

ORDINANCE NO. 381-A

AN ORDINANCE CONCERNING STORM WATER POLLUTION PREVENTION AND EROSION CONTROL FOR DEVELOPMENT AND RESIDENTIAL CONSTRUCTION PROJECTS.

WHEREAS, Summit County has adopted the Snyderville Basin Development Code, the Eastern Summit County Development Code, Ordinance 181-D, and Ordinance 315-B all of which address excavation, placement of fill, grading and or removal of vegetation; and,

WHEREAS, Summit County Storm Water Management Plan requires that more stringent Storm Water Pollution Prevention measures are to be adopted during the implementation period of the Plan; and,

WHEREAS, Storm water pollution prevention and erosion control are only generally addressed in Summit County's Codes or Ordinances; and,

WHEREAS, The United States Environmental Protection Agency and The State of Utah Division of Water Quality have rules, regulations and laws which only address Storm Water Pollution and Erosion Control for construction sites having disturbed areas of (1) acre or more; and

WHEREAS, The State of Utah Division of Water Quality is concerned about various waterways and lakes which have been determined to be impaired; and,

WHEREAS, The State of Utah Division of Water Quality has limited staff to review, inspect or enforce Storm Water Discharge Permits issued by the Division; and,

WHEREAS, The Summit County Engineering Division has been charged with the review, inspection and enforcement of construction activities of projects which require a permit under the Codes and Ordinances adopted by the County;

BE IT ORDAINED BY THE BOARD OF COUNTY COMMISSIONERS OF SUMMIT COUNTY, STATE OF UTAH, AS FOLLOWS:

Section 1. Requirements for Storm Water Pollution Prevention Permit and Erosion Control Permit. (SWP3 and ECP)

- 1) It shall be unlawful and punishable as a Class C Misdemeanor provided for any person, firm, public utility, public agency, or corporation, to make, enlarge or change any excavation, re-grade existing contours, place fill or strip vegetation without complying with the provisions of this ordinance and obtaining a Storm Water Pollution Prevention Plan (SWP3) and Erosion Control Plan (ECP) Permit as provided for herein. It shall also be unlawful for any person hiring or directing

another person, firm, or corporation to perform the work without obtaining a SWP3 and ECP Permit.

- 2) It shall be unlawful and punishable as provided to change or expand the excavation, regrading of existing contours, placement of fill or stripping of vegetation without first requesting a modification of the SWP3 and ECP Permit issued for the work.
- 3) A SWP3 and ECP Permit shall be required for any project which requires a permit under any other Ordinance, Development Code or Building Permit issued by Summit County.
- 4) A SWP3 and ECP Permit shall be required for Commercial and Industrial uses occupying a site of 1 acre or more, and which are found to be discharging sediment off site, into a waterway, or tracking onto a road or street.

Section 2. Emergency Conditions

Emergency excavations, grading, or placement of fill may be made without a permit if the reason for the excavation or grading or placement fill is to prevent loss of life or damage to property which appears to be imminent if the action is delayed by waiting to secure said permits. In such emergency situations, those making the excavation, grading or placement of fill **MUST** contact the County Engineer's Office at the earliest possible time, but in no case later than the first working day following the emergency work in order to secure a formal permit. None of the provisions of this ordinance are waived for emergency situations except for the prior permit requirement.

Section 3. Applications

Applications shall be made by the owner of the property on which the work is being done. In the case of work within a public right-of-way, by the firm, public utility, public agency or corporation actually doing the work, or in the case of work within a private road or private road right-of-way, by the owner of the road or association responsible for the maintenance of the road. Applications for all permits shall be made to the County Engineer's Office as provided, and state the purpose therefor, the person, firm, public utility, or corporation doing the actual work and the name of the person, firm, public utility, or corporation for whom or by which the work is being done and shall contain an agreement that the applicant will comply with all ordinance and laws of Summit County, the State of Utah, and the Federal Government relating to the work to be done. The application shall also provide for an agreement that the applicant shall indemnify the County for any loss, liability, or damage that may result from or because of the making, placement, existence, or manner of guarding or constructing any such excavation. The application shall be accompanied by a Storm Water Pollution Prevention and Erosion Control Plan (SWP3 and ECP). Said plan shall have a drawing of the location of the intended excavation, grading, filling or stripping of vegetation, the pertinent dimensions thereof. The SWP3 and ECP plan shall employ Best Management Practice (BMP's) and shall contain the layout, typical sections and details of the erosion control and sediment control measures to be used in the plan.

Section 4. Permits

1) All permits issued pursuant to this ordinance shall be valid for a period not to exceed the Development Permit, “Grading” Permit or “Excavation” Permit issued in conjunction with the SWP3 and ECP Permit. A copy of the permit issued shall be available on site at all times when work is under way.

2) Excavations, grading, or filling of sites which are one (1) acre or more, are required by State and Federal regulations to file a “Notice of Intent” with the Utah Division of Water Quality, Storm Water Permits Section (<http://waterquality.utah.gov/updes/stormwater.htm>). A copy of the Notice of Intent shall be submitted with the Application as provided herein.

Section 5. Exemptions

The following activities are exempt from the requirements of this ordinance:

- (1) Actions by a public agency or utility, the County or other governmental agency to remove or alleviate an emergency condition, restore utility service, or reopen a public thoroughfare to traffic; or
- (2) Actions by any person when the County determines, and documents in writing, that the actions are necessary to remove or alleviate an emergency condition, restore utility service, or reopen a public thoroughfare to traffic;
- (3) Landscape maintenance activities on fully developed property.
- (4) Bona fide agricultural and farming operations which constitute the principle use of any parcel or tract of ground located in the County and which meet the requirements of the zoning for that portion of the County in which the operation is located.

Section 6. Fees

A review fee and inspection fee, in the current amount as set by resolution of the Board of County Commissioners, shall accompany each application for a permit. Fees must accompany the application.

Section 7. Completion Bond

Applicants shall file a completion bond with the County Engineer in the amount as set by resolution of the Board of County Commissioners at the time the permit is approved. This may be cash, a letter of credit from an FDIC Insured Financial Institution, or a corporate surety bond. The bond shall be valid until one year after all work shown in the permit is completed to guarantee that the conditions of the permit together with any restorative works is completed properly. The bond will be released only upon recommendation of the County Engineer.

Section 8. Supervision and Inspection

1) The County Engineer shall from time to time inspect or cause to be inspected, all work done pursuant to permits to insure the enforcement of the provisions of this title. Notification shall be given to the County Engineer at least 24 hours prior to the commencement of any work and within 24 hours after implementing the SWP3 and ECP. The Completion Bond shall not be released without an inspection made to determine satisfaction of all applicable provisions of this ordinance.

2) For construction sites whose area of disturbance is one (1) acre or more, the applicant shall retain qualified personnel to inspect the sediment control measures, a) at least once each two and after a storm event which precipitated 0.5 inches of water or more within 24 hours. The inspector shall prepare written reports of each inspection and make recommendations for correcting any sediment control measure (BMP) found not performing as intended. A copy of each inspection shall be kept on site until such time as the disturbed area has been permanently stabilized. A copy of the report shall also be submitted the office of the County Engineer.

The applicant shall implement all recommendations of the inspector, or the County Engineer to correct any sediment control measure (BMP) found not performing as intended.

Section 9. Appeals

An applicant for a SWP3 and ECP whose application has been denied or approved with conditions, may appeal the denied or imposed conditions to the Board of Adjustment. A notice of appeal must be filled with the office of the County Engineer within 10 days of the denial or imposition of conditions of the permit. The notice of appeal shall contain the following information:

- (1) An application containing the applicants name, address and daytime telephone number,
- (2) A statement describing the basis for the appeal; and
- (3) The relief sought by the applicant.

The appeal shall be scheduled on the next available Board of Adjustment meeting.

Section 10. Failure to Comply

In the event of failure on the part of any person, firm, public utility, or corporation to comply fully with the provisions of this ordinance, law enforcement authorities of Summit County are authorized to:

- (1) Initiate criminal action by citation or information under Section 10 of this ordinance and/or proceed to forfeit bond, or

(2) Proceed to forfeit bond; or

(3) Install or repair such erosion control and sediment control measures as required to restore the SWP3 and ECP; or

(4) Give written notice to such person, firm, public utility, or corporation to restore such BMP's as required to restore or implement the SWP3 and ECP. Such notice may be served either by personal service or by mailing the notice to the person, firm, public utility, or corporation by certified mail and posting a copy thereof on such installation for a period for 10 days. If the SWP3 and ECP is not implemented or restored within 10 days after the notice is complete, said authorities may implement the SWP3 and ECP the same at the expense of the person, firm, or corporation and recover costs and expenses, and also the sum of \$100.00 for each day the SWP3 and ECP were not in effective operation after notice was complete, in an action for that purpose; or,

(5) If such person, firm, public utility, or corporation refuses to implement a SWP3 and ECP, said authorities may bring an action to abate the same as a nuisance, and if judgement is recovered by said authorities, there shall also be recovered, in addition to having the same abated, the cost of action and the sum of \$100.00 for every day such nuisance remained after notice was given for its implementation in the manner provided in Subsection (2) of this Section. (UCA 27-12-135).

Section 11. Penalty

Any person who violates the provisions of this ordinance is guilty of a Class "C" Misdemeanor, punishable by a fine not to exceed seven hundred and fifty dollars (\$750.00), or a jail term of up to ninety (90) days, or by both such fine and jail term.

Violators of this ordinance are also subject to any penalties that may be imposed by the State of Utah, or the Federal Government, under the Clean Water Act.

In addition to any criminal fines and/or penalties which may be assessed for a violation of this ordinance, Summit County shall have the right to issue a Stop Work Order on the entire construction site, and/or install or maintain appropriate erosion control and sediment control measures on any site which is required to have such measures in the event that construction activity is commenced or continued without such measures having been installed or required by this ordinance. Summit County shall have the right to have such measures installed and maintained by County Personnel or to have hire a private contractor to perform such work at the expense of the permittee, property owner, developer or contractor responsible for such measures. The County may assess said expenses against the bond posted by the permittee.

It is unlawful for any person, firm, public utility, public agency, or corporation to continue any further work on the construction site after a Stop Work Order has been issued. A violation of a Stop Work Order is punishable as a Class C Misdemeanor.

Summit County may also pursue civil remedies for a violation of this ordinance.

Section 12. Specific Requirements

Specific standards and requirements for the enforcement of this ordinance are attached as Appendix "A" which are made a part of this ordinance by reference.

Section 13. Repeal of Ordinance No. 381

Summit County Ordinance 381 are hereby repealed.

Section 14. Severability

Should any section, paragraph, sentence, clause, or phase of this ordinance be declared unconstitutional or invalid for any reason, the remainder of said ordinance shall not be affected thereby.

Section 15. Effective Date

This ordinance shall become effective after publication of such in accordance with applicable State Law.

PASSED AND ADOPTED by the Board of County Commissioners of Summit County, Utah, this ____ day of _____, 2004.

SUMMIT COUNTY BOARD COMMISSIONERS

KEN WOOLSTENHULME, CHAIR

BOB RICHER

SHAUNA KERR

ATTEST:

SUE FOLLETT
Summit County Clerk

APPROVED AS TO FORM:

Deputy Summit County Attorney

COMMISSIONER VOTED:

WOOLSTENHULME _____
(AYE OR NAY)

RICHER _____
(AYE OR NAY)

KERR _____
(AYE OR NAY)

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Section 1. General

The purpose of this ordinance is to prevent the discharge of sediment and other construction related pollution from construction sites by storm water runoff. Construction sites are a major source of pollution to waterways and storm drain systems located within Summit County and the surrounding area. Storm Water runoff carries sediment from construction sites in to nearby water ways, lakes, canals, irrigation systems and storm drain systems. The sediment clogs storm drain systems, pollutes the water in the streams and lakes and damages wildlife habitat and water quality. The same potential for polluting waterways, lakes, canals, irrigation systems, and storm drain systems can occur from commercial or industrial operations. Existing and future commercial and industrial operations which are allowing sediments to be discharged from the operation site, or allowing sediments to be tracked onto public or private roads and streets must also comply with the provisions of this ordinance.

A second purpose of this ordinance is to minimize long-term changes in storm water runoff quantity and quality associated with development. Land development projects and associated increases in impervious cover alter the hydrologic response of local watersheds and can increase stormwater runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition. Other potential hydrologic alterations include reduced infiltration rates and lower in-stream base flow levels. These hydrologic changes adversely affect local fishery resources and aquatic habitat, and are often accompanied by increased pollutant loadings. This ordinance is intended to minimize these adverse effects by requiring

developments to incorporate permanent, post-construction Best Management Practices (BMPs) that treat storm water runoff quantity and quality and maximize on-site infiltration of runoff to promote groundwater recharge.

This Appendix shall establish guidelines for the preparation of the SWP3/ECP, which will include both temporary and permanent BMPs to control erosion and prevent polluted runoff both during and after construction.

Section 2. Definitions

For the purpose of this ordinance and appendix, the definitions listed hereunder shall be construed as specified in this section.

APPLICANT- Any person or entity which files or is required to file an application for a SWP3 and ECP.

APPLICATION- The form and supporting information filed with Summit County for review and approval of a SWP3 and ECP.

APPROVAL- The proposed plan conforms to this ordinance and appendix in the opinion of the County Engineer.

BEST MANAGEMENT PRACTICES (BMPs)- Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

COMMENCEMENT OF CONSTRUCTION- The initial disturbance of soils associated with clearing, grading or excavating activities or other construction activities.

CONTROL MEASURE- Any Best Management Practice or other method used to prevent or reduce the discharge of pollutants.

CIVIL ENGINEER- A professional engineer registered in the State of Utah to practice in the field of civil works.

CWA- Clear Water Act or the Federal Water Pollution Control Act.

DEVELOPMENT OR DEVELOPMENT ACTIVITY- Any of the following activities requiring a permit pursuant to the Codes and Ordinances of Summit County.

- A. Construction, clearing, filling, excavating, grading, paving, dredging, mining, drilling or otherwise significantly disturbing the soil of a site.

B. Building, installing, enlarging, replacing or substantially restoring a structure, impervious surface, and the long-term stockpiling of materials.

C. Construction, elimination or alteration of a driveway onto a public road.

DISCHARGE OF STORM WATER ASSOCIATED WITH CONSTRUCTION

ACTIVITY- Storm Water “point source” discharges from areas where soil disturbing activities (e.g. clearing, grading, or excavating, etc.), construction material or equipment activities(e.g. fill piles, concrete truck washout, fueling, etc.), or other industrial storm water directly related to the construction process (e.g. concrete or asphalt batch plants, etc.) are located.

DISTURBANCE- To alter the physical location, natural appearance, existing vegetation of the land by clearing, grubbing, grading, excavating, filling, building or other construction activity.

EPA- The United State Environmental Protection Agency.

EROSION- is the wearing away of the ground surface as a result of the movement of wind, water or ice.

EXCAVATION- Is the mechanical removal of earth material.

EXISTING GRADE- Is the grade prior to grading.

FILL- Is a deposit of earth material placed by artificial means.

FINAL STABILIZATION- All soil disturbing activities at the site have been completed, and that a uniform (e.g. evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of rip rap, gabions, or geotextiles) have been employed. In some parts of the County, background native vegetation will cover less than 100% of the ground (e.g. arid areas). Establishing at least 70% of the natural cover of native vegetation meets the vegetative cover criteria for final stabilization. For example, if the native vegetation covers 50% of the ground, 70% of 50% would require 35% cover for final stabilization.

FINISHED GRADE- The final grade of size which conforms to the approved plan.

GAS STATION- A permanent commercial or private facility that involves transferring fuel into mobile vehicles or equipment.

GEOTECHNICAL ENGINEER- See “soils engineer.”

GRADE- The vertical location of the ground surface.

GRADING- Any excavating or filling or combination thereof.

IMPERVIOUS SURFACE - Any surface which prevents or retards the penetration of water into the ground, including, but not limited to, paved streets, graveled or paved areas such as driveways, parking areas, packed earth material, oiled macadam or other treated surfaces, sidewalks, walkways, roof surfaces, patios and formal planters.

MAXIMUM EXTENT PRACTICABLE- A level of effort to be undertaken where technical feasibility and financial cost to be incurred are appropriate for the probable negative impacts to water quality to be minimized. Implementation of a storm water management practice is considered practicable unless one or both of the following apply:

- A. The practice is not technically feasible for the proposed use and physical characteristics of the site; or

B. The cost of implementing the practice would outweigh the benefits of maintaining water quality. Costs are considered to outweigh benefits only if they exceed \$0.50 per square foot of the lot or land on which the development takes place.

NATURAL LANDSCAPE- The cover and topography of land before any man-made change, or, in areas where there have been man-made modifications, that state of the area and topography of land as of the date of adoption of this Article.

PERMIT- A Summit County Storm Water Pollution Prevention Permit and Erosion Control Permit.

PERMITTEE- The recipient of a Summit County Storm Water Pollution Prevention Permit and Erosion Control Permit.

PERSON- Any individual, corporation, partnership, association, company or body politic, including any agency of the State of Utah and the United States Government.

PLAN- A Storm Water Pollution Prevention Plan and Erosion Control Plan.

POINT SOURCE- Any discernable, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, collection system, from which pollutants are or may be discharged. This

term does not include return flows from irrigated agriculture or agricultural storm water runoff.

PROFESSIONAL INSPECTION- The inspection required by this ordinance to be performed by the civil engineer, soils engineer, hydrologist, or engineering geologist. Such inspections include that performed by persons supervised by such engineers, hydrologists or geologists and shall be sufficient to form an opinion relating to the conduct of the work.

ROUGH GRADE- The stage at which the grade approximately conforms to the approved plan.

RUNOFF COEFFICIENT- The fraction of total rainfall that will appear at a conveyance as runoff.

SITE- Any lot or parcel of land or contiguous combination thereof, under the same ownership, where grading is performed or permitted.

SLOPE- An inclined ground surface the inclination of which is expressed as a ration of horizontal distance to vertical distance.

SOIL- Naturally occurring superficial deposits overlying bedrock.

SOILS ENGINEER (GEOTECHNICAL ENGINEER)- An engineer experienced and knowledgeable in the practice of soils engineering (geotechnical) engineering.

SOILS ENGINEERING (GEOTECHNICAL ENGINEERING)- The application of the principles of soils mechanics in the investigation, evaluation and design of civil works involving the use of earth materials and the inspection or testing of the construction thereof.

STORM WATER- Storm water runoff, snow melt runoff, and surface runoff and drainage.

STORM WATER DISCHARGE ASSOCIATED WITH INDUSTRIAL ACTIVITY-

Existing Commercial or Industrial operations whose operation may allow sediment, mud or debris to flow from the site or is tracked onto adjacent public or private roads by vehicles leaving the site.

SWP3- Storm water pollution prevention plan, referring to the plan required in the permit.

UNSTABILIZED- Areas of land which are disrupted or whose natural landscape has been changed due to excavation, grading grubbing and clearing, or other construction activity and which has not been finally stabilized.

Section 3. Storm Water Pollution Prevention Plan and Erosion Control Plan (SWP3 and ECP)

A. The Storm Water Pollution Prevention Plan and Erosion Control Plan shall contain the following:

(1) General Information including:

- a brief narrative description of the project
- legal description of site
- copies of relevant permits, easements, rights-of-way, and discharge permission agreements
- copies of maintenance easement(s) and covenant(s)
- total area of parcel/site
- area of expected disturbance by clearing, grading, excavation, filling, or other activities
- contact information for the applicant/permittee

(2) A Site Plan Map or maps that show:

- existing topography and proposed grades (2' contour interval or greater if needed for readability)
- existing drainage courses and impoundments (wet or dry)
- existing wetlands on or adjacent to the site
- existing soil and vegetation cover types

- environmentally sensitive features
- boundary of the 100-year flood plain (if applicable)
- receiving water body(ies) or , if far offsite, distance to and name(s) of receiving water body (ies)
- boundaries of individual drainage areas within the site and discharge point locations (per-and post-development, if different)
- location of construction activities
- extent/limits of clearing and grading
- existing and proposed utility locations
- location and finished elevations of proposed permanent structures including buildings, roads, and parking areas
- location of existing on-site or adjacent storm drain systems and canals
- landscaping plan, including any proposed irrigation system
- location of temporary and permanent stormwater runoff and erosion control BMPs

(3) Technical Information including:

- results of any soil or geologic tests/borings
- construction sequence and schedule for implementation of temporary erosion and sediment control measures
- area of new impervious surfaces and total post-development impervious area

- grades of all impervious surfaces
- hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in this ordinance (see Appendix F for additional details)
- design drawings (plan and profile), construction details, grades, elevations, and supporting engineering calculations (as applicable) for individual permanent stormwater BMPs and proposed drainage systems (see Appendix E for details)
- a description of how the SWP3 and ECP use non-structural controls to the maximum extent practicable for long-term treatment of stormwater runoff, and justification for any use of large-scale structural surface runoff controls (use form provided in Appendix D).

B. The proposed measures and controls described in the SWP3 and ECP shall be designed to meet the following goals and criteria.

(1) The proposed measure and controls shall be designed to prevent or minimize, to the maximum extent practical, the discharge of sediment, debris and other construction- related pollutants from the construction site by storm water runoff.

(2) The proposed measures and controls shall be designed to prevent or minimize, to the maximum extent practicable, the deposit, discharge, tracking by

construction vehicles or other vehicles leaving the construction site, or dropping of mud, sediment, debris or other potential pollutants onto public or private roads and streets. Any such discharge shall be cleaned up and removed prior to the end of the work shift in which the deposit occurred, or prior to sunset whichever comes first.

(3) The proposed measures and controls shall consist of the Best Management Practices (BMPs) available at the time that the plan is submitted. BMPs may include, but shall not be limited to, temporary silt or sediment fences, sediment traps and detention ponds, gravel construction (drain rock) entrances and wash down pads to reduce or eliminate off site tracking, straw bale sediment carriers, establishment of temporary and permanent vegetative cover, use straw mulch as a temporary ground cover, erosion control blankets, temporary interceptor dikes and swales, storm drain inlet protection, check dams, surface drains, pipe slope drains, level riprap pads for culvert outlet protection, reinforced soil retaining systems and gabions.

(4) Existing vegetation should be preserved wherever possible and disturbed portions of the site shall be stabilized. Stabilization practices may include, but not be limited to temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of nature vegetation, and other appropriate measures. Use of impervious surfaces

for stabilization shall be avoided. Except as provided below, stabilization measures shall be initiated as soon as possible in disturbed portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 10 working days after the construction activity in that portion of the site has temporarily or permanently ceased.

(a) Where the initiation of stabilization measures by the 10th day after construction activity temporarily or permanently ceases is precluded by deep snow or frozen ground conditions, stabilization measures shall be initiated as soon as practicable.

(b) Where construction activity on a portion of the site is temporarily ceased, and earth disturbing will resume within 15 working days, temporary stabilization measures need not be initiated on that portion of the site.

(5) Measures shall be employed to minimize the risk of discharge of construction-related pollutants (such as paint, thinners, solvents, fuels and oils) from the construction site. Such measures may include implementation of storage practices to minimize exposure of the material to storm water as well as spill prevention and response.

(6) The SWP3 and ECP shall include long-term, post-construction runoff control measures that meet the following performance criteria:

(a) Peak Flow Rate Criteria. The flow rate of runoff from the proposed land development shall not exceed the pre-development runoff rate. Pre- and post- development rates shall be checked for the 10 and 100-year storm events. Structural controls such as detention or extended detention ponds shall include spillways that are adequate to transport the entire peak runoff of the 100-year storm event. The 10-year storm event shall be used for sizing underground storm water conveyance systems, i.e., pipe sections between catch basins and storm drainage manholes. Surface conveyance systems such as canals, drainage channels/ditches/swales, curb and gutters, and culverts shall be designed to safely pass the 100-year storm event. Design storms and runoff values shall be calculated using the methods described in Appendix F.

(b) Flood Control Criteria. Development activities that result in new releases of surface water from the development that inundate, erode, deposit sediment or otherwise damage downstream property, real or personal, shall not be allowed. Releases of runoff to downstream property that, prior to the proposed development, would not have received any runoff, will require that the downstream property owner provides an

easement and consent that shall be written in the land record, and that Summit County grants approval. When releases of runoff are directed into an irrigation canal or ditch, written permission will be required from the canal company president for acceptance of storm water into a canal unless otherwise covered by a flood control agreement. The canal company may also stipulate how the storm drain will enter the canal and any erosion protection needed. Entrance into the smaller private ditches will require the approval of the relevant water right holder and owner of the property upon which the ditch is located. If there is a question as to whether or not the ditch can carry the additional storm water, a capacity evaluation shall be submitted for the ditch in question.

©) Water Quality Criteria. Surface and subsurface (i.e. infiltration) storm water BMPs shall be implemented and maintained such that they provide water quality treatment for (i.e., infiltrate or capture and treat) the runoff volume (WQ_v) associated with a storm event of **0.5 inch in 1 hour** under post-development site conditions. Storm water BMPs shall be designed to remove a proportion of the average annual load of Total Suspended Solids (TSS), according to the sliding scale shown in Appendix E. The required removal rate is based on the percentage of impervious cover under post-development site conditions, and BMPs must be applied to all impervious areas in such a manner that the overall weighted average TSS removal rate

(from one or more BMPs) equals or exceeds the required removal efficiency level. BMPs will also be implemented to remove floatables from storm water runoff prior to discharge of the water from the development site.

(d) Groundwater Recharge Criteria. Annual groundwater recharge rates shall be maintained by promoting infiltration through the use of non-structural and structural methods. At a minimum, annual recharge from the post development site shall mimic the annual recharge from pre-development site conditions. Specifically, BMPs shall be implemented to ensure that the increase in surface runoff volume from the 1-hour, 0.5" storm event relative to pre-development conditions (i.e., the post-development WQv minus the pre-development WQv) is recharged into the groundwater rather than discharged off-site as surface runoff. Infiltration facilities must be situated in areas with suitable soils and adequate depths to groundwater (see Appendix E for detailed suitability information). Adequate pretreatment must be provided for runoff from pollution "hot spots" prior to recharging such runoff into the ground. Pollution "hot spots" include:

- road salt storage facilities
- parking lots that receive road salt applications

- vehicle salvage yards and recycling facilities
- vehicle service and maintenance facilities
- vehicle and equipment cleaning facilities, including carwashes
- fleet storage areas
- industrial sites
- marinas (service and maintenance)
- outdoor liquid container storage
- outdoor loading/unloading facilities
- public works storage areas
- facilities that generate or store hazardous materials
- commercial container nurseries
- permanent, temporary, and mobile fueling operations

(e) Water Quality Criteria for Gas Stations. Because the paved portions of gas stations are sources of harmful pollutants such as oil, gas, grease, metals, and other organic compounds, new gas station developments shall be required to install oil/water separators approved by the County Engineer to treat runoff from all impervious surfaces. Examples of appropriate oil/water separator devices are provided in Appendix E. Oil/water separators shall be installed off-line, upstream of any additional water quality BMPs and detention basins, and as close to the source of oil-generating activity as possible. Separators shall be sized to the water

quality design storm (WQv; 1-hour 0.5" storm) and shall be inspected monthly and maintained as needed. During larger storm events, excess flows should be safely directed away from the separator to another BMP. In addition to installing oil/water separators, gas stations must also install controls to meet all other treatment criteria listed above. Oil-water separators should not be used alone to treat storm water runoff, but rather as pretreatment to another storm water BMP or series of BMPs.

Section 4. Temporary and Permanent Erosion and Sediment Control/Stormwater Treatment Methods

Refer to Appendix B, C, D, and E for examples of temporary and permanent erosion and sediment control/stormwater treatment measures. The permittee may use those controls which may apply to his/her site, or may use other BMPs, and erosion and sediment control measures provided they are approved by the County Engineer. However, when selecting long-term (post-construction) stormwater treatment methods, the applicant must demonstrate that they have employed non-structural controls (e.g., reduction in paved area, disconnection of rooftop runoff, source control/pollution prevention, etc.) to the maximum extent practicable rather than relying solely on structural controls such as detention ponds. A more detailed list of non-structural control measures is provided in Appendix D. Non-structural controls are the preferred treatment method because they limit the increase in volume and rate of runoff associated with development, help preserve groundwater recharge, and limit pollutants at their source. Large-

scale structural surface runoff controls (e.g., large detention ponds) will only be permitted when the applicant demonstrates to the satisfaction of Summit County that it is not feasible to meet the storm water quantity and quality requirements through the use of non-structural and subsurface techniques alone. The worksheet included in Appendix D should be filled out by the applicant to demonstrate the use of non-structural techniques. If BMPs other than those shown in Appendix B, D or E are used, the permittee must demonstrate to the satisfaction of the County Engineer that the alternative controls will successfully meet the requirements listed in Section 3 above. Summit County may require more than the minimum control requirements specified if hydrologic, geologic, or topographic conditions warrant or if unique flooding, stream channel erosion, or water quality problems exist downstream from a proposed project.

Section 5. Proper Operation and Maintenance

A. The permittee shall install the erosion and sediment control measures required by the approved SWP3 and ECP before commencing any construction activities on the site to which the plans apply, or at such time as indicated on the plan. The permittee shall contact County Engineer's Office to schedule an inspection of the installed measures prior to commencing other construction activities.

B. The permittee shall maintain such measures on the site in good condition until the disturbed areas have been finally stabilized and the measures are no longer necessary to prevent or minimize, to the maximum extent practicable, the discharge of sediment,

debris and other pollutants from the site by storm water runoff or vehicular tracking. The erosion control measures shall be properly installed and maintained in accordance with the manufacturers specifications and good engineering practices. Once the temporary erosion control measures have been deemed no longer necessary, or once the site is finally stabilized, the controls shall be removed from the site in a timely manner.

