ROADS

Daily roadway and bridge use, along with scheduled repairs, can generate substantial amounts of sediment and pollutants. The most common contaminants in highway discharges are heavy metals, inorganic salts, polycyclic aromatic hydrocarbons, and suspended solids. Salting and sanding practices, for example, leave concentrations of chloride, sodium and calcium on the roadway surface. Through ordinary operation and wear and tear, vehicles release metals, hydrocarbons, rubber particles and other solid materials on highway surfaces. Rain and melting snow often wash these materials off the highway and into adjacent waterways.

Roadway and bridge maintenance pollution prevention practices can reduce pollutant loadings from existing road surfaces as part of a larger operation and maintenance program. These practices include routine maintenance activities such as sweeping, vegetation maintenance, and cleaning of stormwater discharge control structures. They can also include modification of existing practices such as roadway resurfacing or deicing. Roadway systems make up a large part of urban, rural, and offroad infrastructure. Because of traffic use and weathering, they need regular repairs and maintenance. The amount of pollutants found on roads and bridges varies, due to climate, traffic volume, and other factors including surrounding land use, the bridge or roadway's design, the presence of roadside vegetation, insecticide use, and the frequency of vehicle accidents and chemical spills. In colder climates, deicing materials applied to roadways can also influence pollutant levels in roadway discharges, thereby affecting local water quality.

- **PAVED**
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    - **CONCRETE WASTE MANAGEMENT**
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- **SOLID WASTE MANAGEMENT**
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- **NON-PAVED ROADS**
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  - **ROLLING DIP**
  - **NON-CULVERTED (TEMPORARY) STREAM CROSSINGS**
  - **CULVERTED STREAM CROSSINGS**
  - **ACCESS ROAD**

PAVED ROADS:

CHECK DAMS

DEFINITION

Check dams are barriers placed across swales, ditches, and other constructed drainages to reduce channel slope and flow length.

PURPOSE

Check dams slow runoff velocity and promote infiltration, thereby reducing channel erosion and serving as coarse sediment traps above each check dam.

PLANNING CRITERIA & IMPLEMENTATION

Constructed drainages on steeper slopes where runoff velocities exceed 5 feet per second. May be placed below spillways to reduce water velocity and erosion. Helps establish grass linings and other vegetation in swales or drainage ditches where erosion is a concern. Not applicable in natural streams except as part of an approved restoration plan.

Check dams may be installed as a temporary best management practice for project construction or as a permanent component of a stormwater management strategy. Porous check dams may be temporary or permanent installations, while non-porous check dams are permanent.

- Porous check dams: Low piled or stacked linear structures made of rock, gravel, sand bags, fiber rolls, logs, pine needles, and other materials that allow some water flow, limiting water pressure against the dam. Native rock or wood materials found on-site may be used, if appropriate, to reduce cost. Materials should not have the potential to be a pollutant source (e.g. low quality sand bags, railroad ties, or other wood treated with creosote). Porous check dams release part of the flow through the structure, reducing head of flow over the dam and the forces against the side of the dam. Porous check dams integrate well with vegetation in stream restoration projects.
- Solid check dams: Low grade control structures made of a non-porous material such as concrete, metal, or masonry. These structures require design by a licensed professional civil engineer and are more expensive to construct than porous check dams.

MAINTENANCE

Inspect temporary check dams on a regular basis (i.e. weekly) and before, during, and after storms. Remove accumulated sediment behind each check dam when the sediment reaches one-half the height of the dam. For permanent check dams, create an operation and maintenance plan that includes regular inspections of structural integrity and removal of accumulated sediment. Consider seasonal impacts. For instance, check dams will require closer scrutiny during spring snowmelt and rain-on-snow events, or may require more frequent cleaning in the fall from leaves and pine needles. Replace any missing or damaged rock, gravel bags, fiber rolls, etc., to maintain maximum effectiveness.

CONCRETE WASTE MANAGEMENT

DEFINITION

Concrete work, especially concrete wash-out activities generate water and slurry containing fine particles often having a high pH (caustic), which is detrimental to stormwater quality as well as any aquatic life nearby. The discharge of concrete washout waters are classified as a "Prohibited Discharge" under the EPA Construction General Permit unless managed by an appropriate control.

PURPOSE

The concrete waste management guidelines and practices provided in this BMP are intended to minimize or eliminate the discharge of concrete wastes into the storm drain system and waterways.

PLANNING CRITERIA & IMPLEMENTATION

Concrete waste management guidelines and practices are to be implemented on all construction projects where concrete or mortar is used, where concrete dust and debris result from demolition activities and concrete truck washout occurs. Where slurries containing Portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition. Where concrete trucks and other concrete-handling equipment (e.g., pumper trucks) are emptied and/or washed on-site. Multiple washouts may be needed to assume adequate capacity and to allow for evaporation.

The following procedures and techniques will assist in mitigating stormwater pollution from concrete wastes:

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
- PCC and AC waste shall not be allowed to enter storm drains or waterways.
- PCC and AC waste shall be collected and properly disposed of in conformance with Standard Specifications Section 107.
- Collect slurry residue and place in a temporary containment facility and allow slurry to dry. Dried slurries shall be properly disposed before project completion.
- Temporary concrete washout facilities shall be located a minimum of 100 feet, where practical, from storm drain inlets, open drainage facilities, and watercourses, unless determined infeasible by the Engineer. Each facility shall be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign shall be installed adjacent to each washout facility advising concrete equipment operators on the location of the washouts and their proper use. The sign shall be in conformance with the provisions in Standard Specifications Section 625.
- Temporary concrete washout facilities shall be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Temporary washout facilities shall have a temporary pit or bermed area of sufficient volume

to completely contain all liquid and waste concrete materials generated during washout procedures.

- Wash concrete only from mixer truck chutes into approved designated concrete wash out facility.
- Hardened concrete waste in washout facilities shall be broken up, removed, and disposed of per BMP MM-05 Construction Debris and Litter Management. Hardened concrete can be broken up and incorporated into fill as approved by the Engineer.
- Below-grade concrete washout facilities shall be lined material. Plastic lining material shall be a minimum of 40-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
- The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

MAINTENANCE

- Monitor on-site concrete waste storage and disposal procedures at least weekly.
- Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 4 inches for above grade facilities and 12 inches for below grade facilities. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete, maintaining liners, and returning the facilities to a functional condition.
- When the washout is 75% full (not including freeboard), it must be cleaned or a new washout constructed.
- Ensure signage is properly maintained at all onsite temporary washout facilities.

CONTAMINATED SOIL MANAGEMENT & REMEDIATION

DEFINITION

Contaminated soil is an environmental problem caused by the release of hazardous substances into the environment. The most common sources of contamination come from industrial activities such as landfills, agricultural sites, and oil spills. Other sources include hazardous waste disposal sites, military bases, underground tanks, chemical spills, and leaking sewer pipes. These sources can lead to a variety of contaminants including heavy metals, volatile organic compounds (VOCs), petroleum hydrocarbons, pesticides, herbicides, PCBs (polychlorinated biphenyls), and other hazardous materials.

PURPOSE

The presence of contaminants in soil can adversely affect human health and the environment, so remediation is often necessary to restore and protect the affected area.

