as necessary around items such as generators or high duty compressors.
- Noisy plant will be sited as far away as possible from nearby residential properties and places of work as permitted by site constraints.
- Engines, vehicles and equipment will be switched off when not in use.
- Significant sources of noise such as the use of abrasive tools, will be enclosed.
- Plant will be used and serviced regularly in accordance with manufacturer's instructions.
- Cranes will be shut down during work periods / throttled to minimum when not in use. All tower cranes will be subject to approval/oversail licensing from Limerick City and County Council.
- Machinery having rotating parts will be serviced according to supplier recommendations to prevent friction induced sound.
- Materials should be lowered, not dropped, insofar as practicable and safe.
- All personnel must be made aware that noisy construction activities resulting in raised noise levels must be minimised and made aware of the above control measures.

3.10.2.3 Vibration

Vibration from construction activities will be limited to the values set out in the following table but will likely be far below these values. It should be noted that these limits are not absolute, but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%.

Allowable Vibration during Construction Phase

Allowable vibration (in terms of peak particle velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
3 mm/s	3 to 8 mm/s	8 to 10 mm/s

3.10.2.4 Dust Generating Activities

Construction activities have the potential to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with ambient conditions, including rainfall, wind speed and the distance to potentially sensitive locations. There is potential for dust emissions from construction activities associated with the construction of the new buildings. The Main Contractor will ensure that a dust minimisation plan is prepared and implemented during the construction phase of the project. Construction activities are likely to generate some dust emissions, particularly during the site clearance and excavation stages. The following avoidance, remedial or reductive measures will be implemented as part of the dust minimisation plan:

- During very dry periods when dust generation is likely, construction areas will be sprayed with water.

- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor through regular servicing of machinery.

- Vehicle speeds will be limited in the construction site to 10 km/h.

- Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly, as required.

- Wheel-wash facilities will be provided with rumble grids to remove excess mud from wheels. These facilities will be located at the exit from the site.

- The technique adopted for all works shall minimise the release of dust into the atmosphere.

- Daily visual inspections will be carried out at locations around the site boundary as required. These inspections which will be carried out by the Environmental Officer, will monitor the effectiveness of dust mitigation measures.

3.10.2.5 Construction and Security Lighting

Artificial lighting is a requirement to ensure working areas are adequately lit for the safe operation and working conditions for all personnel during winter periods of the year. Construction sites by their nature are areas of curiosity and unauthorised access during out-of-hours periods by members of the general public is a common occurrence irrespective of the level of determent offered by the site hoarding.

It is envisaged that artificial lighting will be a requirement on this construction site. In order to minimise the impact of such lighting on neighbouring properties and impact on protected species – Bats etc. the following lighting requirements shall be adopted.

Lighting Arrangement: Construction lighting can be arranged in different ways onsite to allow for the most efficient use. Lighting can be fixed to support poles, scaffolding, and tower cranes, or it can be put on movable supports.

Construction Lighting Requirements: Every part of the construction site that is in use should be well-lit, either with natural light or artificial lighting. This ensures that wherever people are working, they are able to do their work effectively and move around the site safely and efficiently.

If work needs to carry on beyond daylight hours, or the building structure is enclosed, artificial lighting must be used.

Illuminate Shadow Areas: It is common on construction sites for shadows to form, obscuring hazards such as machinery and nails. To avoid any injuries, aim to provide extra lighting around the construction site to help illuminate any areas currently in shadow.

Always Provide Emergency Lighting: To ensure the safety of everyone on site, provide emergency lighting. This ensures that workers descending scaffolding or escaping the site in an emergency, don't have to do so in the dark.

Light Emergency Routes: When there is an emergency on the construction site, it is essential everyone can follow a well-list escape route. Ensure emergency lighting is provided in all emergency routes so that it can illuminate escapes if the primary lighting fails. Emergency lighting doesn't need to be very bright, it only needs to be bright enough to illuminate emergency escape routes sufficiently.

Illuminate General Working Areas: To light general working areas, overhead lighting can be suspended from grids to illuminate spaces effectively. This ensures workers can complete projects safely and efficiently, without damaging their eyes or becoming susceptible to injury. Lighting general working areas is especially important out of hours when there is no more natural light.

Lighting Requirements and Surrounding Areas: When lighting construction sites, light spillage to be kept to a minimum. If the construction area is particularly close to residential properties and busy roads, light spillage must be avoided as it can cause distraction. Ensure lighting is not affecting surrounding areas. Where necessary, appropriate lighting should also be provided around site boundaries to ensure pedestrians are able to pass by safely.

Points to Consider:

- Hazards should be easily noticeable so they can be assessed.
- All lighting must be suitable for the work undertaken and the environment.
- Different coloured lights must be easily distinguishable to promote safety.
- No strobes, flickers, or glares should be caused by lighting.
- Lights should not pose a risk to health and safety.
- Lighting should be easily accessible so that maintenance can be carried out and units can be replaced with ease.

In order to minimise interference of the Normal Working Hours Construction site lighting and the Out-of-hours Security Lighting on the adjacent neighbouring properties, the public traffic routes and on the use of the Canal by Otters and other wildlife as outlined in the NIS the following limitations shall be observed:

- Only illuminate what needs to be illuminated – Minimise or Prevent light spill. If lighting a Pathway, the light should be directed at the Path only, with no uplight or illumination of nearby Trees, bushes, river, waters, buildings, etc.
- Reducing the light levels.
- Height of Luminaires - drop the maximum height of the Luminaires (with good cut-off, no uplight, narrow beams etc.).
- Reflectance – Ensure against Downward lighting which can be reflected from bright surfaces.
- Shielding of Luminaires & Light – Add Shields/Baffles or allow natural objects (trees etc) to stand between the luminaire.
- Type of Light – Use warm coloured lighting (e.g. HPS) which is less disruptive than colder coloured lighting (e.g. Metal Halide).

- Minimising or eliminating UV light. LED lighting has no UV, HPS has a little (0.2%), and Metal Halide (2%-7%).

- Lighting Controls – Provide motion sensors so light auto turn off at night.

3.10.2.6 Litter and Mud on Public Roads

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily inspections will be undertaken to monitor tidiness.
- A regular program of site housekeeping will be established to ensure a safe and orderly site.
- If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind.
- Food waste will be strictly controlled on all parts of the site and source separated.
- Wheel wash facilities will be provided for vehicles exiting the project site.
- Wheel wash run off will be stored in an onsite storage tank and will be disposed of by licensed waste haulage company and disposed of off-site at a licensed facility.
- In the unlikely event that mud is carried over from the project site to the public roads, they will be cleaned regularly as required and will not be allowed to accumulate.
- Loaded lorries and skips will be covered as required.
- Surrounding roads used by trucks for access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required.
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

3.10.2.7 Soils, Groundwater and Surface Water

There is a water course located adjacent the west boundary of the site – City Canal. During the construction phase, control measures will be put in place to mitigate against nuisance and protect the environment.

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off or groundwater. The Construction Industry Research and Information Association has issued a guidance note on the control and management of water pollution from construction sites, CIRIA C532 - Control of Water Pollution from Construction Sites, guidance for consultants and contractors (Masters-Williams et al 2001). The guide is written for project promoters, design engineers and site and construction managers. It addresses the main causes of pollution of soil, groundwater and surface waters from construction sites and describes the protection measures required to prevent pollution of groundwater and surface waters and the emergency response procedures to be put in place so that any pollution, which occurs, can be remedied. The guide addresses developments on green field and potentially contaminated brownfield sites.

The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination. Site activities considered in the guidance note include the following:

- excavation
- earthmoving
- concreting operations

Additional specific guidance is provided in the CIRIA C649 technical guidance on Control of Water Pollution from Linear Construction Projects (Murnane et al 2006).

Surface run-off from wheel washing areas can contain pollutants such as:

- detergents
- oil and fuel
- suspended solids
- grease

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters include:

- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site.
- Where at all possible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together.
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land.
- Minimise the use of cleaning chemicals.
- Use trigger-operated spray guns, with automatic water-supply cut-off.
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt.
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.
- The above measures will be implemented, as appropriate along with the following site specific measures:

- Fuel, oil and chemical storage on site will be secure.
- Site storage will be on an impervious base within a secondary containment system such as a bund.
- A spill kit with sand, earth or commercial products that are approved for the stored materials will be kept close to the storage area. Staff will be trained on how to use spill kits correctly.
- Damaged, leaking or empty drums will be removed from site immediately and disposed of via a registered waste disposal contractor.
- Mobile plant will be refuelled in a designated area, on an impermeable base away from drains or watercourses.
- A wheel wash will be installed for use by all construction vehicles leaving site.
- A road sweeper will be used to remove dirt and debris from roads.
- Silt traps will be located around the site to collect run off, with settled solids removed regularly and water recycled and reused where possible.
- A filter drain and silt pits will be located at the base of all embankments, settled solids will be removed from the silt pits regularly.
- A bypass petrol interceptor will be installed on the outfall pipe to the Canal to prevent any hydrocarbon spills from entering the receiving waters of the Canal.

Further guidance is available from:

CIRIA C741 - Environmental Good Practice on Site Guide, 2015

Inland Fisheries Ireland – Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters, 2016

3.11 Sitework Remediation Options

3.11.1 Excavation of Contaminated Soils

This remedial option is focusing on minimising the potential risks associated with the removal of existing material on site which has been established to contain elements of contamination. The proposal is to import clean material to place as a capping layer over the top of the existing levels which will act as a barrier or separating layer between the finishing layers and the existing substrate material. The advantage of this approach is of an immediate and permanent benefit. The alternative would involve the excavation and removal of a vast quantity of material which would be labour intensive, generate large volumes of waste soil which would require classification and appropriate disposal and result in significant associated costs.

3.11.2 Capping Layer

The aim of the capping layer is to address risks posed to future site users from Lead, TPH, PAH and asbestos contamination present within soils to break the associated pollutant linkage.

It is considered that the emplacement of a clean cover system (capping layer) in all landscaped areas of the future development will remove the risks by breaking the pathway. Where buildings or hardstanding such as car parking, paved areas or roads are proposed, capping remedial works are not considered necessary as these features will effectively encapsulate contaminant concentrations preventing end users from coming into direct contact with soils.

The aim of the cover system/capping layer is to create an engineered horizontal layer of "uncontaminated" material on site to sever the source-pathway pollutant linkage and thus prevent direct contact between human (health) receptors, and the contaminated soil. It is considered sufficient to provide private domestic gardens with a capping layer consisting of a minimum of 600mm of clean material, comprising of a 200mm capillary break layer overlain by a minimum of 400mm 'clean' soil.

Sufficient and suitable top soils are not present on site and consequently this will need to be imported onto site for use in landscaped areas.

3.12 Mitigation Measures to Minimise Environmental Impacts

The following measures should be employed on site to minimise the impact of the remedial works outlined in section 3.8 and to be applied where any excavation of existing infill material is required for the construction of roads, sewers, attenuation storage, ducting, foundations etc. in order to prevent cross contamination of clean areas or off site receptors.

- Where off-site disposal of contaminated soils (waste) is required, all lorry loads will be sheeted once loaded and before leaving site to reduce dust generation. Provision will be made for washing vehicle wheels at the site entrance to prevent any mud being deposited on local roads.

- Any stockpiles, compounds and treatment areas will be positioned so as to minimise impact on neighbouring properties. In particular any stock piles containing contaminated soils will be placed on an impermeable surface while awaiting the results of validation testing. The stockpiles will be sheeted to minimise dust emissions and also to minimise the potential for leaching rainwater and run off contaminating clean areas.

- Adequate precautions will be taken during site works to prevent surface water run-off from the site affecting the local surface waters and drainage network.

- Dust monitoring and dust suppression will be carried out during any remedial works. As a minimum this will include visual inspections to identify dust generating activities and damping down such sources as when required. The aim should be to prevent the generation of dust and any potential risk to site workers and neighbouring properties.

- Monitoring for airborne asbestos fibres will also be completed during any earthworks and routinely during construction works until the capillary break of the capping layers / hardstanding have been laid. This will include within any areas where earthworks are being undertaken and at the site boundaries. Where asbestos fibres are identified above detection limits, mitigation measures will be taken to mitigate and prevent the release of fibres to include damping down of sources and in particular any vehicle haul routes. This monitoring will be undertaken in conjunction with monitoring specified below in regard to dust.

3.13 Remediation to Protect Services

Elevated contaminants have been identified in places and can permeate plastic water supply pipes. Consequently, all services should be laid in trenches backfilled with material considered to be clean and not contaminated. Minimum thickness of clean granular material to services to be in accordance with Irish Water Code of Practice and Details for water and wastewater infrastructure.

3.14 Health and Safety Measures for Construction Workers

The risks posed to construction workers through short term exposure to the reduced quality soils containing elevated concentrations of heavy metals hydrocarbons, PAH and asbestos can be minimised through adherence to the relevant health and safety regulations / guidance.