C. Maintenance Covenants

(1) Establishment of Covenant. Maintenance of all long-term stormwater management facilities, including non-structural practices such as natural area conservation and buffer establishment, shall be ensured through the creation of a formal maintenance covenant that must be approved by Summit County and recorded into the land record prior to final plan approval. As part of the covenant, the location of each permanent structure will be added to the county's storm water map and a schedule shall be developed for when and how often maintenance will occur to ensure proper function of the stormwater management facility. The covenant shall also include plans for periodic inspections to ensure proper performance of the facility between scheduled cleanouts. The property owner listed on the land record is responsible for performing these periodic inspections and keeping written records of the inspections and any maintenance activities performed. Sample inspection forms are provided in Appendix G. These written records shall be retained for a minimum of three years from the date of the

inspection or maintenance activity. A copy of these written records shall be sent to Summit County within one week of the inspection.

(2) Maintenance and Inspection Plan Requirements. All permanent stormwater management facilities must undergo, at the minimum, semi-annual inspections in the fall and in the spring to document maintenance and repair needs and ensure compliance with the requirements of this ordinance and accomplishment of its purposes. These needs may include; removal of silt, litter, and other debris from all catch basins, inlets and drainage pipes, grass cutting and vegetation removal, necessary replacement of landscape vegetation, and removal and replacement of contaminated filter media. Specific maintenance needs for individual long-term BMPs are provided in Appendix E and sample inspection forms are provided in Appendix G. Following each inspection, a copy of the completed inspection form shall be sent to Summit County within one week of the inspection. Any maintenance needs found must be addressed in a timely manner.

(3) Failure to Maintain Practices. If a responsible party fails or refuses to meet the requirements of the maintenance covenant, Summit County, after reasonable notice, may correct a violation of the design standards or maintenance needs by performing all necessary work to place the facility in proper working condition. In the event that the stormwater management facility becomes a danger to public safety or public health, Summit County shall notify the party responsible for

maintenance of the stormwater management facility in writing. Upon receipt of that notice, the responsible person shall have 30 days to implement maintenance and repair of the facility in an approved manner. After proper notice, Summit County may assess the owner(s) of the facility for the cost of repair work; and the cost of the work shall be a lien on the property.

Section 6. Inspection and Entry

A. The permittee shall allow authorized employees and representatives of Summit County, State of Utah Division of Water Quality, and the Environmental Protection Agency (EPA), to enter the site to which the permit applies at any time during or after construction and to inspect the erosion and sediment control and permanent stormwater treatment measures installed and maintained by the permittee. The permittee shall allow inspection of any other construction activity pertaining to the conditions of the permit. This right of entry shall be formalized in a Maintenance and Inspection Easement that must be approved by Summit County and recorded into the land record such that the easement remains binding on all subsequent land owners.

B. Inspections During Construction

(1) For construction sites greater than 1 acre, qualified personnel (provided by the permittee) shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to

precipitation, areas with structural control measures, and locations where vehicles enter or exit the site at least once every seven (7) calendar days and within 24 hours of the end of a storm that is 0.5 inches or greater. Where sites have been temporarily stabilized, such inspection shall be conducted at least once every month.

(2) Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

(3) Based on the results of the inspection, the pollution prevention, erosion and sediment control, and stormwater runoff control measures identified in the SWP3 and ECP shall be revised as appropriate as soon as practical after such inspection. Such modifications shall provide for timely implementation of any changes to the plan within seven (7) calendar days following the inspection. Such modifications may include maintenance of existing controls, adjustments in the locations of

controls, or addition of new controls to ensure that the ECP/SWP3 is meeting its goals and criteria.

(4) An inspection report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with Section 6B(3) above, shall be made and retained as part of the SWP3/ECP Plan for at least three years from the date that the site is finally stabilized (see Appendix G for sample inspection forms). During construction, the reports shall be maintained onsite along with a copy of the SWP3/ECP Plan. The construction inspection reports shall identify any incidents of non-compliance. Where a report does not identify any incidents of non-compliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed by the permittee or their duly authorized representative and the inspector.

Section 7. Revocation or Suspension of SWP3 and ECP

A. A SWP3 and ECP may be revoked or suspended by the County Engineer or designee upon the occurrence of any of the following:

(1) Failure of the permittee to comply with the plan or any portion thereof, or any condition of the permit; or

(2) Failure of the permittee to comply with any provision of this ordinance, or any other applicable law, ordinance, rule or regulation; or

(3) A determination by the County Engineer that the erosion and sediment control measures implemented by the permittee pursuant to the plan are inadequate to prevent or minimize, to the maximum extent practicable, the discharge of sediment, debris or other pollutants from the construction site by storm water runoff or vehicular tracking.

B. Summit County shall mail permittee written notice of non compliance or personally serve notice to the person responsible for maintaining the erosion control and sediment control measures, before revoking or suspending a permit. The notice shall state the nature and location of the non compliance and shall specify what action is required for the permittee to avoid revocation or suspension of the permit, which in the absence of

exceptional circumstances shall not be less than 5 working days or more than 10 working days. The notice shall be sent by certified mail to the address listed for the permittee on the application.

C. For the purposes of this ordinance, exceptional circumstances include, but are not limited to, situations which involves risk of injury to persons, damage to storm drain facilities, or damage to other property. Summit County may take any action deemed necessary to alleviate any such exceptional circumstances defined above and may bill the permittee, property owner, developer or contractor responsible for creating the exceptional circumstances for the cost of alleviating said circumstance.

D. A stop work order on all construction activity on the site may be issued upon the revocation or suspension of a permit. No construction activity may be commenced or continued on any site for which a permit has been revoked or suspended and a stop work order issued until the permit has been reinstated or reissued.

E. A SWP3 and ECP may be reinstated or reissued upon review and approval of a written description of the permittee's proposed actions to bring the erosion control and sediment control measures into compliance with all provisions of this ordinance, or submission, review and approval of a revised SWP3 and ECP.

Section 8. Compliance with Federal and State Law

Nothing contained in this ordinance is intended to relieve any person or entity from any obligation to comply with applicable federal and/or state laws and any other regulations pertaining to clean water and/or storm water runoff and erosion control.

APPENDIX B: PERIMETER CONTROL EXEMPTIONS

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DEFINITION 1

PURPOSE 1

APPLICATION 1

DEFINITION: Certain construction sites may be exempt from installing silt fence or other temporary perimeter controls if the site meets certain criteria.

PURPOSE: Exemptions for silt fence or other perimeter controls are for construction sites where such controls may be ineffectual, excessive, and/or detrimental to nearby water resources and other natural resources.

APPLICATION: All exemptions must be approved by the Summit County Engineer and must meet the following criteria:

1. Total disturbance is less than 1 acre.
2. A 50 foot wide vegetated buffer exists down gradient from the disturbed portion(s) of the site.
3. A 100 foot wide vegetated buffer exists down gradient between the disturbed portions(s) of the site and any live stream or existing drainage way.
4. The site and vegetated buffer have less than 5% slope (slope must be documented).
5. The vegetated buffer has at least 70% ground cover.

**APPENDIX C1: EROSION AND SEDIMENT
CONTROLS**

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Appendix C2: Typical Residential Stormwater Pollution Prevention Plan C2-1

List of Temporary and Permanent Erosion/Sediment Controls contained in Appendix B.

- (1) Revegetation
- (2) Mulching
- (3) Geotextiles
- (4) Surface Roughening
- (5) Silt Fence
- (6) Straw Bale Barrier
- (7) Stabilized Construction Entrance
- (8) Division Ditch/Dike
- (9) Water Bar
- (10) Storm Drain Inlet Protection
- (11) Brush Barrier
- (12) Gravel Check Dams
- (13) Straw Bale Check Dams
- (14) Slope Drains
- (15) Open Chute Drains
- (16) Rock Lined Ditches
- (17) Grassed/Matted Swales
- (18) Temporary Excavated Sediment Traps
- (19) Equipment and Vehicle Wash Down Area
- (20) Material Storage
- (21) Waste Disposal

UDOT Standard Drawings Temporary Erosion Control Drawings Number 1010- 1014

This list is not to be construed to be the limit of available BMPs, only as a partial list, and as examples which may be employed.

REVEGETATION

DEFINITION: Placement of seed material or sod over open area for temporary or permanent erosion control.

PURPOSE:

- Reduce velocity of storm water runoff.
- Reduce erosion by preventing rainfall directly hitting soil.

APPLICATION :

- All areas disturbed by construction activity, including cut and fill slopes.

LIMITATIONS:

- Revegetation on slopes steeper than 3:1 must utilize geotextiles to promote establishment of vegetative cover.

INSTALLATION:

Temporary Seeding

- Grade and shape the area to be seeded so that it will drain properly and accommodate seeding equipment.
- Loosen compacted soil by racking, or discing where hydraulic seeding will not be used, to provide for seed retention and germination.
- Apply seed and fertilization suitable for the area and season. The seed species and fertilization requirements must be developed by a professional or the local Soil Conservation Service Office.

Permanent Seeding

- Grade and shape the area to be seeded so that it will drain properly and accommodate seeding equipment. If slopes are steeper than 3:1, the use of hydraulic seeding equipment is encouraged.
- Loosen compacted soil by racking, or discing where hydraulic seeding will not be used, to provide for seed retention and germination.
- Spread at least 3 inches of topsoil, if required, before seeding. If topsoil is required, the subsoil should be serrated or disced to provide an interface.

- Apply seed and fertilization suitable for the area and season. The seed species and fertilization requirements must be developed by a professional or the local Soil Conservation Service Office.

MAINTENANCE:

- Inspect seeded areas after every rainfall event and at a minimum of monthly .
- Replace seed on any bare areas, or area showing signs of erosion as necessary.

MULCHING

DEFINITION: Placement of material such as straw, grass, wood-chips, wood-fibers or fabricated matting over open area.

PURPOSE:

- Reduce velocity of storm water runoff.
- Reduce erosion by preventing rainfall directly hitting soil.
- Facilitate plant growth by holding seeds and fertilizer in place, retaining moisture and providing insulation against extreme temperature.

APPLICATION :

- Any exposed area to remain untouched longer than 14 days and that will be exposed less than 60 days (seed areas to be exposed in excess of 60 days).
- Areas that have been seeded.
- Stockpiled soil material.

LIMITATIONS:

- Anchoring may be required to prevent migration of mulch material.
- Down-gradient control may be required to prevent mulch material being transported to storm water system.

INSTALLATION:

- Rough area to receive mulch to create depressions that mulch material can settle into.
- Apply mulch to required thickness and anchor as necessary.

- Recommended Application Rates:
 - Straw: 2-3 bales/1000 square feet (90-120 bales/acre)
 - Wood Fiber: 25-30 pounds/1000 square feet (1000-1500 pounds/acre)
- Ensure material used is weed free and does not contain any constituent that will inhibit plant growth.

MAINTENANCE:

- Inspect mulched areas after every rainfall event and at a minimum of monthly .
- Replace mulch and any bare areas and re-anchor as necessary.
- Clean and replace down-gradient controls as necessary.

Recommended Application Rates for Mulching.

| Material | Application | Depth | Comments |
|--|----------------------|-----------------|---|
| <u>Gravel:</u> Washed 3/4" to 1 1/2" | 9 cu yd/1000 sq ft | 3 inches | Good for traffic areas. Good for short slopes. |
| <u>Straw:</u> Air-Dried, free of seeds and coarse material. | 2-3 bales/1000 sq ft | 2 inches (Min.) | Subject to wind blowing. Tack down or keep moist. |
| <u>Wood Fiber Cellulose:</u> Free from growth inhibitors; dyed green | 35 lb/1000 sq ft | 1 inch (Min.) | For critical areas, double application rate; Limit to slopes <3% and < 150 feet |

GEOTEXTILES

DEFINITION: Matting or netting made biodegradable materials (such as Excelsior blanket, jute, wood fiber, straw, coconut, paper, or cotton) to reduce rainfall impact and surface erosion on disturbed soils.

PURPOSE:

- Reduce velocity of storm water runoff.
- Reduce erosion by preventing rainfall directly hitting soil.
- Facilitate plant growth by holding seeds, fertilizer, and mulch in place, retaining moisture and providing insulation against extreme temperature.
- Provide flexible roadway ditch lining to promote establishment of vegetative cover.

APPLICATION:

- Areas that have been seeded, fertilized and mulched with slopes that are steeper than 3:1.
- Stabilize vegetated roadway ditches while permanent vegetative cover becomes established.

LIMITATIONS:

- Effectiveness may be reduced drastically if the fabric is not properly selected, designed, or installed.
- Should not be placed on 1:1 slopes if they are to be covered with overlying material.
- Many synthetic geotextiles are sensitive to light and must be protected prior to installation.

INSTALLATION:

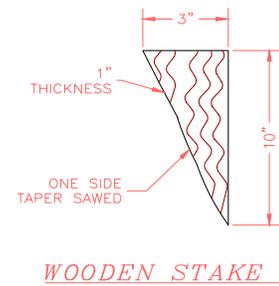
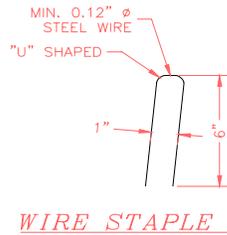
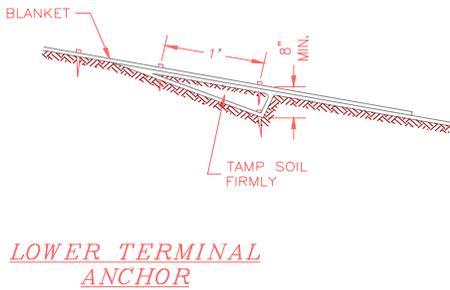
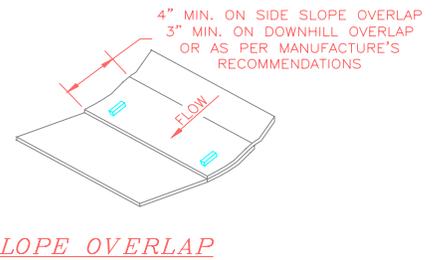
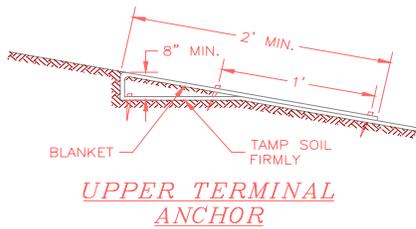
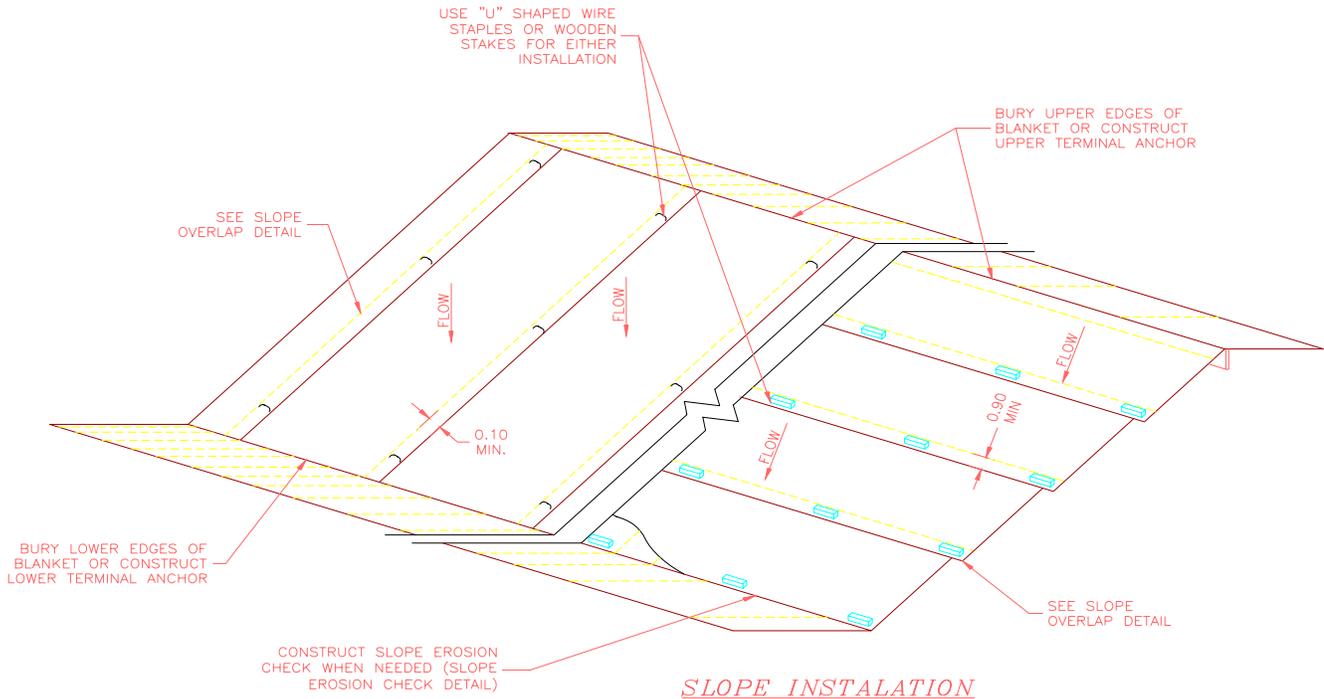
- Allow for an overlap of 4 inches on both sides of each roll and 36 inches at the ends of the roll.
- The fabric must extend beyond the edge of the exposed area at least 12 inches at the sides and 36 inches at the top and bottom.
- At the top of the area, bury the end of each roll in a trench at least 8 inches deep. The trench should then be backfilled and tamped.
- Staples should be driven perpendicularly into the slope face. Staples must be of 3/16" diameter (or heavier) steel wire. Allow for spacing of approximately 5 feet apart along the sides and center of each roll and not more than 12 inches apart along upper end of a roll or at the overlap of two rolls.
- The soil must be reasonably smooth. Fill and compact any rills and gullies. Remove any protruding rocks and other obstructions.
- Apply the individual rolls up and down the slope, from top to bottom--never along the contour.

- Make sure that the fabric makes uniform contact with the slope face underneath. No bridging of rills or gullies should be allowed.

MAINTENANCE:

- At a minimum, inspect geotextiles on a monthly basis, and after rain events greater than 0.5 inch of precipitation.
- Clean and replace down gradient controls as necessary.

GEOTEXTILES— TYPICAL DESIGN / LAYOUT



SURFACE ROUGHENING

DEFINITION: Rough preparation of working areas leaving depressions and uneven surface.

PURPOSE: Depressions trap water and sediment reducing erosion and facilitating establishment of vegetative cover.

APPLICATION:

- Surface roughening is appropriate for all construction that will not be receiving impervious cover within 14 days and that will be exposed less than 60 days (seed areas to be open in excess of 60 days).

LIMITATIONS :

- Will not withstand heavy rainfall.
- Slopes steeper than 2:1 (50%) should be benched.

CONSTRUCTION:

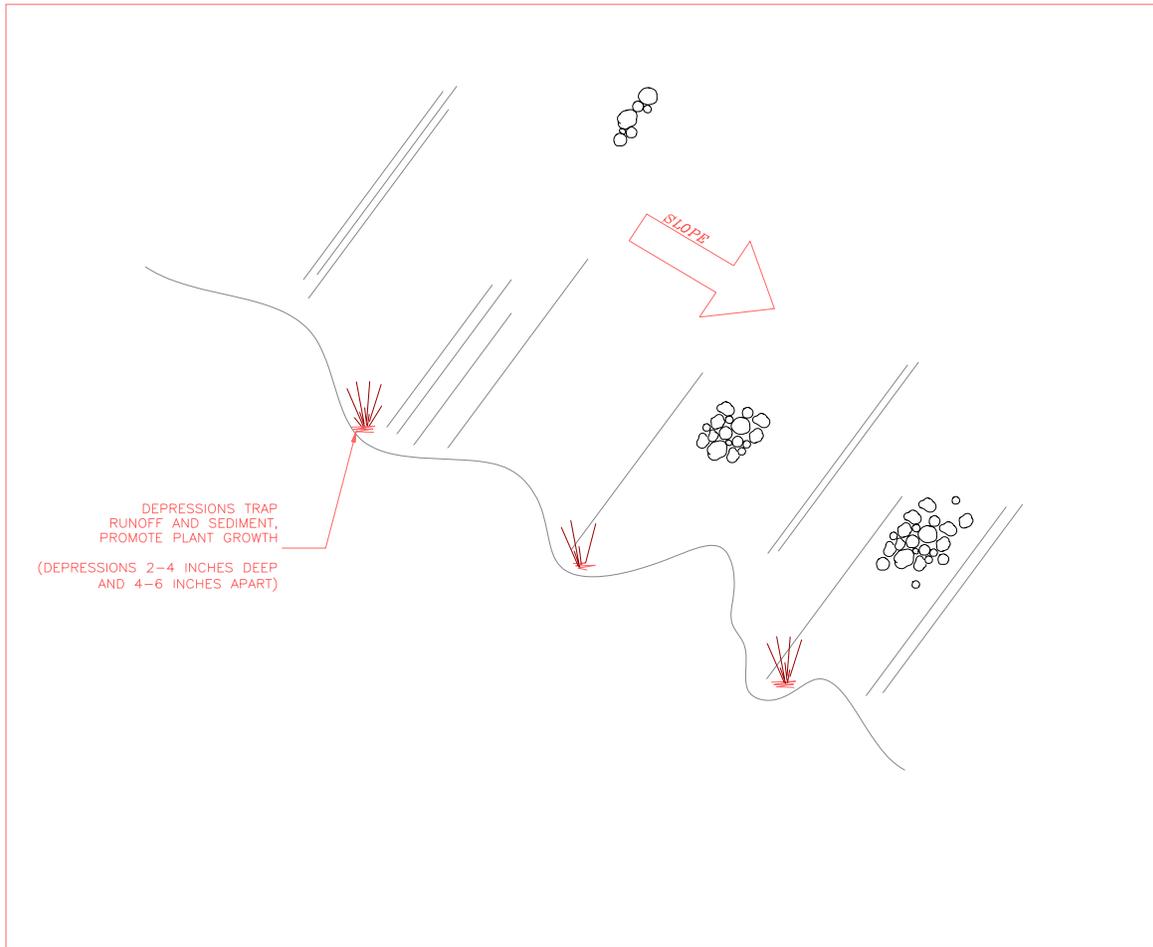
- Surface should be left in rough condition during initial earthwork activity.
- Surfaces that have become smoothed or compacted due to equipment traffic should be roughened by use of disks, spring harrows, teeth on front end loader, or similar, operating along the contour of the slope. Tracking (by crawler tractor driving up and down slope) may also be used to provide depressions parallel to contours.
- Avoid compaction of soils during roughening as this inhibits plant growth and promotes storm water runoff. Limit tracked machinery to sandy soil.
- Seed or mulch areas to be exposed in excess of 60 days.
- Employ dust controls.

MAINTENANCE:

- Inspect following any storm event and at a minimum of weekly.
- If erosion in the form of rills (small waterways formed by runoff) is evident, perform machine roughening of area.
- For vegetated slopes reseed areas that are bare or have been reworked.

SURFACE ROUGHENING

*TYPICAL
DESIGN LAYOUT*



SILT FENCE

DEFINITION: A temporary sediment barrier consisting of filter fabric stretched across and secured to supporting posts and entrenched.

PURPOSE: To filter storm water runoff from up-gradient disturbed area and trap sediment on site.

APPLICATION:

- **Perimeter Control:** Place fence at down-gradient limits of disturbance.
- **Sediment Barrier:** Place fence at an offset distance from the toe of slope or soil stockpile required to contain anticipated sediment and storm water.
- **Protection of Existing Waterways:** Place fence at top of stream bank.
- **Inlet Protection:** Place fence surrounding catch basins.
- **Sediment Removal:** Place fence to capture sediment moving through roadway ditches.

LIMITATIONS:

- Recommended maximum drainage area of 0.5 acre per 100 feet of fence.
- Recommended maximum up-gradient slope length of 150 feet.
- Recommended maximum uphill grade of 2:1 (50%).
- Long-term ponding should not be allowed behind fence.

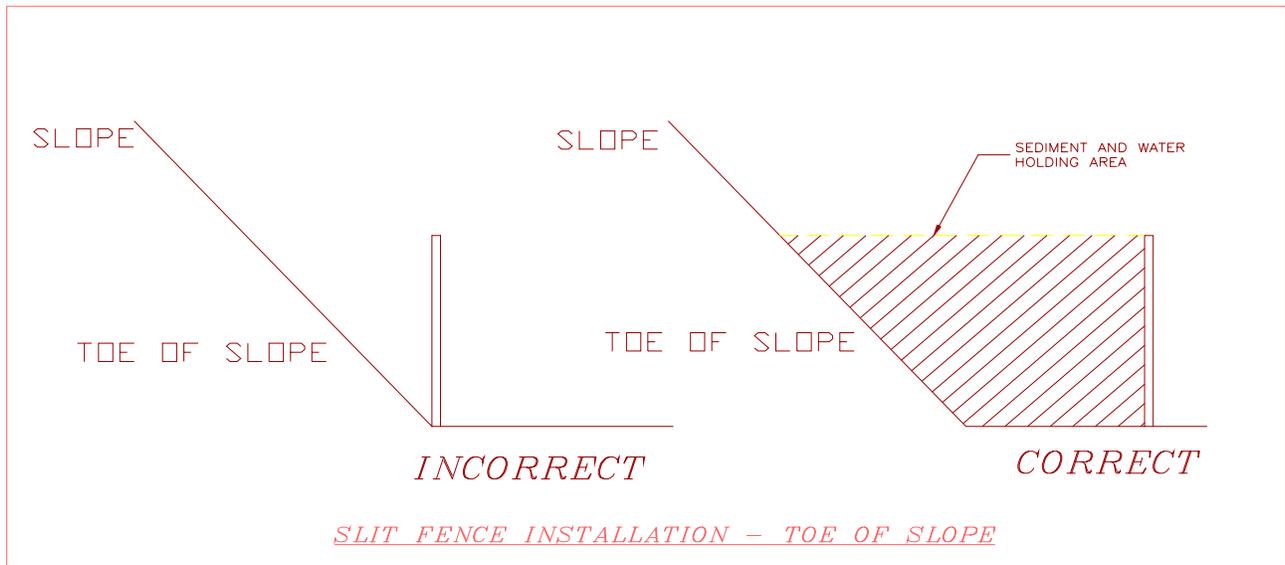
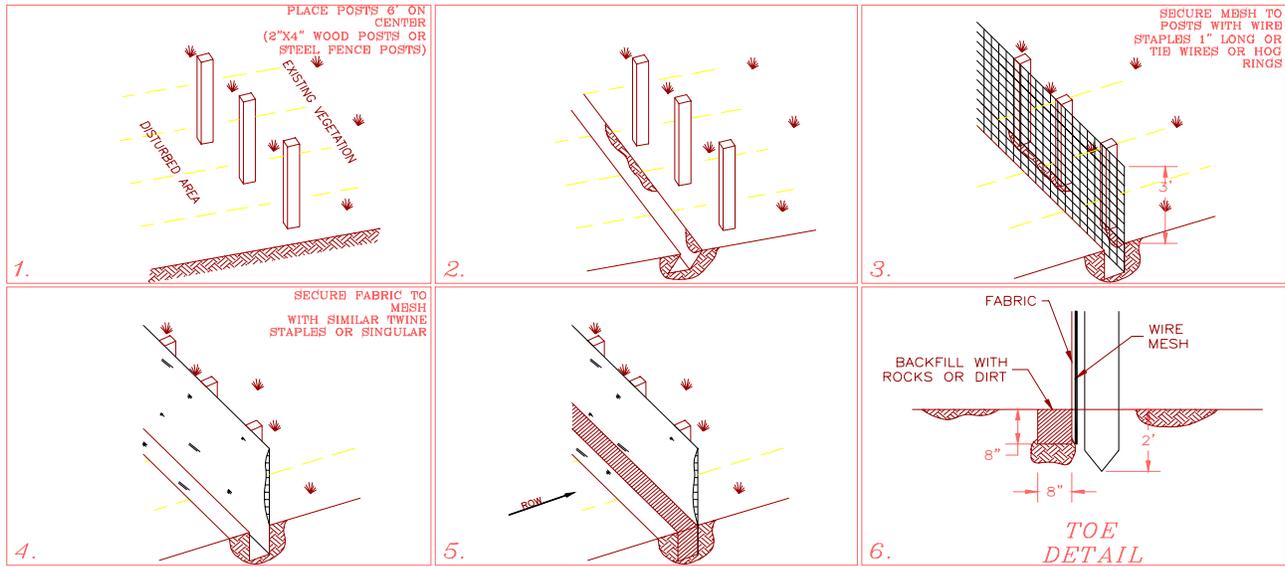
INSTALLATION:

- Place posts 6 foot on center along contour (or use preassembled unit) and drive 2 feet (min.) into ground. Excavate an anchor trench (8 inches wide and 8 inches deep) immediately up-gradient of posts.
- Secure wire mesh (14 gage min. with 6 inch openings) to up slope side of posts. Attach with heavy duty wire staples 1 inch long, tie wires or hog rings.
- Cut fabric to required width, unroll along length of barrier and drape over barrier. Secure fabric to, mesh with twine, staples, or similar, with trailing edge extending into anchor trench.
- Backfill trench over filter fabric to anchor.