PLANNING CRITERIA & IMPLEMENTATION

There are several different techniques used for remediating contaminated soil. The most effective method will depend on the type and concentration of contaminants present in the soil as well as local regulations. Common techniques include excavation/removal; biological treatment; thermal treatment; physical/chemical treatment; and in situ treatment.

- Excavation/removal involves physically removing contaminated soils from an area and disposing them at a regulated landfill site or off-site facility designed to handle hazardous materials properly.
- Biological treatment uses microorganisms to break down contaminants into harmless byproducts while thermal treatment utilizes heat to destroy or remove contaminants from soils through oxidation or distillation processes.
- Physical/chemical treatments involve using chemicals like surfactants or adsorbents to bind with contaminants while in situ treatments are used when it is not feasible to excavate contaminated soils due to their volume or location.
- In situ treatments involve introducing chemical agents directly into the subsurface soils for on-site remediation without having to excavate them first.

MAINTENANCE

Several techniques are available due to individual project maintenance needs: interim control measures like applying mulch are not permanent and need continuous maintenance to be effective, while abatement measures are designed to be low-maintenance and last at least 20 years. Make sure your practice or combination of practices addresses both risk pathways: incidental ingestion and plant uptake. Combine soil management with good hygiene practices to further lower exposure.

HAZARDOUS WASTE MANAGEMENT

DEFINITION

Potentially hazardous materials may be used, stored, generated, or encountered at a construction site.

PURPOSE

Proper handling, storage, and disposal practices are necessary to minimize the potential for the release of these materials to the environment.

PLANNING CRITERIA & IMPLEMENTATION

Any time potentially hazardous materials are on a construction site, the practices described herein are to be implemented. Hazardous materials may include, but are not limited to:

- Fuels, lubricants, and oils
- Solvents
- Paints, stains, and wood preservatives
- Contaminated soil
- Vehicle fluids (e.g., antifreeze)
- Herbicides and pesticides
- Asphalt and concrete products
- Acids and caustics
- Construction wastes (e.g., lead paint, asbestos products, treated lumber)

Does not address preexisting contamination or site assessments. Hazardous waste releases require the services of a Certified Environmental Manager to oversee response, cleanup, and remediation efforts. Contractor is required to follow all federal, state and local laws regarding handling, storing, and transporting waste materials, and during implementation:

- Comply with SPCC plan requirements when appropriate.
- Hazardous waste shall be kept separate from construction and domestic waste. Do not mix waste products.
- Waste shall be stored in sealed containers constructed of suitable materials, and provided cover or secondary containment to prevent spills from being discharged. Store materials in temporary storage facilities with roofs and secondary containment. Secondary containment shall provide sufficient volume to contain 100% of the aggregate volume of all containers plus a minimum of 4inches of free-board, or in accordance with SPCC plan requirements.
- Locate storage areas away from storm drains, gutters, ditches, and waterways.
- Store materials that might be incompatible (chemically reactive) separately.
- Store materials in an appropriate type of container.
- All containers shall be labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and other applicable federal, state and local requirements. Labels should identify, the material, health hazards, environmental hazards, and collection date.
- Waste shall be disposed of in accordance with the manufacturer’s recommendations and

federal, state and local requirements.

- Maintain Safety Data Sheets on-site for all materials at the site.
- Provide sufficient space between stored materials to allow access and minimize the need for excess handling.
- Implement good housekeeping practices.
- Properly dispose of stormwater collected in the secondary containment — assume it is contaminated unless proven otherwise.
- Do not dispose of liquid wastes in waste bins or other solid waste containers.
- Promptly clean all spills. Never wash spills down a storm drain.
- Recycle materials when possible.
- Train employees in proper material handling, storage, and disposal practices.

MAINTENANCE

- Ensure materials and wastes are properly stored and labeled.
- Ensure the secondary containment is functioning and determine if containment facilities require servicing.
- Inspect all pumps, hoses, and other equipment that has been used in conjunction with hazardous materials. Replace or repair those that are found to be defective.
- Inspect the construction site weekly for evidence of spills and releases.
- Verify spill containment and cleanup supplies are stocked and available.

INFILTRATION SYSTEMS (BASINS)

DEFINITION & PURPOSE

An infiltration basin is a large, engineered structure designed to detain stormwater runoff and infiltrate the detained runoff over a period of days. Infiltration basins, while similar in design to a dry basin, do not include an outlet structure that is designed to slowly draw down the water quality storage volume of the basin. Infiltration basins designed as on-line facilities include a high-flow bypass or emergency spillway. Infiltration basins designed as off-line facilities may not have an emergency spillway, as runoff can be designed to bypass the facility based on the elevation of the water stored in the facility.

ADVANTAGES & DISADVANTAGES

Advantages:

- Reduces stormwater discharged to surface waters and can provide effective removal of pollutants of concern to lake clarity.
- When land area is adequate, an appropriately sized infiltration basin can replicate predevelopment runoff characteristics more closely than most other BMP's.
- Can provide stormwater volume reductions to prevent downstream channel erosion and can reduce potential downstream flooding.

Disadvantages:

- Applicability limited to sites with higher soil Ksat rates and low pollutant loads (unless pretreatment is provided). Depending upon inflowing pollutant loads, frequent maintenance may be necessary to maintain effectiveness.
- Siting is frequently constrained due to a lack of available land area and high seasonal groundwater elevations.

PLANNING CRITERIA & IMPLEMENTATION

The following guidelines are water quality design considerations for infiltration basins. Refer to applicable drainage design manuals within the responsible jurisdiction for requirements associated with structural integrity, drainage design, public safety, and other factors. Consider designing an accessible forebay or an equivalent pretreatment device at the inlet of an infiltration basin for removal of coarse sediments and debris. Accessible maintenance facilities, especially for subsurface infiltration basins, can markedly improve the ease of maintenance and contribute to extended effectiveness. A soils/hydrology investigation is typically necessary when siting an infiltration basin to determine soil permeability, depths to seasonal high groundwater, depths to restrictive layers, and any other potential impediments to successful infiltration. The bottom of an infiltration basin shall not be closer than 1 foot to high seasonal groundwater indicators. Where space is available, size the basin to retain at least the 20-yr/1-hr volume generated from the tributary impervious area.

Above ground infiltration basins shall be designed to infiltrate stormwater within 96 hours. An underdrain system may be used to increase infiltration through above ground systems during winter periods when soil is more likely to freeze. A minimum 8-inch diameter underdrain pipe, encased in gravel, can be used to drain the soils below infiltration basins. A valve attached to the underdrain

system can be used to control the rate of draw down in the basin. The valve can either be actively managed or left open during the winter season to allow snowmelt to quickly move through the soils in the basin and reduce the potential for frozen soils to occur.

In areas where salt-based deicers are directed to infiltration basins, soil may become less fertile and less capable of supporting vegetation. Incorporating organic amendments such as dry wood chips or composted material can help to mitigate this potential problem.

