HOMEOWNER BMPS

URBAN

- **LOW IMPACT DEVELOPMENT**
- **WASTE MANAGEMENT**
- **STREET RUNOFF COLLECTION**
- **STORM DRAINAGE STRUCTURES**
- **CULVERTS**
- **IRRIGATION**
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RURAL

- **EROSION & SEDIMENT CONTROL**
- **LOW IMPACT DEVELOPMENT**
- **WASTE MANAGEMENT**
- **HORSE PROPERTY BMPS**

URBAN:

LOW IMPACT DEVELOPMENT

DEFINITION

Systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration, or use of stormwater in order to protect water quality and associated aquatic habitat.

PURPOSE

LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible.

APPLICABILITY

EPA currently uses the term green infrastructure to refer to the management of wet weather flows that use these processes, and to refer to the patchwork of natural areas that provide habitat, flood protection, cleaner air and cleaner water. At both the site and regional scale, LID/GI practices aim to preserve, restore and create green space using soils, vegetation, and rainwater harvest techniques.

LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels and permeable pavements. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions.

WASTE MANAGEMENT

DEFINITION

A planned waste management system designed for solid and/or liquid waste containment, management and disposal in a manner which does not degrade the environment. Waste management systems are utilized for livestock wastes, municipal waste treatment plant effluent and sludges, agricultural processing wastes and industrial processing wastes.

PURPOSE

Waste management systems are implemented to manage agricultural, municipal and industrial wastes in a manner which minimizes impacts to the air, soil, surface and ground water resources, and to protect the public health and safety. Systems are specifically designed to preclude discharges to the environment and to the fullest extent practicable, recycle wastes through soil and vegetation.

APPLICABILITY

Each waste management system 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, and waste treatment technology establish the minimum acceptable standards for waste management systems.

PLANNING CRITERIA

Design criteria must be in accordance with applicable federal, state and local regulations, industry standards and completed by a qualified professional engineer. Typical components of waste treatment systems include, but are not limited to:

Sediment/Debris Basins or Other Settling Facilities
Dikes, Diversions or Terraces
Disposal Lagoons, Aerated Lagoons, Oxidation Ditches
Drainage Field Ditches, Drainage Land Grading
Grassed Waterways or Ditches
Waste Storage Facilities
Irrigation Systems
Effluent Land Application
Subsurface Drains
Pumping Plants
Waterspreading Facilities

All system components should be consistent with accepted engineering practices and protect public health and safety. Surrounding land uses should be incorporated into the waste management system development review process and mitigation measures installed to minimize off-site impacts.

METHODS AND MATERIALS

A waste management system must be designed, engineered, constructed and maintained as a system. Individual components should not be constructed without an overall waste management plan approved. Public health and safety, wildlife and livestock should all be protected from potential hazards through the installation of safety devices and management practices. A comprehensive operations and maintenance plan should be developed for the system to ensure proper day-to-day operations.

MAINTENANCE

The operation of a waste management system will require ongoing inspection and maintenance to keep the system functioning. A comprehensive maintenance plan should address all system inspection and maintenance needs, including contingency and emergency response issues.

EFFECTIVENESS

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

STREET RUNOFF COLLECTION

DEFINITION

Concrete or asphalt structures for the collection of surface runoff from paved roadway surfaces, parking lots, or other impervious surfaces.

PURPOSE

To prevent erosion of roadside shoulders and adjacent roadway slopes from surface runoff. To direct street runoff to collection and conveyance systems off of the street.

APPLICABILITY

To be used for collection of surface runoff from paved surfaces.

PLANNING CRITERIA

Street runoff collection systems should be designed by a qualified professional engineer. Systems should be designed to the specifics of the site including: topography, elevation, soils, climate and the proposed discharge area.

METHODS AND MATERIALS

1. Roadways should be designed to drain from the roadway surface into lateral runoff collection facilities such as curb and gutter or roadside ditches.

2. Paved roadways to be used as streets in residential or commercial areas should be complete with curbs, gutters, and appropriate infiltration and drainage facilities.

3. Paved roadway shoulders should be constructed along all existing paved roadways which do not meet the above standards. They should be constructed wherever roadside drainage facilities are required to reduce erosion or other surface runoff management problems.

4. In steep areas with cross slopes in excess of 15 percent and where the roadway is bounded by a fill slope, the roadway should be constructed to drain away from the fill slope.

5. Curbs and gutters should be designed to the specifications and requirements of the specific area.

6. Curb design should be incorporated into roadway slope stabilization structures to eliminate concentrated surface flows along the toe or over the top of slopes.

7. Asphalt-concrete dikes should be used in limited situations where damage from vehicular traffic is not likely to occur. Acceptable uses include incorporation into slope toe stabilization along roadways and along parking lots which are not bordered by fill slopes.

8. Asphalt-concrete dikes should not be used along crowned roadways above adjacent fill slopes where damaged sections could allow concentrated runoff flows off the roadway onto the fill slope face. Dikes should not be utilized in areas of snow accumulation as snow plows will damage them.

9. Construction materials should satisfy minimum requirements of the appropriate state and local regulatory agencies.

MAINTENANCE

The following standards apply to the maintenance of roadway surfaces, curb and gutter drainage facilities, and infiltration facilities associated with paved streets.