MAINTENANCE :

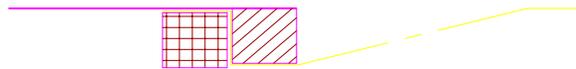
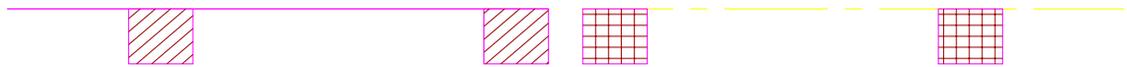
- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff bypassing ends of barriers or undercutting fence (repair immediately).
- Repair or replace damaged areas of the fence and remove accumulated sediment.
- Re-anchor fence as necessary to prevent shortcutting.
- Remove accumulated sediment when it reaches ½ the height of the fence.

SILT FENCE TYPICAL DESIGN LAYOUT

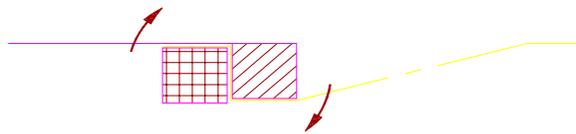


*SILT FENCE
TYPICAL
DESIGN LAYOUT*

ATTACHING TWO SILT FENCES

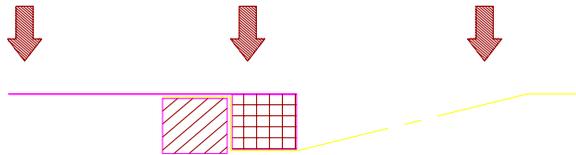


PLACE THE END POST OF THE SECOND FENCE INSIDE THE END POST OF THE FIRST FENCE



ROTATE BOTH POSTS AT LEAST 180 DEGREES IN A CLOCKWISE DIRECTION TO CREATE A TIGHT SEAL WITH THE FABRIC MATERIAL

DIRECTION OF RUNOFF WATERS



DRIVE BOTH POSTS ABOUT 24 INCHES INTO THE GROUND AND BURY FLAP

STRAW BALE BARRIER

DEFINITION: Temporary sediment barrier consisting of a row of entrenched and anchored straw bales.

PURPOSE: To filter storm water runoff from up gradient disturbed area and trap sediment on site.

APPLICATION:

- **Perimeter Control:** Place barrier at down gradient limits of disturbance.
- **Sediment Barrier:** Place barrier at an offset distance from the toe of slope or soil stockpile required to contain anticipated sediment and storm water.
- **Protection of Existing waterways:** Place barrier at top of stream bank.
- **Velocity Dissipation:** Reduce velocities in roadway ditches.

LIMITATIONS:

- Recommended maximum drainage area of 0.5 acre per 100 foot barrier.
- Recommended maximum up gradient slope length of 150 feet.
- Recommended maximum uphill grade of 2:1 (50%).

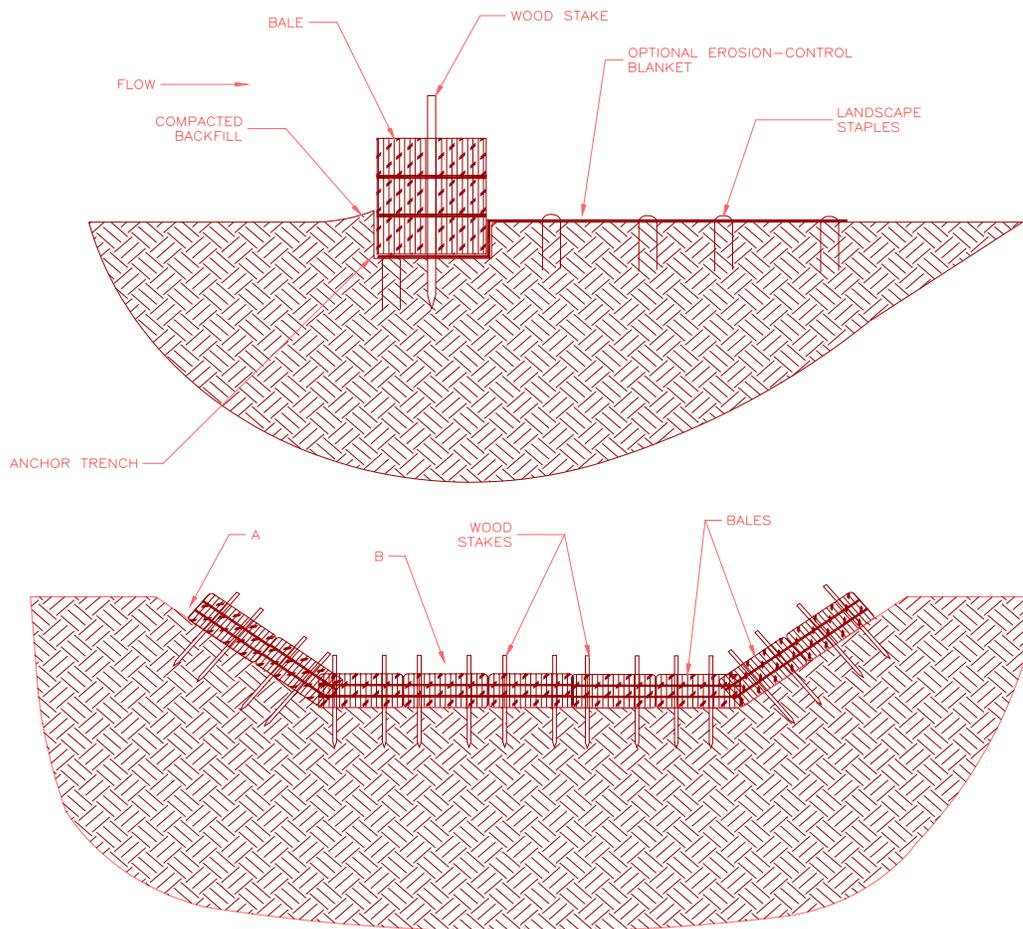
INSTALLATION:

- Excavate a 4-inch minimum deep trench along contour line, i.e. parallel to slope, removing all grass and other material that may allow underflow.
- Place bales in trench with ends tightly abutting, fill any gaps by wedging loose straw into openings.
- Anchor each bale with 2 stakes driven flush with the top of the bale. Extend Stakes 18 inches (min.) into the ground.
- Backfill around bale and compact to prevent piping, backfill on uphill side to be built up 4-inches above original ground at the barrier .
- In roadway ditches, straw bales should not be placed in such a way as to direct water around sides. Riprap should be placed around straw bale edges.

MAINTENANCE:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff bypassing ends of barriers or undercutting barriers.
- Repair or replace damaged areas of the barrier and remove accumulated sediment.
- Realign bales as necessary to provide continuous barrier and fill gaps.
- Re-compact soil around barrier as necessary to prevent piping.

*STRAW BALE CHECK DAM
TYPICAL DESIGN
LAYOUT*



CHECK DAM SPACING

THE FOLLOWING TABLE PROVIDES CHECK DAM SPACING FOR A GIVEN DITCH GRADE:

| <i>DITCH (%)</i> | <i>CHECK DAM SPACING (FEET)</i> |
|------------------|---------------------------------|
| 1.0 | 200 |
| 2.0 | 100 |
| 3.0 | 66 |
| 4.0 | 50 |
| 5.0 | 40 |
| 6.0 | 33 |

STABILIZED CONSTRUCTION ENTRANCE

DEFINITION: A stabilized pad of crushed stone located where construction traffic enters or leaves the site from or to a paved surface.

PURPOSE: To reduce potential for vehicle tracking of sediment or flow of sediment onto a paved surface where it may runoff to a storm water collection system, waterway, or lake.

APPLICATION:

- At any point of ingress or egress at a construction site where adjacent traveled way is paved. Applies to all sites which require a Storm Water Pollution Prevention Permit and Erosion Control Permit.
- Any project having a duration of 3 months or more must install filter fabric beneath the crushed stone to minimize sediment pumping into the crushed stone.

LIMITATIONS: Not listed.

INSTALLATION:

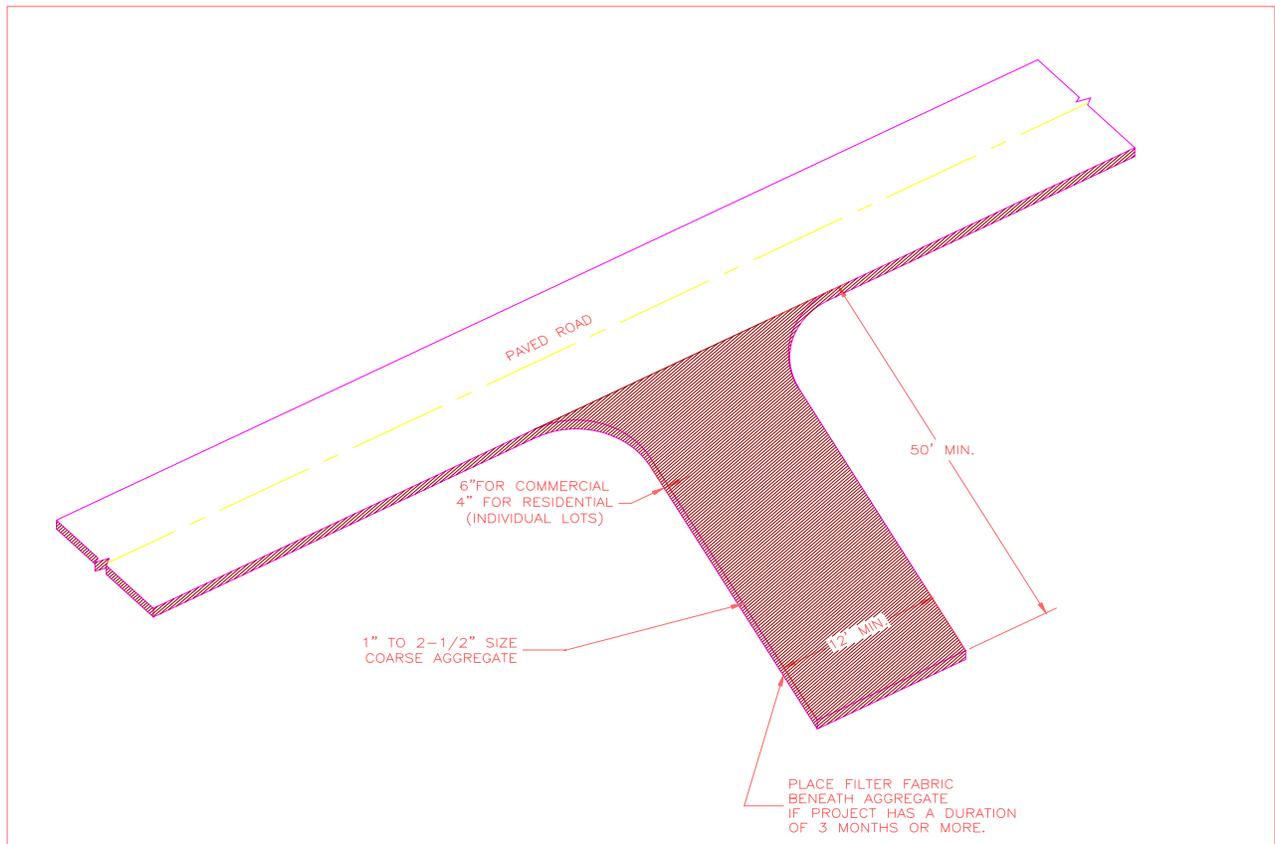
- Clear and grub area and grade to provide slope shown for driveway, or access/intersection. If adjacent to waterway, use a maximum slope of 2%.
- Compact subgrade and place filter fabric if required.
- Place coarse aggregate, 1 to 2 ½ inches size, to a minimum depth of 6 inches for commercial projects, and 4 inches for residential projects.

MAINTENANCE:

- Inspect daily for loss of gravel or sediment buildup.
- Inspect adjacent roadway for sediment deposit and clean by sweeping or shoveling.
- Repair entrance and replace gravel as required to maintain control in good working condition.
- Expand stabilized area as required to accommodate traffic, and off site street parking and prevent erosion at driveway.

STABILIZED CONSTRUCTION ENTRANCE

*TYPICAL DESIGN
LAYOUT*



DIVERSION DITCH/DIKE

DEFINITION: A temporary sediment barrier and storm water conveyance consisting of an excavated channel and compacted earth ridge.

PURPOSE: To protect down-gradient areas from sedimentation and erosion by diverting runoff to a controlled discharge point.

APPLICATION:

- Construct along the top of construction slope to intercept up-gradient runoff.
- Construct along the toe of construction slope to divert sediment laden runoff.
- Construct along midpoint of construction slope to intercept runoff and channel to a controlled discharge point.
- Construct around base of soil stockpiles to capture sediment.
- Construct around perimeter of disturbed areas to capture sediment.

LIMITATIONS:

- Recommended maximum drainage of 5 acres.
- Recommended maximum side slopes of 2:1 (50%).
- Recommended maximum slope on channel of 1%.

INSTALLATION:

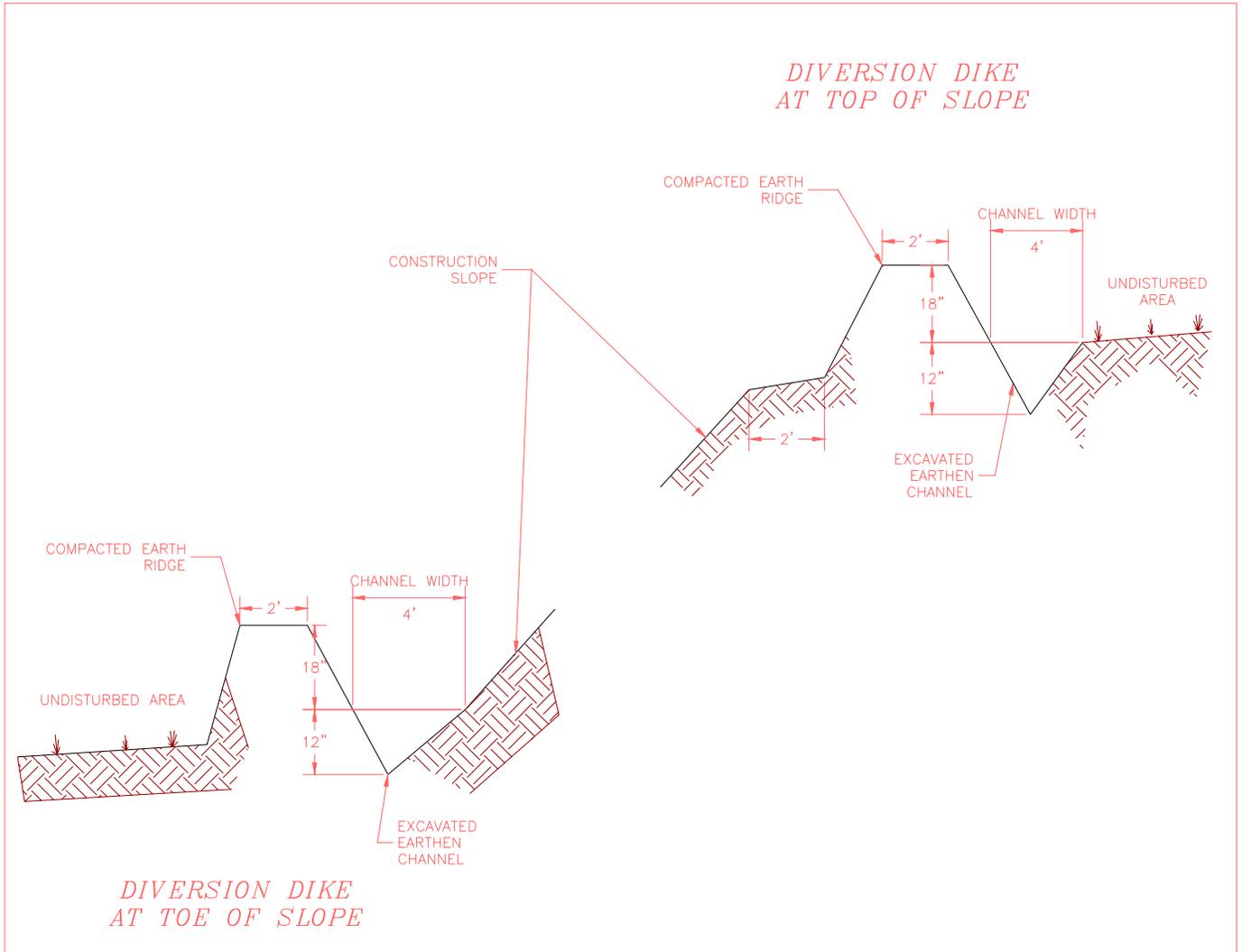
- Clear and grub area for ditch/dike construction.
- Excavate channel and place soil on down gradient side.
- Shape and machine compact excavated soil to form ditch/ridge.
- Place erosion protection (Riprap, mulch, appropriate geotextiles) at outlet.
- Stabilize channel and ridge as required with mulch, gravel or vegetative cover.

MAINTENANCE:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff breaching dike or eroding channel or side slopes.
- Check discharge point for erosion or bypassing of flows.
- Repair and stabilize as necessary.
- Inspect daily during vehicular or construction equipment activity on slope, check for and repair any traffic damage.

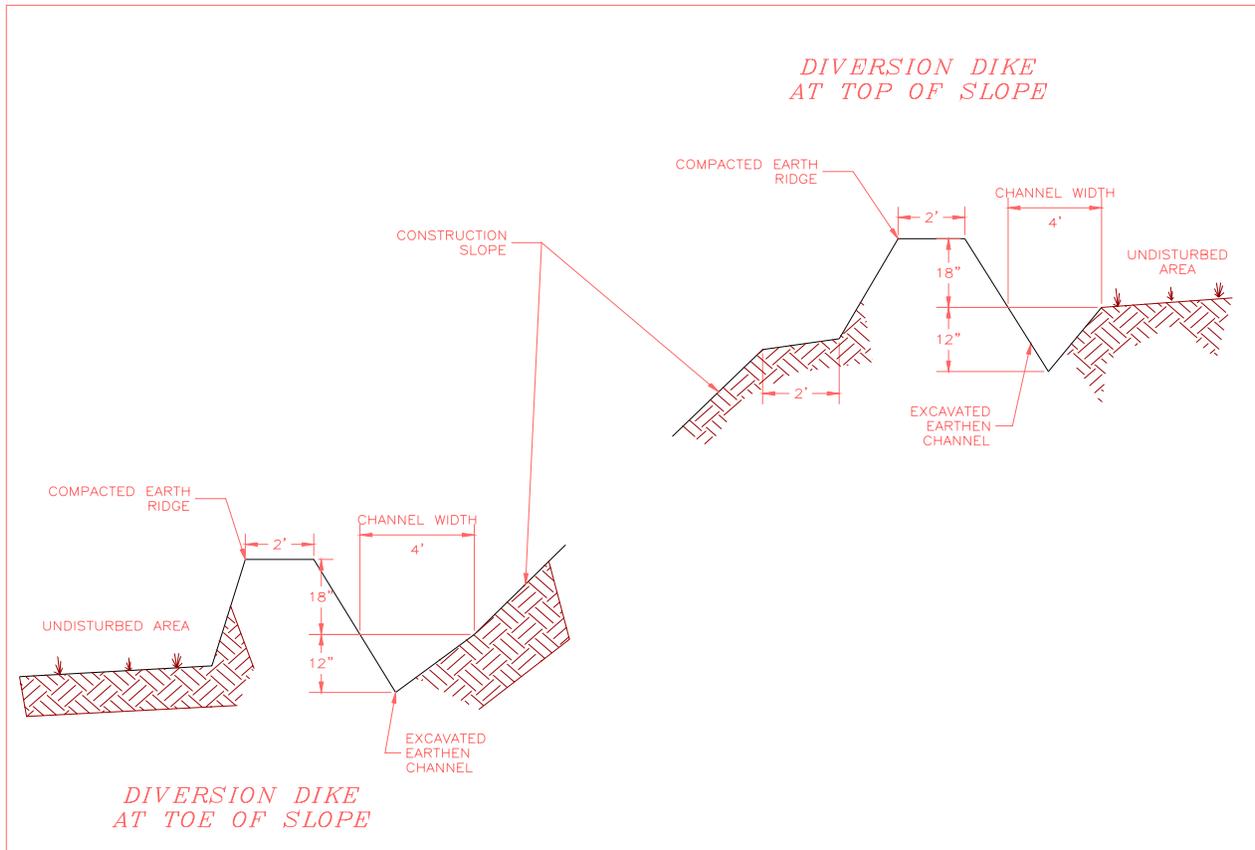
DIVERSION DIKE

TYPICAL DESIGN LAYOUT



DIVERSION DIKE

TYPICAL DESIGN LAYOUT



WATER BAR

DEFINITION: A constructed drainage feature that diverts water off unpaved roads or trails to a controlled discharge point.

PURPOSE: To prevent water from ponding and/or flowing on/or along an unpaved road or trail by diverting runoff to a controlled discharge point.

APPLICATION:

- Construct along roads/trails to intercept up-gradient runoff and prevent rills from forming on fill slopes.
- Construct in low areas where water ponding is likely to occur to divert water off of the road/trail surface.
- Construct where erosion problems are occurring due to uncontrolled runoff.

LIMITATIONS:

- Discharge point should be stable and not sensitive to increases in runoff.
- Unfiltered discharges should not be directed directly into natural waterways.
- Waterbars must be appropriately sized for specific traffic types and levels of use.

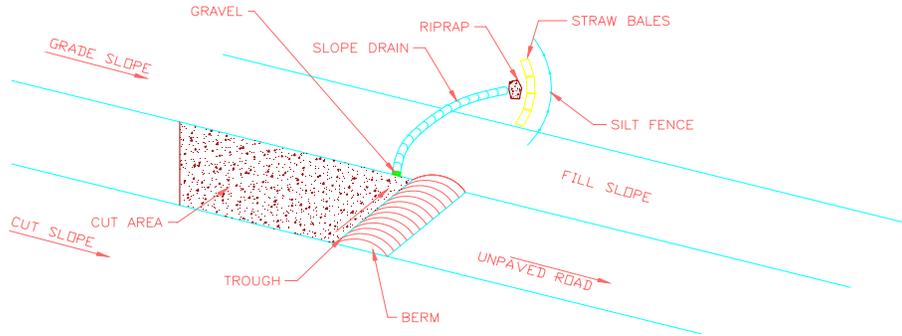
INSTALLATION:

- Location and frequency should be based on road slopes, runoff patterns, and topography.
- Determine discharge point and appropriate discharge method (slope drain, vegetated swale, rip rapped chute, or storm drain).
- Excavate trough and/or construct berm with fill.
- Compact the fill material.
- Construct discharge point.
- Use straw bales, silt fencing, gravel check dams, excavated sediment traps, or existing vegetation to filter the discharge as necessary .

MAINTENANCE:

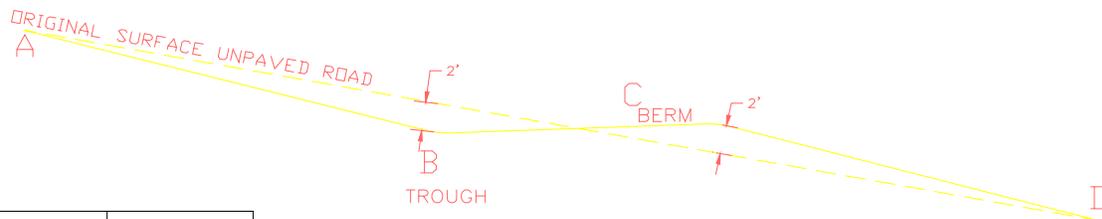
- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Remove sediment as necessary .
- Inspect for runoff breaching water bar or eroding at/or below the discharge point.
- Repair vehicle ruts on the top of the berm and stabilize as necessary.

WATER BAR — PLAN VIEW



#1 WATER BAR — CROSS SECTION

BERM METHOD

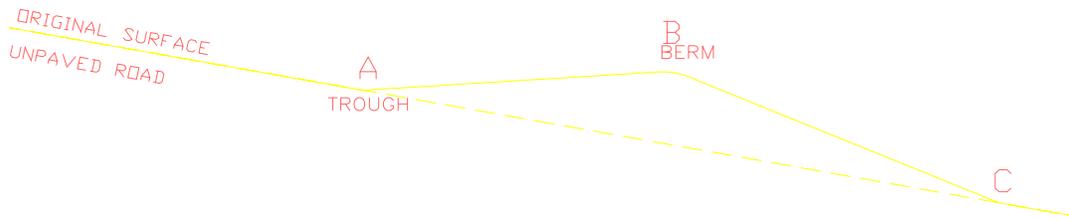


| SEGMENT | SLOPE DISTANCE |
|---------|----------------|
| A-B | 25' |
| B-C | 15' |
| C-D | 15' |

CUT AND FILL METHOD

#2 WATER BAR — CROSS SECTION

BERM METHOD



| SEGMENT | SLOPE DISTANCE |
|---------|----------------|
| A-B | 8' |
| B-C | 16' |

BERM METHOD

STORM DRAIN INLET PROTECTION

DEFINITION: Concrete block, filter cloth, and gravel filter placed over inlet to storm drain system.

PURPOSE: Reduce sediment discharge to storm drain system by filtering storm Water flows and reducing flow velocities allowing deposition of sediment.

APPLICATION:

- Construct at storm drain inlets in paved or unpaved areas where up-gradient area is to be disturbed by construction activities.

LIMITATIONS:

- Recommended for maximum drainage of one acre.
- Excess flows may bypass the inlet requiring down gradient controls.
- Ponding will occur at inlet.

INSTALLATION:

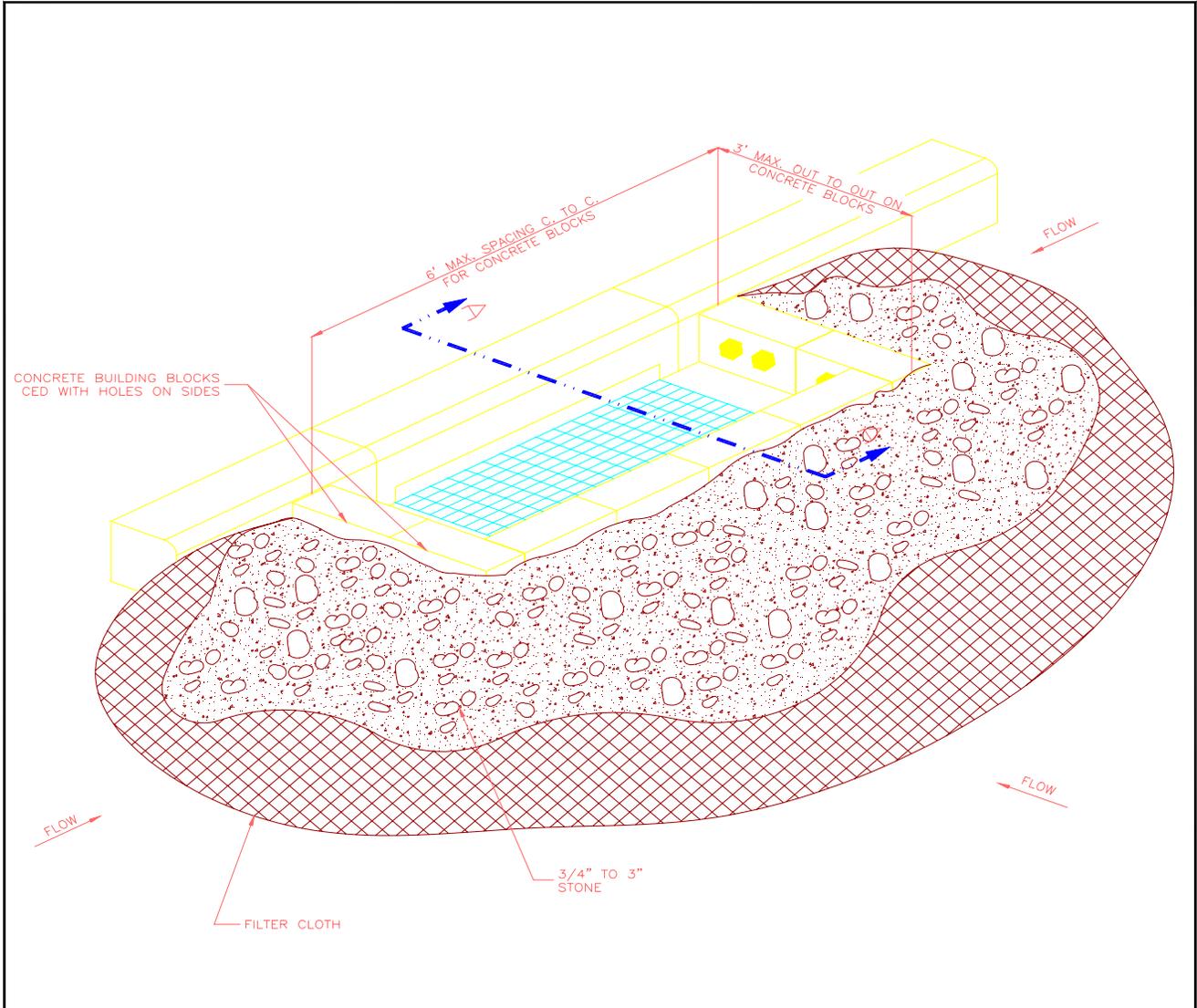
- Place wire (with ½ inch openings) over the inlet extending 12-inches past inlet opening. Place filter fabric over mesh.
- Place concrete blocks around the inlet with openings facing outward. Stack blocks to minimum height of 12-inches and a maximum height of 24-inches.
- Place wire mesh around outside of blocks.
- Place gravel (¾ inch to 3 inches) around blocks.