The health and safety implications of working with potentially contaminated soils will be fully considered prior to the commencement of any earthworks through the development of an appropriate health and safety plan. It is considered that the measures adopted to minimise the exposure of construction workers to contaminants should include the following as a minimum:

- Hygiene facilities.
- Provision should be made for washing and toilet facilities; clean and dirty collection, laundering and storage facilities for protective clothing; and wash facility for footwear.
- Personal hygiene.
- Restrictions should be adopted for eating, drinking and smoking on site.
- Personal protective equipment (PPE).

3.15 Asbestos Considerations

3.15.1 ACM General

The site investigation, soil analysis and GQRA identified asbestos within shallow soils on site. In order to ensure there are no significant risks to construction workers on site and off site occupiers, a watching brief will be maintained to visually identify suspect ACM fragments. A strategy of asbestos monitoring for fibres in air and use of personal monitoring will also be completed. For this purpose, a specialist contractor will be employed. It is likely that this will be completed daily during the start of any earthworks for a period, down scaled to regular periodic monthly monitoring should asbestos not be identified or should monitored airborne fibres not be identified above detection limits. The contractor will be required to monitor weather conditions, and complete site inspections for visual dust generation. Where asbestos is identified or unsatisfactory air monitoring results are returned or visual evidence of dust is noted, a risk assessment may need to be completed and additional mitigations and or remediation undertaken.

3.15.2 Asbestos Survey – Existing Structure

An ACM Survey was undertaken by Precision Group and completed in 2019 on the existing industrial building located within the development site, which is estimated to have been constructed in the

1980's. The survey was based upon the methodology set out in HSG264. Each accessible area was inspected to locate materials presumed or strongly presumed to contain asbestos, and samples were taken where necessary.

The main structure on the site is a large Industrial unit (520 sq m) with internal stores, office and welfare facilities. The main building is of traditional construction from traditional materials, concrete floor slab, metal frame, concrete block lower walls. The roof and upper sections of the walls are covered with corrugated asbestos cement panels. Internal walls and ceilings of the offices and welfare facilities are, concrete block with sections of timber stud walls covered with, gypsum based plaster/plasterboard or wood based panel. Rainwater goods are of asbestos cement. Windows and doors are metal or timber as are internal trims. Sanitary goods are ceramic, plastic or metal.

Electrical fuses internally are cartridge type (no flash guards) all electrical equipment was considered as live so not fully inspected. Floor coverings are Carpet, modern vinyl tiles on upper office area. The rear GF store has a modern type cold room constructed of modern materials, the ceiling of this area is gypsum based plaster board supported by timber frame. Externally the building has sections of heavy vegetation and scrub around the external walls.

Asbestos Cement products containing Chrysotile were identified in six samples/inspections - in all of the incidents the cement products were unsealed and in fair condition whilst attached to the building, the fragments on the ground externally have exposed fibres on edges.

Precision considered that the Cement products are not a significant risk to health in their present condition and undisturbed.

Precision recommends that all the Cement products are to be removed by a competent contractor prior to any work that may disturb them, subject to contractor's method statement risk assessment and notification to the HSA may be required.

Removal or work on these products will be carried out in line with current asbestos legislation and guidance documents to ensure safe and appropriate working practice. An air-monitoring regime appropriate to the works will be undertaken in conjunction with any removal works.

The Main Contractor will adhere to the recommendations of the Precision Survey Report and Key legislation and guidance during the course of such works as listed below and in accordance with BMP WM-6:

- The Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations, 2006/2010 (and associated Approved Code of Practice - Asbestos-containing Materials (ACMs) in Workplaces Practical Guidelines on ACM Management and Abatement.
- The Safety, Health and Welfare at Work (Construction) Regulations, 2013
- Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001
- Chemicals (Asbestos Articles) Regulations, 2011
- The Waste Management Act 1996/2005 and current Regulations

3.16 Invasive Species Management

A baseline invasive species survey has been carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2015)) by SLR Consulting. None were identified.

If the presence of such species is found during the construction period at or adjacent to the site, particularly in areas where its excavation may be required, an invasive species management plan will be prepared by the Project Ecologist and implemented by the Environmental Officer to prevent the introduction or spread of any invasive species within the site of the works. An invasive species management plan, if required, will set out best practice control methods as summarised in the following sections.

Where importation of soil material is required for the purpose of the capping and topsoil layer, an invasive species survey of the material source will be carried out prior to excavation at source. This survey shall also include the transfer route from the source to the site.

3.16.1 General Best Practice Control Methods

The following general best practice guidelines in the treatment and control of invasive species during construction works are outlined below having regard to guidance documents particularly those issued by Transport Infrastructure Ireland (Tii) and The Best Practice Management Guidelines produced by Invasive Species Ireland.

3.16.2 Site Management

Careful preparation of the site and planning of the works is crucial to successful treatment of invasive species. The following list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Should any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate the risk.

3.16.3 Establishing Good Site Hygiene

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits and warning signs shall be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of off-site with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.

- A suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

Plant and equipment which is operated within an area for the management of materials in contaminated areas should be decontaminated prior to relocating to a different works area. The decontamination procedures should take account of the following:

- Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it.
- Decontamination will only occur within designated wash-down areas.
- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material.

3.17 Emergency Planning & Response

As required under the Safety, Health and Welfare at Work Act 2005 a Project Supervisor Construction stage (PSCS) will be appointed by the Client for the project and will ensure that construction/installation works are carried out consistent with all existing emergency response plans and procedures.

The emergency management procedure to be employed shall ensures that emergencies such as fires, explosions, accidents, leaks, sabotage or emergencies caused by force majeure, occur as little as possible; if they do, however, occur, it ensures that all counter measures proceed in a controlled manner so that greater damages are avoided and the possible effects upon persons, the environment and property are avoided or limited.

3.18 Environmental Emergency

3.18.1 Preparedness and Response

In the event of an environmental emergency, a procedure for Environmental Emergency Preparedness and Response will be developed prior to commencement of construction and can be implemented by the CMT in order to ensure to minimise environmental impacts. An environmental emergency at the site may include;

- Discovery of a fire within the site boundary.
- Uncontained spillage / leakage / loss of containment action.
- Discharge concentration of potential pollutants in excess of environmental trigger levels.

The general required emergency response actions will be posted at strategic locations, such as the site entrance, canteen and near the entrances to buildings.

A set of standardised emergency response procedures will govern the management of emergency incidents. The main contractor will be required to develop emergency incident response procedures in the detailed CEWMP and to develop an Emergency Incident Response Plan.

The Emergency Incident Response Plan will contain emergency phone numbers and the method of notifying Local Authorities, Statutory Authorities and stakeholders. Contact numbers for key personnel will also be included therein. Contractors will be required to adhere to and implement these procedures and ensure that all staff and personnel on site are familiar with the emergency arrangements.

In the event of an emergency incident occurring, the contractor will be required to investigate and provide a report including the following, as a minimum:

- A description of the incident, including location, the type and quantity of contaminant and the likely receptor(s);
- Contributory causes;
- Negative effects;
- Measures implemented to mitigate adverse effects; and
- Any recommendations to reduce the risk of similar incidents occurring.

The Main Contractor will consult with the relevant statutory authority, stakeholders and relevant parties such as the HSA, Fire and Ambulance Services, EPA, IFI, Irish Water and Limerick City and County Council when preparing and developing response measures. Furthermore, if any sensitive receptor is impacted, the appropriate environmental specialists will be informed and consulted with accordingly.

Any response measures will be incorporated into the Emergency Incident Response Plan that should be disseminated accordingly to construction staff, and the Employer's Representative.

3.18.2 Emergency Access

The Main Contractor will maintain emergency access routes throughout the construction period and identify site access points for each phase. This shall be developed in consultation with the emergency services.

3.18.3 Extreme Weather Event

Given the location of the site and the proximity to tidal waters the Main Contractor will be required to consider the impacts of extreme weather events and relates conditions during construction. The contractor will use a short to medium range weather forecasting service from Met Eíreann or other approved meteorological data and weather forecast provider to inform short to medium term programme management, environmental control and mitigation measures.

The detailed CEP will consider all measures deemed necessary and appropriate to manage extreme weather events and will specifically cover training of personnel and prevention and monitoring arrangement for staff. As appropriate, method statement will also consider extreme weather events where risks have been identified, e.g. construction works adjacent to the Canal and River Shannon

3.18.4 Unexpected Discoveries

The Main Contractor will be required to put in place appropriate procedures to be employed in the event of encountering unexpected archaeological or cultural heritage assets or subsurface contamination during intrusive ground works.

The contractor will be required to develop appropriate procedures as part of their detailed CEWMP and the Environmental Officer will ensure that specialists are facilitated to ensure management in

accordance with industry best practice and effective compliance with the relevant legislation. All unexpected discoveries will be reported to the appropriate authorities and documented in an appropriate manner.

3.19 Waste Management

3.19.1 Waste Management Goals

This project will aim to recycle or salvage for reuse to its maximum potential all waste generated on-site. Waste reduction will be achieved through building design, and reuse and recycling efforts will be maintained throughout the construction process.

Waste Prevention Planning: The main contractor will implement procedures that will endeavour to segregate and recycle construction materials which include:

- Paper / corrugated cardboard
- Plastic and glass
- Timber – natural and engineered
- Metals

Project Construction Documents – Requirements for waste management which will be included in all work. The Main Contractor will be contractually required along with all subcontractors to comply with the principals of this CEWMP. A copy of this Plan will accompany all Subcontractor Agreements and require subcontractor participation.

A Construction Waste Reduction Plan shall be developed by the Main contractor, implemented and executed as follows and as per Table 1:

- Salvageable materials will be diverted from disposal where feasible.
- There will be a designated area on the construction site reserved for a row of dumpsters each specifically labelled for respective materials to be received.
- Before proceeding with any removal of construction materials from the construction site, the Site Supervisor will inspect containers for compliance with this plan.
- Wood cutting will occur in centralised locations to maximise reuse and make collection easier.
- All hazardous waste will be handled by a licensed hazardous waste haulier.

3.19.2 Waste Management Communication & Education Plan:

The Main Contractor will conduct on-site pre-commencement meetings with all subcontractors. Attendance will be required for the subcontractor's key field personnel. The purpose of the meeting will be to reinforce to subcontractor's key field employees the commitments made by their companies with regard to the project goals and requirements.

As each new subcontractor comes on site, the recycling coordinators will present him/her with a copy of the Construction Environmental and Waste Management Plan and provide a tour of the recycling areas.

The subcontractor will be expected to make sure all their crews comply with the CEWMP.

All recycling containers will be clearly labelled. Containers shall be located in close proximity to the construction site in which recyclables/salvageable materials will be placed. The selected location will be such that skip collection vehicles will not traverse the construction site. The skips will be located on a hardcore base with a temporary access road. This will eliminate the risk of soil material being removed from the site and deposited on the public road on the wheels of the vehicles.

Lists of acceptable/unacceptable materials will be posted throughout the site.

All subcontractors will be informed in writing of the importance of non-contamination with other materials.

The Site Supervisor shall inspect the containers on a weekly basis to insure that no contamination is occurring and precautions shall also be taken to deter any contamination by the public.

3.19.3 Keeping of Records

The Construction Manager will ensure that fully detailed records are maintained of any 'incident / event' likely to cause non-compliance and / or harm to the environment. Environmental Incidents/Near Miss Reports are reported and recorded.

Complaints and Follow up Actions on the construction site will be managed by the CMT and contractors will ensure that all complaints are recorded according to CMT requirements.

Each contractor will be responsible for ensuring that a full record and copy of all Safety Data Sheets (SDS) pertaining to their works is kept on file and up to date in their site offices. Contractors will also retain a duplicate copy of all SDSs held by the contractors.

The CMT will be responsible for monitoring the movement and treatment of all waste during the construction phase of the project. Monitoring will be carried out by the CMT who will record the nature, quantities and off-site destination of waste.

3.19.4 Expected Project Waste, Disposal, and Handling:

Table 1: The following table identify waste materials expected on this project, their disposal method, and handling procedures:

Material	Quantity	Disposal Method	Handling Procedure
Land clearing debris	TBC	Keep separate for reuse and or wood sale	Keep separated in designated areas on site.
Clean dimensional wood and palette wood	TBC	Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. Recycle at:	Keep separated in designated areas on site. Place in "Clean Wood" skip.
Plywood, OSB, particle board	TBC	Reuse, landfill	Keep separated in designated area on site. Place in skip container.
Painted or treated wood	TBC	Reuse, landfill	Keep separated in designated area on site. Place in skip container.
Concrete	TBC	Recycle to:	Keep separated in designated area on site.
Concrete Masonry Blocks	TBC	Keep separate for re-use by on-site construction or by site employees	Keep separated in designated area on site
Metals	TBC	Recycle to: Ferrous and non-ferrous metals (banding, stud trim, ductwork, piping, rebar, roofing, steel, iron, galvanized sheet steel, stainless steel,	Keep separated in designated area on site. Place in "Metals" container.