1. All roadway and parking surfaces should be kept clean and free from substances which will deteriorate the quality of runoff waters from these surfaces.

2. All roadways should be swept with a vacuum sweeper. Any time an exceptional buildup of litter, sediment material, or debris is present, the surface should be swept, regardless of the schedule.

3. All drainage and infiltration facilities associated with roadways must be maintained to serve the originally intended purposes.

4. Curbs and gutters should be inspected regularly for damage from snowplows or other road maintenance equipment.

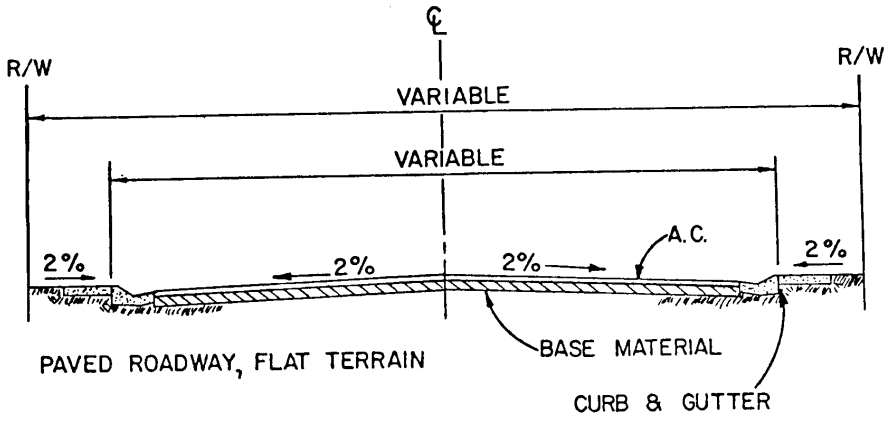
5. Drainage systems and infiltration facilities should be inspected during each major storm or snowmelt for clogging, damage or signs of deterioration. Repair and cleaning should be accomplished as quickly as possible.

6. All major street repairs should incorporate infiltration and drainage facilities to prevent roadway deterioration caused by inadequate drainage.

EFFECTIVENESS

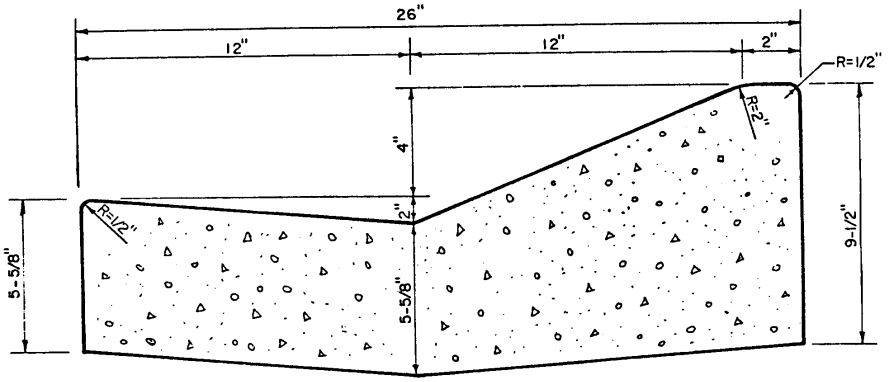
Street runoff collection systems are highly effective in minimizing erosion and sediment transport if the system is designed, installed and maintained properly.

TYPICAL STREET CROSS-SECTION

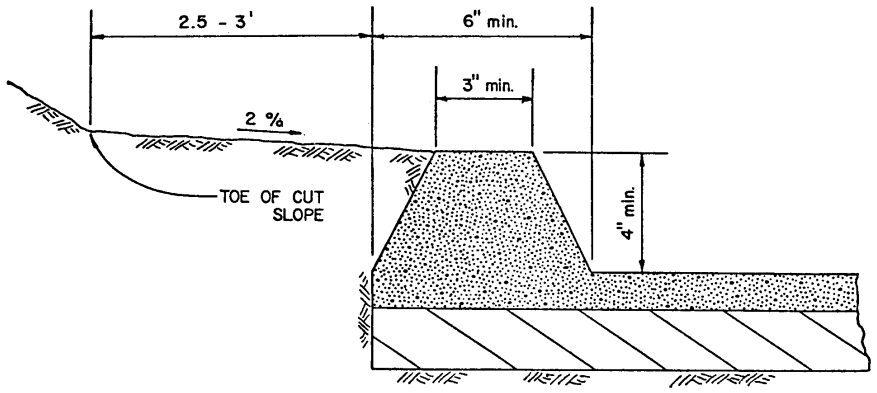


CURB & GUTTER

CONCRETE ROLLED CURB AND GUTTER



TYPICAL SECTION FOR AC DIKE



CULVERTS

DEFINITION

A culvert is a conduit used to provide free passage of surface drainage water under a highway, street, roadway or driveway.

PURPOSE

To provide an uninterrupted drainage pattern for surface and/or ground water flows.

APPLICABILITY

Applicable to all areas where roads or driveways cross surface drainage systems or intercept ground water flows.

