

General Stormwater Good Management Practices (GMPs) for Industrial Sites

1 Background

Christchurch City Council (CCC) holds consents with Environment Canterbury (ECan) to permit discharge of stormwater from the network into the receiving waterways. CCC has an obligation to monitor its network in order to achieve the surface water quality, sediment quality, and aquatic ecology objectives that apply to these consents. Normal residential discharges are generally accepted into the network since these pollutants are able to be treated downstream (e.g., in constructed wetlands, retention basins, etc.). Industrial discharges, however, warrant tighter controls due to the potentially larger and/or more hazardous pollutant volumes, loads, and characteristics that can overload downstream treatment systems. This document provides a set of good management practices (GMPs) for guiding stormwater management on industrial sites to ensure that only clean stormwater is discharged into the network.

2 Stormwater or Wastewater?

Stormwater is any precipitation that flows off a hard surface such as a roof, driveway, forecourt, or road into a gutter, sump/catchpit, stream, river, or lake. Stormwater discharges should be clean so they comply with the Water Supply, Wastewater and Stormwater Bylaw (CCC 2014). Contaminated stormwater runoff must be treated prior to discharge. Cooling and condensing water may be accepted into the stormwater network subject to CCC's approval. Other contaminated sources of water from industrial sites including washwater, process wastewater, and bilge and ballast water must be discharged along with sewage to the sewer according to a Trade Waste consent and the Trade Waste Bylaw (CCC 2015).

3 Introduction to GMPs

Industrial sites can have numerous activities occurring on-site that can generate a wide range of contaminants that are harmful to the environment. GMPs can eliminate and/or reduce stormwater contamination at the source via tactical site layout, housekeeping, checks and maintenance, spill control and safeguards, and employee training. At some sites, engineered treatment solutions may also be necessary to remove pollutants and/or mitigate the effects of increased runoff rates and volumes. Pollution prevention measures should be considered foremost since they are generally cheaper and easier to implement compared to treatment solutions.

3.1 Good Housekeeping

Good housekeeping reduces or eliminates pollutants by maintaining a clean, tidy site. These practices include:

- Containing and covering rubbish, waste, and debris;
- Scheduling regular pickup of rubbish and waste;
- Removing redundant containers and equipment from site;
- Inspecting drums, tanks, and containers routinely for leaks and structural integrity;
- Establishing procedures for the proper handling of materials, equipment, and spills; and
- Sweeping or cleaning hardstand routinely.

In particular, skip and material storage areas, vehicle and equipment maintenance areas, and loading bays all benefit from good housekeeping. Training employees in good housekeeping techniques and involving them in routine monitoring of on-site practices has proven to be effective for implementing these measures.

3.2 Exposure Minimisation

Minimising the exposure of stormwater runoff to pollutants reduces the need for treatment measures. It prevents spilled materials and debris from being picked up by runoff and carried into drains and waterways. Exposure minimisation may include providing temporary cover (e.g., tarps, awnings) for materials or activities when wet weather is expected or moving materials or activities under cover (e.g., buildings, silos, sheds). Often, stormwater contamination can be minimised or eliminated with quite simple practices such as keeping skip lids closed, storing chemical drums inside, and bunding polluted or potentially polluted areas.

3.3 Erosion and Sediment Controls

Erosion occurs due to site-specific factors including topography, activities, soils, ground cover, materials, and weather. Erosion controls must be implemented in exposed areas that are susceptible to erosion including unstabilised soils, stockpiles, and haul roads. Seeding, sodding, planting, and mulching should be considered foremost to protect the land surface at the source. Dust controls may also be required to minimise losses from wind and vehicle traffic. Once eroded, sediment controls such as wheel and equipment cleaning, silt fences, retention ponds, and stabilised vehicle exits help reduce sediment transport and tracking. The fundamental principles to minimise stormwater contamination from erosion are to (1) control run-on water, (2) separate 'clean' water from 'dirty' water, (3) protect the land surface, and (4) prevent sediment from leaving the site. The Erosion and Sediment Control Guideline (ECan 2007) provides more detailed information on minimising adverse effects to waterways from erosion and earthworks.

3.4 Runoff Management

GMPs should be targeted towards controlling flows in order to keep 'clean' water separate from 'dirty' water. Clean runoff can be discharged to the stormwater network, but contaminated runoff must be reused on-site, treated to reduce the volume and load of pollutants, and/or discharged to Trade Waste. Effective stormwater management strategies may include stormwater capture and reuse, soakage, and/or full or partial volume treatment systems. Site managers should consult with a stormwater engineer to develop their own tailored, site-specific stormwater management strategies.