Snow storage within infiltration basins may be acceptable if the following conditions are met:

- Drainage design standards for the responsible jurisdiction allow the practice.
- The limits of snow storage within the basin are clearly designated and do not encroach on the inlet and outlet structures of the basin.
- Basin capacity has been increased to accommodate expected snow storage amounts in addition to the design storm (typically the 20-yr/1-hr storm). The basin must retain the capacity to hold the design storm at all times during snow storage operations.
- Stabilized access for snow plowing equipment is provided.
- Maintenance is conducted annually after spring snowmelt to remove material and debris from the basin, rehabilitate the infiltration capacity of the basin, and to confirm conveyance facilities are functional.

Remove and stockpile any native topsoil for use after rough grading basin dimensions. After completing basin grading activities, till back in topsoil or other soil amendments to improve infiltration capacity, which may be diminished by compaction from heavy equipment during grading. Tilling activities are typically at least 12 inches deep. The basin bottom shall be graded flat to provide uniform ponding and infiltration across the surface area of the basin.

MAINTENANCE

Inspect inlets and outlets to ensure stormwater is being properly conveyed and repair any blocked or diverted conveyances. Inspect forebays or pretreatment devices at the inlet of infiltration basin and remove accumulated sediment and debris. Inspect the basin for standing water 96 hours after a storm event. If water has not fully infiltrated, then infiltration drainage and rehabilitation are needed. Inspect for trash and debris especially at the inlet structures. Inspect for erosion, especially at the inlet locations. Inspect for invasive weeds and remove. Inspect site for unusual or unsafe conditions (snowplow damage, structural damage, dumping, vandalism, etc.). Repair structural components as necessary.

PERVIOUS HARDSCAPES

DEFINITION

Pervious hardscapes allow water to pass through the surface material and sink back into the soil. The water seeps through to a rock base layer and is naturally filtered through the underlying soil where pollutants can be further filtered.

PURPOSE

In a pervious BMP the drainage system is built into the hardscape, and requires less extra drainage features to keep the surface from pooling or flooding.

PLANNING CRITERIA & IMPLEMENTATION

Pervious materials increase infiltration of surface watering landscapes and areas adjacent to buildings and structures. Choices include pervious paver stones, turf block and permeable asphalts and pavements, gravel, decomposed granite, or wood chips. The infiltration rate in a pervious hardscape can be 10 times greater than porous concrete, and more than 90 times greater than permeable pavers.

Any hardscaped areas (such as driveways, paths, patios, and residential parking areas) located a minimum of 2 to 5 feet above the seasonal high groundwater table and at least 100 feet away from drinking water wells are candidates for replacement with pervious hardscape.

MAINTENANCE

Properly maintaining pervious BMP’s will result in optimal performance, an operable infiltration rate, increased safety, reduced overall costs, and can prevent the need for total restoration. When needed, cleaning can be performed by sweeping, vacuuming, and wet vacuuming to remove accumulated deposits. Each facility or project will require its own unique maintenance plan and schedule.

POROUS PAVEMENT

DEFINITION

Porous pavement is a paved surface with a higher than normal percentage of air voids to allow water to pass through it and infiltrate into the subsoil.

PURPOSE

Porous pavement surfaces replaces traditional pavement, allowing parking lot, driveway, and roadway runoff to infiltrate directly into the soil and receive water quality treatment. Porous pavement provides groundwater recharge and reduces stormwater runoff volume. Depending on design, paving material, soil type, and rainfall, porous paving can infiltrate as much as 70% to 80% of annual rainfall.

PLANNING CRITERIA & IMPLEMENTATION

All porous paving systems consist of a durable, load-bearing, pervious surface overlying a stone bed that stores rainwater before it infiltrates into the underlying soil. Porous paving techniques include asphalt, pervious concrete, paving stones, and manufactured "grass pavers" made of concrete or plastic. Porous paving may be used for walkways, patios, plazas, driveways; parking stalls, and overflow parking areas.

Porous pavement is appropriate for pedestrian-only areas and for low-volume, low-speed areas such as overflow parking areas, residential driveways, alleys, parking stalls, bikepaths, walkways, and patios. It can be constructed where the underlying soils have a permeability of at least 0.17 inches per hour. Porous paving is not appropriate for high traffic/high speed areas, because it has lower load-bearing capacity than conventional pavement. Do not use porous pavement in areas of higher potential pollutant loads, because stormwater cannot be pretreated prior to infiltration. Heavy winter sanding will clog joints and void spaces.

MAINTENANCE

Monitor as needed to ensure that the paving surface drains properly after storms. For porous asphalts and concretes, clean the surface using power washer to dislodge trapped particles and then vacuum sweep the area. For paving stones, add joint material (sand) to replace material that has been transported. Inspect the surface annually for deterioration annually. Assess exfiltration capability at least once a year. When exfiltration capacity is found to decline, implement measures to restore original exfiltration capacity. Reseed grass pavers to fill in bare spots as needed.

LIQUID WASTE MANAGEMENT

DEFINITION

According to the Environmental Protection Agency (EPA), liquid waste is defined as any waste material that passes the definition of a "liquid." This means that the material must, "pass through a 0.45 micron filter at a pressure differential of 75 psi," according to the EPA's provided definition of a liquid.

PURPOSE

Liquid waste management is a method to prevent discharge of pollutants to the watercourses, through the collection and proper disposal of hazardous liquid materials. Liquid waste is an important category of waste management because it is difficult to dispose of easily. Unlike solid wastes, liquid wastes cannot be picked up and removed from an environment. Liquid wastes spread out and pollute other sources of liquid if brought into contact. This type of waste can also soak into objects such as soil and groundwater. This pollution then carries over to pollute local agriculture, ecosystems, as well as the human populations within the area of the pollution.

PLANNING CRITERIA & IMPLEMENTATION

Depending on the type of liquid waste, specific procedures exist for handling it safely and legally. Some liquid wastes must be treated prior to disposal or separated from solid material before transporting it. Many liquid wastes go directly into industrial wells, deep wells, saltwater disposal wells, or municipal sewer systems. Some liquid waste can be recycled or reconstituted to form new products, or useful material can be extracted from it.

BMP EXAMPLES & MAINTENANCE

- **UNDERGROUND STORAGE TANKS**

DEFINITION

An underground storage tank is defined as any tank with at least 10 percent of its volume buried below ground. Underground tanks are potential sources of ground water contamination because they are commonly used for the storage of sewage, motor fuels, or other potentially hazardous materials. (Note: The UST program does not cover residential septic tanks.)

PURPOSE

To prevent the discharge of degraded water to ground or surface water supplies.

APPLICABILITY

Applicable to any business or agency, such as gas stations, marinas, utility maintenance yards and farms which store liquids in underground tanks.

PLANNING CRITERIA

The design and installation of new storage tanks and the repair and maintenance of existing tanks must be in compliance with local, state and federal regulations. There has been an increase in the number of leaking underground tanks. These leaking tanks can degrade water quality. Underground tanks which are no longer in use must be removed and disposed of properly or else left in place and filled with an acceptable inert material depending on the applicable state or local laws. Prior to any installation, repair, removal, or closure of underground tanks, secure the necessary permits from the proper authorities. Consult with the respective County Health Department and the Nevada Division of Environmental Protection, Bureau of Corrective Actions (UST/LUST/Petroleum Claims branch). These agencies have compiled an extensive manual geared specifically for owners/operators of tanks.