PLANNING CRITERIA

Culverts should be designed at drainage swales, roadside ditches, streams, and any drainage system so that the natural drainage pattern is not interrupted or abruptly changed when a permanent roadway or driveway is installed. The factors to consider in the design of culverts are contributing watershed, culvert alignment, culvert grade, type of material, inlet structures, culvert size, debris control, and energy dissipation. Failure to properly consider these factors is the primarily cause for culvert failure. **The design and installation of culverts should be conducted by a qualified professional engineer**.

Special consideration regarding culvert design and siting is required if the subject stream supports a fishery and related aquatic ecosystems. Culvert design should insure safe fish passage and not become a barrier. Impacts to existing stream habitat should be minimized and fully revegetated after culvert installation.

METHODS AND MATERIALS

Culverts should have the same alignment as the drainage channel and provide the runoff water with a direct entrance and a direct exit. Sharp turns at the inlet should be avoided because it may cause erosion or blocking of the inlet by debris. The culvert grade should be at least one or two percent more than the waterway entering the culvert. Generally, a ten percent grade will prevent deposition of sediment. Culverts must be sized to handle the peak flow during a heavy storm. Size and material for culverts must conform to the standards of the local, state, or federal agency having jurisdiction. Culverts draining roadside ditches shall be designed for the 20-year, one-hour storm. Culverts for stream crossings must be designed for the 50-year, one-hour storm. A qualified professional engineer must design the culvert as well as the inlet and outlet protection. Headwalls, wingwalls, or aprons should be used for protection against scour. Erosion frequently

occurs at culvert inlets. The culvert should be installed with its inlet flush to the embankment. The edge of the culvert should be rounded or flared to improve flow into it. Rocks can be placed around the inlet to prevent scour. The culvert outlet should always be at ground level, not suspended above the ground. Because culverts increase the flow velocity, outlet protection is usually required. A rock apron should be installed below the outlet. Culverts must discharge to stabilized drainageways. Culverts requiring fishery and aquatic ecosystem considerations should be designed by a qualified professional. Debris control devices can become an obstacle to fish movements and should be considered carefully.

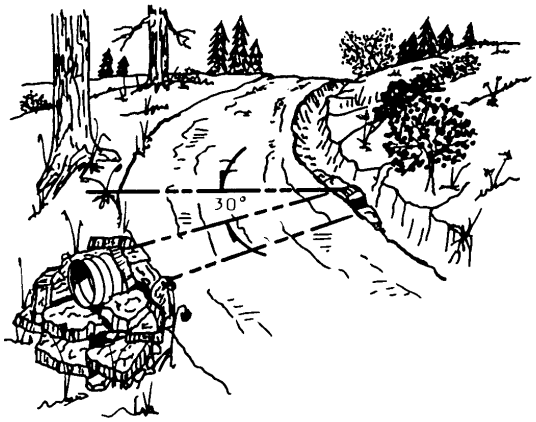
MAINTENANCE

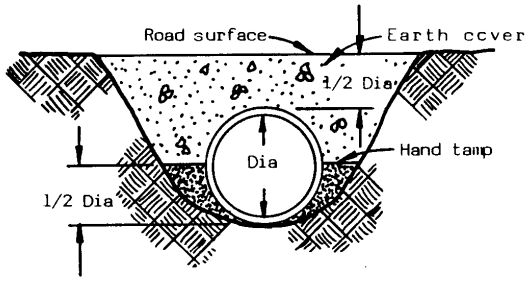
Culverts must be inspected periodically and cleaned out if necessary. If heavy debris is expected, a debris control device should be considered based upon fishery and related aquatic resources. If heavy sediment is expected, a culvert riser should be installed to trap sediment.

EFFECTIVENESS

Culverts are only effective if they are properly installed in accordance with the design criteria. The effectiveness is lost once the culverts are clogged with debris or filled with sediment. Regular street sweeping increases the effectiveness of culverts and reduces the maintenance costs.

CULVERTS





SECTION

IRRIGATION

DEFINITION

Irrigation is the application of water to newly seeded areas, planted trees and shrubs.

PURPOSE

To improve plant establishment and growth, to insure plant survival during the growing season and periods of drought and for revegetation of disturbed sites.

APPLICABILITY

Applicable to most seeding and planting operations. It should be noted that previous BMPs recommend the use of native and adapted species. By nature, these species require less water than most exotic species. Thus, by proper species selection and careful watering practices, water conservation can be achieved.

PLANNING CRITERIA

The use of irrigation will significantly improve the growth, survival, and establishment of plant material during the growing season. Nevada's climate during the growing season is hot and dry. Little precipitation, if any, falls during the summer months. On most sites, the increase survival rate is well worth the additional costs of irrigation, particularly for revegetation of disturbed sites.

The frequency and quantity of irrigation is a function of plant species, site conditions, and precipitation. Deep watering is more effective than shallow watering and helps to conserve water supplies. Water should percolate at least two inches below the root zone during each watering. Thus, watering must be conducted as needed, and not restricted to specific quantities or schedules. Coordinate watering with weather predictions to avoid over watering, which can cause erosion.

Many types of irrigation systems are available. Permanent underground and above ground systems can be installed at a reasonable expense. Above ground systems may be conventional sprinklers, dripline systems or water collars around trees and shrubs. Hand watering using hoses connected to water trucks or hydrants can be used along roadside revegetation projects. Be sure to use the correct nozzle when applying water under high pressure.