3.5 Treatment Controls

Responsible stormwater management may require a combination of pollution prevention and treatment controls to be effective in achieving water quality objectives. Pollution prevention at the source avoids unnecessary contamination risks and reduces contaminant loads (and, thus, operation and maintenance requirements) on treatment systems. Treatment systems may include oil-water interceptors, detention basins, filters, or constructed wetlands. Site managers should review the Waterways, Wetlands, and Drainage Guide (CCC 2003) and consult with a stormwater engineer to select an appropriate treatment system depending on the targeted contaminants, flows, and size constraints.

4 Site Activities

Common pollution sources at industrial sites have been grouped by activity to identify potential stormwater contaminants (Table 4-1) and GMPs (Table 4-2) associated with each activity. Materials shipping and receiving includes loading and unloading raw materials, chemicals, and products to/from industrial sites. Materials handling and processing includes the on-site manufacturing, transfer, and generation of airborne particulates, liquids, and solids. Materials storage areas include tanks, drums, containers, silos, bins, hoppers, and stockpiles.

Vehicle and equipment maintenance and storage includes the following activities:

- Topping up and replacing hydraulic and automotive fluids including fuel,
- Making mechanical repairs,
- Storing vehicles and equipment (i.e., long- or short-term while waiting for repair or maintenance), and
- Storing related materials (e.g., oil, fuel, batteries, tyres, oil filters).

Cleaning and washdown includes cleaning and rinsing vehicles, transfer or process equipment, surfaces, parts, trailers, structures, and tanks (i.e., interior or exterior). Painting and sanding applies to refinishing vehicles, equipment, and any structures. Waste management and disposal includes practices related to the management, disposal, recycling, reuse, and storage of waste, byproducts, and residual materials generated by a site. Building and grounds maintenance includes general site upkeep related to sweeping, landscaping, pest management, and stormwater infrastructure (e.g., downpipes, sumps). Erosion is sediment transport from exposed stockpiles, unstabilised soils, and haul roads which generally results from vehicle traffic, precipitation, and/or wind. Illicit stormwater discharge is any non-stormwater discharge into the stormwater network occurring from incorrect or faulty piping, intentional dumping, and accidental or unaddressed leaks and spills (i.e., negligence). Inspection and training includes conducting regular site inspections and preventive and reactive maintenance to address and prevent contamination issues. This category also includes keeping maintenance records, implementing an environmental management plan with standard operating procedures for site activities (e.g., waste disposal, spill prevention and response, housekeeping), and training employees, contractors, and other site visitors, where appropriate, to minimise environmental risks.

Table 4-1. General Pollution Sources and Contaminants at Industrial Sites

Pollution Sources	Contaminants
Materials shipping and receiving	
<ul style="list-style-type: none"> Leaks, spills, and residues from unloading, loading, transfer, and distribution of materials and products Leaks from faulty piping connections Erosion and tracking from unstabilised soils and roads 	<ul style="list-style-type: none"> Hydraulic and automotive fluids (e.g., oil, lubricants, transmission fluid, brake fluid, antifreeze, coolant) Sediment Site-specific chemicals
Materials handling, processing, and storage	
<ul style="list-style-type: none"> Leaks, spills, and residues from processes Materials storage areas (e.g., tanks, drums, bottles, bags, bins, stockpiles) Generation of leachate Particulate and fugitive emissions from furnaces and processing equipment 	<ul style="list-style-type: none"> Hydraulic and automotive fluids Acids, alkalis Metals such as copper, lead, nickel, and zinc Oxygen demand Sediment, airborne particulates Site-specific chemicals
Vehicle and equipment maintenance and storage	
<ul style="list-style-type: none"> Leaks, spills, and residues from fluids transfer and fuelling Storage areas (e.g., batteries, tyres, air and oil filters) Corroding equipment, chipping paint, and galvanized metal 	<ul style="list-style-type: none"> Hydraulic and automotive fluids Fuel (e.g., gasoline, diesel, fuel additives) Acids, alkalis, metals
Painting and sanding	
<ul style="list-style-type: none"> Paint and thinner spills and overspray Paint application wastes including empty containers Sanding Emissions from ventilation systems 	<ul style="list-style-type: none"> Paint, varnish, solvents Metals such as lead, zinc, cadmium, chromium, and mercury Sediment, particulates
Cleaning and washdown	
<ul style="list-style-type: none"> Rinse water and washwater from vehicles, equipment, drums, and tanks Parts cleaning Poorly designed and/or undersized washpads Faulty washpad diversion valves Cleaners, degreasers, and process residues 	<ul style="list-style-type: none"> Solvents, detergents Sediment, acids, alkalis, metals Site-specific chemicals
Waste management and disposal	
<ul style="list-style-type: none"> Leaks, spills, residues, and leachate from waste and scrap skips and storage areas Improper waste disposal On-site treatment facility 	<ul style="list-style-type: none"> Acids, alkalis, oxygen demand, metals Pathogens, biocide Site-specific chemicals
Building and grounds maintenance	
<ul style="list-style-type: none"> Pest management Landscaping and fertilisers Litter, buildup of residues on hardstand Galvanized metal roofs and downpipes Poorly maintained stormwater infrastructure and erosion controls 	<ul style="list-style-type: none"> Pesticides, fertilisers, insecticides, herbicides Oxygen demand, organics Sediment, metals Nutrients (e.g., ammonia, nitrate, phosphorus) Hydraulic and automotive fluids including fuel
Illicit stormwater network connections	
<ul style="list-style-type: none"> Floor, sink, sewage, or process wastewater drains connected to stormwater network 	<ul style="list-style-type: none"> Oxygen demand, nutrients, organics Pathogens Site-specific chemicals