Material	Quantity	Disposal Method	Handling Procedure
		aluminium, copper, zinc & lead)	
Gypsum Plasterslab	TBC	Recycle with supplier:	Keep scraps separate for recycling – stack on pallets provided on site.
Paint	TBC	Reuse or recycle at:	Keep separated in designated area on site – Lockable container
Insulation	TBC	Reuse, landfill	
Flooring	TBC	Reuse, landfill	
Glass	TBC	Glass: Recycle at:	Keep separated in designated area on site. Place in container: 'Glass'
Plastics	TBC	Plastic Bottles: Recycle at:	Keep separated in designated area on site. Place in container: 'Plastic'
Paper / Cardboard	TBC	Recycle at:	Keep separated in designated area on site. Place in container: 'Mixed Paper / Cardboard' container
TOTAL			

TBC = To Be Calculated

Based on information available and the current design proposal the following waste material is expected to be generated and to be removed from site in accordance with the measures outlined in this plan.

Table 2: Expected Waste Volumes

Table 2.1 – Volumes of existing material on site to be removed particular to Services.

Foul Sewer Excavation Volume Calculation					
Run	**Width**	**Avg Inv Lvl**	**Avg Grd Lvl**	**Length**	**Volume**
	m	**m**	**m**	**m**	**m3**
F1-F2	0.53	4.32	5.85	56.87	52
F2.1-F2.0	0.53	4.43	5.85	34.62	29
F2-F3	0.53	3.78	5.60	45.12	48
F3.1-F3	0.53	4.37	5.80	33.38	29
F3-F4	0.53	3.31	5.50	44.73	56
F4.1-F4	0.53	3.83	5.58	79.28	81
F4-F5	0.53	2.95	5.34	20.10	27
F5.1-F5	0.53	2.80	4.99	75.88	95
F5-F6	0.53	2.22	5.39	25.18	44
F6.1-F6	0.53	4.10	5.70	59.72	56
F6-F7	0.60	2.01	5.34	37.96	80
F7.1-F7	0.53	3.95	5.39	35.78	31
F7-F8	0.60	1.82	5.13	30.11	63

F8.1-F8.0	0.53	3.40	5.04	28.09	27
F8-F9	0.60	1.68	5.14	22.78	50
F9-F10	0.60	1.50	5.45	49.92	124
F10.2-F10.1	0.53	4.23	5.80	23.68	22
F10.1-F10	0.53	3.91	5.75	40.19	43
F10-FOut	0.68	1.35	5.10	13.47	36
				Sub Total	995

Table 2.2 – Volumes of existing material on site to be removed particular to Services.

Storm Sewer Excavation Volume Calculation					
Run	**Width**	**Avg Inv Lvl**	**Avg Grd Lvl**	**Length**	**Volume**
	m	**m**	**m**	**m**	**m3**
S1-S2	0.53	4.34	5.85	54.19	49
S2.1-S2	0.53	4.72	5.85	35.94	25
S2-S3	0.60	3.88	5.60	45.12	52
S3.1-S3	0.53	4.32	5.80	30.71	27
S3-S4	0.68	3.70	5.50	44.72	60
S4.1-S4	0.60	3.98	5.58	80.60	87
S4-S5	0.68	3.60	5.34	20.10	26
S5.1-S5	0.60	3.37	4.99	75.88	82
S5-S6	0.68	3.21	5.39	25.18	40
S6.1-S6	0.53	4.24	5.70	57.04	50
S6-S7	0.75	3.13	5.34	37.96	69
S7.2-S7.1	0.53	3.50	5.00	28.09	25
S7.1-S7	0.68	3.24	5.14	35.35	50
S7-S8	0.75	3.04	5.39	35.85	69
S8-S9	0.75	2.97	5.70	12.90	28
S9.3-S9.2	0.53	4.31	5.80	26.15	23
S9.2-S9.1	0.53	4.14	5.80	41.21	40
S9.1.1-9.1	0.60	3.72	5.55	32.18	39
S9.1-S9	0.60	3.51	5.80	52.64	79
S9-PI	0.83	2.95	5.65	9.25	22
PI-S10	0.83	2.82	5.25	13.76	30

S10-SOut	0.83	2.78	4.50	14.56	23
				Sub Total	**996**

Table 2.3 – Volumes of existing material on site to be removed particular to Services.

Attenuation Excavation Volume Calculation					
Tank A	13.7	2.991	5.39	32.6	1302
Tank B	7.9	3.080	5.39	45.6	1087
Tank C	7.9	3.175	5.70	38.8	1020
				Total	**3409**

Table 2.4 – Volumes of existing material on site to be removed particular to Services.

Watermain Excavation Volume Calculation					
	Width	**Avg Depth**		**Length**	**Volume**
	0.6	1.4		1200	1008

Totals

- 2.1 Foul Sewer = 995
- 2.2 Surface Water = 996
- 2.3 Attenuation Tanks = 3,409
- 2.4 Watermains = 1,008

Total Volume = 6,408 cu m

Assuming Avg density of 1.8 Tonnes per cu m = 11,534 Tonnes (577 Truck movements).

Table 3: In respect to reducing levels of the existing site to formation level for the construction of roads and paths the following waste volumes are expected.

Excavation Volume Calculation particular to roads and other services.				Depth of Proposed RL to Formation Lvl (m) =		0.75
	Width	**Chainage**	**Existing Lvl**	**Proposed Lvl**	**Excav Depth**	**Volume**
	m	m	m	m	m	m^3
Road 1	10	0	4.80	4.80	0.75	
	10	40	5.25	5.08	0.92	334
	10	80	5.25	5.18	0.83	349
	10	120	5.25	5.50	0.50	265
	10	160	5.50	5.40	0.85	270

	10	200	5.75	5.60	0.90	350
					Sub Total	**1568**
Road 2	21	0	5.25	5.083	0.917	
	21	65.15	5.00	5.70	0.05	662
					Sub Total	**662**
Road 3	20	0	5.25	5.50	0.50	
	20	61.4	5.50	5.90	0.35	522
					Sub Total	**522**
Road 4	14	0	5.25	5.27	0.73	
	14	80	4.60	4.70	0.65	773
					Sub Total	**773**
Road 5	18	0	5.25	5.4	0.60	
	18	81.85	6	5.64	1.11	1260
					Sub Total	**1260**
Road 6	15	0	5.75	5.6	0.90	
	15	45.121	6.25	5.6	1.40	778
	15	79.874	6.25	6.1	0.90	599
					Sub Total	**1378**
Road 7	20	0	6.25	5.6	1.40	
	20	58.411	6	6.1	0.65	1197
					Sub Total	**1197**
Road 8	14	0	5.25	5.17	0.83	
	14	38.07	5.25	5.8	0.20	274
					Sub Total	**274**
Total Volume of material to be removed from site particular to roads and utility services (Table 3 + Table 4) =					m^3	**7634**

Particular to the planned demolition of the existing industrial warehouse building and associated external hardstanding areas the following waste types and tonnages are expected.

Table 4

Demolition of Existing Industrial Building							
Waste Type	**Weight**	**Reuse/Recover**		**Recycle**		**Disposal**	
	Tonne	%	Tonne	%	Tonne	%	Tonne
Steel	27	0	0	80	21.6	20	5.4
Concrete	408	0	0	0	0	100	408
Masonry	296	0	0	40	118.4	60	117.6
Hardcore	285	0	0	0	0	100	285
ACM	10	0	0	0	0	100	10
Conc Yard							
Steel	7	0	0	100	7	0	0
Concrete	380	0	0	60	228	40	152
Tarmacadam	80	0	0	25	20	75	60
Hardcore	650	0	0	50	325	50	325
Totals			**0**		**720**		**1362.7**

4.0 WATER POLLUTION CONTROL BEST MANAGEMENT PRACTICES (BMP's)

4.1 Preventative measures

During the construction phase the following procedures will be adhered to by the contractor in order to protect nearby watercourses from pollutants and general interference.

This section provides a toolbox to aid in proper implementation of water pollution control Best Management Practices (BMPs) on the construction site. This is organised into the following parts:

- **Part I**: Introduction briefly presents:

  (1) the principles of erosion and sediment control,

  (2) common storm water pollutants on the construction site, and

  (3) guidelines for implementing a proper monitoring and inspection program for the construction site, including the use of the Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Program (WPCP) to ensure an effective water pollution control program.

- **Part II**: Project Operations and BMPs:

  identifies typical water pollution control challenges for specific construction operations and the BMPs that are available to meet those challenges.

- **Part III**: BMP Implementation and Troubleshooting:

  provides guidance for installing, maintaining and troubleshooting selected BMPs

Best Management Practices (BMPs) refer to a variety of pollution prevention controls implemented throughout a project site at various times of the project. BMPs outlined here are specifically aimed to control pollution in stormwater runoff during the construction phase of a project.

The principal categories of potential pollutants can be broken down into:

- Sediment Control (SE)
- Tracking Control (TC)
- Non-Stormwater (NS)
- Waste and Materials Pollution Control (WM)

4.2 Principles of Erosion and Sediment Control

The greatest water pollution threat from soil-disturbing activities is the introduction of sediment from the construction site into storm drain systems or natural receiving waters. Soil-disturbing activities such as clearing, grubbing, and earthwork increase the exposure of soils to wind, rain, and concentrated flows that cause erosion. On this site there is further risk of contaminates from the existing imported fill material which will be exposed during the construction phase.

A three-pronged approach is necessary to combat this storm water threat:

- Temporary soil stabilisation practices reduce erosion associated with disturbed soil areas (DSAs).

- Temporary run-on control practices prevent storm water flows (sheet and concentrated) from contacting DSAs.
- Temporary sediment control practices reduce sediment caused by erosion from entering a storm drain system or receiving water.

Soil stabilisation BMPs reduce the erosive impact of rain on exposed soil. Run-on control practices reduce the erosive impacts by preventing storm water flows from contacting DSAs. Sediment control BMPs remove sediment from storm water by ponding and settling, and/or filtering prior to discharge offsite. It is imperative that soil stabilisation and sediment control BMPs are implemented together to reduce the discharge of sediment from the construction site.

The following conditions on construction sites contribute to erosion caused by storm water flows:

- Larger areas of impermeable structures and surfaces reduce natural infiltration resulting in increased storm water flow volume and velocity.
- Changes to surface flow patterns cause storm water flows to be more erosive.
- Concentration of flows to areas that are not naturally subjected to such runoff volume increases erosion.

Proper management of a construction project minimises or prevents soil erosion and sediment discharges. Good construction management for soil conservation requires an understanding of the following basic principles:

Soil Erosion Control – The First Line of Defence: Soil stabilisation is a key component in the control of erosion. By stabilising DSAs with covers or binders, the exposed soils are less likely to erode from the effects of wind or rain.

Prevent Storm Water Flows from Contacting DSAs - The Second Line of Defense: Another key component in the control of erosion is the diversion of storm water flows around DSAs or the conveyance of flows through DSAs in a non-erosive manner.

Sediment Control – The Last Line of Defence: Storm water runoff may originate from active or inactive DSAs whether or not proper erosion and/or run-on controls have been implemented. Implementing proper sediment control BMPs can reduce sediment amounts in storm water discharges.

Combine Soil Erosion and Sediment Control - Effective Protection: An effective combination of soil erosion and sediment controls should be implemented to prevent sediment from leaving the site and/or entering a storm water drainage system or receiving water.

Soil stabilisation and other erosion control BMPs are not 100 percent effective at preventing erosion. Soil erosion control BMPs must be supported by sediment control BMPs to capture sediment on the construction site.

Sediment control BMPs alone are not 100 percent effective primarily due to their capacity limits. To be effective for storm water protection, the amount of sediment must be reduced at the source using soil erosion control BMPs, and then sediment control BMPs are used to further reduce the sediment that leaves the site or enters the storm drain system.

Inspection and Maintenance – Ensure Protection for the Duration of the Project: Inspection and maintenance are required for all BMPs (soil stabilisation, run-on control, and sediment control) to maintain effectiveness for reducing or eliminating the amount of sediment that leaves a site.

4.3 Common Pollutants on the Construction Site

There are a number of potential storm water pollutants that are common to construction sites.

The soil-disturbing nature of construction activities and the use of a wide range of construction materials and equipment are the sources of contaminants with the potential to pollute storm water discharges. Common construction activities that increase the potential for polluting storm water with sediment include:

- Clearing and grubbing operations
- Demolition of existing structures
- Grading operations
- Soil importing and stockpiling operations
- Clear water diversions
- Landscaping operations
- Excavation operations

Common construction materials with the potential to contribute pollutants, other than sediment, to storm water include the following:

- Vehicle fluids, including oil, grease, petroleum, and coolants
- Asphalt concrete (AC) and Portland cement concrete (PCC) materials and wastes
- Joint seal materials and concrete curing compounds
- Paints, solvents, and thinners
- Wood products
- Metals and plated products
- Fertilisers, herbicides, and pesticides

Construction-related waste must also be managed to prevent its introduction into storm water. Typical waste on construction sites includes:

- Used vehicle fluids and batteries
- Wastewater from vehicle cleaning operations
- Green waste from vegetation removal
- Non-storm water from dewatering operations
- Trash from materials packaging, employee lunch/meal breaks, etc.
- Contaminated soils
- Slurries from sawing and grinding operations
- Wastewater/waste from concrete washout operations
- Hazardous materials waste
- Sanitary waste

4.4 Monitoring And Inspection Program

The Resident Engineer on site will be responsible for ensuring that all personnel monitor the contractor's water pollution control practices and maintain compliance with the approved project waste management plan. This includes reviewing the contractor's plan, reviewing written inspection reports, and conducting field inspections.