METHODS AND MATERIALS

The installation, repair, removal, or closure of underground tanks must be conducted by qualified professionals. For tanks that are leaking or are suspected of leaking, samples of the soil, ground water, or surface water must be gathered to determine the release of a hazardous substance (including petroleum products) and would have to be accomplished by or overseen by someone with certification as a Environmental Manager under the NDEP Certification Program. Temporary BMPs must be installed and in place during all underground tank activities involving any soil disturbance. The ordinances and statutes of the state and county within which the tank is located shall be complied with.

MAINTENANCE

Underground storage tanks should be tested and monitored periodically in order to detect any leaks.

EFFECTIVENESS

If properly installed and monitored, underground tanks will not cause degradation of water quality.

- **WASTE TREATMENT LAGOON**

DEFINITION

An impoundment made by constructing an excavated pit, dam, embankment, dike, levee, or combination of these for biological treatment of organic waste. This practice does not include holding ponds and tanks.

PURPOSE

Lagoons are constructed to biologically decompose organic waste by aerobic or anaerobic

organisms or a combination of both. The production of methane gas can be a byproduct of anaerobic activity and could be used to offset local energy costs.

APPLICABILITY

This BMP is applicable to lagoons located to serve predominantly rural or agricultural areas where there is a need for a facility to process concentrated organic waste, reduce sources of pollution, minimize health hazards and improve the local environment. Typically, there are no economically feasible alternatives to treatment by any other means.

PLANNING CRITERIA

Each waste treatment lagoon must be designed, engineered, constructed and maintained by a qualified professional for the complete management of the specific type of waste, given the specific site conditions. Industry standards, federal, state and local regulations must be adhered to. The State of Nevada, Division of Environmental Protection (NDEP) has statutes and regulations governing the design, construction, operation and maintenance of waste treatment facilities, including lagoons, through a permitting process. For additional information please contact the NDEP, Bureau of Water Pollution Control.

METHODS AND MATERIALS

A qualified professional engineer should be retained to design, engineer, construct, operate and maintain a waste treatment lagoon.

MAINTENANCE

A comprehensive maintenance plan should be developed in conjunction with the design and construction of a waste treatment lagoon. Lagoons require regular inspection and maintenance to ensure safe operations and effectiveness.

EFFECTIVENESS

A properly designed, constructed and maintained waste treatment lagoon will function effectively while minimizing impacts to the environment.

- **WASTE STORAGE POND**

DEFINITION

An impoundment made by constructing an excavated pit, dam or embankment for the temporary storage of livestock or other agricultural wastes, wastewater, and/or polluted runoff. Depending on the design, waste storage ponds can be aerobic or anaerobic or a combination of both.

PURPOSE

Waste storage ponds are utilized to store liquids, solid wastes and polluted runoff from concentrated livestock or waste areas until they can be safely utilized, evaporated, or otherwise disposed of.

APPLICABILITY

This practice applies generally in predominantly rural or agricultural areas, where there is a need for facilities to temporarily store agricultural wastes or polluted runoff, reduce pollution, minimize health hazards, and improve the environment in predominantly rural or agricultural areas. Waste storage ponds must be designed and constructed to all applicable federal, state and local regulations.

PLANNING CRITERIA

Waste storage ponds should be designed, engineered, and constructed by a qualified professional engineer. All federal, state and local laws, rules and regulations governing waste management, pollution abatement, public health and safety and environmental protection shall be strictly adhered to. A lining may be required if the potential for ground water contamination exists. The owner and operator is responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations.

METHODS AND MATERIALS

A qualified professional engineer should be retained to design, engineer, construct, operate and maintain a waste storage pond.

MAINTENANCE

A comprehensive maintenance plan should be developed in conjunction with the design and construction of a waste storage pond. Storage ponds require regular inspection and maintenance to ensure safe operations and effectiveness.

EFFECTIVENESS

A properly designed, constructed, and maintained waste storage pond will function effectively while minimizing impacts to the environment.

MATERIAL STORAGE STRUCTURE

DEFINITION

A fabricated structure for the temporary storage of animal or other agricultural wastes. Agricultural waste storage facilities typically include holding tanks and manure stacking facilities.

PURPOSE

These structures are a storage component of an agricultural waste storage system. They are constructed to temporarily store liquids, slurry or solid livestock manure, and other agricultural wastes until they can be treated, utilized, recycled, or otherwise disposed of in an environmentally safe manner.

APPLICABILITY

Waste storage facilities are utilized where there is a need for fabricated structures to temporarily store agricultural wastes, reduce pollution of surface and ground waters, minimize public health and safety hazards, and improve the environment. All federal, state and local laws, rules and regulations governing waste management, pollution abatement, public health and safety and environmental protection shall be strictly adhered to. The owner and operator is responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations.

METHODS AND MATERIALS

A qualified professional should be retained to design, engineer, construct, operate and maintain a waste storage structure.

MAINTENANCE

A comprehensive maintenance plan should be developed in conjunction with the design and construction of a waste storage structure. Structures require regular inspection and maintenance to ensure safe operations and effectiveness.

EFFECTIVENESS

A properly designed, constructed, and maintained waste storage structure will function effectively while minimizing impacts to the environment.

ROAD SALT STORAGE

DEFINITION

Road salt must be properly stored in order to prevent degraded runoff or leachate from reaching surface or groundwaters.

PURPOSE

To reduce the problem of degraded runoff resulting from the storage of de-icing chemicals.

APPLICABILITY

Applicable to areas where de-icing salts are stored and located.

PLANNING CRITERIA

The location of salt storage areas is important, and sites should be chosen that are accessible, well drained (but not on an aquifer recharge area), and not subject to overland runoff from upslope areas. A structurally sound and waterproof concrete base and an ample loading area are essential. Concrete pads should be treated with a sealant. Covering techniques for salt piles include:

1. Permanent structure with doors;
2. Structure with open face away from prevailing wind; and
3. Three-sided bunker with permanent or temporary cover.

During loading, minimize the area of the heap that is uncovered at any one time, and following loading, make sure the loading pad is thoroughly swept.

The specific material and application rates on roads and highways should also be considered. This includes checking the calibration and rates of spreader trucks, the possible use of liquid calcium chloride for pre-melting salts, the proper mixes of abrasive and salts, adopting maintenance policies which consider various weather conditions, and evaluating use of alternative de-icing agents.

Alternative de-icing processes have been researched in response to environmental concerns. These include ground heat pipes, electrical resistance heat, incorporation of snow melting chemicals into pavement during construction, and solar heating. The use of these methods is limited due to cost; however, Calcium Magnesium Acetate (CMA) is proving to be a promising alternative to sodium and calcium chlorides. Twice as much CMA must be used to get the same results as sodium chloride but it is neither corrosive nor harmful to the environment.

METHODS AND MATERIALS

Salt storage facilities shall be designed and installed under the direction of qualified professionals. Salt and slag/sand mixtures shall be stored on paved surfaces in a structure with at least three sides. Piles shall be covered during periods when the material is not being loaded or

unloaded.

MAINTENANCE

If properly designed, little maintenance is required other than cleanup of spills.

EFFECTIVENESS

Properly maintained salt storage facilities are very effective in preventing the discharge of degraded runoff.