MAINTENANCE:

- Inspect inlet protection after every large storm event and at a minimum of once monthly.
- Remove sediment accumulated when it reaches 4-inches in depth.
- Replace filter fabric and clean or replace gravel if clogging is apparent.

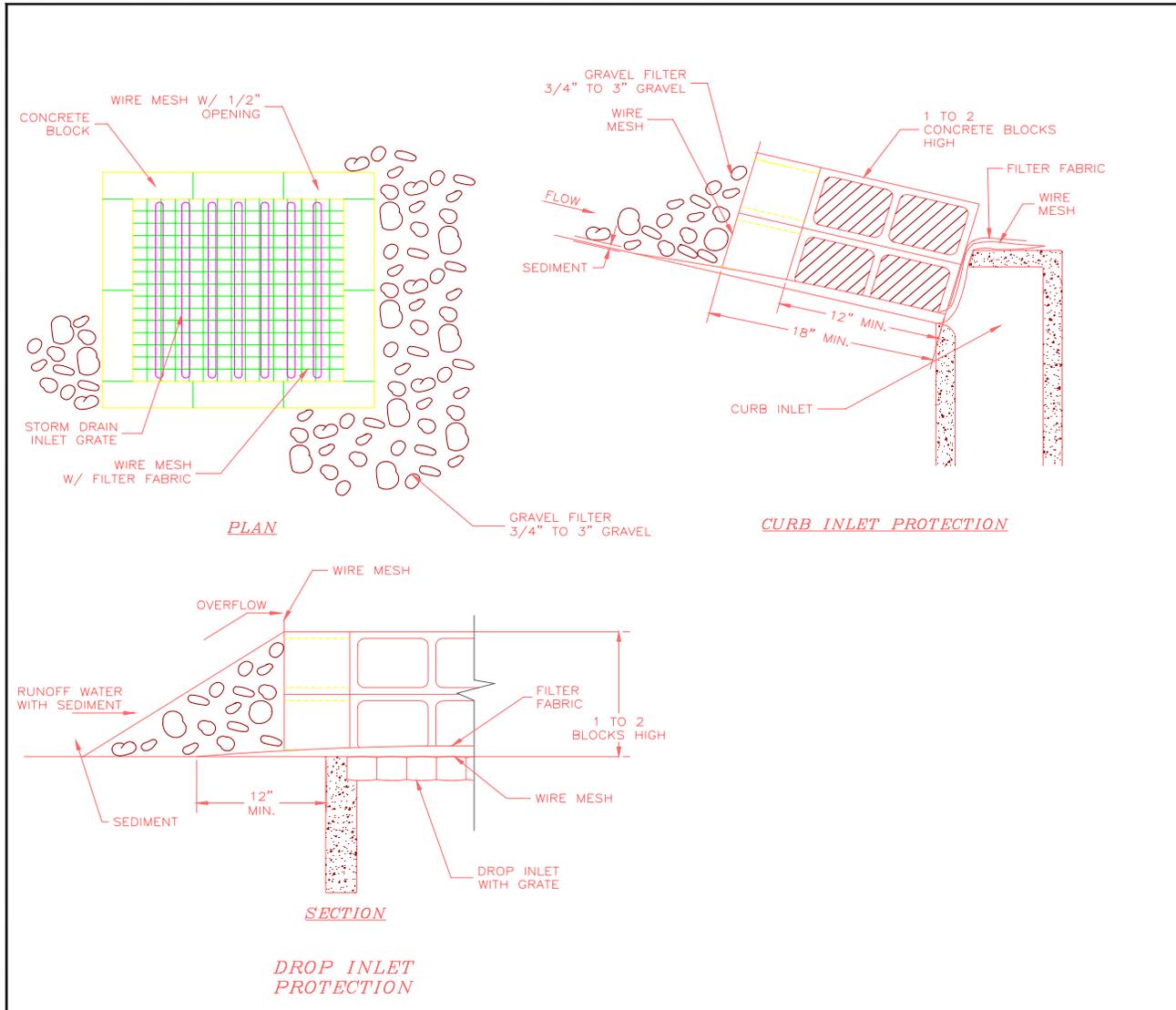
INLET PROTECTION

TYPICAL DESIGN LAYOUT



INLET PROTECTION

TYPICAL DESIGN LAYOUT



STRAW BALE DROP-INLET BARRIER

DEFINITION: Straw Bale placed around inlet to storm drain system. Bale drop-inlets operate by intercepting and ponding sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. When the pond height reaches the top of the barrier, water flows over the bales and into the drop inlet.

PURPOSE: Reduce sediment discharge to storm drain system by some filtering of storm water flows and reducing flow velocities allowing deposition of sediment.

APPLICATION:

- Construct at storm drain inlets in unpaved areas where up-gradient area is to be disturbed by construction activities.
- Use at median drop-inlet boxes.

LIMITATIONS:

- Recommended for maximum drainage of one acre.
- Excess flows may bypass the inlet requiring down gradient controls.
- Ponding will occur at inlet.
- Do not use where ponding may stretch out onto adjacent roadway.

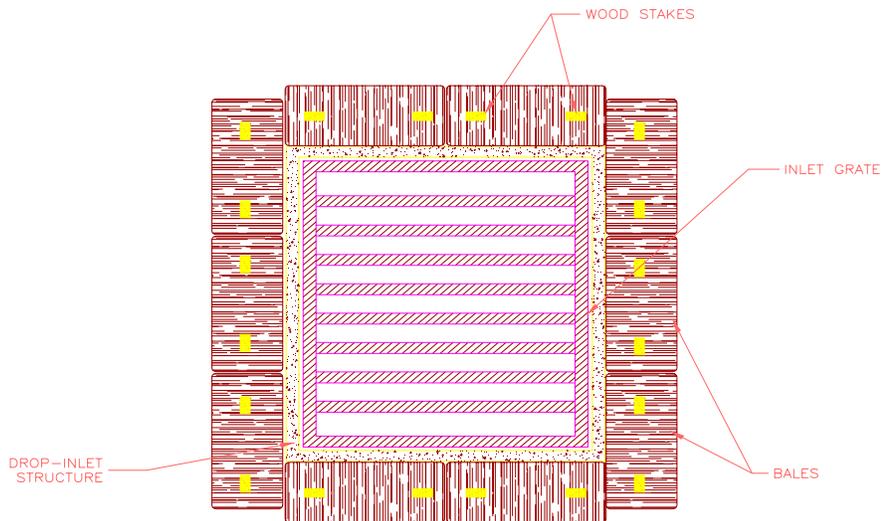
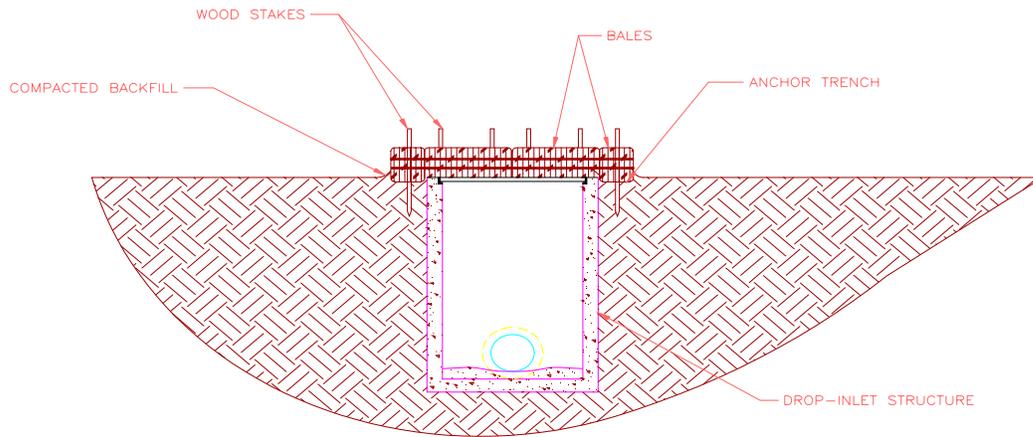
INSTALLATION:

- Excavate a trench around the perimeter of the drop inlet that is at least 6 inches deep by 1.5 times the width of the bale wide
- Place bales in the trench, making sure that they are butted tightly. Some bales may need to be shortened to fit the trench around the drop inlet. Two stakes must be driven through each bale approximately 8 inches from each end. The stakes must be driven a minimum of 18 inches into the ground.
- The bales must also be placed directly against the outside of the drop-inlet. This allows overtopping water to flow directly into the inlet instead of onto nearby soil causing scour.
- Place the excavated soil against the outside of the bales and compacted. The compacted soil should be no deeper than 4 inches against the bale.
- This method may be enhanced with the use of a silt catching/filtering sack placed inside the drop-inlet.

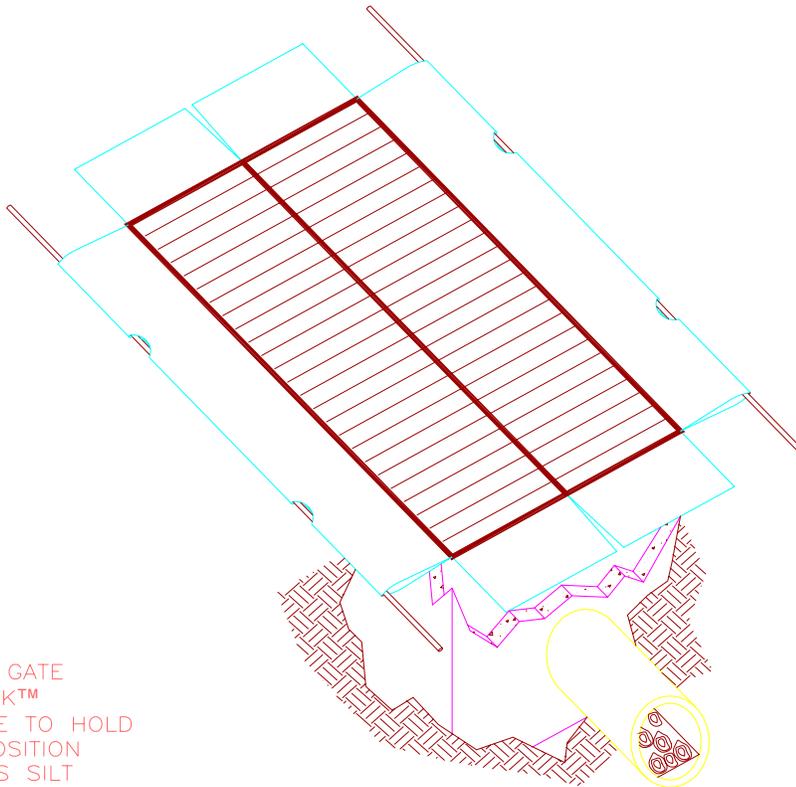
MAINTENANCE:

- Inspect inlet protection after every large storm event and at a minimum of once weekly.
- Remove sediment accumulated when it reaches half the height of the bale.
- Replace bales which become damaged.
- Replace filter sack (if used) if clogging is apparent.

STRAW BALE DROP-INLET BARRIER INSTALLATION



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REMOVE DRAIN GATE
INSERT SILTSACK™
REPLACE GRATE TO HOLD
SILTSACK IN POSITION
SILTSACK TRAPS SILT
REMOVE FILLED SILTSACK
(WITH FRONT-LOADER OR OTHER EQUIPMENT)
LIFT DUMP STRAPS
CLEAN AND REUSE OR
DISCARD AND REPLACE
SIZED TO FIT ANY SIZE OR SHAPE CATCH BASIN
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PERMEABILITY- REGULAR FLOW SILTSACK -40 GAL./MIN./FT²
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BRUSH BARRIER

DEFINITION: A vertical barrier constructed of tree trimmings, limbs, and brush obtained from the clearing operation. A filter cloth should be used over the brush barrier to maximize effectiveness.

PURPOSE: To trap sediment and filter construction runoff.

APPLICATION:

- **Sediment Barrier:** Place barrier at toe of slope or soil stockpile.
- **Velocity Dissipation:** Reduce velocities and trap sediment at culvert outlets and in roadway ditches.

LIMITATIONS :

- Adequate material for the barrier is available from the clearing operation.

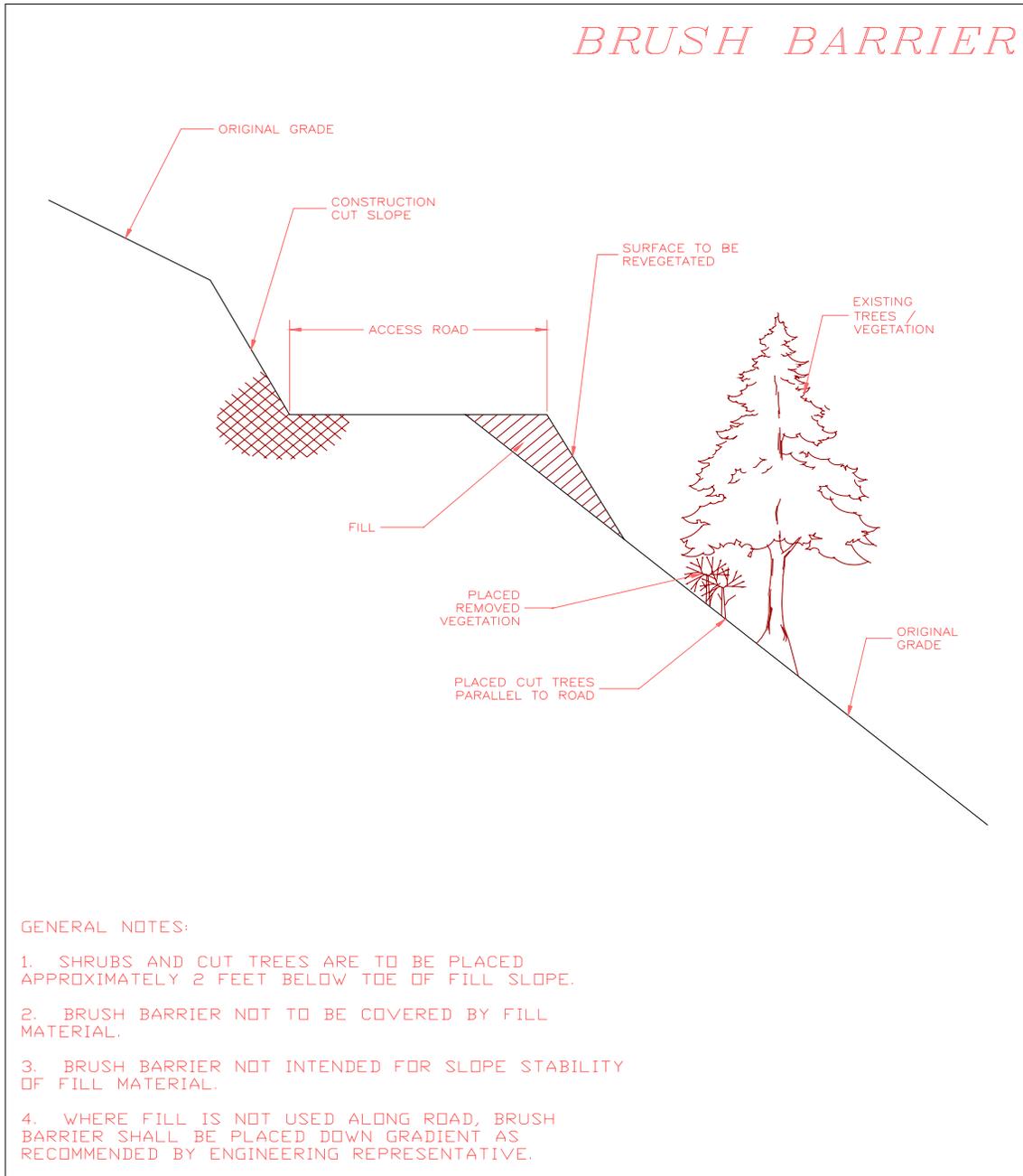
INSTALLATION:

- Construct barrier with trimmings, limbs, and brush and perform necessary trimming.
- Construct small trench (8 inches wide and 8 inches deep) on front side of barrier .
- Cut filter cloth to proper size and place over brush.
- Bury the filter cloth to prevent undermining.
- Attach filter cloth to brush by stapling or other means.
- Brush barriers located below pipe culverts should be constructed prior to culvert installation.

MAINTENANCE:

- Inspect immediately after any rainfall and at least daily during prolonged rainfall.
- Look for runoff bypassing ends of barriers or undercutting barriers.
- Repair or replace damaged areas of the barrier and remove accumulated sediment.
- Re-compact soil around barrier as necessary to prevent piping.

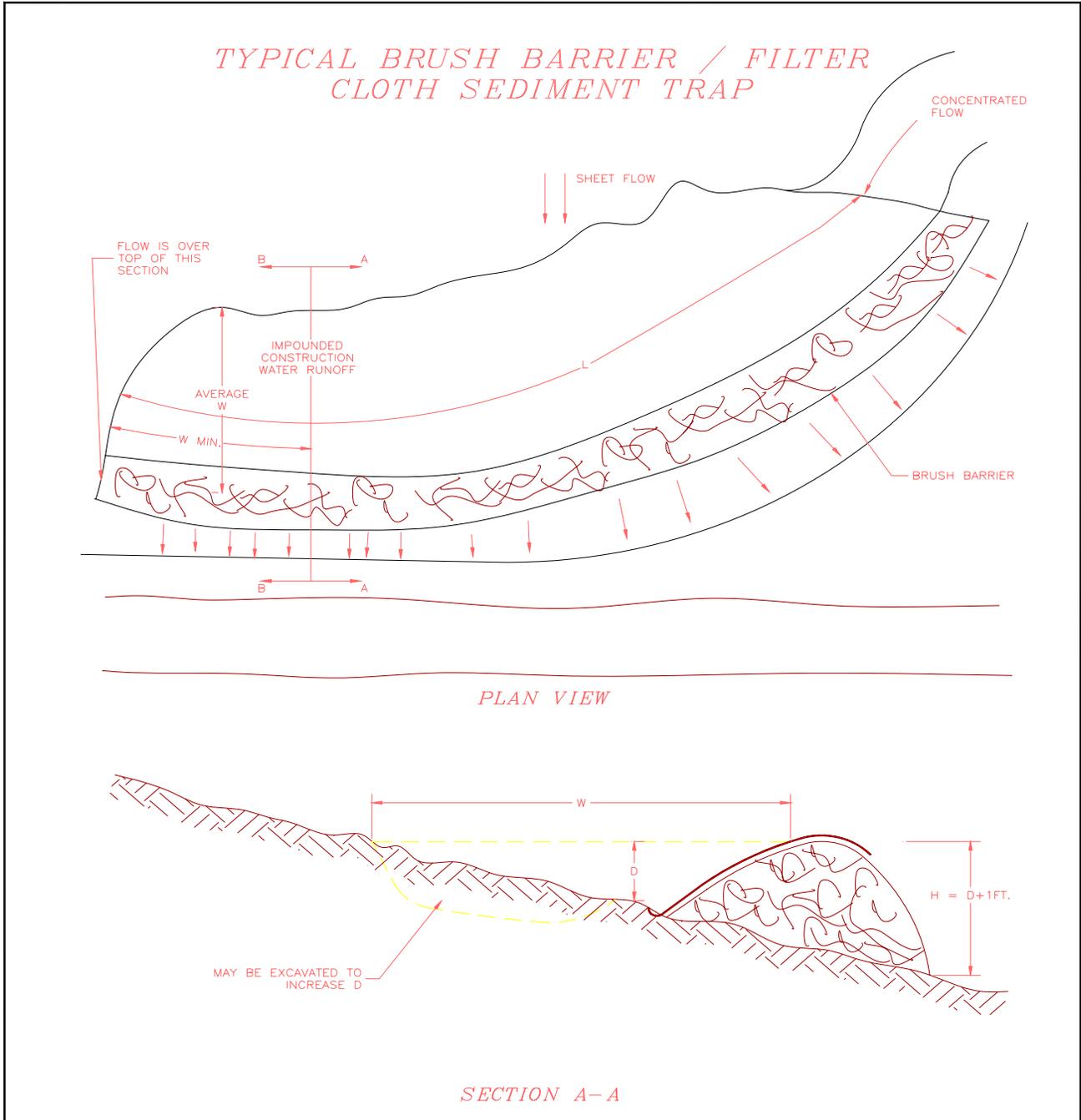
BRUSH BARRIER



GENERAL NOTES:

1. SHRUBS AND CUT TREES ARE TO BE PLACED APPROXIMATELY 2 FEET BELOW TOE OF FILL SLOPE.
2. BRUSH BARRIER NOT TO BE COVERED BY FILL MATERIAL.
3. BRUSH BARRIER NOT INTENDED FOR SLOPE STABILITY OF FILL MATERIAL.
4. WHERE FILL IS NOT USED ALONG ROAD, BRUSH BARRIER SHALL BE PLACED DOWN GRADIENT AS RECOMMENDED BY ENGINEERING REPRESENTATIVE.

*BRUSH BARRIER
TYPICAL DESIGN
LAYOUT*



GRAVEL CHECK DAMS

DEFINITION: Small temporary dam constructed across dry drainage path (i.e. not in live streams).

PURPOSE: To reduce erosion of drainage path by reducing velocity of flow and by trapping sediment and debris.

APPLICATION:

- Temporary drainage paths.
- Permanent drainage ways not yet stabilized.
- Existing drainage paths receiving increased flows due to construction.

LIMITATIONS:

- Maximum recommended drainage area is 10 acres.
- Maximum recommended height is 24".
- Do not use in running stream.

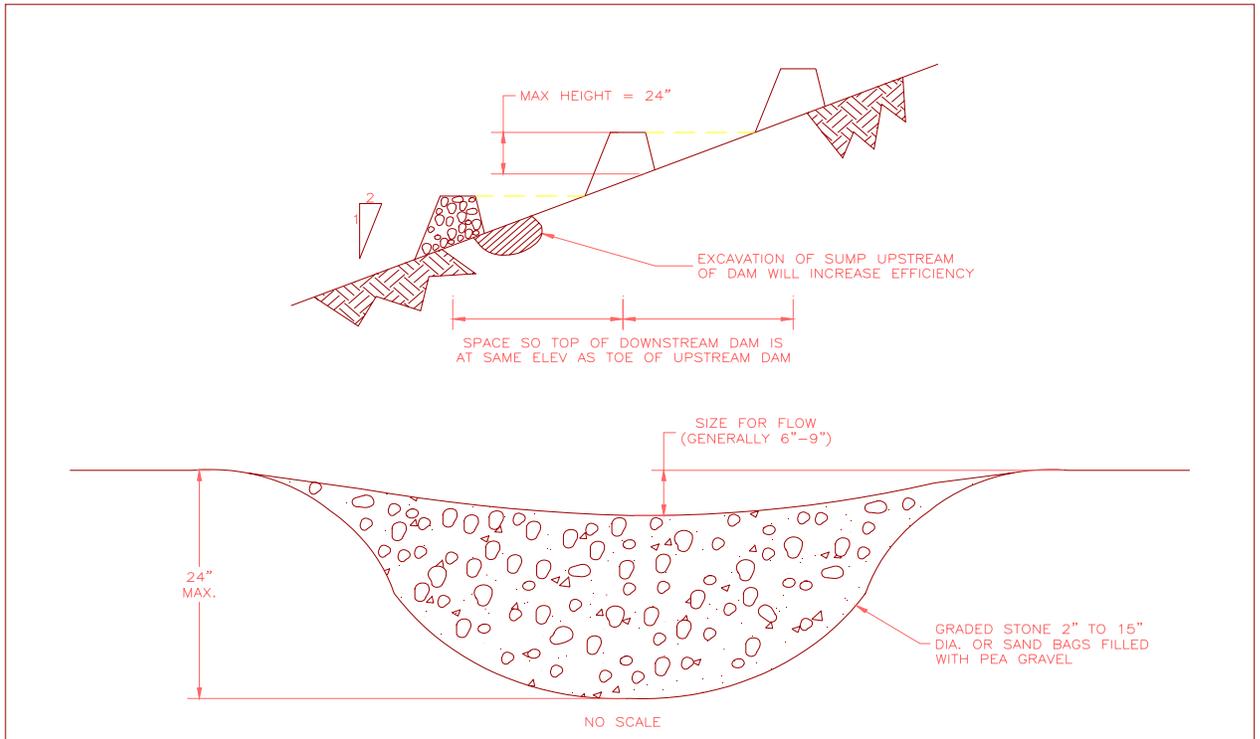
INSTALLATION:

- Prepare location of dam by removing any debris and rough grading any irregularities in channel bottom.
- Place rocks by hand or with appropriate machinery , do not dump.
- Construct dam with center lower to pass design flow.
- Construct 50% side slopes on dam.

MAINTENANCE:

- Inspect dams daily during prolonged rainfall, after each major rain event and at a minimum of once monthly.
- Remove any large debris and repair any damage to dam. channel, or side slopes.
- Remove accumulated sediment when it reaches one half the height of the dam.

GRAVEL CHECK DAMS
TYPICAL DESIGN LAYOUT



| <i>DITCH GRADE (%)</i> | <i>CHECK DAM SPACING (FEET)</i> |
|------------------------|---------------------------------|
| 5.0 | 60 |
| 6.0 | 50 |
| 7.0 | 43 |
| 8.0 | 36 |
| 9.0 | 33 |
| 10.0 | 30 |

STRAW BALE CHECK DAMS

DEFINITION: Small temporary dam constructed across dry drainage path (i.e. not in live streams).

PURPOSE: To reduce erosion of drainage path by reducing velocity of flow and by trapping sediment and debris.

APPLICATION:

- Temporary drainage paths.
- Permanent drainage ways not yet stabilized.
- Existing drainage paths receiving increased flows due to construction.

LIMITATIONS:

- Maximum recommended drainage area is 10 acres.
- Sufficient number of bales are required to force runoff over the flow line.
- Do not use in ditches with slopes of 6% or more. For ditches with slopes over 6%, use rock check dams.
- Do not use where high flows are expected.
- Do not use directly in front of a culvert outlet.
- Do not use in running stream.

INSTALLATION:

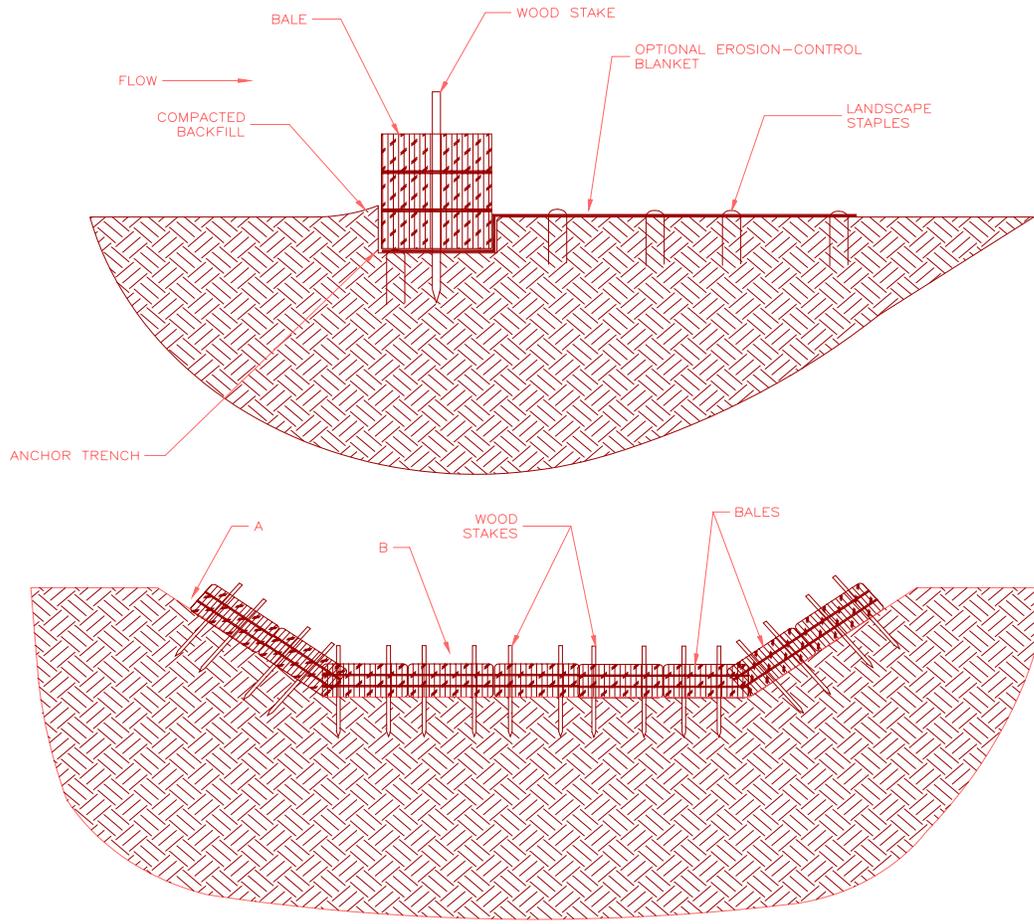
- Prepare location of dam by removing any debris and rough grading any irregularities in channel bottom.
- Bales must be free of weeds declared noxious by the State of Utah, Department of Agriculture.
- Excavate a vertical trench perpendicular to the ditch flow line the length of the straw bale dam that is 6 inches deep, and 1.5 time the width of the bale.
- Place bales in the trench, making sure that they are tightly butted against each other, and the excavated trench on the downstream side.
- Place two stakes through each bale, approximately 8 inches from each end and drive at least 18 inches into the ground.
- Construct dam with center lower to pass design flow.
- Place and compact the excavated material in the remaining trench area on the upstream side. The compacted soil should be no more than 4 inches deep and extend upstream no more than 24 inches.
- Use downstream scour apron where required.