5.0 PROJECT OPERATIONS AND BMPs

5.1 Best Management Practices

Table 2 identifies individual BMPs that are applicable to specific construction operations. The BMPs listed in the table are for general consideration during each phase of construction. The indicated BMPs may not be applicable to every construction operation, nor is every possible BMP listed for each construction operation. The Resident Engineer shall determine the appropriateness of an individual BMP to the construction site.

Table 2 - Storm Water BMPs for Construction Operations

Construction Operation	BMPs
Mobilisation	TC-1 Stabilised Construction Entrance/Exit TC-2 Stabilised Construction Roadway TC-3 Entrance/Outlet Tire Wash
	WM-1 Material Delivery and Storage WM-2 Material Use WM-4 Spill Prevention and Control WM-5 Solid Waste Management WM-6 Hazardous Waste Management WM-9 Sanitary/Septic Waste Management
Clearing/Grubbing	SS-1 Scheduling SS-2 Preservation of Existing Vegetation SS-9 Earth Dikes/Drainage Swales & Lined Ditches SS-10 Outlet Protection/Velocity Dissipation Devices SS-11 Slope Drains
	WE-1 Wind Erosion Control
	NS-1 Water Conservation Practices NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	NS-1 Water Conservation Practices NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	WM-3 Stockpile Management WM-5 Solid Waste Management WM-7 Contaminated Soil Management
Earthwork	SS-2 Preservation of Existing Vegetation SS-9 Earth Dikes/Drainage Swales & Lined Ditches SS-10 Outlet Protection/Velocity Dissipation Devices SS-11 Slope Drains
	SC-1 Silt Fence SC-2 Desilting Basin SC-3 Sediment Trap SC-4 Check Dam SC-5 Fiber Rolls SC-6 Gravel Bag Berm SC-7 Street Sweeping and Vacuuming SC-8 Sandbag Barrier SC-9 Straw Bale Barrier

	SC-10 Storm Drain Inlet Protection
	TC-1 Stabilised Construction Entrance/Exit
	WE-1 Wind Erosion Control
	NS-4 Temporary Stream Crossing NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	WM-7 Contaminated Soil Management
PCC and AC Operations	SC-7 Street Sweeping and Vacuuming
	TC-1 Stabilised Construction Entrance/Exit
	NS-3 Paving and Grinding Operations
	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-5 Solid Waste Management WM-8 Concrete Waste Management
Dewatering Operations	NS-2 Dewatering Operations
Roadway Construction	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-5 Solid Waste Management WM-6 Hazardous Waste Management WM-8 Concrete Waste Management WM-10 Liquid Waste Management
Mobile Operations	SC-7 Street Sweeping and Vacuuming SC-10 Storm Drain Inlet Protection
	TC-1 Stabilised Construction Entrance/Exit
	NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-5 Solid Waste Management WM-6 Hazardous Waste Management WM-8 Concrete Waste Management
Trenching Operations	SC-7 Street Sweeping and Vacuuming SC-10 Storm Drain Inlet Protection
	WM-3 Stockpile Management

5.2 Best Management Practice Implementation

5.2.1 Temporary Soil Stabilisation

SS-2 PRESERVATION OF EXISTING VEGETATION

Preservation of existing vegetation involves the identification and protection of desired vegetation.

Applications

- Delineate Environmentally Sensitive Areas
- Delineate areas where no construction activities are planned
- Delineate areas where construction activities will occur at a later date
- Delineate areas outside the project right-of-way or boundary

Key Points

Timing: Areas to be protected should be delineated prior to clearing and grubbing operations or other soil disturbing activities. It is also appropriate for areas where no construction activity is planned or where activity is planned for a later date.

Layout: Areas of existing vegetation that are scheduled for preservation should be clearly marked with a temporary fence. Minimise disturbance by locating temporary roadways, storage facilities, and parking areas away from preserved vegetation.

Tree Preservation: Keep equipment away from trees to prevent root and trunk damage. Trenching should be as far away from tree trunks as possible, typically outside the drip line. Trenches should be filled in as soon as possible to avoid root drying. Fill trenches carefully and tamp the soil to fill in air pockets. Never expose roots to the air.

SS-9 EARTH DIKES, DRAINAGE SWALES & DITCHES

Earth dikes, drainage swales, and lined ditches are structures that intercept, divert, and convey surface runoff around or through the project site in a non-erosive manner.

Applications

- To convey surface runoff down sloping land
- Along paved surfaces to intercept runoff
- Along the top of slopes to divert surface flow from slopes
- To divert and direct runoff towards stabilised drainage systems
- Below steep grades where runoff begins to concentrate

Key Points

Sediment Control: It may be necessary to use other water pollution control practices such as check dams, plastic sheeting, or blankets to prevent scour and erosion in the swales, dikes, and ditches.

Flow Velocity: Select flow velocity for ditches, swales, and dikes based on careful evaluation of potential risk due to erosion, over topping, flow backup, washout, and drainage flow patterns for each project. In some cases the drainage swale may need to be constructed with asphalt concrete.

Location Selection: Care must be applied to correctly size and locate earth dikes, drainage swales, and lined ditches. Excessively steep, unlined dikes and swales may be subject to erosion and gully formation. Earth dikes, drainage swales and ditches are not suitable as sediment trapping devices.

Inspection and Maintenance: Inspect temporary measures prior to the rainy season, after rainfall events and regularly (approximately once every two weeks) during the rainy season. Inspect channels, embankments, and ditch beds for erosion, washout, and accumulation of sediment and debris. Repair or replace lost riprap, linings, or soil stabilisation as needed.

SS-10 OUTLET PROTECTION/VELOCITY DISSIPATION DEVICES

This BMP requires the placement of rock, riprap, or other material at pipe outlets to reduce flow velocity of exiting storm water and thus prevent scouring.

Applications

- Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels
- Outlets located at the bottom of mild to steep slopes
- Outlets subject to intense water flows
- Outlets that carry continuous flows of water Points where lined conveyances discharge to unlined conveyances.

Key Points

Riprap Selection:. The minimum riprap diameter is determined by the outlet diameter, discharge volume, and apron length. Outlets with slopes greater than 10% need additional protection. Flow rate and local climate may dictate whether loose rock or grouted riprap is appropriate. High flows may wash loose rock away. Grouted riprap may break up in areas of freeze and thaw.

Unprotected Outlets: Flows from unprotected pipe outlets can result in severe erosion. Use a flared end section or riprap at the outlet to reduce flow velocity and erosive potential of concentrated flows.

Installation: Carefully place riprap to prevent damage to underlying filter fabric. Where large riprap is used, the underlying filter fabric may need to be protected with a rock blanket.

Inspection and Maintenance: Inspect temporary velocity dissipation devices prior to the rainy season, after rainfall events and regularly (approximately once every two weeks) during the rainy season. Inspect aprons for riprap displacement or damage to underlying fabric. Inspect for scour beneath the riprap and around the outlets, and repair as needed.

SS-11 SLOPE DRAINS

A slope drain conveys water down a slope into a stabilised receiving water, trapping device, or stabilised area. Slope drains are used with lined ditches to convey surface flow away from slope areas to protect cut or fill slopes.

Applications

- Where concentrated flows are directed over a slope

Key Points

Limitations: Severe erosion may result if a slope drain fails due to over topping or pipe separation.

Drainage Constraints: Limit the area draining to a slope drain to 4 ha (10 ac) per pipe. Large areas may require the use of a rocklined channel or a series of pipes. The maximum slope gradient is generally limited to 1:2 (V:H), as the ability to dissipate water velocity from steeper slopes is difficult.

Installation: Install slope drains perpendicular to the slope contour. Compact the soil around and under the slope drain inlet, outlet, and along the length of the pipe. Protect the pipe inlet with filter fabric or flared end sections for pipes that are greater than 300mm (12 in) in diameter. Ensure that pipe connections are watertight. Securely anchor and stabilise the pipe and appurtenances into the soil.

Velocity Dissipation: Protect outlet with riprap or velocity dissipation devices. For high-velocity discharges, reinforce riprap with concrete or reinforced concrete devices. It may be necessary to capture discharge and allow sediment to settle out.

Inspection and Maintenance: Inspect before and after each rain event and twice monthly until the tributary drainage area has been stabilised. Inspect outlets for erosion and downstream scour. In the event of scour, reduce the flows going into the channel unless other preventive measures can be implemented.

5.2.2 Temporary Sediment Control

SC-1 SILT FENCE

Silt fence is a temporary linear barrier that captures sediment by ponding and filtering storm water runoff to allow sediment to settle out of the runoff water.

Application

- Below the toe of slopes as required
- Down slope of exposed soil areas
- Around temporary stockpiles as required

Key Points

Installation: Install on a relatively level contour. This means the barrier should be installed as close as possible to a level horizontal plane near the toe of the slope. Turn the end of the barrier up the slope to prevent ponded water from escaping around the end.

Setback: A silt fence should be placed with a setback of at least 1m. Where a 1m setback is not practicable due to site conditions, the fence may be constructed at the toe of slope but should be placed as far from the toe as practicable to increase the ponding area and allow sediment to settle out.

Key In: The bottom of the silt fence must be keyed in or water may flow underneath. A trench should be excavated along the proposed layout line of the fence. After the silt fence stakes have been driven into the trench, backfill over the fence fabric and compact.

Cross Barriers: For silt fence installed on a level contour with long reaches, install cross barriers at a minimum of 150m intervals. For silt fence not installed on a level contour, install cross barriers, at a minimum, where the change in elevation equals 1/3 the height of the silt fence.

Limitations: Do not install silt fence across intermittent or permanent streams, channels, or any location where concentrated flow is anticipated.

Inspection and Maintenance: Perform inspection before and after rain events, every 24 hours during extended rain events, and weekly throughout the rainy season. Should silt fence fabric tear or decompose, replace immediately. Remove sediment deposits when the sediment accumulation reaches 1/3 of the barrier height.

SC-2 DESILTING BASIN

A desilting basin is a temporary basin formed by excavation and/or construction of an embankment so that storm water runoff is temporarily detained, allowing sediment to settle out before the water is discharged.

Applications

- Where storm water can enter a drainage system or receiving water from a construction area
- At outlets of DSAs between 2 and 4 ha (5 and 10 ac) in size.

Key Points

Capacity: Desilting basins shall be designed to have a capacity of 100m3 of storage for every 1 ha (55 yd3 per acre) of contributory area. Basin storage capacity is measured from the top of the basin to the principal outlet. Basins must be designed to drain within 72 hours following storm events.

Configuration: The basin inlet shall be located to maximise travel distance to the basin outlet. The outlet structure should be placed as far away from the inlet structure as possible to maximise travel distance and allow suspended sediment to settle out.

Basin Dimensions: The length of the basin shall be more than twice the width of the basin. Basin depth must not be less than one 1m or greater than 1.5. Check the approved SWPPP for actual dimensions.

Limitations: Basins generally require excavation of large surface areas so that sediment will settle out efficiently. The availability of right-of-way may limit basin size or deployment on construction sites. Basins may not be located in live streams. Basins may require protective fencing to ensure safety.

Inspection and Maintenance: Inspect basins before and after rainfall events, weekly during the rainy season, and at 24 hours intervals during extended storm events. Check inlet and outlet structures and spillways for signs of erosion, damage, or obstructions. Examine basin banks for seepage and structural soundness. Remove accumulated sediment when the basin storage capacity is 1/3 full.

SC-3 SEDIMENT TRAP

A sediment trap is a temporary basin formed by excavation or by construction of an earthen embankment across a waterway or low drainage area and has a controlled release structure.

Applications

- Permissible where contributing area is less than 2 ha (5 ac)
- Sites where storm water can enter a storm drain or receiving water from a construction area
- As a supplemental control for reducing sediment before it enters a drainage system or receiving water

Key Points

Location Traps: should be excavated in a suitable area or by constructing a low embankment across a swale where failure would not pose a risk to life or property. Traps should provide access for maintenance, including sediment removal.

Configuration: The trap inlet shall be located as far away from the trap outlet to maximise travel distance and allow suspended sediment to settle out.

Dimensions: The length of the trap shall be more than three times the width.

Limitations: Traps generally require excavation of large surface areas to permit settling of sediment. The availability of right-of-way may limit their size or deployment on construction sites. Sediment traps should be limited to drainage areas of 2 ha (5 ac) or less. Traps may not be located in live streams. Traps may require protective fencing to ensure safety.

Inspection and Maintenance: Traps should be inspected before and after rainfall events, weekly during the rainy season, and at 24-hour intervals during extended storm events. Check inlet and outlet structures and spillways for signs of erosion, damage, or obstructions. Examine trap banks for seepage and structural soundness. Remove accumulated sediment when the trap storage capacity is 1/3 full.