SEPTIC WASTE MANAGEMENT

DEFINITION

Septic systems are underground wastewater treatment structures that use a combination of natural and technological processes to treat wastewater from household plumbing produced by bathrooms, showers, kitchen drains and laundry.

PURPOSE

These systems are used to treat and disperse of relatively small volumes of wastewater, usually from houses and businesses located in suburban and rural locations not served by a public (centralized) sewer system. The process typically begins with solids settling within the septic tank and ends with wastewater treatment in the soil via the drainfield.

PLANNING CRITERIA & IMPLEMENTATION

There are various types of septic or decentralized wastewater treatment systems. If a system is properly installed, sited and maintained it can protect public health, preserve valuable water resources, and maintain economic vitality in a community. Decentralized systems are a cost-effective and long-term option for treating wastewater, particularly in less densely populated areas.

The benefits of using decentralized wastewater treatment systems include:

- Public health benefits - Proper use of decentralized systems reduces the risk of disease transmission and human exposure to pathogens, which can occur through drinking water, surface water and shellfish bed contamination.
- Environmental benefits - Wastewater treatment removes pollution from surface water, recharges groundwater and replenishes aquifers.
- Economic benefits - Decentralized wastewater systems help communities reduce large infrastructure and energy costs to collect and treat wastewater.

MAINTENANCE

Items to include for septic system maintenance include:

- Inspect your septic system frequently.
- Pump the septic tank every 2 to 3 years.
- Repair leaky plumbing fixtures and drips.
- Conserve as much water as possible.
- Dispose of household chemicals properly.
- Keep grease and cooking oil away from your drains and garbage disposal.
- Pay attention to your lawn and watch for spongy grass.
- Don’t flush certain items down the toilet.
- Plant trees away from your septic system.

SOLID WASTE MANAGEMENT

DEFINITION

A management system for the proper disposal of domestic, commercial, agricultural and industrial solid wastes. Includes all landfill sites which must meet current federal, state and local regulations.

PURPOSE

To provide for the proper disposal of solid waste materials in a manner which will control pollution of surface and ground waters in accordance with applicable federal, state and local regulations.

APPLICABILITY

Applies to all entities within the State of Nevada disposing of solid waste including: communities, farms, ranches, recreation sites, commercial and industrial enterprises, mining operations, mineral exploration projects and the public.

PLANNING CRITERIA

The State of Nevada, Division of Environmental Protection has adopted statutes and regulations affecting municipal solid waste landfills and industrial solid waste disposal sites and has implemented a permit program for such facilities. Any solid waste landfill, irrespective of size or quantity, that receives household waste is a Municipal Solid Waste Landfill (MSWLF). There are three classes of disposal sites:

CLASS I MSWLF-	Receives 20 tons or more per day on annual average.
CLASS II MSWLF-	Receives less than 20 tons per day on annual average and has not caused ground water contamination, is located in an area that receives 25 inches or less of precipitation annually, and serves a community that has no practicable alternative for managing its solid waste.
CLASS III -	Receives only industrial solid waste.

The state regulations require that owners and operators meet specific criteria and obtain a permit based upon their disposal site classification. An individual landfill (i.e. farm, ranch, industrial, mining operation, etc.), is no longer allowable without a permit. Entities without a permitted landfill should be transporting their solid waste to a permitted landfill.

SPILL PREVENTION & CONTROL PLANS

DEFINITION & PURPOSE

Spill Prevention and Control Plans (SPCP) should clearly state measures to stop the source of a spill, contain the spill, clean up the spill, dispose of contaminated materials, and train personnel to prevent and control future spills.

PLANNING CRITERIA & IMPLEMENTATION

SPCPs are applicable to construction sites where hazardous wastes are stored or used. Hazardous wastes include pesticides, paints, cleaners, petroleum products, fertilizers, and solvents. When developing an SPCP, a construction site operator should identify potential spill or source areas, such as loading and unloading, storage, and processing areas; places where dust or particulate matter is generated; and areas designated for waste disposal. Also, evaluate spill potential for stationary facilities, including manufacturing areas, warehouses, service stations, parking lots, and access roads.

Conduct this evaluation during the project planning phase, and reevaluate it during each phase of construction. The SPCP should define material handling procedures and storage requirements and outline actions necessary to reduce spill potential and impacts on stormwater quality. This can be achieved by:

- Recycling, reclaiming, or reusing process materials, thereby reducing the amount of process materials that are brought into the facility.
- Installing leak detection devices, overflow controls, and diversion berms.
- Disconnecting any drains from processing areas that lead to the storm sewer.
- Performing preventative maintenance on storm tanks, valves, pumps, pipes, and other equipment.
- Using material transfer procedures or filling procedures for tanks and other equipment that minimize spills.
- Substituting less or non-toxic materials for toxic materials.

The SPCP should document the locations of spill response equipment and procedures to be used and ensure that procedures are clear and concise. The plan should include step-by-step instructions for the response to spills at a facility. In addition, the spill response plan should:

- Identify individuals responsible for implementing the plan.
- Define safety measures to be taken with each kind of waste.
- Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or municipal sewage treatment facilities for assistance.
- State procedures for containing, diverting, isolating, and cleaning up the spill.
- Describe spill response equipment to be used, including safety and cleanup equipment.
- The plan can be a procedural handbook or a poster to be placed in several locations at the site.

LIMITATIONS

Training is necessary to ensure that all workers are knowledgeable enough to follow procedures outlined in the SPCP. Make equipment and materials for cleanup readily accessible and mark them

clearly so workers can follow procedures quickly and effectively.

MAINTENANCE CONSIDERATIONS

Update the SPCP regularly to accommodate any changes in the site, procedures, or responsible staff. Conduct regular inspections in areas where spills might occur to ensure that procedures are posted and cleanup equipment is readily available.

EFFECTIVENESS

An SPCP can be highly effective at reducing the risk of surface and ground water contamination; however, to ensure that procedures are followed, a construction site operator should provide worker training, appropriate materials and equipment for cleanup, and adequate staff time.

COST CONSIDERATIONS

Spill prevention and control plans can be inexpensive to implement; however, adequate time and resources are needed to properly handle and dispose of spills.

STOCKPILE MANAGEMENT

DEFINITION

Livestock containment facilities are structures built or used to hold livestock, including but not limited to corrals, holding pens, feed lots, barns, and sheds.

PURPOSE

To reduce the degradation of surface runoff water quality and the potential to contaminate ground water resources resulting from the confinement of livestock.

APPLICABILITY

Applicable to areas where livestock are concentrated, such as horse corrals, feed yards, and holding pens. Runoff and leachate from these facilities can be high in nutrients from animal feed and manure and create water quality problems especially if located near a streamside management area (SMA) or areas with a high water table.

PLANNING CRITERIA

The siting and construction of livestock containment facilities is important, and sites should be carefully chosen based on the following guidelines.

1. Facilities should not be located in or near a SMA.

2. Facilities should not be located in areas subject to overland surface flow or flooding from upslope areas.

3. Facilities should be located on gently sloping to flat land (5% slope or less).

4. Facilities should not be located in areas which have less than four feet from the soil surface to the ground water table at any time of the year or areas having a high leaching potential.