Table 4-2. General GMPs for Industrial Sites

Activity	GMPs
Materials shipping and receiving	<ul style="list-style-type: none"> □ Conduct material loading/unloading in designated areas outside of drainage pathways. □ Avoid loading/unloading materials in the rain or provide cover for loading docks. □ Enclose trailer ends at truck loading/unloading docks (e.g., using overhangs or door skirts). □ Inspect deliveries for damaged goods prior to unloading; address punctures/leaks immediately. □ Provide berms, kerbs, or vegetated swales around the perimeter to limit run-on. □ Close stormwater drains in the receiving area during transfer of hazardous materials using drain seals/guards/plugs or a shutoff valve. Direct spills to a collection point for recovery and disposal. □ Conduct loading/unloading on a covered, impervious pad to enable easy clean-up of spilled materials. Slope the pad to convey spills and leaks to proper containment and treatment. □ Ensure hose connection points are inside containment areas and drip trays are deployed where spills may occur outside of the containment area.
Materials handling, processing, and storage – general	<ul style="list-style-type: none"> □ Confine material handling and storage to designated, labelled areas outside of drainage pathways and away from surface water and high traffic areas. □ Handle and store materials indoors when possible. Use an impervious pad to facilitate cleanup of spills and leaks. If materials are outside, enclose/contain/cover the area and elevate stored materials on pallets to prevent contact with runoff. □ Put portable containers on pallets. Limit stack height of containers/drums. Provide straps, plastic wrap, or equivalent around stacked containers to provide stability. □ Provide sufficient aisle space for safe handling around stored materials to avoid damage. □ Use taps and funnels to reduce material spills. □ Stabilise areas surrounding handling and storage areas. Pave areas where vegetative or other stabilisation methods are not practicable. □ Minimise flows to handling, processing, and storage areas with berms, kerbs, or vegetated swales. □ Monitor and restrict access to chemical storage areas to prevent theft, vandalism, and misuse. □ Maintain an organized inventory of materials. Limit purchasing, storage, and handling of materials. Eliminate or reduce quantities of hazardous materials and waste by substituting less hazardous materials. Properly dispose of materials that are no longer in use. □ Use an end-of-pipe treatment (e.g., sand filter, interceptor) where contaminants may be present in stormwater discharges. □ Inspect handling and storage areas regularly. Replace or repair leaking tanks, containers, connections, valves, transfer lines, and pipes that may carry or store chemicals or wastewater. □ Schedule preventive maintenance and integrity testing by qualified professionals.
Materials handling, processing, and storage – solids	<ul style="list-style-type: none"> □ Follow all general handling and storage GMPs in addition to these herein. □ Store materials in enclosed silos, hoppers, buildings, or covered piles (e.g., under tarps or awnings). □ Remove residues from finished products before storage or transport. □ Regularly remove spilled material and dust using mobile sweepers, scrapers, and/or scoops. □ Control airborne contaminants by collecting and filtering dust, fumes, and exhaust generated using systems such as baghouses. Place tubs around vents and stacks to capture settling particles. □ Sweep and/or apply water or materials for dust control that will not impact stormwater.
Materials handling, processing, and storage – liquids	<ul style="list-style-type: none"> □ Follow all general handling and storage GMPs in addition to these herein. □ Store liquids indoors or under cover. Use compatible containers that are rigid and durable, corrosion resistant, non-absorbent, leakproof, and equipped with a close fitting cover. □ Clearly label drums, tanks, and containers with their contents. □ Provide secondary containment such as dikes or portable containers with a height sufficient to contain the greater of 10% of the total enclosed tank volume or 110% of the largest tank volume. □ Ensure drain valves for containment areas are maintained in the closed position. Establish protocols for checking containment areas prior to discharge. Clearly tag valves to avoid human error and only use manually operated pumps or valves in containment areas. □ Use spill troughs for containers with taps, double-walled storage tanks, check valves on transfer hoses, drip trays at hose connection points, and fluid level indicators and alarms where applicable to prevent leaks, spills, and overflows. □ Provide kerbs or posts around transfer pumps to prevent collisions from vehicles. □ Handle and store reactive, ignitable, or flammable liquids in compliance with requirements.