SC-4 CHECK DAM

A check dam is a small structure constructed of rock or gravel bags placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment to settle out.

Applications

- In small open channels that drain 4 ha (10 ac) or less
- In steep channels where storm water runoff velocities exceed 1.5 m/s
- In drainage ditches or channels in which grass linings are being established
- In temporary ditches where a short-term service does not warrant establishment of erosion resistant linings
- In combination with other BMPs such as sediment basins and traps

Key Points

Installation: Install check dams 5m from the outfall device and at regular intervals along the channel based on the erosion characteristics and slope degree of the drainage swale. Swales that are very steep or have a high potential of eroding require check dams placed closer together.

Dimensions: Check dams should be placed at a height and distance as to allow small pools to form behind them but allow high velocity flows (typically a 2-year storm or larger) to safely flow over them without an increase in upstream flooding or damage to the check dam. Check dams should be constructed to pond runoff flows so that the backwater from the downstream check dam reaches the toe of the upstream dam.

Limitations: Check dams should not be placed in live streams or in channels that are already grass-lined unless erosion is expected, as existing vegetation may be damaged. Check dams are not appropriate in channels that drain areas greater than 4 ha (10 ac).

Inspection and Maintenance: Check dams require extensive maintenance after storm events or high velocity flows to repair damage. Remove sediment when it reaches 1/3 the check dam height.

SC-5 FIBER ROLLS

A fibre roll consists of straw, flax, or similar material that is rolled and bound into a tight tubular cylinder and placed at regular intervals on a slope face. Fibre rolls intercept runoff, reduce runoff flow velocity, and release the runoff as sheet flow. Fibre rolls are also used as a filter to remove sediment from runoff.

Applications

- Along the top, face, and at grade breaks of exposed and erodible slopes

Key Points

Installation: Proper fibre roll installation is crucial to ensure effectiveness and performance. Fibre rolls should be placed on a level contour in a shallow trench with a maximum depth of 50mm to 100mm. The fibre roll should be staked at each end and at regular intervals along its length with a maximum distance of 1.2m between stakes. If more than one fibre roll is placed in a row, the ends of the adjoining rolls should be tightly abutted together and not overlapped.

Vertical Spacing: When used to create storm water benches on a slope, the vertical spacing of the fibre rolls rows is determined by the inclination and length of the slope. For slopes 1:2 (V:H) and steeper and 15m and greater, fibre rolls shall be placed at intervals no greater than 7.5m. For slopes between 1:20 (V:H) and 1:2 (V:H) and 30m and greater, fibre rolls shall be placed at intervals no greater than 15m.

Sediment Control: Fibre rolls are acceptable for use as sediment control and may be used in conjunction with other soil stabilisation methods (soil binders, mulches, etc.) and/or other sediment controls.

Removal: Fibre rolls are typically left in place. If they are removed, dispose of the accumulated sediment and fill in trenches, holes, or depressions to blend in with adjacent ground contours.

Inspection and Maintenance: Inspect fibre rolls prior to and after rain events, and at least daily during prolonged rainfall. Maintenance includes replacing slumping rolls, removing accumulated sediment, and filling in rills. If fibre rolls split, tear, unravel, or become ineffective, replace them immediately.

SC-6 GRAVEL BAG BERM

A gravel bag berm consists of a single row of gravel bags that are installed end-to-end to form a barrier across a slope to intercept runoff, reduce runoff velocity, release runoff as sheet flow, and provide some sediment removal.

Applications

- Along the top, face, and at grade breaks of exposed and erodible slopes.

Key Points

Installation: Proper gravel bag berm installation is crucial to ensure its effectiveness and performance. Gravel bag berms should be placed on a level contour along the slope. Gravel bags should be tightly abutted together and not overlapped.

Bag Design: Bags should be made of a woven polypropylene, polyethylene or polyamide fabric, or burlap material. When full, a bag should be 450mm long, 300mm wide, and 75mm thick, with a mass of approximately 15kg. Bag dimensions are standardised but may vary based on locally available materials. Alternative bag sizes shall be submitted to the Resident Engineer for approval prior to deployment. Fill material shall be 13mm to 25mm (1/2 in to 1 in) class 2 aggregate base that is clean and free from clay and undesirable materials.

Sediment Control: Although gravel bag berms remove some sediment, they should not be used in place of linear sediment barriers.

Limitations: Gravel bags are sensitive to ultraviolet light resulting in a limited durability that may make them unsuitable for long-term projects. Gravel bag berms are labour intensive. Installation, removal, and maintenance costs should be evaluated when considering this BMP.

Inspection and Maintenance: Inspect gravel bag berms weekly and prior to and after rainfall events during the rainy season. Repair or replace broken or ripped bags, and reshape as necessary. Remove accumulated sediment when it reaches 1/3 the height of the berm. Repair washouts and rills as needed.

SC-7 STREET SWEEPING AND VACUUMING

Street sweeping and vacuuming are practices to remove tracked sediment from public roads in order to prevent sediment and dirt from entering storm drains or receiving waters. Areas of concern include ingress and egress points, portions of roadway within the project limits adjacent to a freeway or other public road, and any other paved surface within project limits that is to remain after construction is complete.

Applications

- Where sediment is tracked onto public or private roadways from the project site

Key Points

Sweepers: Sweepers should have vacuum or other mechanical attachments for collecting dirt and sediment. Adjust brooms regularly to maximise efficiency of sweeping operations. Never use kick brooms or sweeper attachments for the implementation of this BMP.

Inspection: Inspect project ingress and egress points and roadways daily for signs of tracked sediment.

Sweeping Waste Disposal: After sweeping is finished, properly dispose of sweeper waste. Sweeper waste that includes trash and debris should be disposed of at an approved dumpsite. For collected sediment that is free of trash and debris, consider incorporating the sediment back into the project's earthwork operations.

Site Entrances and Exit: Designate a limited number of centralised ingress/egress locations for the site and instruct construction personnel to use only those locations for entering/exiting the project.

SC-8 SANDBAG BARRIER

A sandbag barrier is a temporary linear sediment barrier constructed of stacked sandbags. This type of barrier is designed to intercept and slow storm water sheet flow runoff. Sandbag barriers allow sediment in runoff to settle before the water leaves the construction site. Sandbag barriers can also be used to divert and detain moderately concentrated flows associated with ditches, swales, and storm drain inlets.

Applications

- Along the perimeter of a site
- Below the toe of slopes as required
- Down slope of exposed soil areas
- Around temporary stockpiles as required
- Parallel to a roadway to keep sediment from paved areas
- To divert or direct flow

Key Points

Installation: When used as a linear sediment barrier for slopes, sandbags should be placed along a level contour with the end of each row turned up-slope to prevent flow around the ends. Due to the limited sediment holding capacity behind the bags, they should be used in conjunction with other erosion source controls such as soil binders, covers, and/or mulches to provide effective control.

Setback: A sandbag barrier should be placed with a setback of at least 1m. Where a 1m setback is not practicable due to site conditions, the barrier may be constructed at the toe of slope but should be placed as far from the toe as practicable to increase the ponding area and allow sediment to settle out.

Configuration: Sandbags should be stacked in a pyramid formation. To do this, the base of the barrier should be the widest, with the width decreasing with each higher row. The joints between bags should be staggered for each row.

Cross Barriers: For sandbag barriers not on a level contour and for longer reaches, install cross barriers at a minimum of 150m intervals to prevent concentrated flow.

Limitations: Sandbag materials are sensitive to ultraviolet light resulting in a limited durability that may make them unsuitable for long-term projects. Sandbag barriers are labour intensive. Installation, removal, and maintenance costs should be evaluated when considering this BMP.

Inspection and Maintenance: Inspect sandbag barriers weekly and prior to and after rainfall events during the rainy season. Repair or replace broken or ripped bags, and reshape as necessary. Remove accumulated sediment when it reaches 1/3 the barrier height. Repair washouts and rills as needed. When no longer needed, remove the barrier and accumulated sediment then clean, re-grade, and stabilise the area.

SC-9 STRAW BALE BARRIER

A straw bale barrier is a temporary linear sediment barrier constructed of straw bales. This type of barrier is designed to intercept and slow storm water runoff. Straw bale barriers allow sediment in runoff to settle before water leaves the construction site.

Applications

- Along the perimeter of a site
- Below the toe of slopes as required
- Down slope of exposed soil areas
- Around temporary stockpiles as required

Key Points

Installation: When used as a linear sediment barrier for slopes, straw bales should be placed along a level contour with the end of each row turned up-slope to prevent flow around the ends. Bales should be installed in a shallow trench with ends tightly abutted together.

Setback: Straw bales placed at the toe of slopes should be set back at least 1m from the toe. Where a 1m setback is not practicable due to site conditions, the barrier may be constructed at the toe of the slope but should be placed as far from the toe as practicable to increase the ponding area and allow sediment to settle out.

Configuration: Straw bales should be placed in two rows back to back with a half-bale offset to cover the butted ends of the bales. Key Point #4 – Cross Barriers For straw bale barriers not on a level contour and for longer reaches, install cross barriers at a minimum of 150m intervals to prevent concentrated flow.

Application Limitations: Straw bale barriers should not be used in areas subject to highly concentrated flows such as channels or live streams as they may be easily overtaken or washed away. Straw bale barriers should not be used on paved surfaces, in lined ditches, or for drain inlet protection. Consider using sandbag barriers instead.

Durability Limitations: Straw bales fall apart when removed or degrade when left in place for extended periods. They can be labour intensive to install, remove, and maintain.

Inspection and Maintenance: Inspect straw bale barriers weekly and prior to and after rainfall events during the rainy season. Repair or replace broken or damaged bales as necessary. Remove accumulated sediment when it reaches 1/3 the barrier height. Repair washouts or other damage as needed or required. When no longer needed, remove barrier and accumulated sediment then clean, re-grade, and stabilise the area.

SC-10 STORM DRAIN INLET PROTECTION

Storm drain inlet protection is a practice to reduce sediment from storm water runoff discharging from the construction site prior to entering the storm drain system. Effective storm drain inlet protection allows sediment to settle out of water or filters sediment from the water before it enters the drain inlet. Storm drain inlet protection is the last line of sediment control defence prior to storm water leaving the construction site.

Applications

- Where storm water surface runoff can enter a drain inlet
- Where disturbed drainage areas have not yet been permanently stabilised
- Where ponding will not encroach into traffic
- Where the drainage area is 4 ha (10 ac) or less

Key Points

Identify Drain Inlets: Identify existing and/or planned storm drain inlets that have the potential to receive storm water runoff and discharge from the construction site. For those drain inlets that are to be protected, determine the most effective method to use. Consider drain inlet protection for active inlets that are downstream of DSAs.

Sandbag Barriers: A sandbag barrier is the most common type of protection due to the flexibility of its use. Sandbag barriers are constructed by placing the bags around the inlet to create a holding area that allows suspended sediment to settle.

Filter Fence: A filter fabric fence is effective in open areas where sheet flows are low and are not expected to exceed 0.14m^3/s. Filter fabric fences are installed similarly to silt fences but are constructed to surround the inlet to create an enclosure. Use plastic sheeting or geotextile blankets to stabilise any DSAs within the enclosure to prevent sediment within the enclosed area from entering the inlet.

Sediment Traps: Excavated drop inlet sediment traps are typically used where relatively heavy flows are expected and overflow capacity is needed. A drain inlet sediment trap is constructed by excavating the soils surrounding the inlet to create a temporary trap that detains flows and allows suspended sediments to settle before storm water is discharged from the site.

Inspection: Inspect all inlet protection devices before and after storm events, at 24 hour intervals during extended storms, and weekly during the rest of the rainy season. Check storm drain inlet after several storms to determine if sediment is bypassing inlet protection devices.

Maintenance: Maintenance is critical to ensure that drain inlet protection remains functional. Remove accumulated sediment when it reaches 1/3 the barrier height or 1/3 the holding capacity. For barriers, replace broken or torn bags. For fences, repair/replace fencing material and re-stake fences that are damaged.

5.2.3 Wind Erosion Control

WE-1 WIND EROSION CONTROL

Wind erosion control consists of applying water or other dust palliatives to prevent or alleviate dust nuisance. Dust control shall be applied in accordance with Caltrans standard practices.

Applications

- On all exposed soils that are subject to wind erosion

Key Points

Dust Control Operation: Care should be taken when applying water or palliative to prevent the washing of sediment offsite or into storm drains or receiving waters. Do not apply so much that runoff occurs.

Stockpile and Small Area Management: Cover small stockpiles or small DSAs as an alternative to applying water or dust palliative.

Palliative Application Rates: When applying palliatives or binders as a wind erosion control, refer to the manufacturer's recommendations for guidance.

5.2.4 Tracking Control

TC-1 STABILISED CONSTRUCTION ENTRANCE/EXIT

Stabilised construction access is a defined point of entrance/exit to a construction site that is stabilised to reduce the tracking of sediment (mud and dirt) onto public roads by construction vehicles. Stabilised construction entrances are an effective method for reducing tracking of sediment from the construction site.