In addition to the proper location of livestock confinement facilities, the following guidelines should be followed:

1. Surface runoff and related discharges from livestock containment facilities should be limited by:

* Storing both the facility wastewater and the runoff from confined animal facilities that is caused by storms up to and including a 25-year, 24-hour frequency storm. Storage structures should:

a. Have a compacted clay seal or plastic membrane lining, or
b. Be constructed with concrete, or
c. Be a storage tank.

* Managing stored runoff and accumulated solids from the facility through an appropriate waste utilization system.

2. Surface runoff from these facilities or animal waste stockpile should not be allowed to flow into a SMA.

3. Stockpiling of animal wastes should be thoroughly investigated for the potential to degrade the soil profile and ground water resources. Any runoff or drainage from animal waste stockpiles or the facility area should be routed to the runoff storage system.

4. Manure storage or animal waste piles should be protected from precipitation and surface runoff.

5. When applied to agricultural lands, manure, stored runoff water, stored facility wastewater, and accumulated solids from the facility are to be applied utilizing appropriate nutrient management measures. An appropriate waste utilization system to minimize impacts to surface water and to protect ground water may be achieved through implementation of the SCS Waste Utilization Practice (633).

6. Anaerobic ponds can be used to reduce odors and solids, improve water quality, and generate methane gas.

METHODS AND MATERIALS

Livestock confinement facilities should be located, designed, and constructed under the direction of qualified professionals. If the facility is to be served by vehicle, the site should have loading-unloading areas that are outside of SMAs.

MAINTENANCE

A comprehensive inspection and maintenance program should be developed based upon the specifics of the site. Inspections should be conducted regularly, particularly after precipitation or storm events and repairs made as required.

EFFECTIVENESS

Properly maintained and operated facilities can be effective in preventing the discharge of degraded surface runoff and minimize ground water quality degradation.

STREET SWEEPING

DEFINITION

Street cleaning practices consist of sweeping operations conducted by broom or vacuum type sweepers.

PURPOSE

To remove litter, sediment, and other contaminants from streets and roadways in order to prevent degraded runoff from paved areas.

APPLICABILITY

Applicable to all paved areas, especially streets, highways, and parking lots.

PLANNING CRITERIA

Street sweeping is effective for removing litter and other contaminants from streets, including components of vehicle bodies (such as glass, rubber, rust, and metal), pollutants resulting from vehicle operation (hydraulic fluids and particulate exhaust emissions), atmospheric dustfall, de-icing chemicals, and particles from industrial operations. There are two types of street sweepers.

1. Brush-type. These are designed to loosen surface contaminants and push them to a conveyer which deposits the material into a hopper. These units propel larger particles into the collection bin, but often fail to collect the fine, pollutant-laden dust and dirt. (Research has determined that the major portion of polluting substances reaching the street attach themselves to the very fine particles already deposited there.) Studies have found these sweepers to be relatively inefficient in collecting material smaller than 400 microns, which, though a comparatively small volume, are a major factor in the oxygen demand of runoff pollutants.

2. Vacuum-type. These operate using both a broom for loosening and moving the street contaminants and a vacuum system to collect them. These units are much more efficient in the capture of fine material, when the pavement is dry.

Estimates of the efficiency of street sweepers in removing the tail dust and dirt load on paved surfaces are that vacuum sweepers are about 90% efficient and brush sweepers about 50% efficient, assuming a smoothly paved surface and no interference from parked vehicles. Particles which remain, mostly finer material, will have a high polluting potential.

Street sweeping effectiveness is also a function of sweeping frequency, number of passes per sweeping, equipment speed, and pavement conditions. Contaminants on street surfaces build up rapidly following sweeping or flushing by rain. The average sweeper will cover approximately 25 curb-miles per day. Studies have shown that nearly 90% of the contaminants will accumulate within 12 inches of the curb; only one sweep is needed. Operators of street sweepers should be made aware

of the importance of collecting fine solids; this would improve their efficiency, including the speed at which they operate the equipment. Concrete streets have been found to be generally cleaner than asphalt streets, but this is not a basis for recommending the use of the former. However, broader concrete gutters could lead to greater street cleaning efficiency. Porous pavements should not be used in areas susceptible to heavy loads of contaminants unless sweeping can be performed each day. Damaged pavement is impossible to clean effectively and should be resurfaced.

Roadside ditches, rock-lined ditches, culverts, drop inlets, sediment retention basins, and storm drains also need to be cleaned out periodically. Vacuum-type equipment is also available for this type of maintenance. The "Vactor" type truck is available to maintain these erosion control structures. The use of a "Vactor" type truck is much better than the annual use of a grader to clear roadside ditches along streets and highways without curbs. The grader operator usually digs into the toes of the slopes, thus removing material and ensuring continued annual erosion.

METHODS AND MATERIALS

Sweeping should be scheduled based upon the specific conditions of the site. Based upon the amount of sediments and contamination generation, sweeping frequency should be increased or decreased. The seasons of the year may affect the sweeping frequency with spring and fall typically the greatest. Sweepings should be disposed of in approved locations.

EFFECTIVENESS

Regular street cleaning practices are very effective in maintaining the continuing effectiveness of other roadside erosion control facilities and in minimizing dust conditions caused by constant stirring up of dust particles on streets and parking lots.

NON-PAVED ROADS:

WATERBARS

DEFINITION

A ridge or ridge and channel constructed diagonally across a sloping road or utility right-of-way that is subject to erosion.

PURPOSE

Used to prevent erosion on long, sloping right-of-way routes by diverting runoff at selected intervals.

PLANNING CRITERIA & IMPLEMENTATION

Narrow rights-of-way on long slopes used by vehicles can be subject to severe erosion. Surface disturbance and tire compaction promote gully formation by increasing the concentration and velocity of runoff. Waterbars are practical where runoff protection is needed to prevent erosion on sloping access right of-ways, and on sloping areas generally less than 100 feet in width.

Water bars are constructed by forming a ridge or ridge and channel diagonally across the sloping right-of-way. Each outlet should be stable and should be able to handle the cumulative effect of upslope diversion outlets. The height and side slopes of the ridge and channel are designed to divert water and to allow vehicles to cross.

MAINTENANCE

- Inspect water bars periodically for vehicle wear. Inspect for erosion and sediment deposition after heavy rains.
- Remove debris and sediment from diversion channel and sediment traps, repair ridge to positive grade and cross section. Add gravel at crossing areas and stabilize outlets as needed.
- Repair and stabilize water bars immediately if right-of-way is disturbed by installation of additional utilities.
- In removing temporary water bars, grade ridge and channel to blend with natural ground. Compact channel fill and stabilize disturbed areas with vegetation. Water bars should not be removed until all disturbed areas draining to them have been stabilized, inspected, and approved.
- If water bars are designed for permanent use, correct any erosion problems, stabilize outlets, and apply permanent seeding.

ROCK-LINED INBOARD DITCH

DEFINITION

A drainage ditch cut along the inboard side of the roadbed to intercept drainage from the slope above or small streams.

PURPOSE

Inboard drainage ditches usually direct their water through a culvert that crosses under the road.

PLANNING CRITERIA & IMPLEMENTATION

The inboard ditch is on the inside of the road, usually at the foot of the cutbank. Ditches can be lined with rock when conditions allow.