METHODS AND MATERIALS

Irrigation systems must be designed for the specifics of the project area, proposed plant species, available water source and related factors. **A qualified professional should be consulted for irrigation system design**.

MAINTENANCE

If properly installed, permanent irrigation systems require little maintenance. They should be checked periodically and repaired as necessary. Erosion caused by over watering must be corrected immediately.

EFFECTIVENESS

Irrigation is a very cost effective way to establish vegetation. The decision to irrigate or not is usually based on economics. However, the damage which could occur if an area is not immediately revegetated is more costly than the cost of irrigation. For sites where water is not available on site, large tanks can be temporarily used for the irrigation season.

LANDSCAPING

DEFINITION

A process utilized to alter the land through designing, grading, seeding and planting of native, ornamental and adapted plant species to create an environment which is aesthetically pleasing.

PURPOSE

To stabilize disturbed sites in a manner which controls surface drainage and soil erosion, provides for vehicle and pedestrian access, visual effect, noise abatement and creates an environment which is beneficial and enjoyable.

APPLICABILITY

Applicable to both urban and rural residential, commercial and industrial settings. Landscaping can be utilized for virtually all development applications.

PLANNING CRITERIA

A qualified professional should be consulted regarding the design, installation and maintenance of landscaping projects. The following elements should be considered in developing a landscaping plan.

1. Topography, drainage ways, length of slopes.

2. Soils, elevation, climate, precipitation.

3. Existing vegetation (See BMP 8-2).

4. Irrigation systems which emphasize water conservation.

5. Landscape theme or goal consistent with the existing environment.

6. Maintenance requirements.

7. Economic practicality.

8. Applicable state and local regulations and ordinances.

METHODS AND MATERIALS

Landscaping should be designed given the advantages and disadvantages of the existing environment. Compatibility with the specifics and conditions of the project site will result in a successful landscape. **A qualified professional with experience in the existing environment should be consulted regarding plant species selection, seeding and planting specifications, surface drainage, fertilizer and pesticide application, irrigation systems and maintenance requirements (See Appendix I-1)**.

MAINTENANCE

A comprehensive maintenance program should be developed to maintain the landscape and keep the irrigation and drainage systems functional. Identified repairs should be completed as required.

EFFECTIVENESS

A properly designed, installed and maintained landscape will control erosion, reduce sediment mobilization, conserve water and provide an aesthetically pleasing environment.

FERTILIZER MANAGEMENT

DEFINITION

Fertilizer management is the careful application of fertilizers based upon plant nutritional requirements to prevent any excess from reaching surface or ground waters.

PURPOSE

To establish plants when revegetating or landscaping, to maintain the health and vigor of vegetation, promote nutrient uptake by plants, and prevent excess nutrients from reaching surface and ground waters.

APPLICABILITY

Fertilizer management is applicable to revegetation projects and existing vegetation where fertilization is necessary. Fertilizers are commonly applied as part of the routine maintenance of most landscaped sites, especially around commercial and residential structures. Golf courses and other areas of grass lawns especially need to manage and regulate fertilizer rates in order to meet water discharge standards. Fertilizers should not be used in or near stream channels or in shorezone areas.

PLANNING CRITERIA

Many soils are frequently deficient in nitrogen, phosphorus, and sulfur and, as a result, need additional fertilizer in order to maintain good plant health and vigor. Plant material in poor vigor is often attacked by disease and insect pests. Permanent vegetation is the best form of erosion control and must be healthy and vigorous. However, overuse of fertilizer can cause serious impacts on water quality.

Criteria that should be evaluated include: the type of fertilizer, rate of application, timing, and type of vegetation. There are three types of fertilizers commonly used: conventional or fast release, slow release and organic materials. Conventional fertilizers release their nutrients rapidly, making them available for immediate growth but do not provide the plant with a sustained supply of nutrients. Conventional fertilizer is usually added annually and as a result, over-fertilizing can be a problem in many areas. Slow release fertilizers release their nutrients slowly over a longer period of time, so there is less chance of them being leached out during watering or rainstorms. Organic fertilizers, such as animal manure or composted plant material, can provide some nutrients. However, the concentration of nutrients varies widely, and deficiencies can occur when organic fertilizers are used alone. Organic materials actually tie up nutrients, especially nitrogen, during the decomposition process. Thus, the best use of organic fertilizers is as soil conditioners and amendments along with other types of fertilizers.

These fertilizers add organic matter to the soil and increase water holding capacity. Organic fertilizers must be worked into the soil and not applied as a mulch because surface runoff can transport this material to permanent waterways and streams. These fertilizers must be decomposed by soil microorganisms before the nutrients are released and can be absorbed by plant material.

METHODS AND MATERIALS

The type of fertilizer and rate of application depend largely on the type of vegetation. Fast release fertilizers are commonly used with grass seeding operations, whereas slow release fertilizers are used with tree and shrub plantings. A conventional, fast release fertilizer should be broadcast immediately after germination of the grasses and each spring. Two hundred fifty pounds of ammonium-phosphate-sulfate (16-20-0) per acre will provide the necessary nutrients, including sulfur. This is about six pounds per 1000 square feet. Maintenance fertilization rates should be cut in half, or about three pounds per 1000 square feet. On sites which will not receive maintenance applications, both slow and fast release fertilizers should be applied at rates of 100-150 pounds each per acre.