Applications

- As a preventive method instead of a treatment method (e.g., sweeping or dust control)
- Where dirt or mud can be tracked onto public roads
- Adjacent to water bodies
- Where poor soils are encountered

Key Points

Design: Site conditions may dictate the design and need for access points. Design a stabilised construction entrance/exit to support the heaviest vehicles and equipment that will use it. The access point should be at least 15m in length or four times the circumference of the largest construction vehicle tire, whichever is greater. Designate access points and require all employees, subcontractors, and others to use them.

Grading: Grade construction entrance/exit points to prevent runoff from leaving the construction site. Route runoff from entrances/exits through a sediment-trapping device before discharge.

Aggregate Characteristics: Stabilise the roadway with aggregate, AC, or PCC, depending on expected usage and site conditions. When access points are constructed from aggregate, aggregate should be 75mm to 150mm in diameter and at least 300mm in depth. Place aggregate over a geotextile fabric.

Alternative Stabilisation Methods: Alternative stabilisation methods such as manufactured steel plates or steel pipes/gratings require written approval of the Resident Engineer. The use of cold mix asphalt or AC grindings is not allowed.

Inspection and Maintenance: Inspect and maintain stabilised construction entrance/exit points. Routinely check for damage and effectiveness. Remove accumulated sediment and/or replace stabilisation material as needed.

TC-2 STABILISED CONSTRUCTION ROADWAY

A stabilised construction roadway is a temporary access road that connects existing public roads to remote construction areas. For storm water protection, it should be designed to control dust and erosion created by vehicular traffic.

Applications

- Where displacement of soil occurs because of vehicular traffic during wet weather
- Where dust control is a problem during dry weather
- Adjacent to water bodies
- Where poor soils are encountered

Key Points

Design Site: conditions may dictate the design and need for stabilised construction roadways. Design the roadway to support the heaviest vehicles and equipment that will use it. Grade the roadway to prevent runoff from leaving the construction site. This may require the construction of a drainage ditch to collect and convey runoff.

Stabilisation Materials: Stabilise the roadway with aggregate, AC, or concrete, depending on expected usage and site conditions. Aggregate diameter should be between 75mm and 150mm and at least 300mm in depth. Place aggregate over a geotextile fabric. The use of cold mix asphalt or AC grindings is not allowed.

Inspection and Maintenance: Inspect and maintain the stabilised construction roadway routinely. Re-grade the roadway as necessary. Check for damage and repair as necessary or as directed by the Resident Engineer.

5.2.5 Non-Storm Water Management

NS-1 WATER CONSERVATION

Water conservation involves the use of practices that reduce the amount of water used for a given activity. If less water is used, the potential for erosion decreases and the transport of construction-related pollutants offsite is less likely.

Applications

- On all projects where water is used during the course of construction

Key Points

Watering Equipment: Watering equipment should be kept in good working order. Repair leaky watering equipment promptly.

Equipment Washing: Discourage the washing of vehicles and equipment on the construction site. Workers should never wash their personal vehicles on site. Vehicles and equipment that regularly leave the construction site should be washed offsite.

Paved Areas: Paved areas should be swept and vacuumed rather than washed off. Always protect storm drain inlets or receiving waters from sediment or other pollutants susceptible to non-storm water run-off. When possible, direct runoff water to areas where it can percolate into the ground.

Dust Control: When watering for dust control, ensure that watering operations do not cause erosion.

NS-2 DEWATERING OPERATIONS

This BMP is intended to prevent the discharge of pollutants from construction site dewatering operations associated with storm water (accumulated rain) and non-storm water (groundwater, water from a diversion or cofferdam, etc.). Dewatering effluent that is discharged from the construction site to a storm drain or receiving water is subject to the requirements of the applicable Local Authority Environmental Department requirements.

Applications

- On all projects where the discharge of water is to occur by mechanical means

Key Points

Management Alternatives: If possible, the contractor should consider managing dewatering without discharge to a storm drain or receiving water. Options include:

(1) Retaining the water on site for construction use or allowing water to evaporate/infiltrate,

(2) Discharging to the storm sewer with permission from the local authority;

(3) Discharging to an adjacent land or facility with permission of the owner, and

(4) Having the effluent transported and disposed of offsite using a licensed Transportation, Storage & Disposal contractor. If one of these management options is used, the water is not discharged to a storm drain or receiving water.

Local Authority Notification: If on-site management of the dewatering operation is not the selected option, contact the Local Authority before the dewatering operation commences.

Dewatering uncontaminated storm water and minor discharges of non-storm water can be discharged to a storm drain or receiving water. If the effluent is not visibly clear, it must be treated to remove sediment prior to discharge. All records related to the dewatering operation must be maintained with the project safety file and provided to the Local Authority upon request.

NS-3 PAVING AND GRINDING OPERATIONS

Paving and Grinding Operations include the handling of materials and wastes and the use of equipment associated with pavement preparation, paving, grinding, removal, surfacing, resurfacing, thermoplastic striping, and placing pavement markers.

Application

- During pavement grinding and removal
- During PCC paving
- During AC paving and resurfacing
- During placement of thermoplastic striping and pavement markers

Key Points

Asphalt Concrete (AC): Remove or dispose of grindings and wastes as work progresses. Place AC pieces in embankments above the water table and cover with plastic until they are removed from the site. Remove wastes from the site immediately.

AC Equipment: Coat AC equipment with non-toxic non-foaming products. Clean equipment offsite whenever possible. When paving equipment is kept onsite, place paving equipment on plastic sheeting to capture drips or leaks. Dispose of hardened AC properly.

Wastes: Do not allow wastes, such as AC pieces, PCC grinding residue/slurry, sand/gravel, exposed aggregate concrete residue, or dig-out materials into storm drains or receiving waters. Sweep, vacuum, and collect such wastes and recycle or dispose of properly.

Seal Coats: Do not apply seal coat, tack coat, slurry seal, or fog seal if rain is predicted during the application or curing period. Do not conduct dig out operations in the rain. During application of seal coat, tack coat, slurry seal, or fog seal, cover drainage inlets and manhole covers with filter fabrics. Do not apply these materials in the rain.

Thermoplastic Striping: Verify that equipment shut-off valves function properly to avoid thermoplastic leakage. Do not pre-heat, transfer, or load thermoplastic near storm drains or receiving waters. When filling the pre-heater, leave 150mm of space at the top of the container to prevent spills when the equipment is moved. Clean truck beds daily and recycle thermoplastic material when possible.

Raised/Recessed Pavement Markers: Do not transfer or load bituminous materials near storm drains or receiving waters. Verify that all pressure is released before filling melting tank. When filling the melting tank, leave 150mm of space at the top of the container to prevent spills when the equipment is moved.

NS-4 TEMPORARY STREAM CROSSING

A temporary stream crossing is a structure placed across a waterway that allows construction traffic to cross without contacting the water. Typical types include culvert crossings, ford crossings, and bridge crossings. Temporary stream crossings prevent streambed erosion and downstream sedimentation due to construction traffic.

Applications

- Where appropriate permits have been secured
- Where construction equipment or vehicles must cross a waterway

Key Points

Permits: Verify that applicable permits have been obtained before the stream crossing is installed. Verify that applicable pre-installation water sampling/testing has been completed before, and possibly during, installation.

Design: Verify that the structure design has been prepared under the direction of and approval of a registered civil and/or structural engineer. The structure should not constrict waterway flow such that backups or washouts occur during flood events. Culverts are acceptable for perennial or intermittent streams and can accommodate heavy equipment loads.

Installation: Construct crossings during the dry season. Stabilise adjacent construction roadways, work areas, and streambeds to prevent erosion. Minimise disturbance or removal of adjacent vegetation. If riparian vegetation is disturbed for construction of the stream crossing, the vegetation should be cut no lower than ground level and covered with a layer of clean river cobble.

Use: Vehicles are not to be operated, stored, fuelled, or maintained in wet or dry portions of a waterway without authorisation of the Resident Engineer or as authorised by the Local Authority. Drip pans must be placed under all vehicles/equipment on temporary stream crossing structures that remain idle for more than one hour. Being in such close proximity to a watercourse, this BMP, and others implemented with it, must be installed correctly and maintained to prevent any discharge. Any incident of discharge requires submittal of a Notice of Non-Compliance.

Inspection and Maintenance: Inspect temporary stream crossings weekly and after significant rain events for water flow blockage, sediment buildup, trapped debris, structural damage, riprap displacement, or streambed erosion. Verify that sediment buildup is removed regularly and that riprap/aggregate is replaced as needed to prevent erosion and maintain stability of adjacent areas.

Removal: Ensure that temporary stream crossings are removed promptly when no longer needed. Remove river cobble from disturbed riparian vegetation to ensure rapid re-growth.

NS-5 CLEAR WATER DIVERSION

A clear water diversion is a system of structures that intercepts surface water from a running stream or waterway upstream of a project, transports it around the construction site, and discharges it downstream of the site, with minimal water quality impacts. Typical structures used for clear water diversions include diversion ditches, berms, dykes, slope drains, cofferdams, pipes, and drainage and interceptor swales.

Applications

- Where appropriate permits have been secured
- Where work must be performed in an active drainage system, a running stream, or a water body

Key Points

Permits: Verify that applicable permits have been obtained before the diversion is installed.

During Design: The structure should not constrict waterway flow such that backups or washouts occur due to fluctuations in water depth or flow volume. Materials used to construct diversion structures must be free of potential pollutants such as soil, silt, sand, clay, grease, or oil. At all times during construction, operation, maintenance, and removal, sufficient water flow/volume must be diverted to maintain downstream aquatic life.

During Construction: When possible, construct diversion structures during periods of low or no stream flow. Minimise disturbance and removal of adjacent vegetation. If riparian vegetation is disturbed for construction of the diversion, the vegetation should be cut no lower than ground level and covered with a layer of clean river cobble. The exterior of vehicles and equipment in wet areas of the diversion construction site should be free of petroleum residues and sealed so as to prevent leakage of fuels and oils into the water body if submerged. Only the bucket of an excavator/backhoe may operate in a water body. The main body of the equipment is not to enter the water portions of the water body except to cross the stream to access the work site.

Operation: Barriers should be installed to prevent muddy water from flowing from adjacent construction activity to the stream. Drip pans must be placed under all stationary equipment and vehicles located over water diversions that remain idle for more than one hour. Being in such close proximity to a watercourse, this BMP, and others implemented with it, must be installed correctly and maintained to prevent any discharge. Any incident of discharge requires submittal of a Notice of Non-Compliance.

Inspection and Maintenance: Inspect diversion structures weekly and after significant rain events for damaged linings, sediment buildup, trapped debris, or reduced slope protection. Ensure that debris is removed and linings are repaired promptly.

NS-7 POTABLE WATER/IRRIGATION

Non-storm water discharges that originate from onsite and offsite sources must be properly managed to reduce the potential for pollutants being discharged from the construction site. Sources of these non-storm waters include broken water lines, landscape irrigation, lawn watering, water line flushing, and fire hydrant flushing.

Applications

- All projects susceptible to the above-listed and other non-storm water discharges from the construction site

Key Points

Divert Flows: Where possible, direct potable/irrigation water originating from offsite sources around the construction site or through the site in a way that minimises contact with construction activities.

Onsite Irrigation: Inspect irrigated areas on the construction site for excessive watering. Adjust watering schedules to ensure landscaping receives adequate water but minimises associated runoff. Promptly shut off water to broken lines, sprinklers, or valves and repair as needed.

Water Conservation: Reuse water from line flushing for landscape irrigation.

NS-8 VEHICLE AND EQUIPMENT CLEANING

Wash water from vehicle and equipment cleaning is not to be discharged from construction sites because the rinse water may contain contaminates such as sediment, petroleum/lubricant residues, soaps, or solvents that could enter storm drain systems or receiving waters.

Applications

- All construction sites

Key Points

Offsite Cleaning: Equipment/vehicle cleaning should be conducted offsite. All vehicles that regularly enter and leave the construction site must be cleaned offsite.

Onsite Cleaning: For equipment that must be cleaned on site, the Site Manager must be notified in advance. All waste from onsite cleaning operations must be fully contained and disposed of on site and not allowed to discharge into the public sewers or onto the public road.

Wash Area Requirements: The vehicle wash area must be properly identified by sign and located away from storm drain inlets, drainage facilities, and watercourses. It must be paved with concrete or asphalt and have a berm to contain runoff and prevent run-on. It must be equipped with a sump for the collection and disposal of wash water.

Water Conservation: Use as little water as possible and use a positive shut-off valve to conserve on water usage.

NS-9 VEHICLE AND EQUIPMENT FUELLING

Potential fuel spills and leaks from vehicle/equipment fuelling operations must be prevented from entering storm drain systems or receiving waters.

Applications

- All construction sites

Key Points

Fuel Offsite: All vehicles and equipment that regularly enter and leave the construction site should be fuelled offsite.