MAINTENANCE

Corrective actions entail the application of erosion control measures and sediment retention as specified by situational placement of BMP. Measures intended to be in place before ditch has been cleaned out will minimize sedimentation resulting from erosion disturbances.

OUTSLOPED ROADS

DEFINITION

Outsloped roads provide means of dispersing water in a low-energy flow from the road surface.

PURPOSE

Disperse water along fill slope and reduce erosion; prevent concentration of flow on road surface that would otherwise cause rill, gully, and rut erosion. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety can be met.

PLANNING CRITERIA & IMPLEMENTATION

Outsloping is accomplished with an excavator, dozer, and grader (the excavator pulls back fill and places the material in the ditch; the dozer assists in moving and reshaping the road profile; and the grader completes the final profile). Outslope road is used when:

- Road grade is gentle or flat (< 7%)
- Ditch or cut slope is unstable.
- Surface can be kept smooth.
- Rocky soils, dry hillsides.
- Road is closed.
- Rutting can be controlled.
- Road use is seasonal and traffic is light.

EFFECTIVENESS & MAINTENANCE

Informal observations indicate immediate and long-term facility and resource benefits, including less sediment delivered to stream channels and reduced road maintenance. In areas with highly erodible soils, outsloping roads with unvegetated soils may increase erosion. Outsloping is often combined with other road treatments, including rolling dips and armored crossings to control water. Maintenance of outsloped roads is part of a regular road maintenance regimen.

GRAVEL OR ROCK SLOPE ARMOR

DEFINITION

Rock slope armor is a layer of rock, such as ditch lining rock, cobble rock, concrete rubble, or riprap, which is hand or mechanically placed on an erodible soil slope.

PURPOSE

The primary purpose of rock slope armor is to protect slopes with erodible or ice-rich soils from wind and water erosion, including rainfall, sheet flow run-on, or seepage. Rock slope armor may temporarily stabilize slopes until final stabilization is achieved, or may serve as final non-vegetative permanent stabilization on slopes when implemented in accordance with the Construction General Permit.

PLANNING CRITERIA & IMPLEMENTATION

Rock slope armor is applicable to:

- Slopes where unanticipated flows are encountered. On a cut slope, this could be due to run-on. A temporary diversion should be installed to allow construction of the cut slope, but the rock slope armor provides permanent stabilization.
- Fill slopes around the inlet and outlet of culverts.
- On bridge abutments above the design water elevation and at points where bridge scuppers discharge near or on abutments.
- The downside of roadway super-elevations where the ground surface slopes away from the
- roadway (foreslopes).
- On slopes where groundwater seeps or springs occur.

EFFECTIVENESS & MAINTENANCE

Rock slope protection is most effective when used in combination with long-term vegetative practices. Provide spaces between rocks for containerized plants if desired and overseed to encourage vegetation in rock interspaces. Refer to NRCS "Slope Stabilization using Vegetation" tip sheet for more information. Periodic inspection and maintenance will be required based on post-construction site conditions. Make any repairs necessary to ensure the measure is operating properly.

ROLLING DIP

DEFINITION

Rolling dips are smooth, angled depressions constructed in the roadbed where the road grade reverses for a short distance and surface runoff is directed in the dip to the outside or inside of the road.

PURPOSE

The dip causes storm water runoff to exit the road surface while allowing for passage of motor vehicles at reduced road speeds. Rolling dips along unpaved road surfaces can be an effective way to disperse runoff. While an insloped, outsloped, or crowned road surface can disperse runoff, their function can be reduced by wheel rutting. Frequently installed rolling dips ensure the most reliable form of road drainage with the least amount of maintenance in the future. Rolling dips can also be constructed to drain the cutbank and inboard ditch as well as the road surface.

PLANNING CRITERIA & IMPLEMENTATION

Appropriate for road surface drainage on any low-speed ranch or forest road. Rolling dips may be traveled on in winter if the road surface has sufficient rock and otherwise good drainage.

Construction guidelines:

- Begin the cut portion of the rolling dip about 50 to 80 feet up the road from where you would like the trough of the dip to outlet. This cut portion should increase in its outslope as it approaches the trough. The trough portion of the rolling dip should be oriented at a 30 degree skew to the road. At the trough the reverse grade or fill portion of the dip should begin, running for about 15 to 20 feet in length. The fill portion should then gradually return to the original road grade.
- Angle the axis of the dip no less than 30 degrees and up to 60 degrees to the road alignment.
- A steeper angle is required for steeper road grades.
- The lowest portion of the dip should be 11 to 18 inches deep into the roadbed with the cross-slope of the dip axis at least 1% greater than that of the original roadbed cross-slope.
- If rolling dips are constructed along rocked roads than rolling dip needs to be rocked.
- The outlet must be on stable ground or armored or otherwise stabilized.
- On average, no more than 150’ of road surface or ditch should be connected to a rolling dip.

MAINTENANCE

Instruct road maintenance personnel as to the function and design of rolling dips. Check outlet for erosion and repair as needed. Periodically inspect before and during rainy season. Remove sediment buildup, repair ruts.

NON-CULVERTED (TEMPORARY) STREAM CROSSINGS

DEFINITION

A bridge, ford or temporary structure installed across a stream or watercourse for short-term use by vehicles or heavy equipment.

PURPOSE

To provide a means for vehicles to cross streams or watercourses without moving sediment into streams, damaging the streambed or channel, or causing flooding. Where heavy equipment must be moved from one side of a stream channel to another, or where light-duty construction vehicles must cross the stream channel frequently for a short period of time.

PLANNING CRITERIA & IMPLEMENTATION

- Contact the local Conservation Commission regarding any stream crossing or other work conducted in a wetland resource area. The Wetlands Protection Act requires that for any stream crossing or other work conducted in a wetland resource area, or within 100 feet of a wetland resource area, the proponent file a "Request for Determination of Applicability " or a "Notice of Intent " with the Conservation Commission.
- Careful planning can minimize the need for stream crossings. Try to avoid crossing streams, whenever possible, complete the development separately on each side and leave a natural buffer zone along the stream.
- Temporary stream crossings are necessary to prevent damage to stream banks and stream channels by construction vehicles crossing the stream. This reduces the sediment and other pollutants continually being tracked into the stream by vehicles. These are temporary crossings that represent channel constrictions which may cause obstruction to flow or erosion during periods of high flow. They should be in service for the shortest practical period of time and should be removed as soon as their function is complete.
- Select locations for stream crossings where erosion potential is low. Evaluate stream channel conditions, overflow areas, and surface runoff control at the site before choosing the type of crossing. When practical, locate and design temporary stream crossings to serve as permanent crossings to keep stream disturbance to a minimum.
- Plan stream crossings in advance of need, and when possible, construct them during dry periods to minimize stream disturbance and reduce cost. Ensure that all necessary materials and equipment are onsite before any work is begun. Complete construction in an expedient manner and stabilize the area immediately.
- When construction requires dewatering of the site, construct a bypass channel before undertaking other work. If stream velocity exceeds that allowed for the in-place soil material, stabilize the bypass channel with riprap or other suitable material. After the bypass is completed and stable, the stream may be diverted.
- Unlike permanent stream crossings, temporary stream crossings may be allowed to overtop during peak storm periods. The structure and approaches should, however, remain stable. Keep any fill needed in floodplains to a minimum to prevent upstream flooding and reduce erosion potential. Use riprap to protect locations subject to erosion from overflow.