The use of native and adapted species for revegetation and landscaping reduces the need for heavy fertilizer applications. These plants are normally adapted to the local soil conditions.

MAINTENANCE

Maintenance applications of fertilizers should be made when loss of vigor or slow growth indicates a possible nutrient deficiency. At lease one additional application is required following the original grass seeding and should be applied in the spring. Soil testing is recommended to determine actual nutrient deficiencies.

EFFECTIVENESS

The use of fertilizer is usually necessary to achieve early and complete establishment of plants when revegetating or landscaping. Overuse is harmful. Fertilizer management is extremely effective in reducing the input of nutrients to surface or ground water systems.

PESTICIDE/HERBICIDE MANAGEMENT

DEFINITION

Application of pesticides to urban vegetation for the control of pests.
Note: Herbicides are defined as pesticides and weeds are defined as pests.

PURPOSE

To develop a pest management program consistent with selected urban landscape goals that is environmentally acceptable.

APPLICABILITY

Pesticides apply to all land uses where increased pest control is needed.

PLANNING CRITERIA

Planning Considerations

1. Integrated pest management principles should be used, some major features of which, are incorporated in subsequent items.

2. Consider the use of plant varieties resistant to the target pest(s), and adjust planting dates to help control weed, insect, and disease problems.

3. Mechanical cultivation and biological controls should be considered, where appropriate.

4. Consider the affect of adequate plant nutrients and soil moisture, favorable pH, and good soil condition to reduce plant stress and improve plant vigor.

5. Consider use of hand weeding for small, isolated areas, or on larger areas where labor costs are not prohibitive. Spot spraying rather than full-coverage spraying is another alternative.

6. Minimize exposure to chemicals, wear protective clothing, and use safety equipment as appropriate.

7. Properly locate chemical mixing and equipment rinsing stations relative to the potential for contamination of ground or surface water. Extreme care must be taken to follow loading and mixing procedures. Provide for managing accidental spills.

8. Properly rinse equipment and re-use rinse water for subsequent batches of the same pesticide or herbicide, where possible.

9. Store pesticides in original containers in a locked, well ventilated, weather resistant building. Post warning signs on or around the building. Locate the building so that accidental spills will create minimal environmental effects. Dispose of pesticide containers according to label directions and adhere to local or state regulations.

10. Provide emergency wash stations for personnel who might be accidentally exposed to chemicals, and formulate a safety plan complete with information about locations of emergency treatment centers for personnel exposed to chemicals.

11. Ensure that backflow prevention devices are installed and operating properly on irrigation systems used for applying pesticides.

METHODS AND MATERIALS

The selection and application of pesticides and herbicides requires professional knowledge and certification except for those chemicals available for sale to the public. Consumers should read and follow all label instructions explicitly to avoid health hazards or environmental contamination.

1. Identify the target pest(s) and the life cycle periods when it is most vulnerable to control. For weeds, identify the species. Determine the best mechanical, biological, or chemical control method or combinations of control and list limitations on use.

2. Specifications for any pest management measure will be described and consistent with state and local regulations. Appropriate land grant university publications concerning pesticide use should be maintained and updated as part of the field office technical guide. All recommendations for specific chemicals, rates of application, level of plant tolerance, and effectiveness ratings shall be in accordance with these publications.

3. A reference section should be included at the end of the specifications that contains those sources used in developing these specifications to provide easy access to more in-depth technical information.

4. All specifications will be consistent with the state and local regulations.

MAINTENANCE

Reapplication of pesticides will be needed to maintain the landscape at the desired level.

EFFECTIVENESS

Using recommended rates and application procedures will provide control of the targeted pest(s) and have little or no effect on water quality.

SNOW DISPOSAL PRACTICES

DEFINITION

Snow disposal practices are those practices which move snow out of the way of human activity.

PURPOSE

To permit snow to be disposed of economically but with minimal effect on water quality.

APPLICABILITY

Applicable mainly to areas such as parking lots, where large amounts of snow are concentrated on-site or removed off-site, and roads and highways where snow is stockpiled or trucked away to disposal sites.

PLANNING CRITERIA

Many state and county highway authorities have a policy of maintaining bare pavement to protect lives and promote safety. Thus, ice and snow are removed as quickly as possible from roads, driveways, and parking areas. The most common treatments include sodium chloride, calcium chloride and sand mixes for preventing icy conditions. The use of an abrasive alone often is not sufficiently effective. With normal highway or roadway snow removal practices, the snow is blown or plowed to the side or center of the roadway. The main concern from a water quality standpoint is the in corporation of deicing compounds, sediment, and debris into the snow, slush, and ice which is picked up and moved to areas where it can degrade water quality or is allowed to melt in place.

Local codes may require that all commercial, tourist accommodation, public service, recreation, and multi-residential projects provide snow storage areas of adequate size to store snow removed from parking, driveway and pedestrian access areas or have arrangements to remove and store accumulated snow off-site. The melting snow in snow disposal areas can be a significant source of sediments, nutrients, hydrocarbons, metals and debris. If not properly planned, these materials can be discharged directly into waterways and streams. Therefore, snow storage or disposal areas should not be located in or adjacent to, stream management areas (SMA).