Fuelling Area Location: Designated fuelling areas are selected by the contractor and approved by the Resident Engineer. The fuelling area should be on level grade and must be at least 15m downstream of storm drain facilities or receiving waters. The fuelling area should be protected by a berm or dike to prevent storm water run-on and to prevent storm water from leaving the fuelling area.

Spill Response: Absorbent spill clean-up materials and spill kits must be available in fuelling areas and on fuelling trucks. Spills should be cleaned up immediately. Absorbent materials should be used on small spills. All used absorbent materials must be disposed of properly.

Leak Containment: Drip pans or absorbent pads must be placed under vehicles/equipment if being fuelled in areas other than a dedicated fuelling area with an impermeable surface.

Fuelling Guidelines: Fuelling operations are not to be left unattended. Fuel tanks are not to be topped off. Mobile fuelling trucks must also follow BMP guidelines.

Fuel Nozzles: Fuel nozzles are to be equipped with automatic shut-off to control drips. Where required by Air Quality Management Districts, vapour recovery nozzles shall be used.

NS-10 VEHICLE AND EQUIPMENT MAINTENANCE

Petroleum products, lubricants, solvents, and other pollutants related to vehicle/equipment maintenance must be prevented from entering storm drain systems or receiving waters.

Applications

- All construction sites

Key Points

Offsite: Storage and Maintenance All vehicles and equipment that regularly enter and leave the construction site should be maintained offsite.

Maintenance Area Design: Designated vehicle maintenance areas must be at least 15m downstream of storm drain facilities or receiving waters. For long-term projects, a portable tent or cover over the maintenance area is recommended.

Maintenance Operations: For maintenance involving fluids, place drip pans or absorbent pads under the vehicle unless the work is being done in a dedicated maintenance area constructed over an impermeable surface.

Spill Prevention/Cleanup: All fluid and oil leaks must be cleaned up immediately. The maintenance area must be equipped with appropriate absorbent spill clean-up materials.

Waste Disposal: All used absorbents must be disposed of properly. Waste fluids must be placed in appropriate leak-free containers with secondary containment. All used maintenance materials should be disposed of properly off the construction site. Used fluids, tires, batteries, etc. are not to be dumped or buried on the construction site.

NS-11 PILE DRIVING OPERATIONS

Proper control and use of equipment, materials, and waste products from pile driving operations will reduce the discharge of potential pollutants to the storm drain system or watercourses.

Applications

- All construction sites near or adjacent to a watercourse or groundwater where permanent and temporary pile driving operations take place.

Key Points

Be Prepared: Use drip pans or absorbent pads at all times. However, the equipment should be as leak-free as possible. Have spill kits and clean-up materials available at all pile driving locations. Implement other BMPs as applicable.

Equipment Use: Park equipment over plastic sheeting or equivalent. Plastic sheeting is not a substitute for drop pans or absorbent pads. Use less hazardous products, e.g. vegetable oil, when practicable.

Equipment Storage: Store pile driving equipment away from flow lines, drainage courses, and inlets. Protect hammers and other hydraulic attachments from run-on by placing them on plywood. Cover them with plastic when rain is forecast.

Inspection and Maintenance: Inspect entire pile driving areas and equipment for leaks and spills on a daily basis. Inspect equipment routinely for damage and repair equipment as needed.

NS-12 CONCRETE CURING

Following proper procedures in the use of cure, chemical or water, during construction of concrete structures will minimise pollution through run-off.

Applications

- All construction sites where concrete structures are subject to curing requirements.

Key Points

Use of Chemical Cure: Protect drain inlets prior to application of cure. Use proper storage and handling techniques at all times and have spill kits available at the location of curing. .Avoid over-spraying cure, allowing it to become airborne.

Use of Water Cure: Ensure cure water does not flow to inlets or watercourses but rather to collection areas for infiltration or other means of removal approved by the RE and in accordance with all applicable permits.

Inspection and Maintenance: Ensure that cure is stored, handled, and used properly. Ensure that the Contractor keeps cure containers leak-free and spray nozzles clean.

NS-13 MATERIAL AND EQUIPMENT USE ON WATER

Following proper procedures in the use, storage, and disposal of materials and equipment on barges, boats, docks, temporary construction pads, or similar location will minimise or eliminate the discharge of potential pollutants to a watercourse.

Applications

- All sites where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse.

Key Points

Be Prepared: Use drip pans and absorbent materials under equipment and vehicles expected to be idle more than one hour. Ensure that an adequate supply of spill clean-up materials is available. Identify types of spill control measures to be employed, including the storage of necessary clean-up materials and equipment.

Be Aware: Ensure NS-10 is implemented. If repairs cannot be made, remove the equipment from over the water. Ensure compliance with all other permits associated with the project.

Secure the Area: Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc. Secure all materials to prevent discharge to the watercourse via wind.

Inspection and Maintenance: Ensure timely and proper removal of accumulated waste. Inspect equipment for leaks and spills on a daily basis and ensure necessary repairs are done. Ensure proper procedures of storage and use of materials and equipment are being followed. Inspect and maintain all associated BMPs and perimeter controls to ensure continuous protection of the watercourse.

NS-14 CONCRETE FINISHING

Following proper procedures in performing concrete finishing methods will minimise the impact of potential pollutants on runoff.

Applications

- All sites where concrete finishing operations are performed.

Key Points

Containment: Ensure containment of all waste materials from high-pressure water blasting, sandblasting, grinding, etc. Without containment or water suppression of particles, these operations can become problems.

Disposal: Refer to NS-2, “Dewatering” and the Dewatering Manual for options. Ensure disposal method is approved by the RE and is in compliance with applicable permits in advance of disposal.

Secure the Area: Protect all inlets that may be affected by any concrete finishing work. Direct any water, through none rodible methods, to collection areas for infiltration or other disposal means.

Inspection and Maintenance: Inspect containment structures prior to use, during use, and prior to rainfall. If any repairs are required, ensure these are done in a timely manner and especially before a rain event. After use or at the end of the shift, ensure containment structures and general work area are clean and the wastes are disposed of properly.

NS-15 STRUCTURE DEMOLITION/REMOVAL OVER OR ADJACENT TO WATER

Following proper procedures during structure demolition or removal operations will protect watercourses from debris and wastes associated with these operations.

Applications

- All construction projects with full or partial structure demolition or removal, e.g., bridge widenings, concrete channel removal, etc.

Key Point

Containment: Use attachments on construction equipment to catch debris or use covers or platforms to collect debris and prevent it from falling into the watercourse. Debris catching devices must be emptied regularly and the debris stored away from the watercourse and protected until removal.

Disposal: Dispose of accumulated debris in a timely manner and at an approved disposal site. For hazardous waste disposal, refer to WM-6.

Inspection and Maintenance: Inspect equipment and any debris catching devices on a daily basis. Ensure any stockpiles are protected and disposed of properly. Any discharge must be reported to the RE immediately.

NS-16 TEMPORARY BATCH PLANTS

Proper control and use of equipment, materials, and waste products from temporary batch plant facilities will reduce the potential of pollutant discharges to storm drain systems and/or watercourses, reduce air emissions, and mitigate noise impacts.

Applications

- Construction projects where temporary batch plant facilities are used. Batch plants may be on or off site.

Key Points

Planning: A Notice of Intent (NOI) must be submitted to the Local Authority for construction and operation of a temporary batch plant. Consideration for minimising nuisance noise and impacts to air and water quality should be observed during construction and operation. Appropriate BMPs must be implemented within the boundaries of the batch plant.

Layout and Design: Batch plants should be located at least 100m away from any recreational area, school, residence, or other structure not associated with the construction project. AC or PCC berms should be constructed around plant equipment to facilitate proper containment and cleanup. Runoff should be directed to a collection area or baker tank.

Operational Procedures: Designate a concrete washout area in accordance with WM-8. All operations should be conducted so as to have no visible emissions including fabric or cartridge type filters for dry material transfers, dust-tight service hatches on silos and auxiliary bulk storage trailers, wet suppression systems at all transfer points, and covered conveyors and transporting vehicles. All plant roads shall be stabilised, watered, treated, or paved so as to control dust and tracking. All entrances and exits shall likewise be stabilised.

Materials Storage and Disposal: Refer to WM-1, “Material Delivery and Storage” as well as WM-2, “Material Use” for proper handling procedures and secondary containment requirements. All stockpiles within the batch plant boundaries shall be in accordance with WM-3, “Stockpile Management.” Refer to WM-4, 5, 8, and 10 for further discussion of handling and disposal of wastes.

Inspection and Maintenance: Inspect batch plant equipment, components, and BMPs daily during construction and operation.

NS-17 STREAMBANK STABILISATION

Proper planning and procedures for work in and around streams and channels can reduce the potential for discharge of sediment and other pollutants and minimise the impacts of construction activities on watercourses and habitat.

Applications

- Construction projects that disturb or occur within stream channels and associated riparian areas.

Key Points

Planning: Planning should consider scheduling, avoidance of in-stream construction, minimising disturbance area and construction time, using pre-disturbed areas, selecting crossing location, and selecting equipment.

Associated BMP Selection for Streambanks: Preservation of existing vegetation (SS-2) in a streambank provides water quality protection, streambank stabilisation, and riparian habitat. Hydraulic mulch (SS-3), hydroseeding (SS-4), soil binders (SS-5), straw mulch (SS-6), or a combination may be used on disturbed streambanks to provide temporary soil stabilisation. Be sure to review the limitations of each so that a selection of the most appropriate one for the given conditions may be made. Also consider possible use of other soil stabilisation and sediment control BMPs provided the application is appropriate and the limitations are not applicable.

In-stream Sediment Control: The primary goal while working in a stream is minimising turbidity. There are three general ways to achieve this: construct a water diversion away from the work area, implement a water barrier around the work area, or employ practices that minimise sediment suspension.

Inspection and Maintenance: Inspect BMPs and equipment daily and ensure necessary repairs for both are done in a timely manner. If a piece of equipment leaks, remove it from the stream immediately for repairs.

5.2.6 Waste Management and Materials Pollution Control

WM-1 MATERIAL DELIVERY AND STORAGE

Materials associated with construction activities must be delivered and stored using practices that prevent these materials from polluting receiving waters. Typical materials include PCC components, petroleum products, pesticides, herbicides, fertilisers, detergents, plasters, acids, lime, glues, adhesives, paints, and solvents.

Applications

- All construction sites with applicable material storage

Key Point

Storage Areas: Store materials indoors in existing structures when available. Temporary storage sheds must meet building and fire code requirements and should be located away from vehicle traffic. Storage instructions should be posted, and employees should be trained in proper storage and delivery procedures.

Hazardous Materials: Do not store hazardous materials directly on the ground. Store liquid chemicals in drums and bags on pallets under cover and in secondary containment. Store materials in original containers with their original product labels.

MSDS: The contractor must provide the Resident Engineer with the Material Safety Data Sheets (MSDS) for all materials stored on the site.

Liquid Materials and Petroleum Products: Do not store incompatible materials in the same temporary storage facility. Allow sufficient space between stored containers to allow for spill cleanup and emergency response access.

Containment: Temporary containment facilities for storage must be of sufficient volume to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater. Accumulated rainwater or spills should be removed from containment areas promptly.

Bagged/Boxed Materials: Store materials delivered in bags and boxes on pallets. Cover bagged/boxed materials on non-working days and prior to rain events to protect materials from wind and precipitation.

Spill Cleanup: Contain and clean up spills immediately in accordance with BMPs detailed in Spill Prevention and Control (WM-4).

WM-2 MATERIAL USE

Materials associated with construction activities must be used in accordance with practices that prevent them from polluting receiving waters. Typical materials include AC, PCC, PCC compounds, petroleum products, pesticides, herbicides, fertilisers, detergents, plasters, acids, lime, glues, adhesives, paints, solvents, and curing compounds.

Applications

- All construction sites with applicable material uses

Key Points

MSDS: The contractor must provide the Resident Engineer with the Material Safety Data Sheets (MSDS) for all materials used on the site.

Paint Materials: Mix paint indoors or in a containment area. Allow time for drying before rain events. Never clean brushes or rinse equipment so waste water enters street, gutter, storm drain, or receiving water. Items used with water-based paint can be cleaned, discharging rinse water to a sanitary sewer. When dry, empty latex paint cans, brushes, etc. can be disposed of with other construction debris. Filter used paint thinner/solvents and reuse. Paint thinners and solvents that cannot be recycled must be disposed of as hazardous waste.

Landscaping-Related Products: The contractor must complete a "Report of Chemical Spray Form" when spraying herbicides and pesticides. Products must be applied by a licensed applicator. Do not over-apply fertilisers or pesticides and follow product usage recommendations. Apply in small amounts, allowing time for product to work in or dry before rain events.

Spill Cleanup: Maintain spill clean-up materials near areas that products will be used.

WM-3 STOCKPILE MANAGEMENT

Construction stockpiles of materials such as soil, PCC, AC, PCC/AC rubble, aggregate base, aggregate sub-base, and asphalt based cold-mix have the potential to pollute receiving waters if not protected from contact with storm water.