	<ul style="list-style-type: none"> □ Keep absorbents and other cleanup materials readily available for immediate cleanup of spills. Use dry methods rather than hosing down the area. Sweep up spent absorbents promptly.
Vehicle and equipment maintenance and storage	<ul style="list-style-type: none"> □ Follow all materials handling and storage GMPs in addition to these herein. □ Use dedicated handling equipment to reduce tracking of materials to other areas. Store equipment that has residues or sediment on it under cover or indoors. □ Conduct fuelling (including transfer from delivery trucks) on a concrete pad since asphalt is not chemically resistant to fuels. Collect stormwater runoff and provide treatment or recycling. □ Train personnel on proper fuelling techniques. Do not overfill fuel tanks after pump shutoff. □ Store and repair vehicles and equipment indoors or under cover. □ Check for leaks and use drip trays. Empty drip trays before they overflow and dispose of the contents properly. □ Remove parts from liquids slowly to avoid spills. Drain fluids from parts (e.g., oil filters) prior to disposal or recycling. Use drip trays, drain boards, and drying racks to direct fluids into a tank for reuse. □ Promptly transfer used fluids to the proper, labelled container. □ Dispose of greasy rags, oil and air filters, batteries, spent fluids, and degreasers properly.
Painting and sanding	<ul style="list-style-type: none"> □ Follow all materials handling and storage GMPs in addition to these herein. □ Paint and sand indoors when possible. Enclose outdoor areas including the ground surface with tarps, plastic sheeting, and/or drip trays to contain overspray, debris, and spills. □ Prohibit outdoor painting and sandblasting in windy weather. □ Mix paints and solvents in designated areas away from drainage pathways and surface water, preferably indoors or under cover. □ Use water-based paints, coatings, and solvents with low volatility when possible. □ Use high transfer application techniques (e.g., brushing and rolling) that reduce overspray. □ Dry empty paint cans under cover prior to disposal. □ Wash paint brushes, rollers, and other equipment in utility sinks that drain to Trade Waste.
Cleaning and washdown	<ul style="list-style-type: none"> □ Clean empty drums/containers and contaminated wooden pallets in a Trade Waste area. Ensure that there is no contact of residues with precipitation or runoff. Store pallets under cover and/or on a concrete pad. □ Perform all vehicle, equipment, and parts cleaning on a contained, concrete washpad. □ Clean accumulated dust and residues from vehicles, equipment, and surfaces to minimise transport and tracking of contaminants around the site. □ Use waterblasters only in enclosed areas where washwater can be fully contained. □ Use an oil-water interceptor or equivalent to remove solids and hydrocarbons from washwater. □ Avoid liquid cleaners and/or use minimal amounts of phosphate-free, biodegradable detergent. □ Do not allow washwater to enter stormwater drains or surface water. Treat and discharge washwater to Trade Waste or reuse it on-site. □ Washpad diversion valves can fail and cause illicit stormwater discharges. Contact Trade Waste if you have this type of valve to ensure it's operating correctly.
Waste management and disposal	<ul style="list-style-type: none"> □ Manage all process wastewater and washwater according to Trade Waste approval. □ Minimise run-on of stormwater into the area by grading it for runoff. Direct contaminated runoff and any leachate to on-site treatment or the sewer. Capture particulates with sediment traps, vegetated swales, retention/detention basins, or equivalent. □ Store residues and waste in enclosed and/or covered areas. □ Do not pour liquid waste into floor drains, sinks, or sumps. Collect liquid waste in a properly labelled container and dispose of it using a licensed waste hauler. □ Use covered containers for solid wastes such as skips or drums that are durable, corrosion resistant, non-absorbent, and leakproof. □ Regularly dispose of waste material from air quality systems and other operations. □ Avoid cross-contamination of waste streams (e.g., separate solvents, treated wood, rubbish, etc). □ Limit storage time of waste to prevent degradation and generation of leachates. □ Ensure hazardous and solid waste are separated and disposed of properly. Non-hazardous substances that are contaminated with a hazardous substance are considered hazardous. □ Label and track the production of waste material (e.g., used oil, spent solvents, batteries). □ Reduce waste by recycling and/or reusing materials where possible.
Building and grounds	<ul style="list-style-type: none"> □ Maintain and clean out drains, channels, roof gutters, and underground pipes regularly to prevent blockages and allow proper drainage.