METHODS AND MATERIALS

Snow disposal areas should be designed and installed by qualified professionals. The location of such areas must be carefully evaluated in terms of site criteria, especially drainage patterns.

These areas should not be located in or adjacent to SMAs. If the area is paved, drop inlets with grease and oil traps should be designed. Infiltration trenches may be required. If unpaved, the operation of the site should be such that vehicles operate on gravel or 12" of packed snow. Drainageways should be protected from direct discharge of snow from trucks or loaders by berms of snow, straw bales, or other barriers.

MAINTENANCE

Snow disposal areas should be inspected after snow melt periods and cleaned of trash if necessary. Occasionally sand/salt deposits may accumulate and need to be removed.

EFFECTIVENESS

If properly designed and located out of SMAs, snow disposal areas can effectively prevent the discharge of degraded melt water. Regular sweeping of areas to be plowed prior to the snow season can improve the appearance of these areas by eliminating the accumulation of trash.

ROAD SALT STORAGE & RELATED PRACTICES

DEFINITION

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

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 premelting 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 process 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.

STREET CLEANING PRACTICES

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, rocklined 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 effect 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.

WELLHEAD PROTECTION

DEFINITION

Preventative actions by which communities or public drinking water supply purveyors can protect their current and future drinking water supply from contamination.

PURPOSE

To protect and maintain the quality of the public drinking water supply now and in the future through the development of a comprehensive Wellhead Protection Program.

APPLICABILITY

Wellhead protection is applicable to any well which provides drinking water for human consumption.

PLANNING CRITERIA

There are seven elements which comprise the state of Nevada's Wellhead Protection Program.

1. Identify roles and responsibilities of all affected entities and formation of a Wellhead Protection Program team.

2. Delineation of Wellhead Protection Areas (WHPA) for each well or well field.

3. Inventory and identify existing and potential contaminant sources within the WHPAs.

4. Develop and implement WHPA management strategies.

5. Develop contingency plans for emergencies.

6. Plan for the siting of new wells.

7. Encourage and involve public participation.

The basic concept of wellhead protection is to determine the land surface area or WHPA, that should be managed in order to protect the ground water being pumped from a well. After identifying and mapping existing and potential contaminant sources, various management options can be developed and implemented. Wellhead protection programs also contain contingency plans to deal with accidents and emergencies. Public participation and education are key elements of wellhead protection.

METHODS AND MATERIALS

A Wellhead Protection Program should be designed by the local community or utility company, as management of WHPAs will be the responsibility of the community. The Nevada Division of Environmental Protection, Bureau of Water Quality Planning can provide guidance and technical assistance to communities and utilities in the development and implementation of a wellhead protection program.

MAINTENANCE

Successful wellhead protection programs require long term maintenance and management at the local level. Funding and maintenance requirements vary significantly depending upon the specifics of the community. Technical assistance is available from the state for maintenance of a wellhead protection program.

EFFECTIVENESS

A community wellhead protection program which is developed consistent with Nevada's State Wellhead Protection Program will be very effective in ensuring a good quality public drinking water supply into the future.

RURAL:

EROSION AND SEDIMENT CONTROL

DEFINITION

Erosion and sediment control structures encompass a host of specific structures that are designed to control a variety of surface drainage, erosion and sediment problems.

PURPOSE

Erosion and Sediment Control Structures protect the watershed and natural resources in a number of ways, for example:

* By preventing the formation of, or the advancement of rills and gullies;
* Reducing the flow velocity in watercourses or providing structures capable of with-standing high flow velocity;
* Stabilizing the grade and controlling head cutting in natural or artificial channels;
* Conveying water from one elevation to another;
* Diverting water away from unstable slopes; and
* By filtering and retaining sediment.

APPLICABILITY

These practices are applicable on sites where:

1. Flow velocity is such that structures are required.

2. Excessive grade or overfill conditions occur.

3. Water needs to be moved from higher to lower elevations.

4. Critical slopes have sheet erosion problems.

5. Vegetative cover is being established.

6. Concentrated runoff from unstabilized areas can be diverted onto stabilized areas.

7. There is a sedimentation or an erosion problem.

METHODS AND MATERIALS

Erosion and Sediment Control Structures include the following:

1. Chute Spillway
2. Flume
3. Pipe Drop
4. Straight Drop Spillway
5. Drop Inlet Spillway
6. Box Inlet Spillway
7. Check Dam
8. Waterbreaks or Waterbars
9. Retaining Walls

The location, design and installation of erosion and sediment control structures should be based on site requirements using qualified engineering assistance.

Material selection for construction should be made with consideration for economic feasibility, durability, and aesthetic values.