Applications

- All construction sites with applicable stockpiles

Key Points

General Guidelines: Stockpile protection is a year-round requirement. Install temporary barriers around stockpile perimeters to prevent contact with storm water when required. Temporary barriers can be berms, dikes, silt fences, straw bales, or sandbag barriers. All active stockpiles are to be protected by linear sediment barriers prior to rain events.

Soil Stockpiles: During the rainy season, cover inactive soil stockpile or protect them with soil stabilisation at all times. During the non-rainy season, cover inactive soil stockpiles or protect them with linear barriers prior to rain events.

Paving Material Stockpiles: During the rainy season, cover inactive stockpiles of PCC, AC, AC/PCC rubble, and aggregate base and sub-base, and protect with a temporary perimeter barrier at all times. During the non-rainy season, cover inactive stockpiles or protect with a linear barrier prior to rain events.

Asphalt Based Cold-Mix Stockpiles: Place active and inactive cold-mix stockpiles on plastic and cover with plastic prior to rain events. The key is to prevent contact between rainfall and run-on with the stockpiles.

WM-4 SPILL PREVENTION AND CONTROL

Spill prevention and prompt appropriate spill response reduces the potential for polluting receiving waters with spilled contaminants. Spills of concern include chemicals and hazardous wastes such as soil stabilisers/binders, dust palliatives, herbicides, growth inhibitors, fertilisers, de-icing products, fuels, lubricants, paints, and solvents.

Applications

- All construction sites where chemicals or hazardous materials are stored or used

Key Points

Spill Types: Be prepared for spills. Locate and clearly label spill kits and used absorbent containers. Respond to all spills immediately upon discovery. The appropriate spill response is determined by the quantity and/or composition of spilled substance, as follows:

〉 A “minor spill” involves a small quantity of oil, gas, paint, etc. that can be controlled by the first responder upon discovery of the spill.

〉 A “semi-significant spill” can be controlled by the first responder with the aid of other personnel and may require cessation of all other activity.

〉 A “significant/hazardous spill” is a spill that cannot be controlled by personnel in the immediate vicinity.

Minor Spill Response

〉 Contain the spill.

〉 Recover the spilled material.

〉 Clean the spill area. Use absorbent materials. Do not hose down the area.

〉 Dispose of clean-up materials appropriately.

Semi-Significant Spill Response:

〉 On impermeable surfaces, surround the spill with absorbent material to contain it. Clean spill using absorbent material.

〉 On dirt areas, construct an earthen dike to contain the spill. Dig up contaminated soil and dispose of properly.

〉 If spill occurs during rain, cover spill area to prevent contaminating storm runoff.

Key Point

Significant/Hazardous Spill Response:

〉 Contractor notifies the RE immediately.

〉 Contractor calls 999 and appropriate emergency response services.

〉 Contractor notifies the Local Authority.

- All verbal notification must be followed up by written reports.

- Contractor obtains services of spill contractor or a HazMat team immediately. Contractor staff is not to attempt cleanup until qualified assistance has arrived onsite.

Education: Train employees regarding the appropriate response for spills for the materials they use. Incorporate spill response procedures into regular safety meetings.

WM-5 SOLID WASTE MANAGEMENT

Solid construction wastes must be collected, stored, and disposed of using practices that minimise contact with storm water. Solid wastes include such items as used brick, mortar, timber, steel, vegetation/landscaping waste, empty material containers, and litter.

Applications

- All construction sites

Key Points

Waste Storage Areas: Solid waste storage areas should be located in an area with little potential for flooding and at least 15m from drainage facilities and receiving waters. Use berms, dykes, or temporary diversion structures to protect stockpiled waste materials from contacting storm water. During foul weather, waste should be stored in watertight skips or securely covered. Salvage or recycle waste as appropriate.

Litter Control: Provide adequate trash receptacles in the yard, field trailer areas, and where workers gather for breaks and meals. Do not place litter receptacles near drainage inlets or receiving waters. All litter within the construction site is to be collected weekly, regardless of the litter's origin. Litter is to be removed from the site by waste hauling contractors.

Skips: Provide an adequate number of watertight skips to collect the anticipated volume of construction waste. Plan for additional skips and skip pickups during demolition phases. Do not place skips near drainage inlets or receiving waters. Full skips are to be removed from the site and disposed of appropriately. Washing out skips on the project site is prohibited.

Litter and Debris: Do not let litter interfere with the functioning of the storm drain system. Ensure that litter and debris are removed regularly from drainage grates and ditch lines.

Hazardous Wastes: Separate potentially hazardous waste from non-hazardous waste. Do not dispose of toxic liquid wastes in skips designated for construction wastes. Dispose of hazardous wastes in accordance with WM-6.

WM-6 HAZARDOUS WASTE MANAGEMENT

Hazardous wastes should be collected, stored, and disposed of using practices that prevent contact with storm water. The following types of wastes are considered hazardous: petroleum products, concrete curing compounds, palliatives, septic wastes, paints, stains, wood preservatives, asphalt products, pesticides, acids, solvents, and roofing tar. There may be additional wastes on the project that are considered hazardous. It is also possible that non-hazardous waste could come into contact with these hazardous wastes, such that they become contaminated and are therefore considered hazardous waste.

Applications

- All construction projects

Key Points

Hazardous Material Use: Use containment berms in fuelling areas. Provide secondary containment in paint mixing areas and paint clean-up areas. Place hazardous waste collection containers at convenient locations.

Hazardous Waste Storage Areas: Ensure that adequate waste storage volume is provided and is located away from storm drains and receiving waters. Provide temporary containment sufficient to contain precipitation from a 24-hour, 25- year storm event, plus 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater. Temporary containment should be impervious to spilled wastes for a minimum of 72 hours. Equip storage areas with appropriate spill clean-up materials. Allow sufficient space between storage containers to allow for spill cleanup and emergency response access.

Hazardous Waste Containers: Store hazardous wastes in appropriate sealed containers that are clearly labelled with contents and starting date of accumulation. Do not mix different types of waste together in one container. Do not store incompatible wastes in the same temporary containment facility. If dry waste containers are not watertight, store containers on pallets. Prior to predicted rain events, cover the containment area.

Disposal: Hazardous waste is to be transported from the site by a licensed hazardous waste transporter and disposed of at an authorised, licensed disposal or recycling facility within 90 days of being accumulated. Properly dispose of rain water removed from temporary containment that may have mixed with hazardous waste.

Education: Contractor and subcontractor employees should be educated regarding identification, storage, and disposal of hazardous wastes. Ongoing hazardous waste training should be incorporated into regular safety meetings.

Inspection and Maintenance: Ensure that hazardous waste storage areas are inspected in conformance with contract provisions. Repair or replace perimeter controls, containment structures, covers, and liners as needed.

WM-7 CONTAMINATED SOIL MANAGEMENT

Contaminated soil on construction sites should be managed to prevent any pollutants from entering storm drain systems or receiving waters. Typical soil contamination is due to spills, illicit discharges, underground storage tank leaks, or aerially deposited lead (ADL). Contaminated soils tend to occur on projects in urban or industrial areas. Soil contaminants and locations are often identified in the project plans and specifications.

Applications

- Areas of contamination as identified on project plans and specifications
- Suspected areas of contamination due to site history, spills, leaks, soil discoloration/odour, abandoned tanks, pipes, or buried debris
- Highway widening project where adjoining soils may contain ADL

Key Points

Aerially Deposited Lead (ADL): Soil from areas with ADL may be used as indicated in the contract special provisions providing that operations result in no visible dust. When excavating soils containing ADL, monitor air quality. Soils containing ADL may also be transported to a licensed landfill or other disposal site. At all times, prevent storm water, groundwater, etc. from mixing with and transporting contamination.

Identification and Coordination: If needed, an approved certified lab shall test suspected soil. Upon confirmation of contamination, contractor shall work with appropriate local agencies to implement appropriate excavation, transportation, and disposal practices.

Stockpiling: Avoid stockpiling contaminated soils. If stockpiling is necessary, cover stockpile with plastic sheeting or tarps, install a berm around stockpile to prevent run-on, and locate the stockpile away from storm drains and receiving waters.

Underground Storage Tank Removal: Obtain required approvals and permits from Local Authority prior to removal. If tank contains liquid or sludge, ensure that it is tested for hazardous substances prior to removal. Test underlying soils to determine if there is contamination. Prevent storm water, groundwater, etc. from mixing with and transporting contaminated substances from the storage tank. Ensure that tank and any liquid, sludge, or contaminated soils are transported and disposed of properly.

WM-8 CONCRETE WASTE MANAGEMENT

Concrete waste materials must be properly managed to minimise or eliminate contact with storm water.

Applications

- On construction sites where new concrete is placed or demolition of concrete structures occurs
- Where concrete slurries are generated such as sawing, coring, grinding, and grooving
- At mortar mixing stations

Key Points

Concrete Slurry Waste: Place temporary berms or sandbags around coring and saw-cutting locations to contain slurry. Vacuum slurry waste or collect it in a temporary lined pit and allow it to dry. Dispose of concrete waste in compliance with Solid Waste Management (WM-5).

Temporary Concrete Washout: Wash out concrete trucks in designated areas only. Locate washout facilities a minimum of 15m from storm drains or receiving waters. Keep the washout areas away from areas of construction traffic. A sign shall be installed at each location in accordance with Chapter 8 - Roadworks Signage. The facility shall have a pit or berm to provide sufficient volume to contain all concrete waste resulting from washout. Allow concrete waste to dry and then dispose of on a regular basis

Above Grade Washout Facilities: Above grade facilities shall be constructed as shown in the details. A minimum length and width of 3m is recommended, but the area should have sufficient volume to contain the anticipated waste. The lining material shall be a minimum of 1000 Guage polyethylene sheeting, free of holes or other defects.

Below Grade Washout Facilities: Below grade facilities shall be constructed as shown in the details. A minimum length and width of 3m is recommended, but the area should have sufficient volume to contain the anticipated waste from operation. The lining material shall be a minimum of 1000 Gauge polyethylene sheeting, free of holes or other defects. Commercial type lath and flagging shall be used.

Inspection and Maintenance: Washouts should be maintained to provide a minimum 100mm freeboard for above ground facilities and 300mm freeboard for below grade facilities. Maintenance includes removal and disposal of hardened concrete as previously described. Existing facilities must be cleaned or additional facilities constructed when the washout is 75% full.

Washout Removal: Materials used to construct the facility become the property of the contractor and shall be removed and disposed from site, all depressions shall be backfilled and repaired.

WM-9 SANITARY/SEPTIC WASTE MANAGEMENT

This BMP includes procedures to prevent the introduction of wastes from construction site toilet facilities to storm drains or receiving waters.

Applications

- All construction sites that use temporary or portable sanitary/septic waste systems

Key Points

Installation: Temporary sanitary facilities should not be located near drainage facilities or receiving waters, nor should they be located in areas that will collect water. If the site is deemed to be a high wind area by the RE, the facilities shall be secured to prevent overturning.

Sanitary Sewer Discharge: Discharges direct to the sanitary sewer should be in compliance with Local Authority requirements. Ensure that the temporary facility is properly connected to the sanitary sewer to prevent illicit discharges.

On-Site Disposal: Waste water shall not be discharged or buried within the site. Ensure that any on-site disposal systems comply with local authority requirements.

Inspection and Maintenance: The contractor's Water Pollution Control Manager shall monitor sanitary/septic waste storage and disposal procedures weekly. Ensure that the sanitary/septic facilities are maintained in good working order and wastes are transported offsite by a licensed service.

WM-10 LIQUID WASTE MANAGEMENT

This BMP includes procedures to prevent pollutants related to non-hazardous liquid wastes from entering storm drains or receiving waters. Liquid wastes include drilling slurries, drilling fluids, wastewater that is free from grease and oil, dredgings, and other non-storm water liquid discharges not covered by separate permits. This BMP does not apply to the following:

- Dewatering operations (See NS-2)
- Solid wastes (See WM-5)
- Hazardous wastes (See WM-6)
- Concrete slurries (See WM-8)
- Liquid wastes covered by specific laws or permits

Applications

- All construction sites where liquid wastes are generated

Key Points

Capture: Capture all liquid wastes that have the potential to impact water entering the storm drain system. Use temporary dykes or berms to direct surface flow of liquid wastes to a containment structure or device. If liquid waste contains sediment, capture and treat the flow to remove sediment or capture in a containment structure to allow sediment to settle.

Containment: Contain liquid wastes in a controlled area that is structurally sound, leak-free, and provides sufficient storage for the anticipated volume. Appropriate structures include holding pits, sediment basins, roll-off bins, and portable tanks. Locate the containment structure such that accidental releases do not discharge to storm drains or receiving waters or threaten health or safety.

Disposal: Some liquid wastes may require testing and certification that they are non-hazardous before an appropriate disposal method is selected. Liquid waste may need to be treated to remove sediment or other pollutants prior to disposal. Typical liquid waste disposal requires Dewatering (NS-2) with disposal of resulting solids per Solid Waste Management (WM-5).

Inspection and Maintenance: Frequently inspect liquid waste containment areas and capturing devices for damage. Repair as needed.