MAINTENANCE:

- Inspect dams daily during prolonged rainfall, after each major rain event and at a minimum of once monthly.
- Remove any large debris and repair any damage to dam, channel, or side slopes.

- Remove accumulated sediment when it reaches one half the height of the dam.

*STRAW BALE CHECK DAM
TYPICAL DESIGN
LAYOUT*



CHECK DAM SPACING

THE FOLLOWING TABLE PROVIDES CHECK DAM SPACING FOR A GIVEN DITCH GRADE:

| <i>DITCH (%)</i> | <i>CHECK DAM SPACING (FEET)</i> |
|------------------|---------------------------------|
| 1.0 | 200 |
| 2.0 | 100 |
| 3.0 | 66 |
| 4.0 | 50 |
| 5.0 | 40 |
| 6.0 | 33 |

SLOPE DRAIN

DEFINITION: A device used to carry concentrated runoff from the top to the bottom of a slope.

PURPOSE:

- Convey runoff from offsite around a disturbed portion of the site.
- Drain saturated slopes that have the potential for soil slides.

APPLICATION:

- Use on cut or fill slopes before permanent storm water drainage structures have been installed.
- Use where diversion ditches or other diversion measures have been used to concentrate flows.
- Use on any slopes where concentrated runoff crossing the face of the slope may cause gullies, channel erosion, or saturation of slide-prone soils.
- Use as an outlet for a natural drainage way.

LIMITATIONS: Not suitable for drainage areas greater than 10 acres.

INSTALLATION:

- The slope drain design should handle the peak runoff for the 10-year 24-hour storm. Typical relationships between area and pipe diameter are shown below:

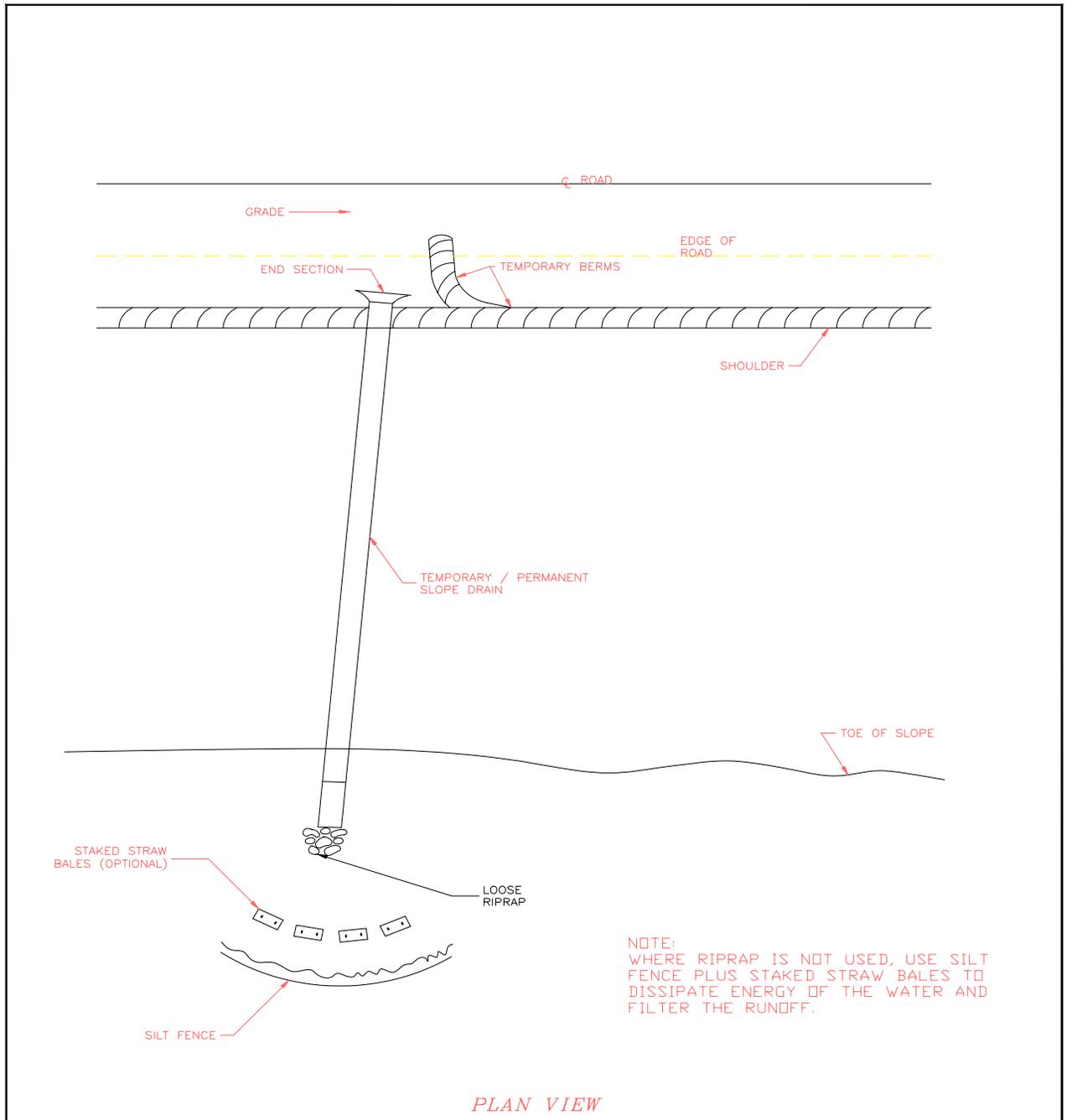
| Maximum Drainage Area (Acres) | Pipe Diameter (inches) |
|-------------------------------|------------------------|
| 0.50 | 12 |
| 0.75 | 15 |
| 1.00 | 18 |

- Place slope drain on undisturbed or well-compacted soils.
- Place filter cloth under the inlet, extend it to 3 to 6 feet in front of the inlet, and key it in 6 to 8 inches on all sides to prevent erosion. A 6 to 8 inches metal toe plate may also be used for this purpose.
- Securely stake the drain pipe to the slope at intervals of 10 feet or less, using grommets.
- Make sure that all slope drain sections are securely fastened together and have watertight fittings.
- Extend the pipe beyond the toe of the slope and discharge at a non-erosive velocity into a stabilized area or to a sediment trap. Use riprap outlet protection if necessary.

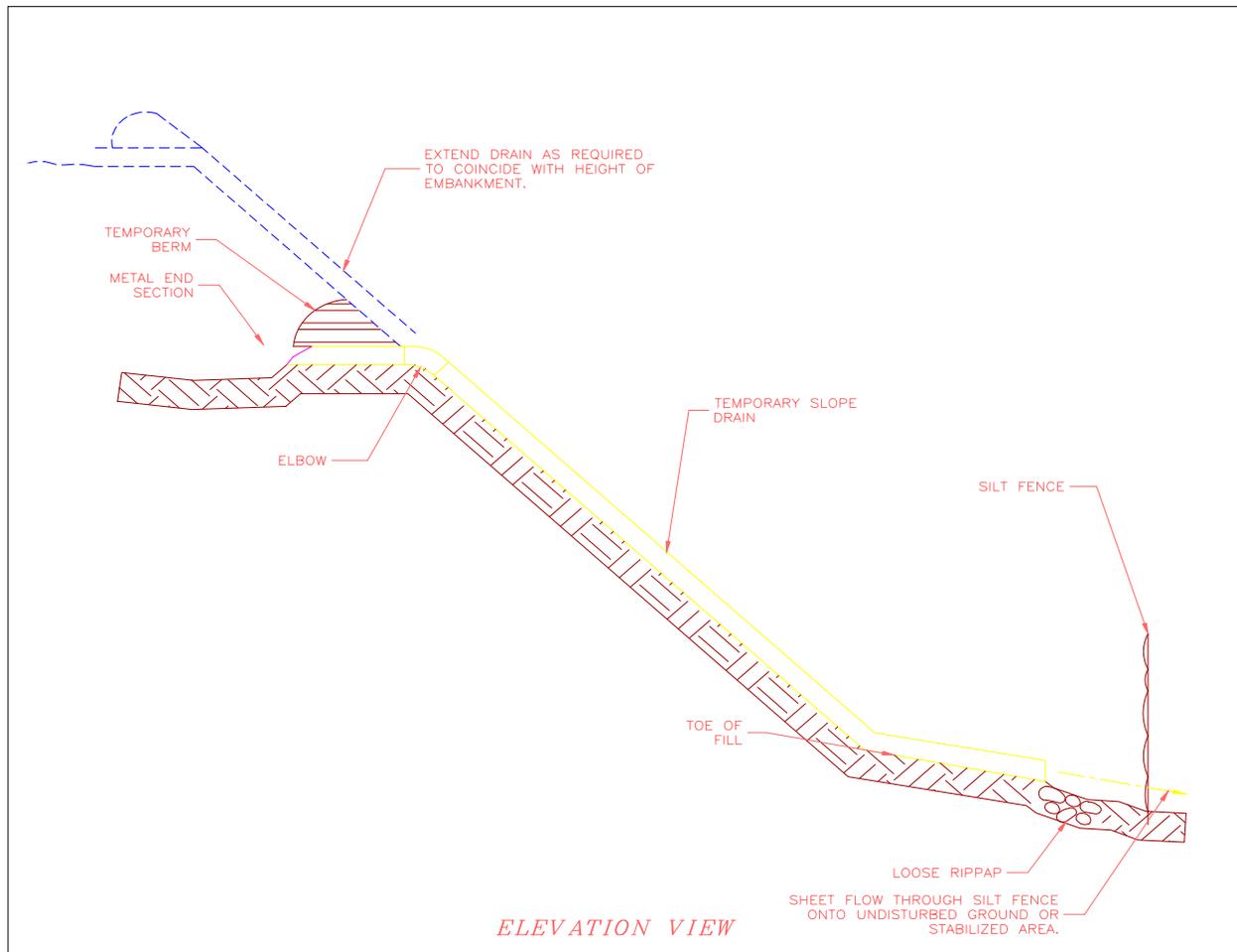
MAINTENANCE:

- Inspect the slope drain regularly and after every storm. Check to see if water is bypassing the inlet or undercutting the inlet or pipe. If necessary , install head walls or sandbags to prevent bypass flow.
- Check for erosion at the outlet point and check the pipe for breaks or clogs.

*SLOPE DRAIN
TYPICAL DESIGN
LAYOUT*



SLOPE DRAIN
TYPICAL DESIGN LAYOUT



OPEN CHUTE DRAIN

DEFINITION: An excavated channel placed across disturbed slopes used to protect exposed slopes by intercepting runoff and directing it to a stabilized outlet or sediment-trapping device.

PURPOSE: Convey runoff over disturbed soil without causing further erosion of the slope.

APPLICATION:

- Used on cut and fill slopes as a permanent or temporary storm water drainage structure.
- Used where diversion ditches or other diversion measures have been used to concentrate flows.

LIMITATIONS:

- Should be sized based on anticipated runoff, sediment loading and drainage area size.
- May require temporary slope drain until final grade is established and open chute drain is constructed.
- Recommended maximum slope of 2:1 (50%).
- Recommended minimum slope of 20:1(5%).

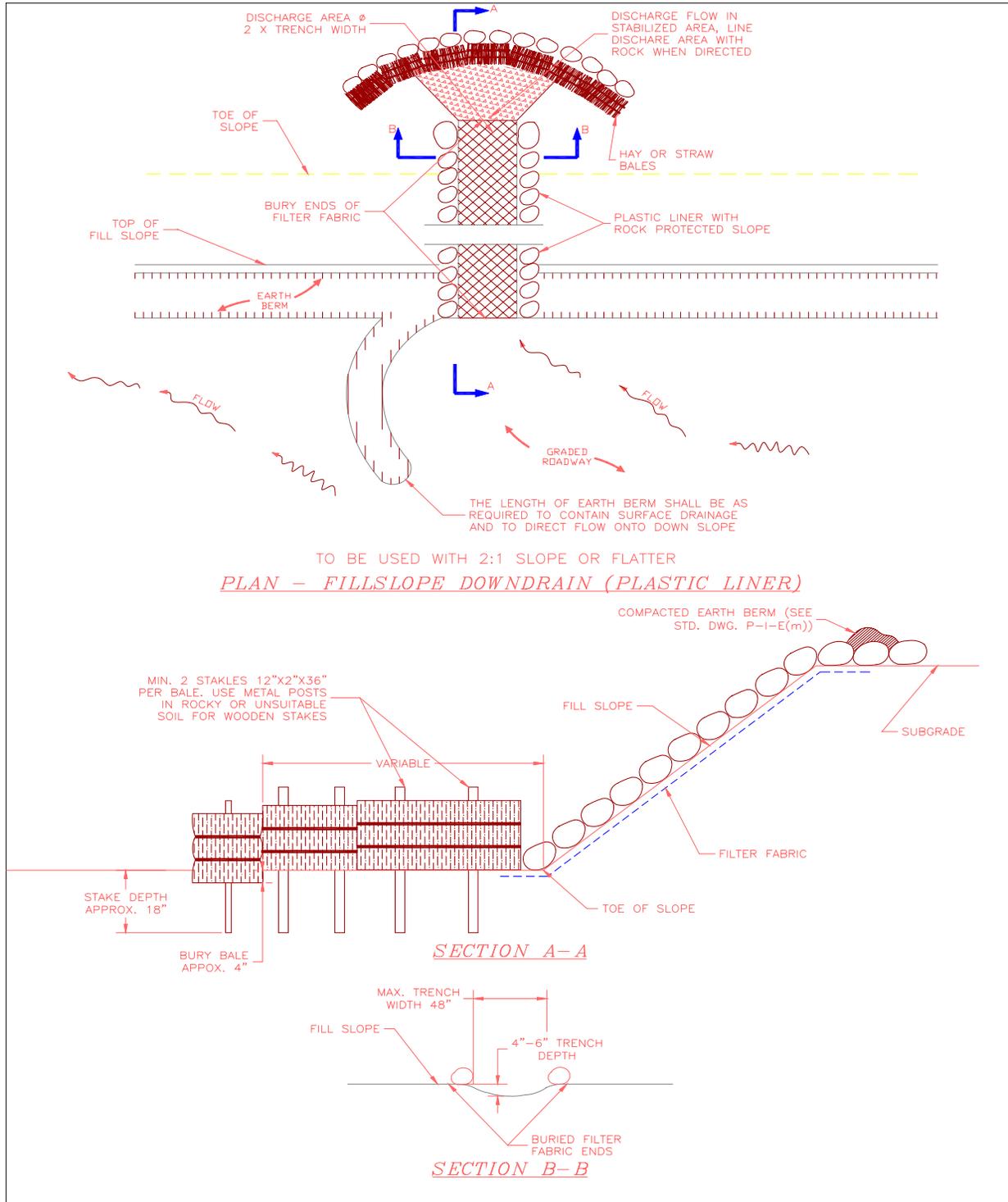
INSTALLATION:

- Detail design is required.
- Implementation of energy dissipaters at the outlet end to protect against scour.
- The elevation of the top of the lining of the inlet structure must not be higher than the lowest diversion dike(s) or other devices that direct flow to the chute.
- Design with adequate capacity to convey the 50-year , 6-hour storm.
- Compact some soil around the inlet to ensure that a good bond is attained at the interface of the structure and diversion dikes and to prevent piping failure. Place Rip Rap if required.

MAINTENANCE:

- Inspect after major storms. Look for piping failure at the interface of the inlet and adjoining diversion dike(s) or berm(s).
- Repair any damage promptly .

OPEN CHUTE DRAIN TYPICAL DESIGN LAYOUT



ROCK-LINED (RIP RAP) DITCHES

DEFINITION: A channel or ditch lined with rocks to prevent erosion. May be used as a temporary or permanent control.

PURPOSE: Convey runoff without causing erosion of the a ditch or channel.

APPLICATION:

- Used in ditches or channels which may or may not have continuous flow.
- Used along roadways where the ditch or channel does not jeopardize the Clear Zone.

LIMITATIONS:

- Should be sized based on anticipated runoff, sediment loading and drainage area size.
- Recommended maximum slope of 2:1 (50%).
- Ditches or Channels having slopes greater than 8% must utilize geotextiles beneath the rock.
- Minimum Rock size shall be 6". The gradation shall be determined by the detailed design.

INSTALLATION:

- Detail design is required.
- Implementation of energy dissipaters at the outlet end to protect against scour.
- Design temporary ditches with adequate capacity to convey the 50-year , 6-hour storm. Design permanent ditches per Summit County Standards.
- Excavate ditch or channel to the designed cross section and grade. The ditch or channel side slope may be no steeper than 2:1.
- Place geotextiles (if required) along the full width of the excavated ditch or channel. Be sure to overlap the material as required in the manufacturers guidelines.
- Place the rock by machine, or by hand as required.

MAINTENANCE:

- Inspect after major storms. Look for undermining failures.
- Repair any damage promptly .

GRASSED/MATTED SWALES

DEFINITION: A channel or ditch lined with vegetated matts to prevent erosion. May be used as a temporary or permanent control.

PURPOSE: Convey runoff without causing erosion of the a ditch or channel.

APPLICATION:

- Used in ditches or channels which do not have continuous flow.
- Used along roadways where the ditch or channel is used to convey storm water.

LIMITATIONS:

- Should be sized based on anticipated runoff, sediment loading and drainage area size.
- Recommended maximum slope of 20:1 (5%).

INSTALLATION:

- Detail design is required.
- Implementation of energy dissipaters at the outlet end to protect against scour.
- Design temporary ditches with adequate capacity to convey the 50-year , 6-hour storm. Design permanent ditches per Summit County Standards.
- Excavate ditch or channel to the designed cross section and grade. The ditch or channel side slope may be no steeper than 3:1.
- Place matt along the full width of the excavated ditch or channel. Be sure to overlap the material if required in the manufacturers guidelines.

MAINTENANCE:

- Inspect after major storms. Look for undermining failures.
- Repair any damage promptly .

TEMPORARY EXCAVATED SEDIMENT TRAP

DEFINITION: A small temporary containment area with gravel (Rip Rap) outlet.

PURPOSE:

- Reduce velocities and peak discharge of storm water runoff.
- Create temporary ponding to allow settlement and deposition of suspended solids.
- Protect down-gradient discharge point from sediment laden runoff and eroding velocities.

APPLICATION:

- Temporary control for runoff from disturbed areas of less than 3 acres.
- Temporary control for discharge from diversion dike, surface benching, or other temporary drainage measures.

LIMITATIONS:

- Should be sized based on anticipated runoff, sediment loading and drainage area size.
- May require silt fence at outlet for entrapment of very fine silts and clays.

INSTALLATION:

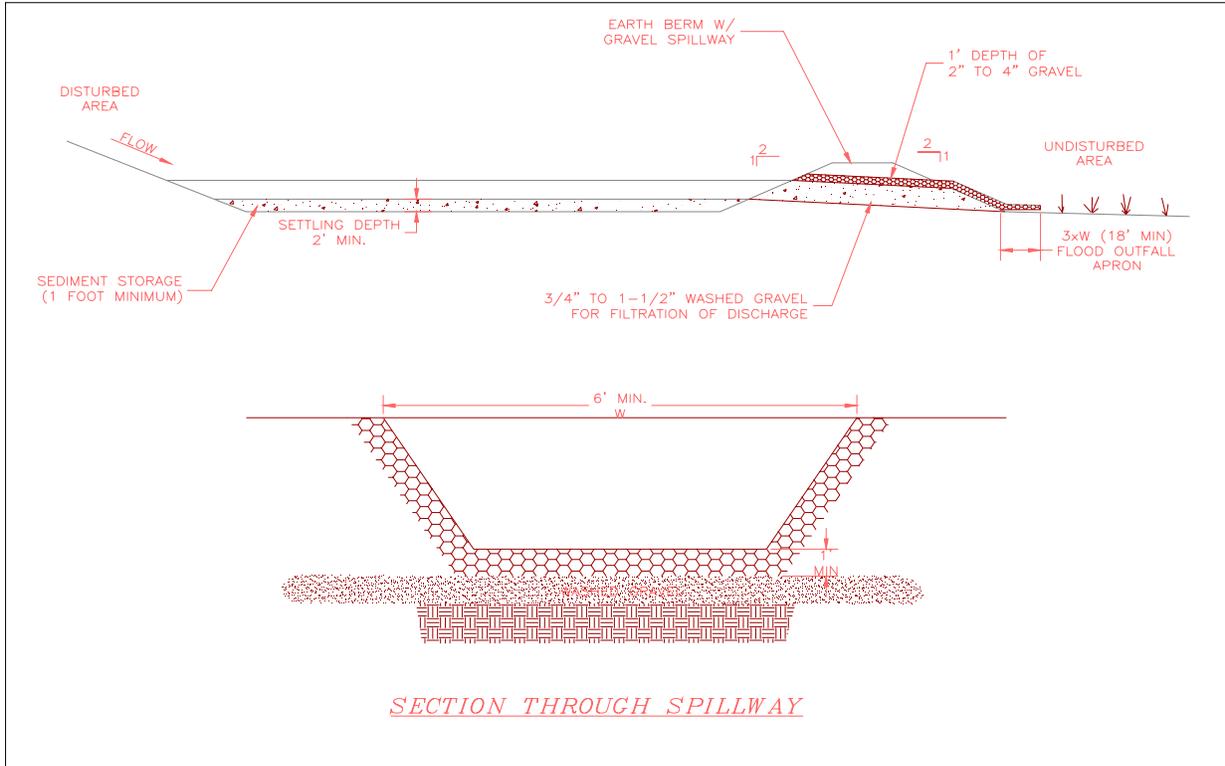
- Design basin for site specific location.
- Excavate basin or construct compacted berm containment.
- Construct outfall spillway with gravel (Rip Rap) apron.
- Provide downstream silt fence if necessary.
- Use straw bales in trap to reduce gullyng.

MAINTENANCE:

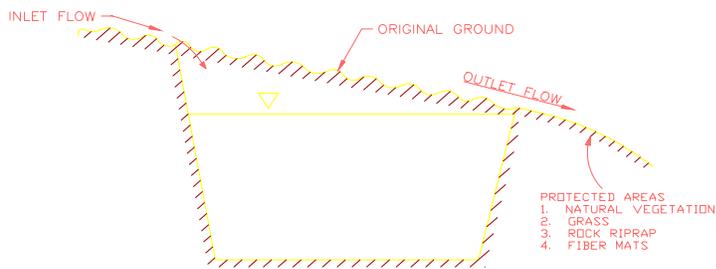
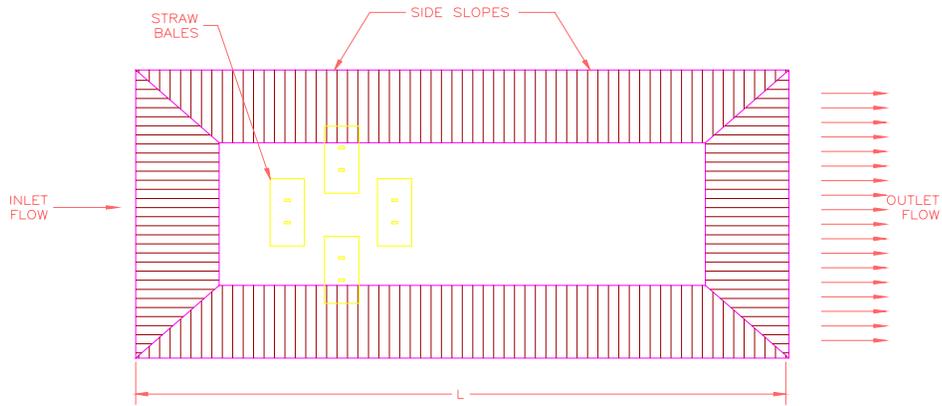
- Inspect after each rainfall event and at a minimum of monthly.
- Repair any damage to berm, spillway or sidewalls.
- Remove accumulated sediment as it reaches 50% height of available storage.
- Check outlet for sediment/erosion of down-gradient area and remediate as necessary. Install silt fence if sedimentation down stream is apparent.

TEMPORARY EXCAVATED SEIMENT TRAP

TYPICAL DESING LAYOUT



*TEMPORARY EXCAVATED
SIDEWENT TRAP
TYPICAL DESIGN LAYOUT*



EQUIPMENT AND VEHICLE WASH DOWN AREA

DEFINITION: A stabilized pad of crushed stone for general washing of equipment and construction vehicles.

PURPOSE: To reduce potential of sediment being tracked onto roads and streets by vehicles leaving a construction site and entering a storm water collection systems, or waterways.

APPLICATION:

- At any site where regular washing of vehicles and equipment must occur to reduce the potential of sediment being tracked onto roads and streets by vehicles leaving a construction site.
- May also be used as a filling point for water trucks limiting erosion caused by overflow or spillage of water.

LIMITATIONS:

- Cannot be utilize for washing equipment or vehicles that may cause contamination of runoff such as fertilizer equipment or concrete equipment. Solely used to remove mud from vehicles leaving construction sites.
- A Sediment trap must be used in conjunction to control sediment runoff with wash water.

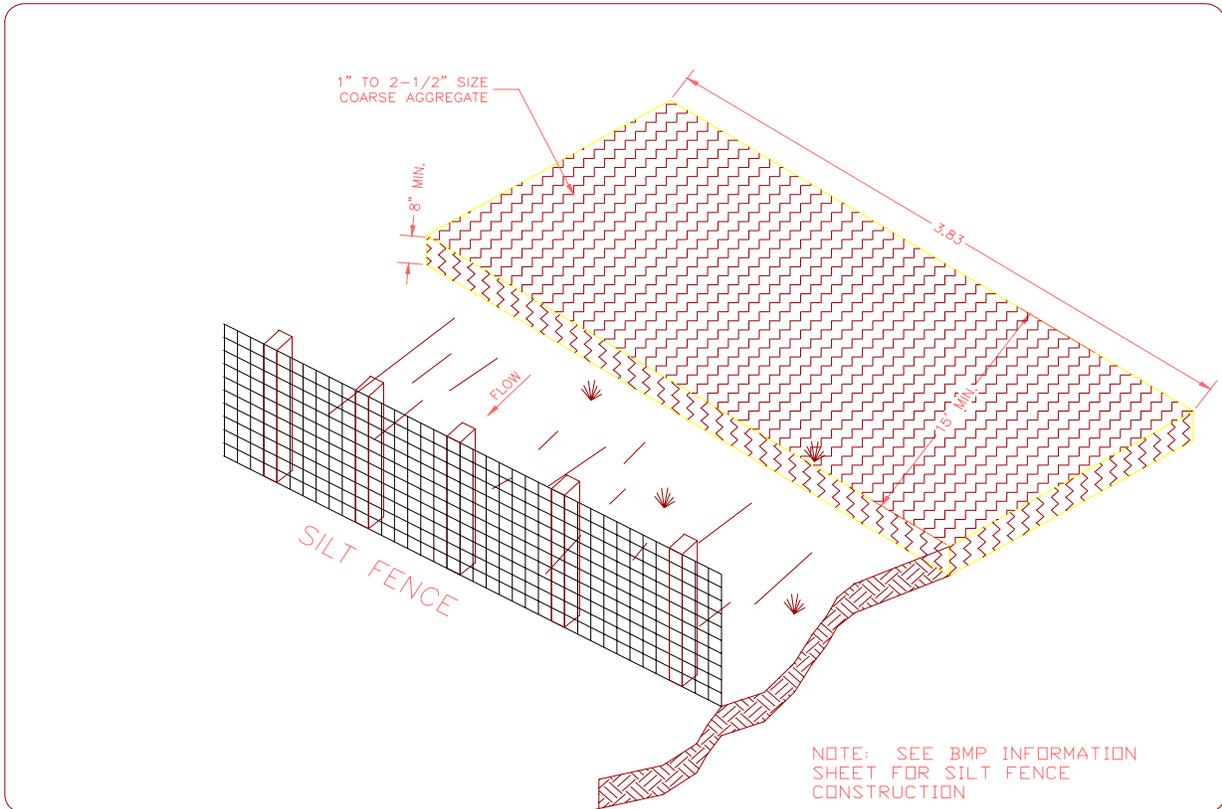
INSTALLATION:

- Clear and grub area and grade to provide maximum slope of 1%.
- Compact subgrade and place filter fabric if desired (required for wash areas which will remain in use for 3 months or more).
- Place coarse aggregate, 1 to 2 ½ inches in size, to a minimum depth of 8 inches.
- For small projects, instal silt fence down gradient (see silt fence BMP information sheet).
- For large projects, instal sediment basin down gradient (see excavated sediment trap BMP information sheet).

MAINTENANCE:

- Inspect daily for loss of gravel or sediment buildup.
- Inspect adjacent area for sediment deposit and install additional controls if necessary.
- Repair area and replace gravel as required to maintain control in good working condition.
- Expand stabilized area as required to accommodate activities.
- Maintain silt fence as outline in specific silt fence BMP information sheet.
- Maintain sediment trap as outline in specific sediment trap BMP information sheet.

*EQUIPMENT AND VEHICLE
WASH DOWN AREA
TYPICAL DESIGN LAYOUT*



MATERIAL STORAGE

DEFINITION: Controlled storage of on-site materials.

PURPOSE: To limit potential for materials contaminating storm water runoff.

APPLICATION:

- Storage of hazardous, toxic, and all chemical substances.
- Any construction site with outside storage of materials.

LIMITATIONS:

- Does not prevent contamination due to mishandling of products.
- Spill Prevention and Response Plan still required.
- Only effective if materials are actively stored in a controlled location.