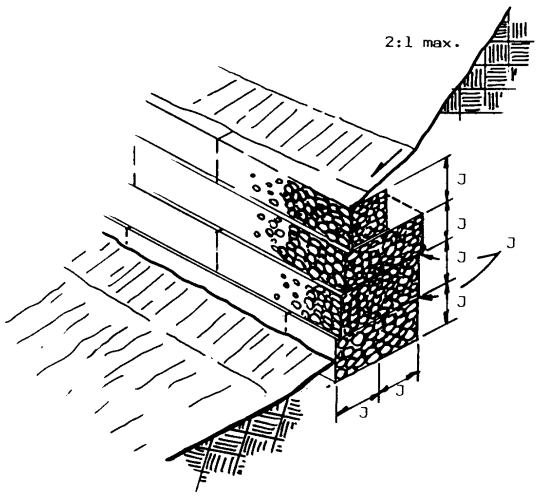
MAINTENANCE

Erosion and sediment control structures require regular inspection, maintenance and repairs given the specifics of the project site. During periods of runoff (i.e., spring snow melt, etc.) and precipitation events (i.e., snow, rain, thunderstorms, etc.), maintenance activities may require expansion. Erosion and sediment structures which are not properly maintained may not function and potentially risk failure, resulting in additional resource degradation.

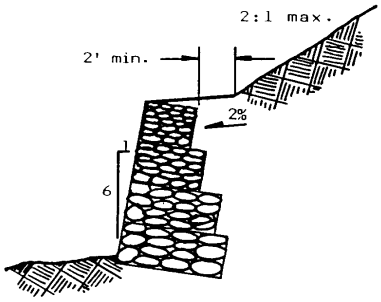
EFFECTIVENESS

Properly designed, installed and maintained, erosion and sediment control structures will effectively reduce the transport of sediments, minimize erosion and the degradation of water resources and reduce negative impacts to natural resources (i.e., vegetation, wildlife, etc.).

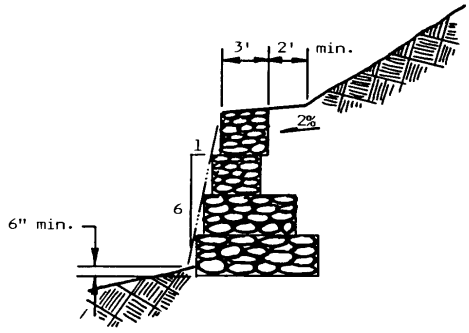
GABION RETAINING WALLS
FIGURE 1



3-DIMENSIONAL



SECTION



SECTION

GABION RETAINING WALLS

LOW IMPACT DEVELOPMENT

DEFINITION

Systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration, or use of stormwater in order to protect water quality and associated aquatic habitat.

PURPOSE

LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible.

APPLICABILITY

EPA currently uses the term green infrastructure to refer to the management of wet weather flows that use these processes, and to refer to the patchwork of natural areas that provide habitat, flood protection, cleaner air and cleaner water. At both the site and regional scale, LID/GI practices aim to preserve, restore and create green space using soils, vegetation, and rainwater harvest techniques.

LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels and permeable pavements. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions.

WASTE MANAGEMENT

DEFINITION

A planned waste management system designed for solid and/or liquid waste containment, management and disposal in a manner which does not degrade the environment. Waste management systems are utilized for livestock wastes, municipal waste treatment plant effluent and sludges, agricultural processing wastes and industrial processing wastes.

PURPOSE

Waste management systems are implemented to manage agricultural, municipal and industrial wastes in a manner which minimizes impacts to the air, soil, surface and ground water resources, and to protect the public health and safety. Systems are specifically designed to preclude discharges to the environment and to the fullest extent practicable, recycle wastes through soil and vegetation.

APPLICABILITY

Each waste management system 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, and waste treatment technology establish the minimum acceptable standards for waste management systems.

PLANNING CRITERIA

Design criteria must be in accordance with applicable federal, state and local regulations, industry standards and completed by a qualified professional engineer. Typical components of waste treatment systems include, but are not limited to:

Sediment/Debris Basins or Other Settling Facilities
Dikes, Diversions or Terraces
Disposal Lagoons, Aerated Lagoons, Oxidation Ditches
Drainage Field Ditches, Drainage Land Grading
Grassed Waterways or Ditches
Waste Storage Facilities
Irrigation Systems
Effluent Land Application
Subsurface Drains
Pumping Plants
Waterspreading Facilities

All system components should be consistent with accepted engineering practices and protect public health and safety. Surrounding land uses should be incorporated into the waste management system development review process and mitigation measures installed to minimize off-site impacts.

METHODS AND MATERIALS

A waste management system must be designed, engineered, constructed and maintained as a system. Individual components should not be constructed without an overall waste management plan approved. Public health and safety, wildlife and livestock should all be protected from potential hazards through the installation of safety devices and management practices. A comprehensive operations and maintenance plan should be developed for the system to ensure proper day-to-day operations.

MAINTENANCE

The operation of a waste management system will require ongoing inspection and maintenance to keep the system functioning. A comprehensive maintenance plan should address all system inspection and maintenance needs, including contingency and emergency response issues.

EFFECTIVENESS

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

HORSE PROPERTY BMPS

DEFINITION

Horse property BMPs are practical tactics designed to mitigate the cost and impact of challenges associated with owning and maintenance of horse facilities, such as changing local regulations, damage from storms and other weather events, and limited resources which can interrupt day-to-day operations.

PURPOSE & APPLICABILITY

BMPs aim to improve the sustainability of horse properties by maximizing the resiliency of the land and waters that service the facility.