MAINTENANCE

- Inspect temporary crossing after each rainfall event for accumulation of debris, blockage, erosion of abutments and overflow areas, channel scour, riprap displacement, or piping along culverts.
- Remove debris; repair and reinforce damaged areas immediately to prevent further damage to the installation.
- Remove temporary stream crossings immediately when they are no longer needed. Restore the stream channel to its original cross-section, and smooth and stabilize all disturbed areas.
- Leave in-stream sediment traps in place to continue capturing sediment.

CULVERTED STREAM CROSSINGS

DEFINITION

A stabilized area or structure constructed across a stream to provide controlled access for people, livestock, equipment, or vehicles.

PURPOSE

This practice is applied to improve water quality by reducing sediment, nutrient, or organic loading to a stream, and to reduce streambank and streambed erosion. This practice applies to all land uses where an intermittent or perennial watercourse (stream) exists, controlled access from one side of the stream to the other side is necessary to reduce or eliminate environmental degradation, or soils, geology, fluvial geomorphology, and topography are suitable for construction of a stream crossing.

PLANNING CRITERIA & IMPLEMENTATION

For culvert crossings, consider incorporating natural streambed substrates throughout the culvert length for passage of aquatic organisms. Natural streambeds provide passage and habitat benefits to many life stage requirements for aquatic organisms and may reduce maintenance costs. Consider including a well-graded rock riprap apron on the downstream edge of concrete crossings to dissipate flow energy. Consider all life stages of aquatic organisms in the stream crossing design to accommodate their passage, in accordance with the species' requirements. Consider the habitat requirements of other aquatic or terrestrial species that may be affected by construction of a stream crossing. For example, a crossing may be designed with features that also promote safe crossing by terrestrial vertebrates. For concrete fords, consider using precast concrete panels in lieu of cast-in-place concrete slabs. To the extent possible, the panels must follow the contours of the streambed in order to avoid potential problems with sediment accumulation. As with the poured-in-place concrete, install a gravel base and toe walls.

Locate stream crossings to avoid adverse environmental impacts and consider:

- Using the "riffle" section of the stream for the proposed crossing, for it is frequently one of the most
- stable sections of a stream. When riffles are not present, consider using a stable straight reach.
- Effects of large woody material on the operation and overall design of the crossing.
- Short-term and construction-related effects on water quality.
- Overall effect on erosion and sedimentation that will be caused by the installation of the crossing and any necessary stream diversion.
- Effects on upstream and downstream flow conditions that could result in increases in erosion,
- deposition, or flooding. Consider habitat upstream and downstream of the crossing to avoid fragmentation of aquatic and riparian habitats.

Prepare plans and specifications for stream crossings in accordance with this standard. Clearly describe the requirements for applying the practice to achieve its intended purpose in the plans and specifications must as a minimum, include the following in plans and specifications:

- Location of stream crossing.

- Stream crossing width and length with profile and typical cross sections.
- Thickness, gradation, quantities, and type of rock or stone.
- Type, dimensions, and anchoring requirements of geotextile.
- Thickness, compressive strength, reinforcement, and other special requirements for concrete, if used.
- Applicable structural details of all components, including reinforcing steel, type of materials,
- thickness, anchorage requirements, lift thickness, covering.
- Load limits for bridges and culverts.
- Vegetative requirements that include seed and plant materials to be used, establishment rates, and season of planting.
- Location, type, and extent of fencing required.
- Method of surface water diversion and dewatering during construction or a statement making the contractor responsible for selecting such.
- Location of utilities and notification requirements.
- Additional site-specific considerations.

MAINTENANCE

Develop an operation and maintenance plan and implement it for the life of the practice. Include the following items in the operation and maintenance plan, as a minimum:

- Inspect the stream crossing, appurtenances, and associated fence at least annually and after each major storm event. Make repairs, if needed.
- Remove any accumulation of organic material, woody material, or excess sediment.
- Replace surfacing stone used for livestock crossing as needed.

ACCESS ROAD

DEFINITION

An access road is an established route for equipment and vehicles.

PURPOSE

This practice is used to accomplish one or more of the following purposes: To provide a fixed route for vehicular travel for resource activities involving the management of conservation forestry operations, livestock, agriculture, wildlife habitat, and other conservation enterprises.

This practice applies where access is needed from a private or public road or highway to a land use enterprise or conservation measure, or where access is needed in a planned land use area. Access roads range from single-purpose, seasonal-use roads, designed for low speed and rough driving conditions, to all-purpose, all-weather roads. Single-purpose roads provide access to areas such as forest fire lines, forest management activities, remote recreation areas, or for maintenance of facilities.

PLANNING CRITERIA & IMPLEMENTATION

Consider visual resources and environmental values during planning and design of the road system. Consider locating roads outside of the active floodplain to reduce bank erosion potential and the effects on stream hydrology. Limiting the number of vehicles and vehicle speed will reduce the potential for generation of particulate matter and decrease safety and air quality concerns. During adverse weather, some roads may become unsafe or may be damaged by use. Consider restricting access to the road at that time. When revegetation is needed, consider revegetating using species or diverse mixes that are native or adapted to the site and have multiple benefits. In addition, where appropriate, consider a diverse mixture of forbs and wildflowers to support pollinator and other wildlife habitat.

Consideration should be given to:

- Effects on downstream flows, wetlands, or aquifers that would affect other water uses or users.
- Effects on wildlife habitats that would be associated with the practice.
- Utilizing buffers where possible to protect surface water.
- Short-term and construction-related effects of this practice.

Provide plans and specifications that describe the requirements for applying the practice to achieve its intended purpose. As a minimum, include:

- A plan view of the proposed road that shows water features, known utilities, and other features that affect the design.
- Road width and length with profile and typical cross section(s) including turnouts, parking, and turnarounds.
- Design road grades or maximum grades when applicable.
- Soils investigation. Include location of soil borings and plot of the soil/geologic boring showing the Unified Soil Classification System, as needed.
- Type and thickness of surface treatment including any subbase preparation.

- Grading plan.
- Cut and fill slopes where applicable.
- Planned drainage features.
- Location, size, type, length, and invert elevations of all required water control structures.
- Vegetative requirements that include vegetation materials to be used, establishment rates, and
- season of planting.
- Erosion and sediment control measures, as needed.
- Safety features.
- Construction and material specifications.

MAINTENANCE

Prepare a written operation and maintenance plan for the access road. As a minimum, include the following activities:

- Inspect culverts, roadside ditches, water bars, and outlets after each major runoff event and restore flow capacity as needed. Ensure proper cross section is available and outlets are stable.
- Maintain vegetated areas in adequate cover to meet the intended purpose(s).
- Fill low areas in travel treads and regrade, as needed, to maintain road cross section. Repair or replace surfacing materials as needed.
- Selection of chemical treatment(s) for surface treatment or snow/ice removal, as needed.
- Select the chemicals used for surface treatment or snow and ice removal to minimize adverse effects on stabilizing vegetation.
- Selection of dust control measures, as needed.