INSTALLATION:

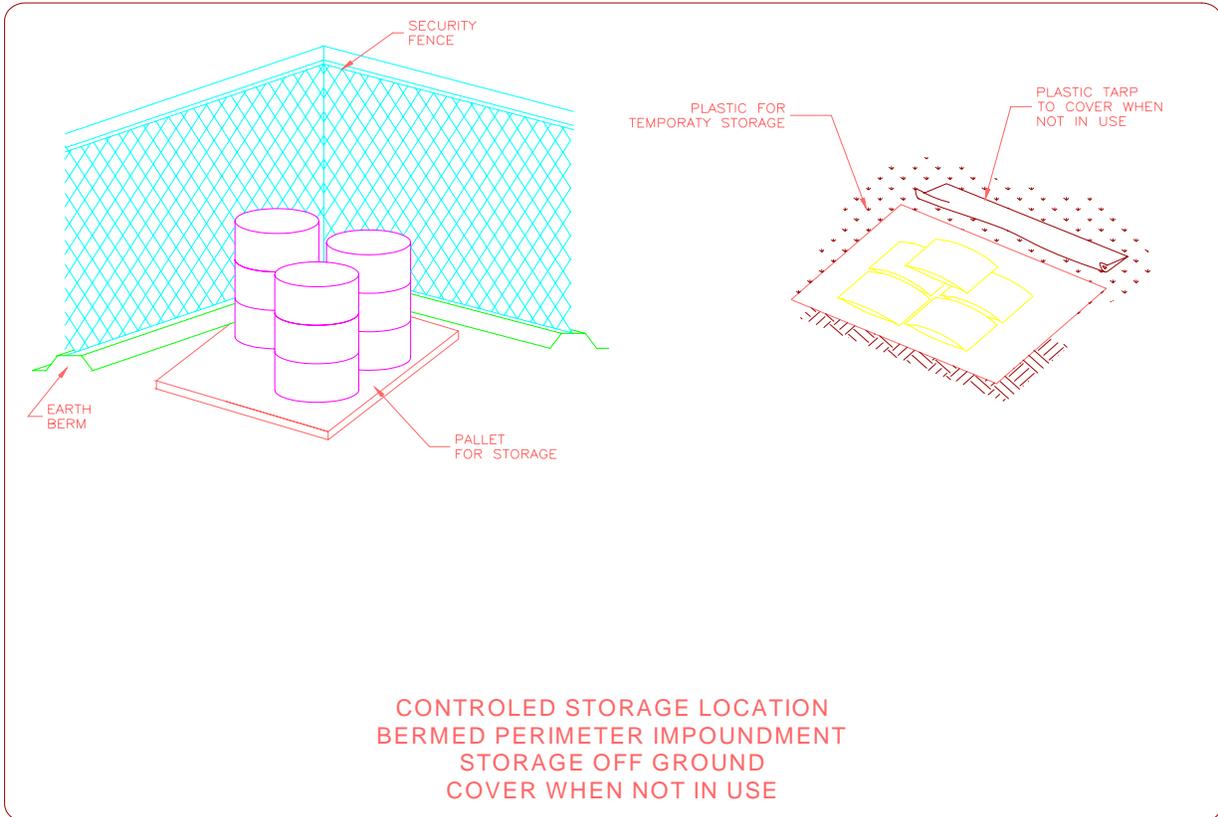
- Designate a secured area with limited access as the storage location. Ensure no waterways or drainage paths are nearby.
- Construct compacted earthen berm or similar perimeter containment around storage location for impoundment in the case of spills.
- Ensure all on-site personnel utilize designated storage area. Do not store excessive amounts of material that will not be utilize on-site.
- For active use of materials away from the storage area ensure materials are not set directly on the ground and are covered when not in use. Protect storm drainage during use.

MAINTENANCE:

- Inspect daily and repair any damage to perimeter impoundment or security fencing.
- Check that materials are being correctly stored (i.e. standing upright, in labeled containers, tightly capped) and that no materials are being stored away from the designated location.

MATERIAL STORAGE

TYPICAL DESIGN LAYOUT



WASTE DISPOSAL

DEFINITION: Controlled storage and disposal of solid waste generated by construction activities.

PURPOSE: To prevent or reduce discharge of pollutants to storm water from improper disposal of solid waste.

APPLICATION: All construction sites.

LIMITATIONS: On-site personnel are responsible for correct disposal of waste.

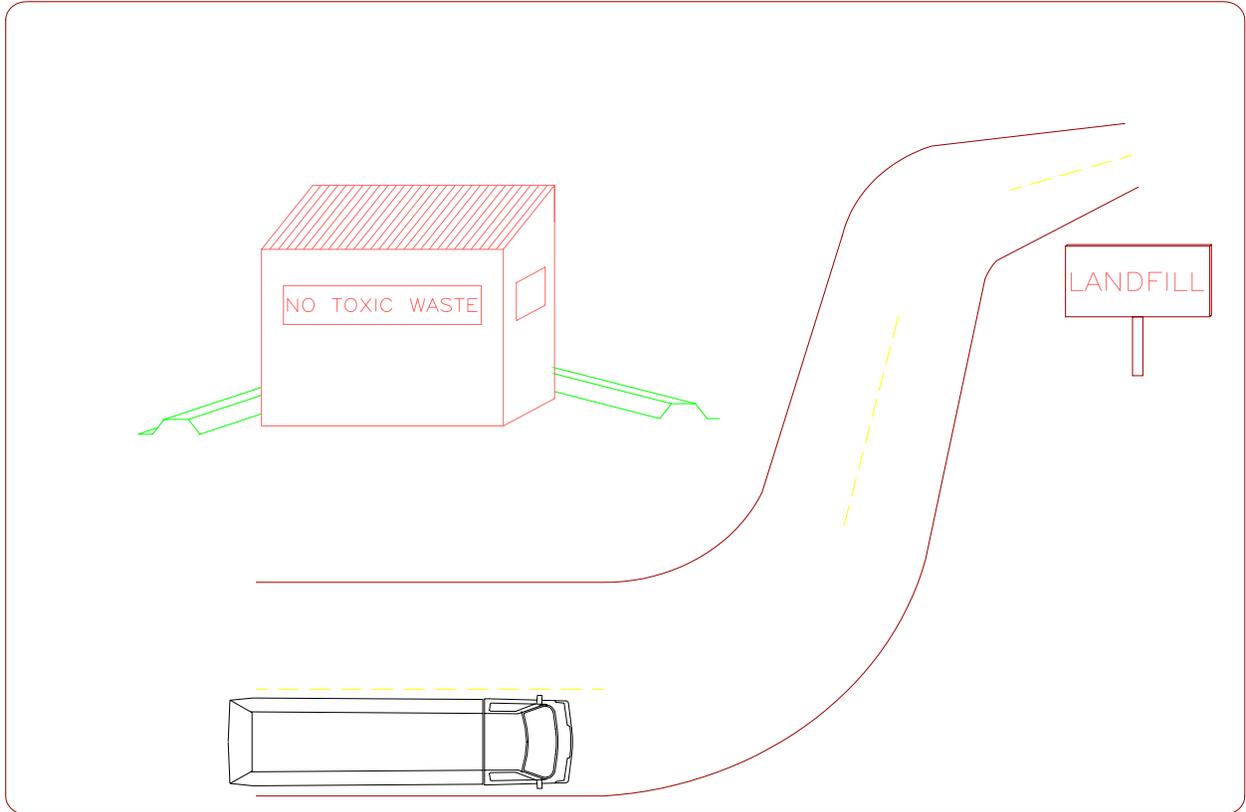
INSTALLATION:

- Designate one or several waste collection areas with easy access for construction vehicles and personnel. Ensure no waterways or storm drainage inlets are located near the waste collection areas. Construct compacted earthen berm or similar perimeter containment around collection area for impoundment in the case of spills and to trap any windblown trash.
- Use water tight containers with covers which are to remain closed when not in use. Provide separate containers for different waste types where appropriate and label clearly.
- Ensure all on-site personnel are aware of and utilize designated waste collection area properly and for intended use only (e.g., all toxic, hazardous or recyclable materials shall be properly disposed of separately from general construction waste).
- Arrange for periodic pickup, transfer and disposal of collected waste at authorized disposal location. Include regular Porta-potty service in waste management activities.

MAINTENANCE:

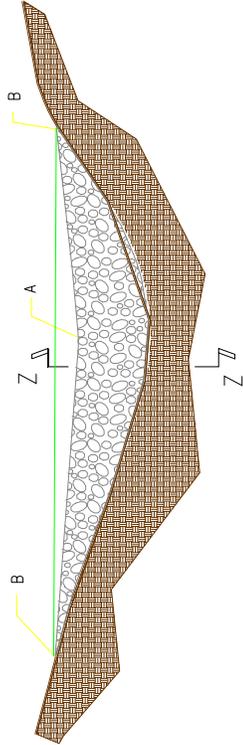
- Discuss waste management procedures at progress meetings.
- Collect site trash daily and deposit in covered containers at designated collection area.
- Check containers for leakage or inadequate covers and replace as needed.
- Randomly check disposed materials for any unauthorized waste (e.g., toxic materials).
- During daily site inspections check that waste is not being incorrectly disposed of on-site (e.g., burial, burning, surface discharge, discharge to storm drain).

WASTE DISPOSAL
TYPICAL DESIGN LAYOUT



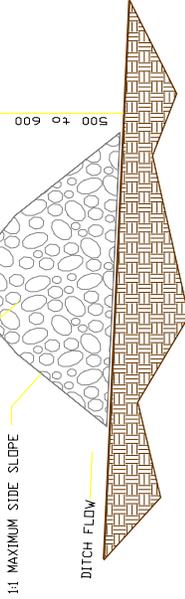
CHECK DAMS

CONSTRUCT THE CHECK DAM SO THAT POINT "A" IS APPROXIMATELY 100 mm LOWER THAN POINT "B".



STONE CHECK DAM

STONE, WELL-GRADED, RANGING FROM 13 mm TO 38 mm.



1:1 MAXIMUM SIDE SLOPE

DITCH FLOW

SECTION Z - Z

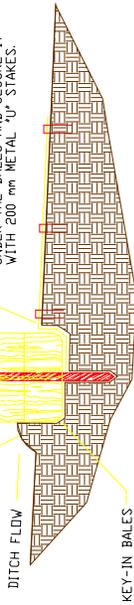
GENERAL NOTES:

1. PLACE CHECK DAMS PERPENDICULAR TO THE FLOWLINE OF THE DITCH.
2. DO NOT PLACE CHECK DAMS ACROSS NATURAL STREAM BEDS.
3. CONSTRUCT CHECK DAMS TO ENSURE WATER DOES NOT FLOW AROUND THE ENDS OF THE DAM.

STRAW OR HAY BALE
50 mm SQUARE BY 1.2 m MINIMUM HARDWOOD STAKE. PROVIDE 2 STAKES PER BALE.

PLACE 75 mm OF EXCAVATED MATERIAL ON THE RECEIVING END OF THE BALE AND COMPACT.

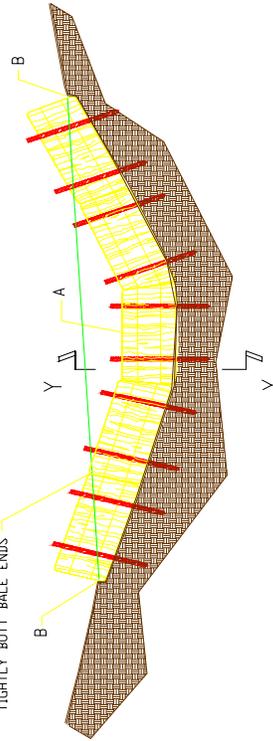
INSTALL 1.8 m WIDE EROSION CONTROL BLANKET AS A SCOUR APRON ALONG THE DOWNSTREAM SIDE OF THE DAM. ANCHOR 250 mm OF THE BLANKET EDGE UNDER THE BALES AND SECURE IT WITH 200 mm METAL "U" STAKES.



KEY-IN BALES 150 mm DEEP

SECTION Y - Y

CONSTRUCT THE CHECK DAM SO THAT POINT "A" IS A MINIMUM OF 100 mm LOWER THAN POINT "B".



TIGHTLY BUTT BALE ENDS

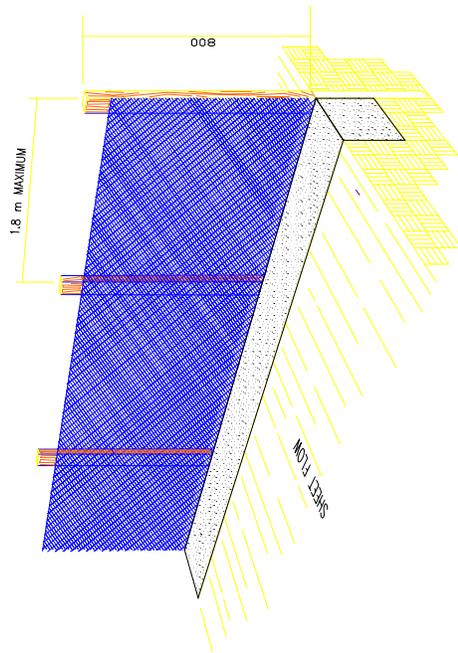
STRAW OR HAY BALE CHECK DAM

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| UTAH DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION SALT LAKE CITY, UTAH | | RECOMMENDED FOR APPROVAL | CHAIRMAN STANDARDS COMMITTEE | APPROVED | DEPUTY DIRECTOR |
| DATE | DATE | DATE | DATE | DATE | DATE |
| APR13,1999 | APR13,1999 | APR13,1999 | APR13,1999 | APR13,1999 | APR13,1999 |
| NO | DATE | APPR | REMARKS | | |
| 1 | 02/25/99 | TJ | TOTALLY REVISED DRAWINGS | | |

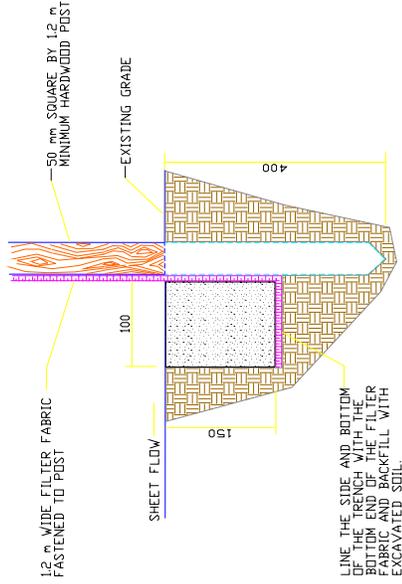
STANDARD DRAWING TITLE
TEMPORARY EROSION CONTROL (CHECK DAMS)
< METRIC >
STD. DWG. NO.
1010

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETERS UNLESS OTHERWISE NOTED.

SILT FENCE



PERSPECTIVE VIEW



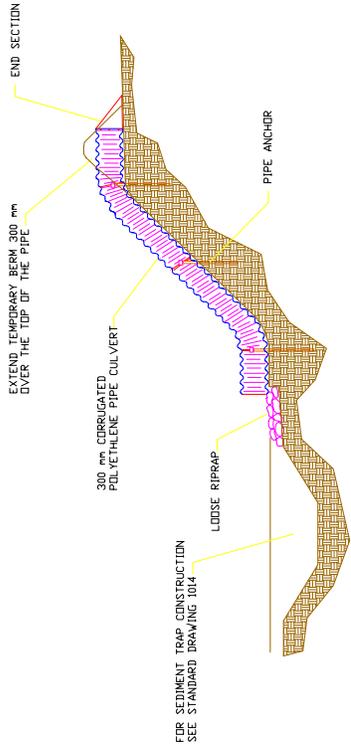
SECTION

GENERAL NOTES:

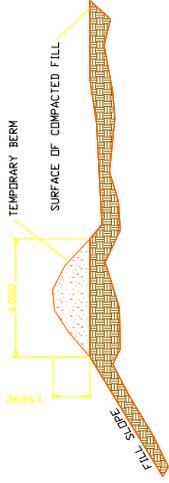
1. WHERE POSSIBLE, LAYOUT THE SILT FENCE 1.5 m TO 30 m BEYOND THE TOE OF SLOPE.
2. ALIGN THE FENCE ALONG THE CONTOUR AS CLOSE AS POSSIBLE.
3. WHEN EXCAVATING THE TRENCH, USE MACHINERY THAT WILL PRODUCE NO MORE THAN THE DESIRED DIMENSIONS.
4. EXTEND THE BOTTOM 400 mm OF FILTER FABRIC TO LINE ALL THREE SIDES OF THE TRENCH.
5. TO AVOID EXCESSIVE PONDING OF WATER AT LOW POINTS ALONG THE FENCE, PROVIDE AN OPENING IN THE SILT FENCE AND INSTALL A CHECK DAM.
6. AVOID USING JOINTS ALONG THE FENCE AS MUCH AS POSSIBLE. IF A JOINT IS NECESSARY, SPlice THE FILTER FABRIC AT POST WITH A 150 mm OVERLAP AND SECURELY FASTEN BOTH ENDS TO THE POST.
7. MAINTAIN A PROPERLY FUNCTIONING SILT FENCE THROUGHOUT THE DURATION OF THE PROJECT OR UNTIL DISTURBED AREAS HAVE BEEN VEGETATED.
8. REMOVE SEDIMENT AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

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| UTAH DEPARTMENT OF TRANSPORTATION STANDARD DRAWING TITLE EROSION CONTROL (SILT FENCE) | | DEPUTY DIRECTOR APR 13, 1999 DATE | |
| REVISIONS 1 02/09/94 T.J. TOTALLY REVISED DRAWINGS | | STD. DWG. NO. 1011 | |
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SLOPE DRAIN AND TEMPORARY BERM

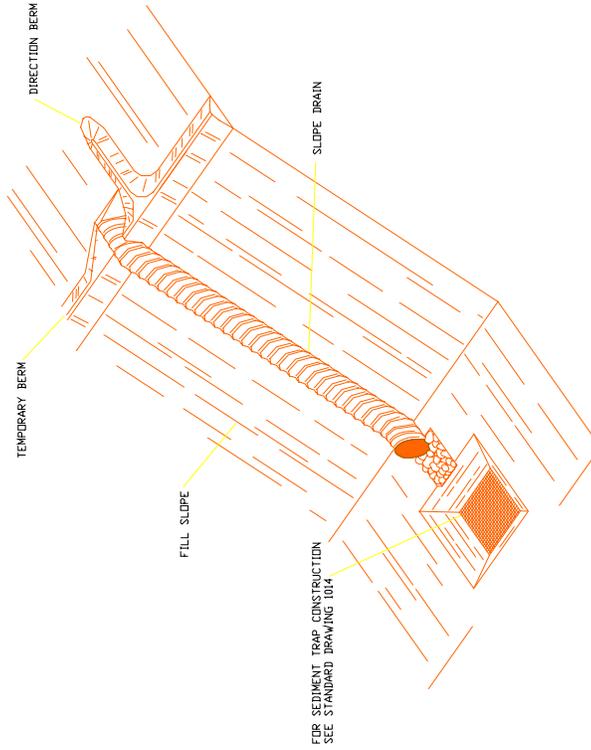


SLOPE DRAIN SECTION



TEMPORARY BERM

- GENERAL NOTES FOR TEMPORARY BERM:
1. COMPACT THE RIDGE OF EXISTING SOIL TO PROVIDE A NON-ERODIBLE BERM THAT MEETS THE RIDE HEIGHT OF THE TEMPORARILY CONSTRUCTED SLOPE. REPAIR ANY EROSION OF THE BERM IMMEDIATELY.
 2. TEMPORARY BERMS ARE TYPICALLY USED IN CONJUNCTION WITH SLOPE DRAINS.



SLOPE DRAIN ISOMETRIC

- GENERAL NOTES FOR SLOPE DRAIN:
1. COMPACT THE SOIL SURFACE AND BERMS AROUND THE ENTRANCE TO THE PIPE END SECTION TO PREVENT WATER FROM UNDERMINING THE PIPE AND ERODING THE SLOPE. REPAIR ANY EROSION AROUND THE INLET, OUTLET OR SLOPE IMMEDIATELY.
 2. ANCHOR THE PIPE TO THE GROUND EVERY 3 m TO PREVENT PIPE MOVEMENT AND SUBSEQUENT FAILURES DURING STORM EVENTS.
 3. USE WATER-TIGHT FITTINGS AT ALL SLOPE DRAIN CONNECTIONS.
 4. EXTEND THE DRAIN A MINIMUM OF 1 m BEYOND THE TOE OF THE SLOPE AND PROVIDE OUTLET PROTECTION.
 5. EXTEND THE SLOPE DRAIN AS REQUIRED TO COINCIDE WITH THE HEIGHT OF THE EMBANKMENT.
 6. MAINTAIN PROPERLY FUNCTIONING SLOPE DRAINS UNTIL SLOPES HAVE BEEN PERMANENTLY STABILIZED.
 7. 50 PERCENT OF THE RIPRAP TO BE BETWEEN 150 mm AND 200 mm WITH A MAXIMUM SIZE OF 300 mm AND A MINIMUM SIZE OF 100 mm.

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| STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION | | DATE | APR13/1999 | DATE |
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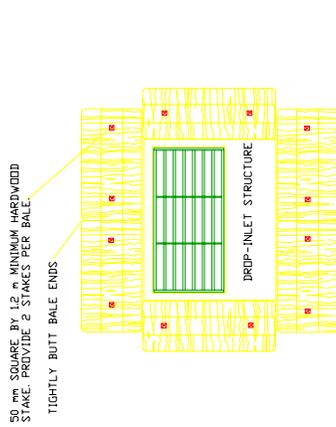
STANDARD DRAWING TITLE: TEMPORARY EROSION CONTROL (SLOPE DRAIN AND TEMPORARY BERM) < METRIC >

STD. DWG. NO. 1012

ALL DIMENSIONS ARE EXPRESSED IN MILLIMETERS UNLESS OTHERWISE NOTED.

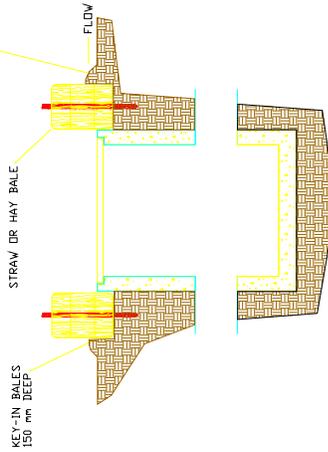
DROP-INLET BARRIERS

STRAW AND HAY BALE DROP-INLET BARRIER



PLAN VIEW

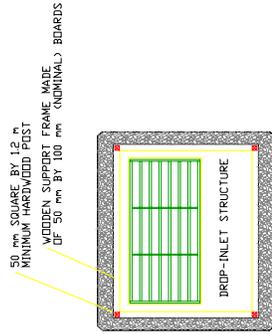
PLACE 75 mm TO 100 mm OF EXCAVATED MATERIAL ALONG THE RECEIVING SIDE OF THE BALE AND COMPACT



SECTION

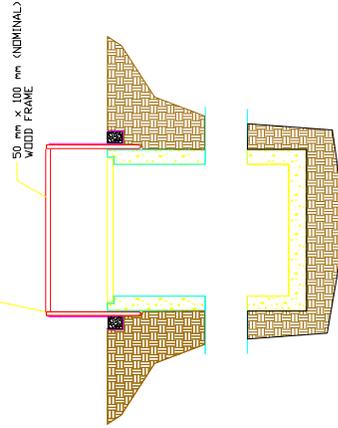
- GENERAL NOTES:
1. KEY-IN BALES IN AN EXCAVATED TRENCH AROUND THE PERIMETER OF THE INLET STRUCTURE THAT IS 150 mm DEEP BY A BALES WIDTH WIDE.
 2. OVERLAP IN CORNERS MUST BE AT LEAST HALF A BALE WIDE.
 3. MORE THAN 10 BALES PER LINE ARE REQUIRED.
 4. IN MEDIAN AREAS, CONSTRUCT SO THAT THE TOPS OF THE BALES ARE NOT HIGHER THAN THE ADJACENT ROADWAY.
 5. THROUGHOUT CONSTRUCTION OR UNTIL DISTURBED AREAS CONTRIBUTING TO THE INLET HAVE BEEN PAVED OR VEGETATED THROUGHOUT CONSTRUCTION AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

SILT FENCE DROP-INLET BARRIER



PLAN VIEW

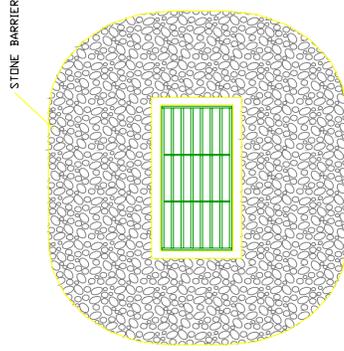
SEE STANDARD DRAWING 1011 FOR SILT FENCE DETAIL.



SECTION

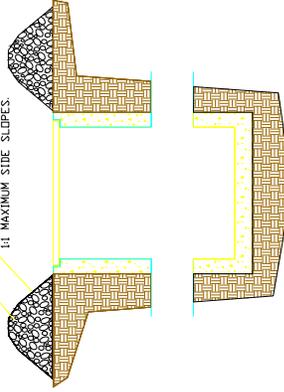
- GENERAL NOTES:
1. EXCAVATE A TRENCH AROUND THE CORNER THE PERIMETER OF THE INLET STRUCTURE.
 2. DRIVE POSTS AT EACH CORNER OF THE INLET STRUCTURE IF THE DISTANCE BETWEEN CORNER POSTS EXCEEDS 1.2 m. PLACE ANOTHER POSTS BETWEEN THEM.
 3. DRIVE POSTS WITH A VOIDEN SUPPORT FRAME MADE OF 50 mm BY 100 mm BOARDS. USE WALLS OR SCREWS FOR FASTENING.
 4. IS NOT HIGHER THAN THE ADJACENT ROADWAY.
 5. MAINTAIN A PROPERLY FUNCTIONING SILT FENCE BARRIER THROUGHOUT CONSTRUCTION OR UNTIL DISTURBED AREAS CONTRIBUTING TO THE INLET HAVE BEEN PAVED OR VEGETATED THROUGHOUT CONSTRUCTION AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

STONE DROP-INLET BARRIER



PLAN VIEW

STONE BARRIER: WELL GRADED, 13 mm TO 38 mm 500 mm TO 600 mm HIGH WITH 1:1 MAXIMUM SIDE SLOPES.