PLANNING CRITERIA & MAINTENANCE

CLEANING

Horses typically generate about 50 pounds of manure each day. Managing manure is a critical activity for all equine facilities, regardless of their size. Manure is not only a source of stormwater pollution, but it can also impact the health of the animals if not managed properly. The best practice is to clean manure from corrals and stalls on a daily basis.

STORING

- The storing practices listed below can protect animal health and prevent pollution of stormwater:
- Store manure away from drainage paths.
- Cover manure to prevent stormwater contact.
- When temporary stockpiles of manure are placed directly on soil, relocate them at least once each year.
- Place permanent stockpiles of manure on concrete or asphalt and cover with a permanent structure to prevent stormwater runoff.

Composting

Composting is the most highly recommended manure management practice since it:

- protects animal health,
- saves money, and
- prevents pollution of waterways.

Composting begins with blending manure with other organic materials. With the help of water and air, the manure decomposes naturally over several weeks into a stable, fertile product called humus. As the manure decomposes, the volume is reduced by about half, harmful parasites are killed, and odors are eliminated. Composting also kills fly eggs, protecting horses from nuisance flies, painful bites and insect-borne diseases.

Hauling Away
An alternative to composting is to haul away the manure for recycling or pay a company to come pick it up. Manure should only be sent to the landfill if there are no recycling options available. The haul away option may be desirable for sites that do not have enough space or other means to compost. This practice also reduces pollution and protects the health of animals.

Spreading
Although the practice of spreading uncomposted manure has been in use for a long time, it can have a significant adverse impact on animal health as well as cause pollution of stormwater runoff. Fresh manure contains more pathogens than composted manure. Land application of manure should occur only when certain conditions are met: the manure will be used for crop production, the manure is tilled into the soil, the ground is not wet or frozen, there is adequate land area to provide a buffer between the manure and any stormwater conveyance systems.

Arenas and Paddocks
Arenas and paddocks have the potential to release excess sediment, which can pollute runoff. Erosion within arenas and paddocks also increases maintenance costs by requiring the surface material to be replaced more often. The best practice is to divert runoff around arenas and paddocks and separate the arenas and paddocks from waterways using vegetated buffer strips.

Runoff Management
- Runoff management results in:
- Improved water quality,
- A drier barnyard,
- A healthier horse environment, and
- Better working conditions.

Divert.
Runoff management involves diverting surface runoff around arenas and paddocks using berms, ditches, underground pipelines or other methods. When there is evidence of flow from the arena or paddock, construct berms downgradient to slow the movement of water and reduce the transport of sediment.

Separate.
Locate arenas and paddocks at least 200 feet away from creeks, steep slopes and floodplains. The limits of local floodplains can be researched through FEMA and County Flood Control.

Program.
Separating arenas and paddocks from waterways with vegetated buffer strips
will filter sediment and absorb nutrients in runoff. Drainage can be managed to keep it
from becoming concentrated as it flows through the buffer.

Improve infiltration and drainage.
Use measures such as base rock and sand to improve infiltration and drainage. Paddocks with a gravel or sand bottom allow for percolation of water and pollutants when built in areas with less than a 10% slope. Sand can be kept within the paddocks and arenas by using boards around the perimeter.

Maintenance and Inspection.
Inspect arenas and paddocks after each rain event for signs of erosion. Repair any damaged areas.

Horse Wash Rack Drains
Horse wash water can potentially contain urine, manure, detergents, bacteria and pathogens. These pollutants can cause adverse health effects to humans and animals. To prevent pollution from wash racks contain the wash water and connect the drain to the sanitary sewer. If this is not practical, the wash water can discharge to a French drain or mulch basin.

Permanent Wash Area
A permanent wash area should:

- consist of a concrete slab with a rough finish or permeable gravel or pavers;
- be elevated from the surrounding ground; and
- be located at least 50 feet from water bodies, wells and domestic septic tank drain fields.

Connect to Sanitary Sewer.
Whenever possible, connect permanent wash areas to the sanitary sewer. Connecting to the sanitary sewer:

- Results in containment and treatment of the wash water preventing wash water and associated pollutants from entering the storm drain or waterways;
- Prevents wash water from flowing over other parts of the site, causing damage and muddy conditions;
- Prevents standing water which can become breeding grounds for disease-carrying insects.

Discharge to French Drain or Mulch Basin
If not connected to the sanitary sewer, the best approach is for the wash area to contain a slab drain that discharges to a French drain or a mulch basin. If there is no slab drain, the next approach is to pitch the slab such that water gently runs off and is collected by a French drain or mulch basin at the lowest point of the slab. A French drain is a trench filled with gravel or rock that also contains a perforated pipe to redirect water away from an area. Pre-manufactured French drain systems are also available for easy installation.

Temporary Wash Area: Discharge to Vegetated Area

Keep temporary wash areas at least 50 feet away from water bodies, wells, and domestic septic tank drain fields. Rotate temporary wash areas between established turf areas to prevent mud and sedimentation problems. Wash areas are not permitted to discharge wash water to storm drains, creeks, ponds, or seasonal drainages. Instead, direct runoff to a pervious, well-vegetated area.