maintenance	<ul style="list-style-type: none"> <input type="checkbox"/> Clean out all outlet controls such as sumps, witches hats, oil-water interceptors, and media filters regularly to maintain their effectiveness and prevent overloading. <input type="checkbox"/> Apply fertilisers and pesticides during dry, calm weather and only if needed. Use natural/organic substances. Adhere to manufacturer’s application guidelines (i.e., do not exceed requirements). <input type="checkbox"/> Apply insecticides during breeding months and only if needed. <input type="checkbox"/> Compost green waste away from drainage pathways or dispose of it properly. <input type="checkbox"/> Ensure roof downpipes are fully intact and cannot receive runoff or spills from potentially polluted areas of the site.
Erosion from stockpiles, soils, and roads	<ul style="list-style-type: none"> <input type="checkbox"/> Retain as much vegetation as possible along streams and roads. <input type="checkbox"/> Wash sand and gravel before storing it outside. Consolidate stockpiles to minimise surface area exposed to precipitation. <input type="checkbox"/> Stabilise soils and stockpiles by seeding, mulching, and/or placing geotextiles on inactive areas. Maintain integrity and effectiveness of ground cover to minimise sinking and erosion of soils. <input type="checkbox"/> Divert stormwater away from areas susceptible to erosion using dikes, swales, and berms. <input type="checkbox"/> Reduce sediment transport using sediment traps, silt fences, outlet protection, detention basins, or equivalent. <input type="checkbox"/> Clean wheels, truck bodies, and other equipment to minimise sediment tracking. Do not allow washwater to enter stormwater drains or surface water. <input type="checkbox"/> Stabilise high traffic areas including vehicle entrances, exits, loading, unloading, and vehicle storage areas with concrete pads, gravel, and pavement where practicable. <input type="checkbox"/> Use rumble strips and gravel aprons at access points to minimise off-site sediment tracking. <input type="checkbox"/> Sweep and/or apply water or materials for dust control that will not impact stormwater.
Illicit stormwater discharge	<ul style="list-style-type: none"> <input type="checkbox"/> Only clean rainwater is permitted to enter the stormwater network. <input type="checkbox"/> Know where all sumps and drains discharge to. Perform smoke or dye testing to investigate unknown drainage pathways. <input type="checkbox"/> Plug building floor drains that have stormwater or unknown connections. If necessary, install a sump that is pumped to the sewer or on-site treatment. <input type="checkbox"/> Update and display facility piping schematics that accurately depict all site drainage. <input type="checkbox"/> Stencil sumps with drainage pathway (e.g., sewer or stormwater) to prevent accidental discharges by staff/visitors into the stormwater network.
Inspection and training	<ul style="list-style-type: none"> <input type="checkbox"/> Establish an Environmental Management Plan. Train employees in spill prevention and response, good housekeeping, cleanup, materials management, and waste disposal procedures. Conduct regular site inspections to ensure procedures are implemented properly. <input type="checkbox"/> Regularly check for leaks, corrosion, proper operation of equipment, and effective control measures. Replace worn or malfunctioning parts promptly. <input type="checkbox"/> Schedule and perform routine preventive maintenance of all equipment. <input type="checkbox"/> Train and employ competent and careful staff including forklift operators and drivers.

5 Additional Information

Additional information on CCC’s Industrial Stormwater and Trade Waste programmes can be found at www.ccc.govt.nz or 03 941 8999. Pollution prevention guidance can also be obtained through ECan at www.ecan.govt.nz or 03 365 3828.

6 References

CCC gratefully acknowledges the use of information compiled by the U.S. EPA’s Office of Water for the Industrial Stormwater Fact Sheet Series (U.S. EPA 2006) and the following sources for the preparation of this document.

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