SECTION

- GENERAL NOTES:
1. PLACE STONE BARRIER AS SHOWN AROUND THE INLET OPENING.
 2. IN MEDIAN AREAS CONSTRUCT SO THAT THE TOPS OF THE STONE BARRIER ARE NOT HIGHER THAN THE ADJACENT ROADWAY.
 3. MAINTAIN A PROPERLY FUNCTIONING STONE BARRIER THROUGHOUT CONSTRUCTION OR UNTIL DISTURBED AREAS CONTRIBUTING TO THE INLET HAVE BEEN PAVED OR VEGETATED THROUGHOUT CONSTRUCTION AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

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STD. DWG. NO.
1013

UTAH DEPARTMENT OF TRANSPORTATION
STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION
SALT LAKE CITY, UTAH

RECOMMENDED FOR APPROVAL

APR 13, 1999 DATE
CHAIRMAN STANDARDS COMMITTEE

APPROVED

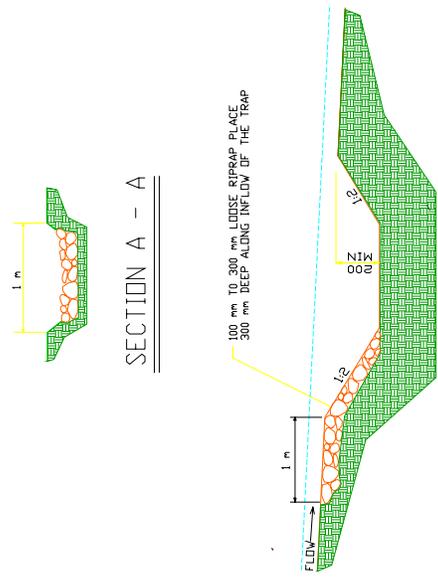
APR 13, 1999 DATE
DEPUTY DIRECTOR

REVISIONS
1 02/26/99 T.J. TOTALLY REVISED DRAWINGS

NO. DATE APPROVED REMARKS

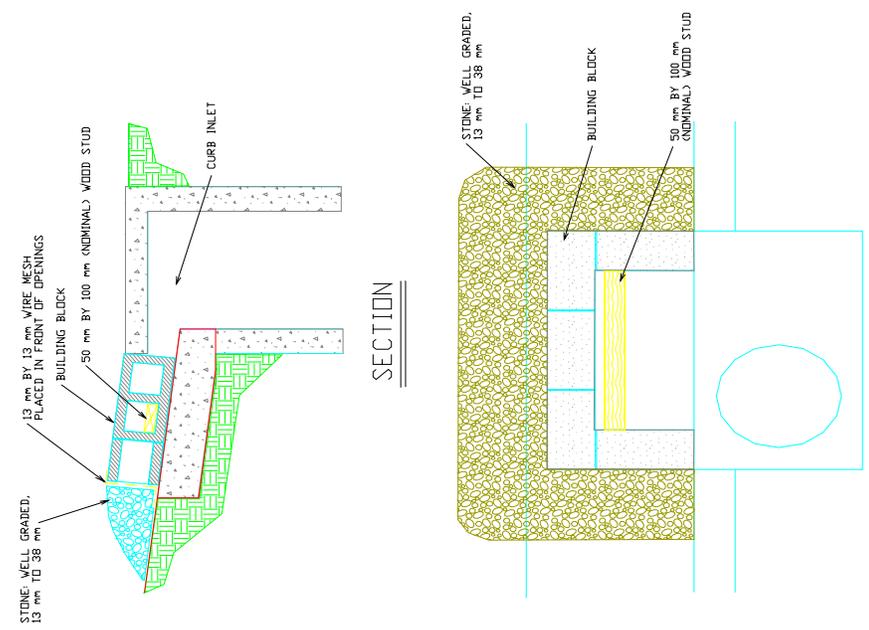
TEMPORARY
INLET CONTROL
(DROP-INLET BARRIERS)
< METRIC >

SEDIMENT TRAP



- GENERAL NOTES:
1. PLACE SEDIMENT TRAPS AT LOCATIONS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
 2. THE STORAGE CAPACITY OF EACH SEDIMENT TRAP WILL BE LIMITED BY THE LENGTH OF THE TRAP.
 3. CONSTRUCT TRAPS AS LONG AS THE WIDTH.
 4. MAINTAIN A PROPERLY FUNCTIONING SEDIMENT TRAP THROUGHOUT CONSTRUCTION OR UNTIL DISTURBED AREAS CONTRIBUTING TO THE BASIN HAVE BEEN PAVED OR VEGETATED.
 5. REMOVE SEDIMENT AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

CURB INLET BARRIER



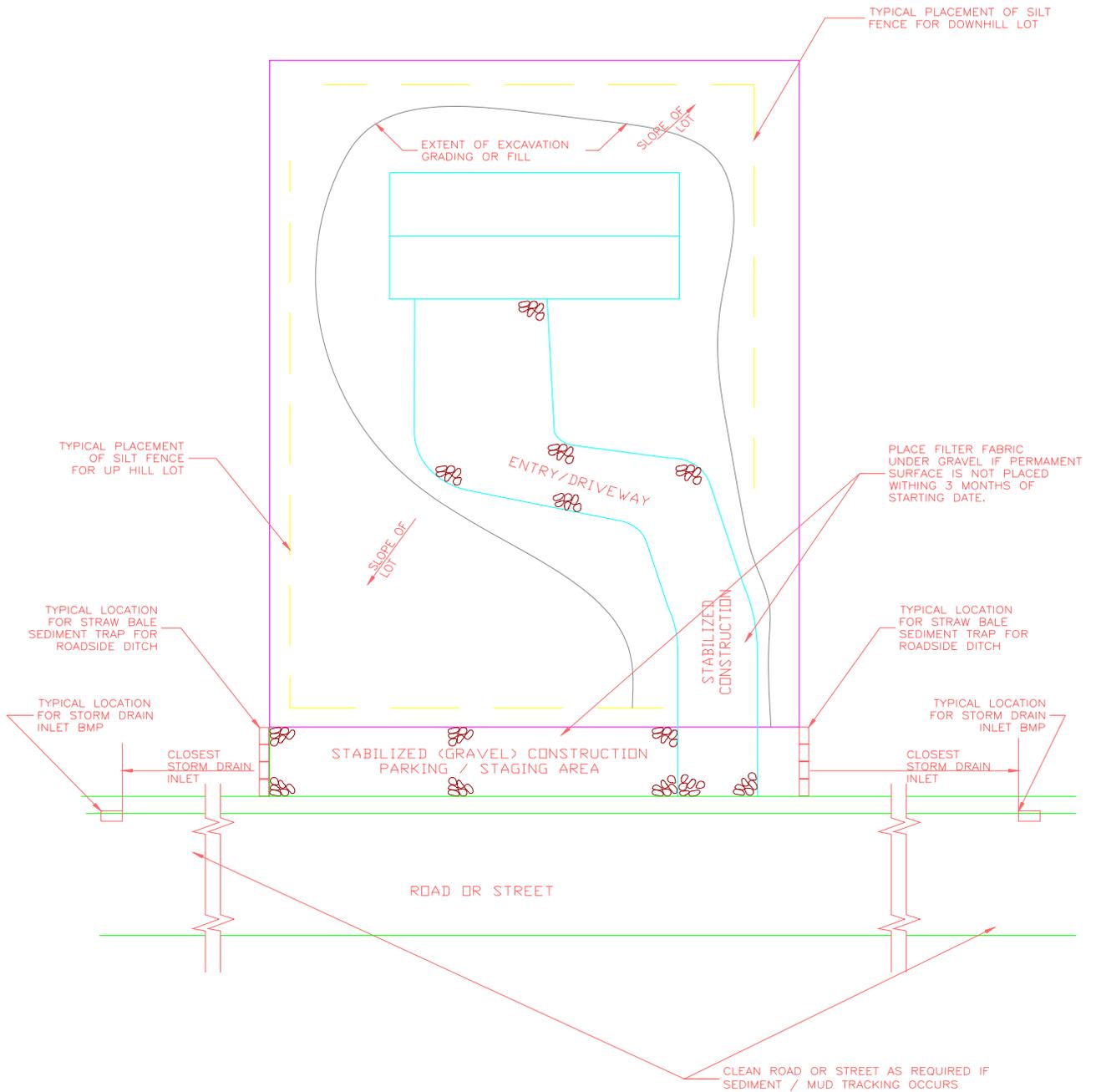
- GENERAL NOTES:
1. PLACE BUILDING BLOCKS, WIRE MESH AND STONE AS SHOWN AROUND THE CURB INLET.
 2. MAINTAIN A PROPERLY FUNCTIONING STONE BARRIER THROUGHOUT CONSTRUCTION OR UNTIL DISTURBED AREAS CONTRIBUTING TO THE INLET HAVE BEEN PAVED OR VEGETATED.
 3. REMOVE SEDIMENT AS IT ACCUMULATES AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.

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| UTAH DEPARTMENT OF TRANSPORTATION STANDARD DRAWINGS FOR ROAD AND BRIDGE CONSTRUCTION SALT LAKE CITY, UTAH | | APR.13.1999 DATE | APR.13.1999 DATE | REMARKS |
| RECOMMENDED FOR APPROVAL | | CHAIRMAN STANDARDS COMMITTEE | DEPUTY DIRECTOR | |
| APPROVED | | | | |
| 1 03/02/94 T. TOTALLY REVISED DRAWINGS | | | | |

STANDARD DRAWING TITLE
CURB INLET BARRIER < SEDIMENT TRAP AND TEMPORARY EROSION CONTROL >
< METRIC >
STD. DWG. NO. 1014

APPENDIX C2: TYPICAL RESIDENTIAL STORM WATER POLLUTION PREVENTION PLAN

TYPICAL RESIDENTIAL STORMWATER POLLUTION PROTECTION PLAN



**APPENDIX D: SELECTED NONSTRUCTURAL POST-
CONSTRUCTION BMPS**

APPENDIX D TABLE OF CONTENTS

| | |
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| Introduction | D-1 |
| BMP 1: Preservation of Undisturbed Natural Areas | D-1 |
| BMP 2: Minimization of Disturbance | D-1 |
| BMP 3: Reduction of Impervious Cover | D-2 |
| BMP 4: Routing of Runoff to Pervious Areas/disconnection of Runoff | D-2 |
| BMP 5: Pollution Prevention/Source Reduction | D-3 |
| Checklist for Nonstructural BMPs | D-4 |

Introduction

As described in Appendix A, Section 4, Summit County requires that proposed developments utilize nonstructural stormwater control BMPs to the maximum extent practicable in order to meet the required criteria for long-term runoff control. This appendix provides a list and description of appropriate nonstructural BMPs that a permit applicant could choose to utilize in their design. This list is not intended to be comprehensive, and alternative nonstructural controls may be selected subject to approval by Summit County. A nonstructural BMP checklist is included in this Appendix. This checklist is intended for planners, designers and/or developers to utilize during the site planning, design, and construction phases of all developments. Additional information and detailed examples of nonstructural controls and environmentally-sensitive design principles can be obtained online at :

http://www.cwp.org/better_site_design.htm

<http://www.georgiastormwater.com/vol2/1-4.pdf>

<http://www.stormwatercenter.net/>

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/post.cfm>

BMP 1: Preservation of Undisturbed Natural Areas

This BMP involves formally designating appropriate undisturbed natural areas within the site as preservation areas. These areas must be specified in the maintenance covenant and recorded by the County in the land record to ensure they remain undeveloped in perpetuity. These areas must be clearly marked and remain undisturbed (i.e., no clearing, grubbing, or construction traffic) during construction. Areas that provide the greatest stormwater benefits through their preservation include:

- wetlands & meadows
- riparian buffers
- forested areas
- areas with high infiltration rates (e.g., hydrologic group A and B soils)
- groundwater recharge zones
- streams and natural drainageways

BMP 2: Minimization of Disturbance

This BMP involves using careful construction sequencing, well-designated limits of disturbance, and well-defined construction entrances/exits to minimize the total area of disturbance (e.g., excavation, grading, clearing, grubbing) and reduce soil compaction from construction traffic. Clearing and grading of forests and native vegetation at a site should be limited to the minimum amount needed to build lots, allow access, and provide fire protection. Site layouts and roadway patterns should be designed to conform with or “fit” the natural landforms and topography of a site. This helps to preserve the natural hydrology and drainageways on the site, as well as reduce the need for grading and disturbance of vegetation and soils.

BMP 3: Reduction of Impervious Cover

This BMP involves modifying the designs of permanent structures to reduce the overall area of impervious surfaces while still achieving development objectives. Specific modifications may include:

- reducing roadway lengths and widths to the minimum size needed to meet traffic and safety needs
- reducing building footprints (e.g., build up rather than out)
- reducing the parking footprint (build underground parking or multi-level parking decks; size a proportion of stalls for compact vehicles; use grass or alternative paving for overflow parking areas)
- reducing lot setbacks and frontages
- using fewer or alternative cul-de-sacs (e.g., install pervious vegetated islands in cul-de-sacs; reduce radius of cul-de-sacs; use alternatives such as T-shaped turnarounds)
- integrating porous areas such as landscaped islands, swales, filter strips, and bioretention areas into parking lot designs
- using alternative paving techniques (e.g., use loose gravel, coarse sand, wood or bark chips, or disconnected pavers for all or parts of driveways and walkways)
- using vegetated swales instead of curb and gutter to convey road runoff

BMP 4: Routing of Runoff to Pervious Areas/disconnection of Runoff

This BMP involves routing the runoff from impervious areas to pervious areas such as natural areas, buffers, lawns, landscaping, filter strips and vegetated channels. In this way, the runoff is “disconnected” from other impervious areas and paved collection/conveyance systems (e.g., curb and gutter) that do not allow for groundwater recharge or uptake of pollutants. Some of the methods for disconnecting impervious areas include:

- designing roof drains to flow to vegetated areas
- directing flow from paved areas such as driveways to stabilized vegetated areas
- breaking up flow directions from large paved surfaces and rooftops
- carefully locating and grading impervious areas and landscaped areas to achieve sheet flow runoff to the vegetated pervious areas

BMP 5: Pollution Prevention/Source Reduction

This BMP involves implementing measures to reduce or contain potential sources of contamination at a site. Specific measures include:

- controlling litter (providing adequate numbers of trash receptacles, emptying receptacles regularly, keeping dumpster lids closed, etc.)
- sweeping streets and paved areas rather than hosing them down or using pressurized washers
- reducing rainfall contact with potential pollution sources by installing roofs/canopies over gas station fueling areas, salt/sand piles, hazardous material storage areas, etc.
- providing secondary spill containment (e.g., berms) for hazardous liquid storage containers
- clearly marking storm drains “No Dumping- Drains to Live Stream”

Checklist for Nonstructural BMPs

Project name:
 Project location:
 Contractor/builder information:
 name:
 address:
 email:
 phone/fax:

Site area (total acres):
 Temporarily disturbed area (acres):
 Permanently disturbed area (acres):
 Undisturbed natural areas or preservation areas
 (acres):

| Best Management Practices (BMPs) | Yes/No | Comments (If applicable, describe actions taken or give explanation of no action) |
|---|--------|---|
| Preservation of Undisturbed Natural Areas | | |
| Specification of natural areas in maintenance covenant. | | |
| Preservation is recorded in the land record. | | |
| Clear demarcation of undisturbed areas during construction. | | |
| Minimization of disturbance | | |
| Construction sequence reduces the amount of land disturbed at one time. | | |
| Well-defined construction access points. | | |
| Limited site clearing. | | |
| Site layout and roadway patterns conform to topography. | | |
| Reduction of impervious cover | | |
| Appropriate road sizing. | | |
| Reduced building footprint. | | |
| Reduction of impervious cover (Cont.) | | |
| Reduced parking footprint. | | |

| Best Management Practices (BMPs) | Yes/No | Comments (If applicable, describe actions taken or give explanation of no action) |
|--|---------------|--|
| Reduced lot setbacks and frontages. | | |
| Alternative cul-de-sac design. | | |
| Integration of porous or infiltration areas (islands, swales etc.). | | |
| Alternative paving. | | |
| Use of vegetated swales in place of curb and gutter. | | |
| Routing of runoff to pervious areas/Disconnection of runoff | | |
| Drains and runoff are directed to vegetated areas. | | |
| Runoff from large impervious surfaces (including pavement and rooftops) is broken into several flow paths. | | |
| Design so that impervious areas direct runoff to vegetated areas. | | |
| Pollution prevention/Source reduction | | |
| Litter/trash control. | | |
| Dry sweep rather than washing or hosing off areas. | | |
| Provide secondary spill containment for hazardous liquid if stored on- site. | | |
| Stencil storm drains. | | |

**APPENDIX E: SELECTED STRUCTURAL POST-
CONSTRUCTION BMPS**

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GENERAL

A. Introduction

This appendix provides a list and description of appropriate structural BMPs that a permit applicant could select from to meet the stormwater treatment requirements described in Appendix A. This list is not intended to be comprehensive, and alternative structural controls may be selected subject to approval by Summit County. Additional information and detailed examples of long-term post-construction stormwater BMPs can be found online at:

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/post.cfm>
http://www.deq.state.id.us/water/stormwater_catalog/index.asp

All structural post-construction BMPs shall be inspected regularly (at least every six months or as otherwise noted) to determine maintenance needs.

For the purposes of meeting the water quality treatment requirements outlined in Appendix A, the sliding scale and TSS design removal rates shown in Tables 1 and 2 should be used. TSS removal rates for alternative structural controls will be determined by the applicant and approved by the County Engineer. Credible references justifying/documenting the removal rates used shall be submitted by the permit applicant.

For sites where newly-developed impervious areas lie within 50 feet of a live water body (perennial or intermittent stream, lake, pond, spring, or reservoir), the Table 1 sliding scale does not apply and the default 80% TSS removal standard must be met. The less-stringent removal efficiencies listed in Table 1 apply only to sites that refrain from creating new impervious cover near live water bodies.

B. Location of Structural BMPs

Structural BMPs should never be constructed in natural streams (perennial or intermittent) or wetlands. BMPs should be designed to only intercept and capture storm water runoff, not natural stream channel runoff.

Table 1.1 Sliding Scale for Required TSS Removal Efficiency (adapted from City of Boise).

| % of parcel area that is impervious | % TSS removal efficiency required^a |
|--|--|
| # 30 | 40 |
| 35 | 47 |
| 40 | 53 |
| 45 | 59 |
| 50 | 62 |
| 55 | 66 |
| 60 | 68 |
| 65 | 70 |
| 70 | 72 |
| 75 | 74 |
| 80 | 75 |
| 85 | 77 |
| 90 | 78 |
| 95 | 79 |
| 100 | 80 |

^afor sites where newly-developed impervious cover lies within 50 feet of a live water body, the values in Table 1 do not apply and instead a removal efficiency of 80% must be met, even if the total site imperviousness % is less than 100%.

Table 2.1 TSS Removal Rates for Selected BMPs (adapted from Schueler 1997, Winer 2000, & EPA 1993).

| BMP | Design Removal Rate (%) | Comments |
|-----------------------------|--------------------------------|--|
| Dry Detention Ponds | 15 | Quantity control pond |
| Wet Detention Ponds | 60 | Quantity control pond |
| Dry Extended Detention Pond | 45 | Sediment forebay included |
| Wet Extended Detention Pond | 80 | Sediment forebay included |
| Evaporation Pond | 100 | Designed to evaporate or retain |
| Bioinfiltration Swale | 70 | |
| Sand Filter | 80 | Pretreatment, includes Austin, underground, pocket, and Delaware designs |
| Organic Filter | 80 | Pretreatment, includes compost and peat/sand |
| Catch Basin Insert | 25 | Off-line only |
| Infiltration Facilities | 95* | *removal rate only valid with adequate maintenance and pre-treatment |
| Sediment Trap | 25 | |
| Grass Buffer Strip | 85 | Minimum width of 10' |
| Oil/Water Separator | 15 | |

BMP1: OIL/WATER SEPARATORS

A. Introduction

This section includes standards for oil/water separators to be installed to treat runoff from gas stations and parking lots. These systems can be used to intercept and remove contaminants from storm water runoff. They can also be used during redevelopment to retrofit an existing system in order to provide water quality treatment. Oil/water separators and catch basin inserts should not be used alone to treat storm water runoff but rather in combination with other BMPs to improve water quality.

B. Description

These structures are used to capture floatables, oil and grease, and sediment found in runoff. Two types of oil/water separators are discussed in this section: coalescing plate interceptor (CP) (Figure 1.1) and the conventional gravity separator, or API (Figure 1.2). The CP and API separators can function as pre-treatment systems if regularly maintained. A third system, the spill control (SC) separator should be considered for sites where there is a risk of leaks and small spills, such as gas station sand chemical storage areas. It is not considered a pre-treatment system.

C. Sizing

The contributing area to any individual oil/water separator should be limited to one acre of impervious cover. The maximum allowable velocity through the throat of the separator (0.5 fps) will also limit the size of the area served. Separators, boxes, or vaults are sized based on the contributing runoff area, sedimentation rates of particles, and maximum velocities through the throat of the separator.

Certain developments such as fuel farms or gas stations should consider properly sized facilities to capture floatables such as oil and grease. The American Petroleum Institute (API) standards related to oil rise rates and turbulence should be used to design these facilities.

D. Access

Provide access for inspection, proper maintenance, and monitoring activities, including clearance from structures to allow for equipment to clean out devices. Provide access to each compartment. If the length or width of any compartment exceeds 15', an additional access point for each 15' is required.

E. Design Life

The system shall be designed either to the manufacturer's specifications or 50 years, whichever is greater.

All metal parts should be corrosion-resistant. Acceptable materials include parts made of aluminum and stainless steel, fiberglass, or plastic. Metal parts that come in contact with storm water runoff should not be painted because the paint tends to wear off.

Vault baffles should be made of concrete, stainless steel, fiberglass reinforced plastic, or other acceptable material and should be securely fastened to the vault. Apply the HS-20 traffic loading standard when locating the API and CP systems in parking lots.

F. Maintenance

Clean accumulated oil, grease, sediments and floating debris every two years, unless inspections show that more frequent maintenance is necessary. Oil/water separators should be inspected monthly to insure proper maintenance.

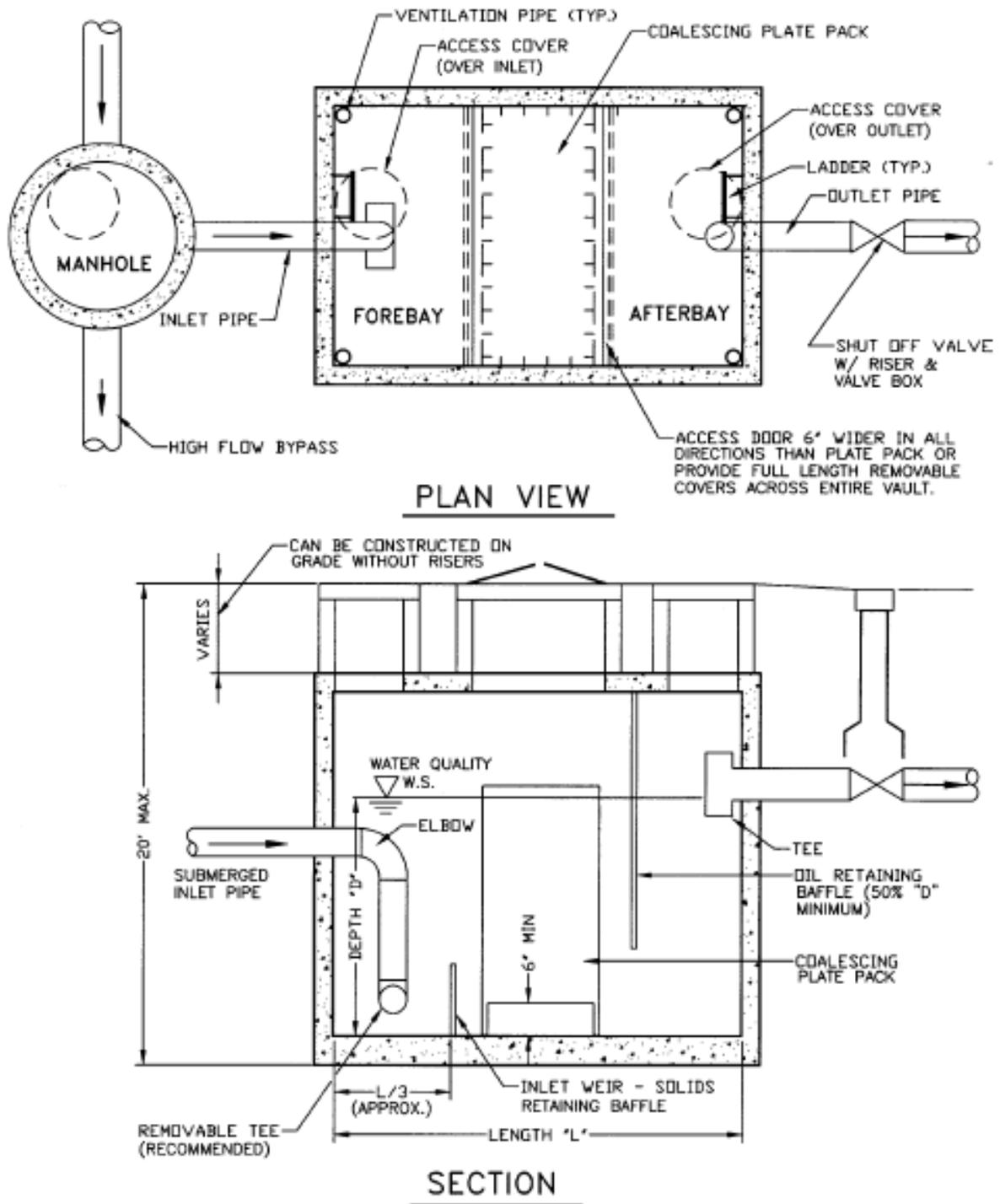
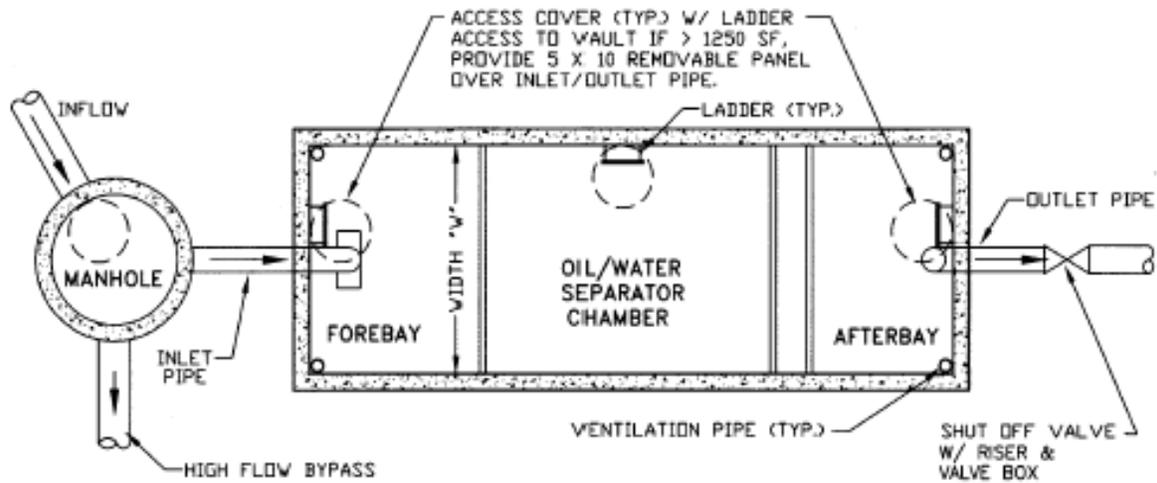
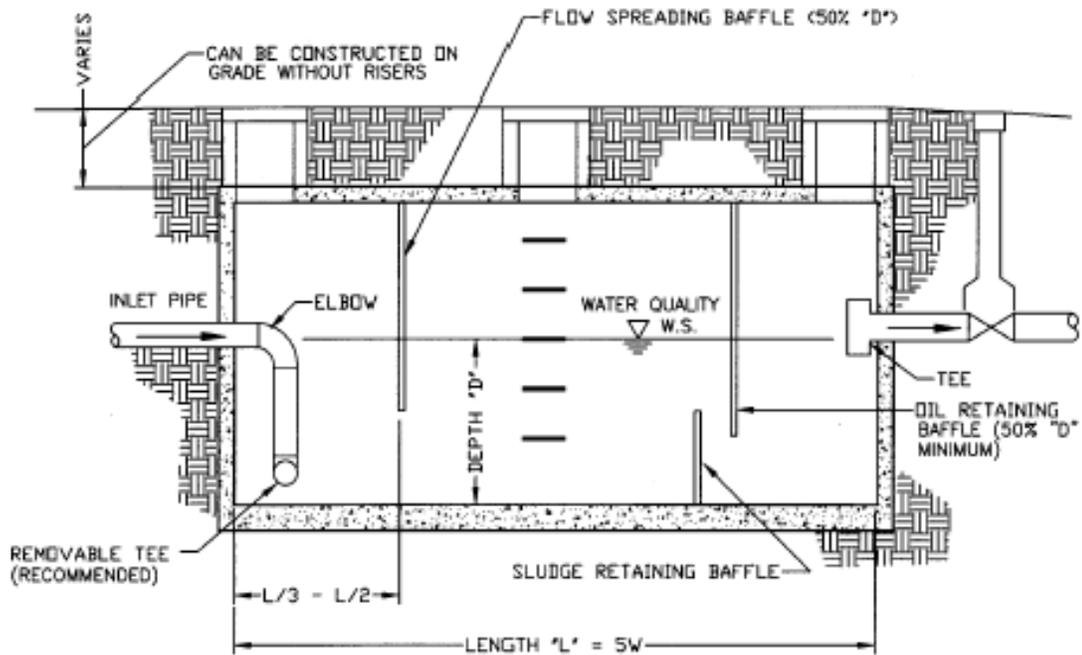


Figure 1.1. Coalescing Plate Oil/Water Separator.



PLAN VIEW



SECTION

Figure 1.2. Conventional Gravity Oil/Water Separator.

BMP2: CATCH BASIN INSERTS

A. Introduction

A catch basin insert is a device installed underneath a catch basin inlet that treats storm water through filtration, settling, absorption, adsorption, or a combination of these mechanisms.

A variety of catch basin inserts are commercially available from various different manufacturers. Summit County does not endorse any single product or manufacturer over any other; however, each selected product will be subject to review by the County and must be approved prior to installation.

Because they have limited capacity and limited sediment removal capabilities, catch basin inserts should NOT be used alone to treat storm water runoff but rather as pretreatment to another storm water management BMP or series of BMPs.

B. Installation

The insert must be fitted with oil-absorbent/adsorbent filter media. The filter must be changed monthly or when the filter media surface is covered with sediment. If the insert is installed in an existing catch basin, the insert shall be demonstrated to fit properly so that there is a positive seal around the grate to prevent low-flow bypass. If the insert is installed in a new or redevelopment project, it shall be installed according to the manufacturer's recommendations. The insert should be installed in the catch basin after the site has been paved or stabilized (for new development) or after completion of construction (for a redevelopment site that is already paved).

C. Access

The catch basin insert shall be located in an easily-accessible area for maintenance activities. It should not be placed in an area with continuous vehicle parking. Consequently, redevelopment projects may have to modify a parking stall in order to provide access to a catch basin insert.

D. Maintenance

Catch basin inserts shall be maintained at a frequency recommended by the manufacturer. Inspections should occur at least monthly during wet months and during periods of high runoff and once every 2 months during the remainder of the year. Full replacement or renewal of oil absorbent/adsorbent material shall be part of maintenance activities. In addition, the catch basin sump should be inspected for sediment accumulation. Filter media shall be disposed of in accordance with applicable regulations. In most cases, dewatered filter media may be disposed of as solid waste. To insure proper maintenance of the catch basin inserts inspections should occur monthly.

BMP3: INFILTRATION FACILITIES (GENERAL)

A. Introduction

This section contains requirements for facilities that manage storm water by subsurface disposal through infiltration. Requirements are included for seepage beds (infiltration trenches), infiltration basins, and infiltration swales. A seepage bed (Figure 3.1) receives runoff in a shallow excavated trench that has been backfilled with stone to form a below-grade reservoir. Seepage beds are typically located beneath landscaped or parking areas. A seepage bed can also be open to the surface and covered with landscaping rock. This type of system is referred to as an open trench. An infiltration basin (Figure 3.2) impounds water in a surface pond until it infiltrates the soil. Infiltration basins do not maintain a permanent pool between storm events and should drain within 48-72 hours after a design storm event. Infiltration swales (Figure 3.3) are vegetated channels designed to retain/detain, treat and infiltrate stormwater runoff.

B. Plan Submittal

For each infiltration facility, the applicant will be required to submit the general information listed in Section 3.A.1 of Appendix A as well as the following additional information:

- site characteristics that pertain to the proposed infiltration system (site evaluation information) soils report and geologic report with boring logs
- written opinion of site suitability by a hydrologist, geologist, soil scientist or engineer
- recommended design infiltration rate
- infiltration test data and results

C. Construction

Before the site is disturbed, the area selected for the infiltration system shall be secured to prevent heavy equipment from compacting the underlying soils. Runoff should be diverted away from the completed infiltration system during all phases of construction, until the site is completely stabilized. Excessive sediment loading during construction can severely impact the long-term performance of infiltration systems.

D. Setbacks and Separation Distances

- Infiltration facilities shall be located 100' from surface water supplies and tributaries used as drinking water and 50' from surface waters not used as drinking water, excluding drainage and irrigation water delivery systems.
- Infiltration facilities shall be located 100' from public and private drinking water wells.
- Infiltration facilities shall be located 5' from bedrock or basalt (vertical distance from bottom of facility to bedrock). Infiltration facilities must not be used on slopes >20%.

E. Infiltration Rate

The infiltration rate shall be measured at a depth equal to the proposed bottom grade of the facility. Appropriate soil types are those that have an infiltration rate of 0.5"/hour or greater, as initially determined from NRCS Soil Textural Classification and subsequently confirmed by field geotechnical tests. Maximum soil percolation rates shall generally not exceed 8" per hour.

F. Maintenance

Systems should be inspected and cleaned during regular semi-annual inspections. This inspection schedule applies to all of the infiltration facilities unless otherwise noted. The maximum depth of sediment allowed should be stated in the O&M Plan with an estimate of impact on infiltration rate. Sediments shall be removed and disposed of properly.

BMP3.1: SEEPAGE BEDS

A. Limitations

Seepage beds are prohibited in the following situations:

- where hazardous or toxic materials greater than SARA Title III “reportable quantities” are stored or handled, including loading and unloading areas
- where there is existing soil and/or ground water contamination
- in fill material, where there is the possibility of creating an unstable grade and potential for movement at the interface between the fill and in-situ soils

Vadose zone characteristics and depth to water will determine where seepage beds will be prohibited. A final determination regarding the use of seepage beds is based on evaluating the natural, unaltered characteristics of the proposed location for the system. Table 3.1 illustrates how restrictions may be applied.

Table 3.1. Restrictions for Seepage Beds.

| Depth to groundwater (below ground surface) | Vadose Zone | | | |
|---|----------------------------------|--|-------------------------------|-------------------------------|
| | Gravels, pebbly gravels, pebbles | Sands, sands interbedded with silt and or clays, silty clays | Rhyollite or Granitics | Basalts |
| < 15 feet ^a | seepage beds prohibited | seepage beds prohibited | seepage beds prohibited | seepage beds prohibited |
| 15-30 feet | additional treatment required | no additional restrictions ¹ | subject to further evaluation | subject to further evaluation |
| 31-100 feet | additional treatment required | no additional restrictions ¹ | subject to further evaluation | subject to further evaluation |
| >100 feet | additional treatment required | no additional restrictions ^b | subject to further evaluation | subject to further evaluation |

^a Assumes bottom of seepage bed is 5' below ground surface.

^b Assumes the separation distance between the bottom of the seepage bed and ground water is 10'.

B. Setbacks and Separation Distances

- Seepage beds must be separated a minimum of 10' from ground water (vertical distance from bottom of facility to seasonal high ground water level). A test boring shall be drilled to a sufficient depth to verify that a 10' separation distance between the proposed bottom of the facility and seasonal high ground watertable is met. Each facility shall have one test boring, unless prior approval is obtained from Public Works.
- Seepage beds must be separated 10' from structures (foundations, septic systems, other seepage beds).
- Seepage beds must be separated 20' from basements.
- Seepage beds must be separated 10' from property boundaries.

C. Design

- Seepage beds should be designed to provide a direct method for removal of contaminants and sediments before direct discharge into the vadose zone. If the bed has a surface inlet, the system must be designed to capture sediment either through a grass buffer strip, biofiltration swale, or sediment trap. Depending on the expected site activities, a pretreatment system, such as an oil/water separator should also be considered.
- A vegetated buffer (20' minimum) is recommended for open trenches.
- A stone aggregate of clean, washed drain rock, 1.5- 2" in diameter should be used. This size of aggregate will give a void ratio of 30-40%. Aggregate between .5-2.0" may be used but the void ratio must be certified.
- The bottom of the seepage bed shall be covered with a 6-12" layer of clean, washed sand that meets either specification: ASTM C-33 or ITD Standard 703.02, "Fine Aggregate for Concrete".
- The seepage bed aggregate must be lined on the sides by an appropriate geotextile fabric. If the trench is an open trench, it should also be lined at the top and the top fabric layer should be located 1' below the surface to prevent surface sediment from passing through into the stone aggregate. Filter fabric can be placed on the bottom of the trench. Filter fabric should have a minimum weight of at least 4 oz./yd², a filtration rate of 0.08"/second, and an equivalent opening size of 30 for non-woven fabric.

- Seepage beds must have observation wells to determine how quickly the seepage bed drains after a storm. Wells shall be placed and every 2000 SF, with a minimum of 1 well/seepage bed. The observation well should be a perforated PVC pipe, 4-6" in diameter, extending to the bottom of the bed where it is connected to a foot plate. It should be capped and locked to prevent vandalism or tampering.
- If the seepage bed is located in a landscaped area, the bed should be constructed in one of the following ways: the bed should be covered with native soils and planted in grass, or if the seepage bed is an open trench, covered with stone aggregate and protected from sediment build-up with a vegetated buffer strip 20-25' wide on either side of the bed.

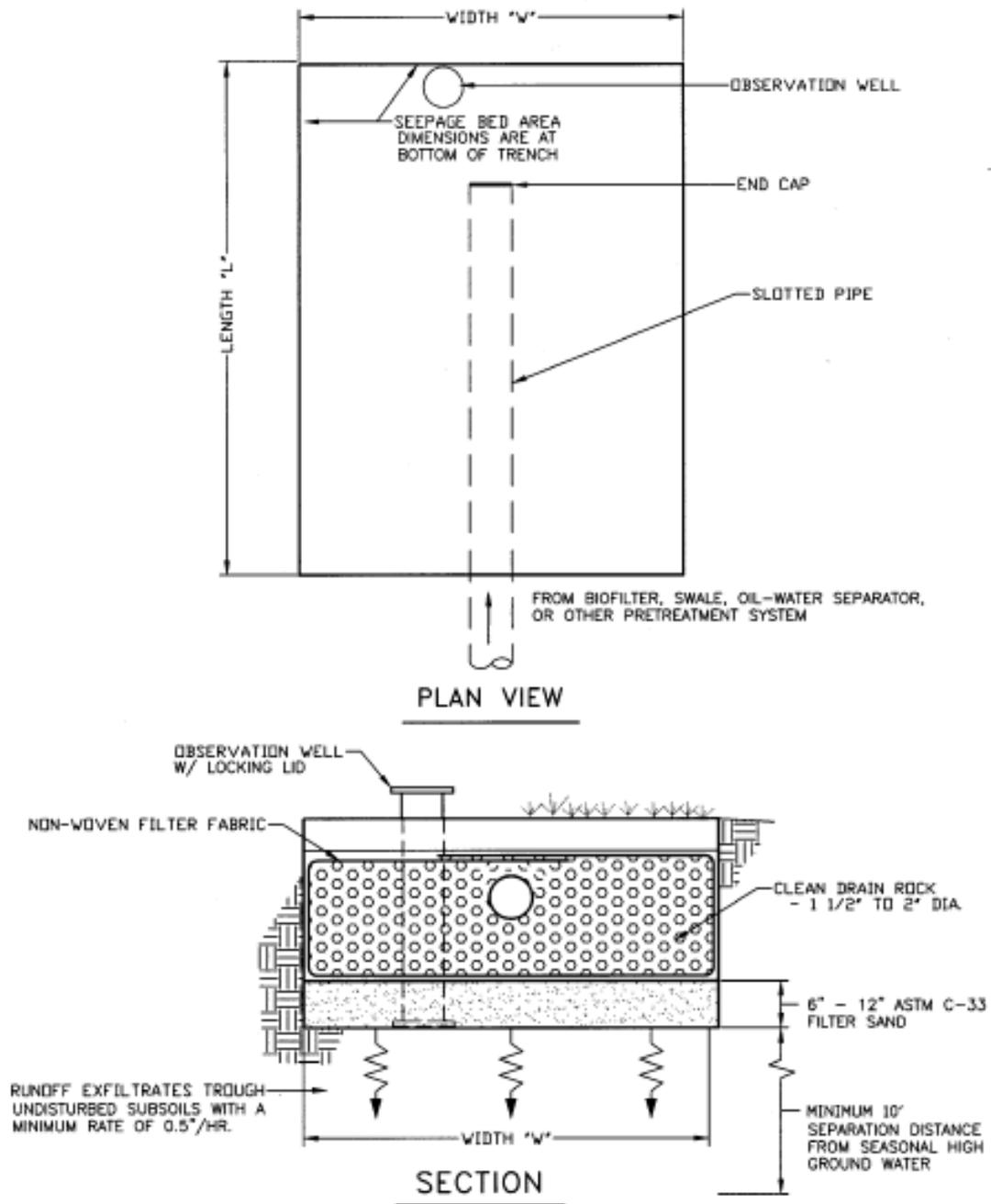
D. Operation and Maintenance

The system should be located so that it can be easily accessed by equipment necessary to maintain the pretreatment system and trench. The buffer and surface vegetation must be maintained by reseeding bare spots and mowing as frequently as needed to preserve aesthetics.

When ponding occurs at the surface or in the bed, corrective maintenance is required immediately. Ponding indicates the bed is clogged. Stripping off the top layer of soil, replacing the clogged filter fabric, and then replacing the top foot of aggregate or soil will correct the problem. Ponded water inside the trench (as visible from the observation well) after 24 hours or several days can indicate that the bottom of the trench is clogged. If this problem has occurred, then it is necessary to remove all of the layers and replace them.

E. Closure or Replacement

The owner is required to repair, replace, or reconstruct the infiltration system if it fails to operate as designed. A system fails to operate as designed when water is standing 24 hours or longer following the design storm. The maintenance and operation schedule for an infiltration system shall include such a provision. The owner is required to notify Summit County if the owner plans to close or replace the infiltration system. Additional studies may be required for all facilities depending on the land use of the site.



BMP3.2 INFILTRATION BASIN

A. Applicability

An infiltration basin is suitable in residential and commercial developments. Infiltration basins should not be placed in locations where the basin could cause flooding to downstream properties or in natural drainages such that the basin would restrict inflows to the point of causing upstream flooding.

B. Sizing

In determining the size of the basin, the critical parameters are the storage capacity and the maximum rate of runoff released from the basin. In addition the basin size should be based on expected sediment accumulation and frequency of maintenance.

C. Forebay/Sediment Trap

A rock or an earthen berm shall be constructed with a minimum top width of 4' and side slopes no steeper than 3:1. The forebay/sediment trap shall have a treatment volume equal to 0.75 times the runoff from the mean annual storm (0.23").

D. Construction Requirements

Infiltration basins shall be constructed in appropriate soil types. Infiltration basins should be excavated in a manner that will minimize disturbance and compaction of the basin. The basin bottom should be sloped to maximize infiltration. In addition, infiltration basins should not be constructed in highly erodible contributing areas, on slopes > 15%, or within fill soils. Inlet and outlet channels must be stabilized.

E. Separation Distance

The bottom of the infiltration basin should be separated by at least 3' vertically from the bedrock layer or seasonal high water table, as indicated by on-site geotechnical test results. Within the 3' separation distance, there must be at least a 2' layer of soil that conforms to infiltration rate requirements.

F. Pretreatment

Each infiltration basin shall have additional pretreatment. One of the following techniques can be used:

- construct grass channel
- construct grass filter strip
- install bottom sand layer
- install upper filter fabric with 6" sand layer
- use washed cobble rock as aggregate
- vegetate basin with deep-rooted turf

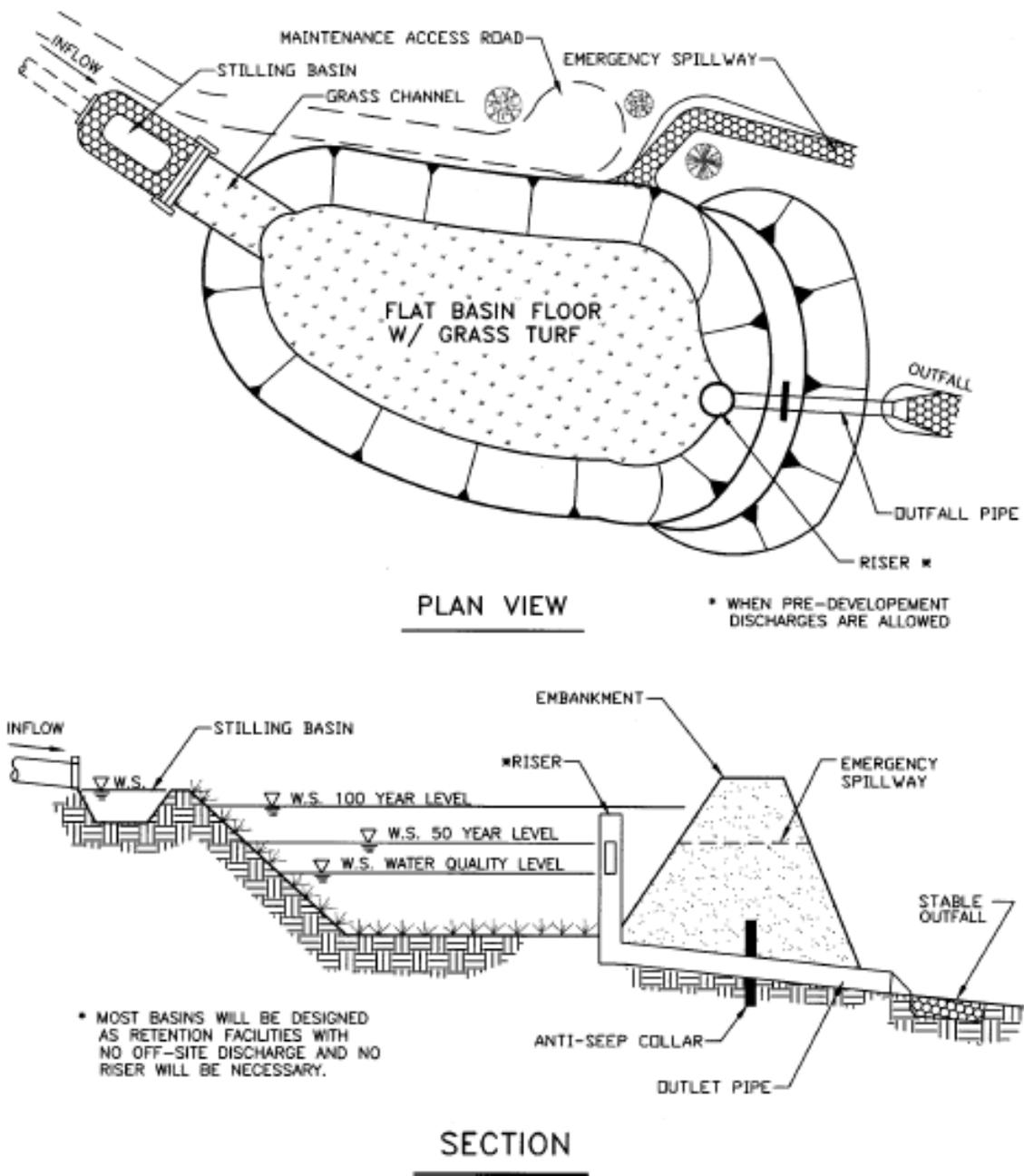


Figure 3.2. Infiltration Basin.

BMP3.3 INFILTRATION SWALE

A. Design

- Swale bottom slopes shall be between 1-4%.
- Curb cut pavement shall be installed at a maximum height of 6" above the swale if curb cuts will be used to introduce flow to the swale. Curb cuts shall be between 12-36" wide.
- A flow spreading device at the swale inlet shall be installed. Appropriate devices include shallow weirs, stilling basins, and perforated pipes. Provide a sediment clean-out area.
- Energy dissipation shall be provided at the inlet. Appropriate means are stilling basins and rip rap pads. If rip rap is used, it should be sized for the expected runoff velocity. A drainage window may be provided to direct the storm water runoff from events larger than the quantity design storm to the free draining material in the under drain. The top of the drainage window should be placed at an elevation above the water surface of the quantity design storm and should be located at the lower end of the swale.
- The swale side slopes shall be no more than 3:1.
- The swale bottom width shall be no greater than 8'.
- Swale shall be a maximum of 1.5' deep.
- The swale shall be grass-covered. Uniformly fine, close-growing, water-tolerant grasses should be used. Landscaping rock may also be used with an open trench.
- The swale under drain shall be constructed using clean 2" drain rock. The rock shall be wrapped in geotextile filter fabric, with a weight of greater than 4 ounces per square yard. The under drain will be a minimum depth of 12".
- A 6-12" layer of clean, washed sand that meets either specification: ASTM C-33 or ITD Standard 703.02, "Fine Aggregate for Concrete" shall be placed below the under drain.

B. Setbacks and Separation Distances

- Swale perimeter slope must be a minimum of 2' from the property line.
- There shall be at least 3' of separation between the bottom of the swale or under drain and the seasonal high ground water table.

C. Landscaping

Vegetate swales uniformly with fine, close-growing, water-tolerant grasses that can withstand seasonally saturated soils. Swales shall not be used until the vegetation is established. The side slopes above the swale treatment area should be vegetated to prevent erosion. Additional grass or nonaggressive ground covers are appropriate.

Barrier shrubs, such as barberry, planted around the swale should be considered when there is a possibility that the public could damage the swale or hinder its function. Other plant materials are appropriate if recommended by a landscape professional.

Trees and shrubs should be planted high on the side slopes or above the water line elevation for the design storm. Avoid using bark, mulch, fertilizers, and pesticides in swale bottoms or sides. These materials tend to run off the planted area and into the swales reducing its treatment effectiveness. When storm water control and landscaping are integrated, the following standards apply:

- Up to 15% of the total area of the swale designated for storm water infiltration may be covered with ground cover plants other than grass.
- Up to 10% of the total area of the swale designated for storm water infiltration may be elevated above the bottom of the swale to allow the planting of trees and shrubs.

The decrease in swale area resulting from this action will be compensated for by infiltration of runoff that occurs during the storm. If trees and shrubs will be used, plant them on the top perimeter of swale side slopes. Minimize shading the vegetation in the swale treatment area. A spacing of at least 20' (6 meters) is appropriate for trees planted close to a swale. Avoid planting trees that would continuously shade the entire length of the swale. In addition, avoid using bark, mulch, fertilizers, and pesticides in these areas. These materials tend to run off the planted area and into the swale reducing its treatment effectiveness.

D. Pretreatment

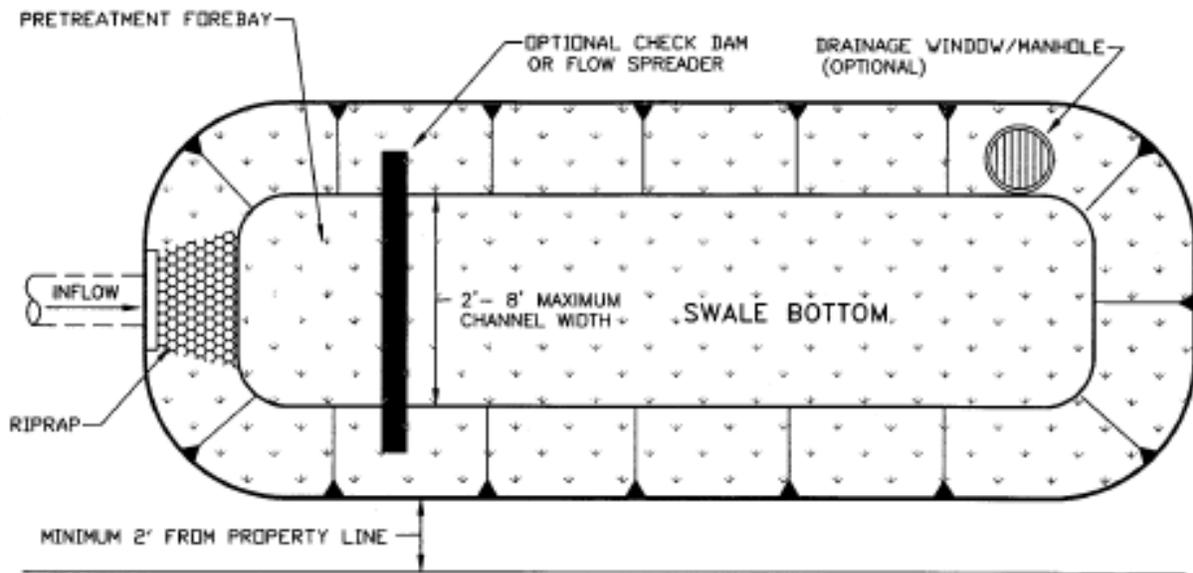
To protect ground water from possible contamination, runoff cannot be infiltrated without proper pretreatment. Pretreatment shall be provided by a grass buffer strip, sediment forebay, biofiltration swale, oil/water separator, or sediment trap.

E. Operation and Maintenance

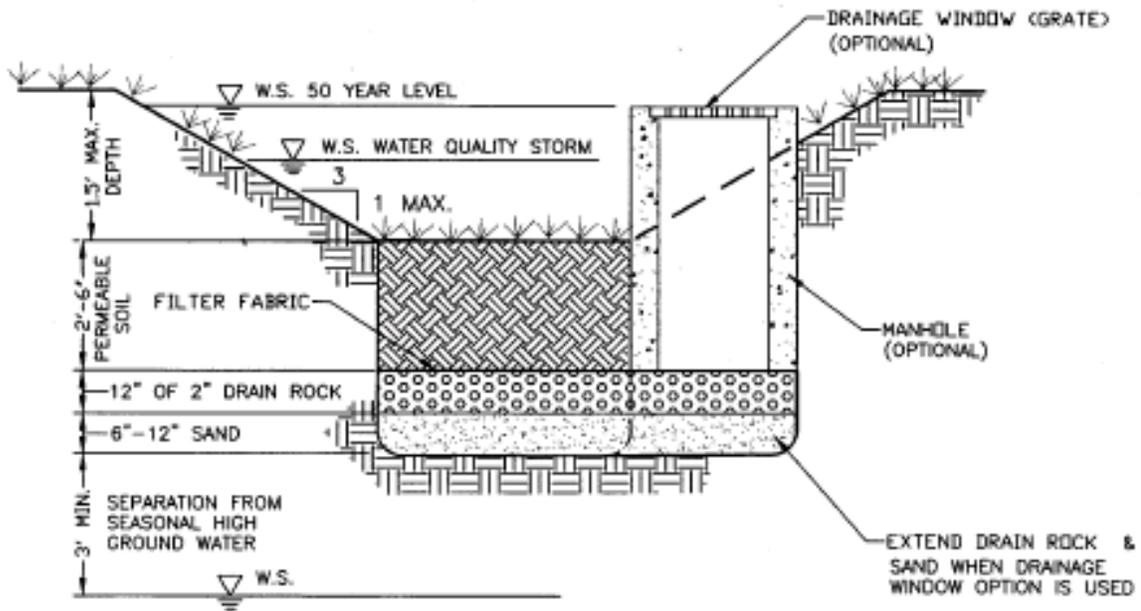
Grass should be mowed to maintain an average grass height between 3"-9", depending on site characteristics. Monthly mowing is needed from May through September to maintain grass vigor. Grass clippings should be removed from the swale and composted on site or disposed of properly off site.

Sediment deposition at the head of the swale should be removed if grass growth is being inhibited for more than 10% of the swale length or if the sediment is blocking the even spreading or entry of water to the rest of the swale. Annual sediment removal and spot reseeding should be anticipated.

The swale should be regraded to produce a flat bottom width then reseeded if flow channelization or erosion has occurred. Regrading should not be required every year.



PLAN VIEW



SECTION

Figure 3.3. Infiltration Swale.

BMP4: PONDS (GENERAL)

A. Definitions

A detention pond (water quantity) (Figure 4.1) is a pond designed to collect and temporarily hold surface and storm water runoff from a site and release it at a slower rate than it is collected. The water should drain within 24 hours. Detention ponds are traditionally used to mitigate downstream impacts and alleviate flooding problems.

An extended detention pond (water quality) (Figure 4.2) is a pond designed to treat and release surface and storm water runoff from a site. Extended detention ponds are designed to provide water quality treatment and may be used to provide peak flow attenuation. The water is held for at least 48-72 hours to allow for treatment of pollutants by settlement, nutrient absorption, and filtering by plant materials.

B. Requirements for All Ponds

- Design Life

The system should be designed for at least a 50-year life.

- Location

Ponds should not be constructed in natural streams or wetlands. Ponds should be located off-channel and should only hold storm water runoff, not natural runoff.

- Site Evaluation/Site Suitability

Sites should be evaluated for soils, depth to bedrock, and depth to water table. Requirements will depend on pond type. Ponds may be used at sites where a receiving body or structure can accept pond discharges. Ponds designed to meet on-site detention requirements shall not be located in regulatory flood plains. Also, ponds should not be used in areas where storm water has the potential to contain soluble metals, toxic organics, or where high sediment loads may occur.

- Design

The design of any detention pond requires consideration of several factors. Balancing the requirements is done by developing an inflow hydrograph, a depth-storage relationship, and a depth-outflow relationship. The inflow/storage/outflow relationships should be based on a storm duration that identifies a peak detention pond volume for the storm interval

required. Refer to Appendix A, Section 3.B(6) for water quantity and quality design criteria.

The factors to be considered include:

- basin size
- minimum free board
- maximum allowable depth of temporary ponding
- recurrence interval of the storm being considered
- storm duration
- timing of the inflow
- allowable outflow rate
- the length of time water remains in the facility.

- Maximum Outflow Rate

The maximum outflow rate shall not be more than the pre-development rate of runoff for each storm return interval. The receiving system must be shown to be capable of accommodating the pre-development flow.

- Outlets

Outlet pipes shall be at least 12" in diameter. If riser pipes are used, they shall be 1 1/2 times the cross sectional area of the outfall pipe. Trash racks or anti-vortex devices shall be installed. All pipe joints are to be watertight. Anti-seep cutoff walls, 8" thick, or other seepage control methods are to be installed around outlet pipes. The channel immediately below the pond outfall shall be protected against erosion and shall transition to natural drainage conditions in the shortest distance possible.

- Dam Safety Requirements

If a pond is categorized as a dam by the State of Utah, the relevant sections of the Utah Code will apply. Contact the Utah Division of Water Rights for more information on dam safety requirements.

- Vegetative Buffers

Vegetative buffer strips shall be established around the perimeter of the pond for erosion control and additional sediment and nutrient removal. Buffer strips should include all areas between the normal pond water surface elevation to the top of the pond embankment.

- Side Slopes/Safety

Take all practical safety precautions. Side slopes should not exceed 4:1 (3:1, if the pond will normally remain dry).

- Soils

A soils investigation is required on all ponds. At a minimum, it shall include information along the centerline of the proposed dam in the emergency spillway location and the planned borrow area. It should include recommendations on cutoff trenches, compaction, and any other special design requirements.

- Freeboard and Emergency Spillway

All open surface facilities shall be designed with adequate freeboard above the maximum design water elevation. Emergency spillways are required on all ponds. The spillway shall be sized to safely pass the 100-year developed peak flow.

- Maintenance Access

Direct access to the pond bottom, inlet sedimentation area, and control structure is required. A right-of-way maintenance easement from a road to the pond (if not accessible from the public right-of-way), shall be provided.

- Inspection

Detention ponds should be inspected during regular semi-annual inspections to determine maintenance needs.

BMP4.1: DETENTION PONDS

A. Definition

Detention ponds are designed to detain a volume of water to attenuate peak flows. A wet pond has a permanent pool and provides temporary storage of storm water runoff. A dry detention pond does not maintain a permanent pool between storm events.

B. Applicability

Detention ponds are suitable in residential, commercial, and industrial sites.

C. Pond Geometry

The pond can be any shape provided that it has sufficient capacity to meet general design requirements.

D. Outlet Design

At the peak flow rate, pond volume shall be equal to the difference between pre and post-development storm volumes. The outlet structure shall be designed in accordance with the water quantity and quality requirements of Appendix A, Section 3.B(6). The outlet design shall incorporate a multi-stage riser that will allow water (above the permanent pool, in a wet pond) to be drained over 24 hours. The outlet shall be designed to mimic pre-development flow rates. The outlet structure shall be designed to prevent clogging and plugging.

E. Construction Requirements

Detention ponds shall be excavated in a manner that will minimize disturbance and compaction of the pond. Sediment measuring devices shall be installed at opposite ends of the bottom of the basin or sediment trap to measure sediment accumulation.

F. Sediment Storage

Ponds shall be designed to contain computed storage volume plus 15% of the computed storage volume to adequately accommodate sediment deposition.

G. Forebay/Sediment Trap

Each pond shall have a sediment forebay or equivalent upstream pretreatment. The forebay shall have a separate cell formed by an acceptable barrier. A fixed vertical sediment depth marker shall be installed in the forebay to measure sediment accumulation.

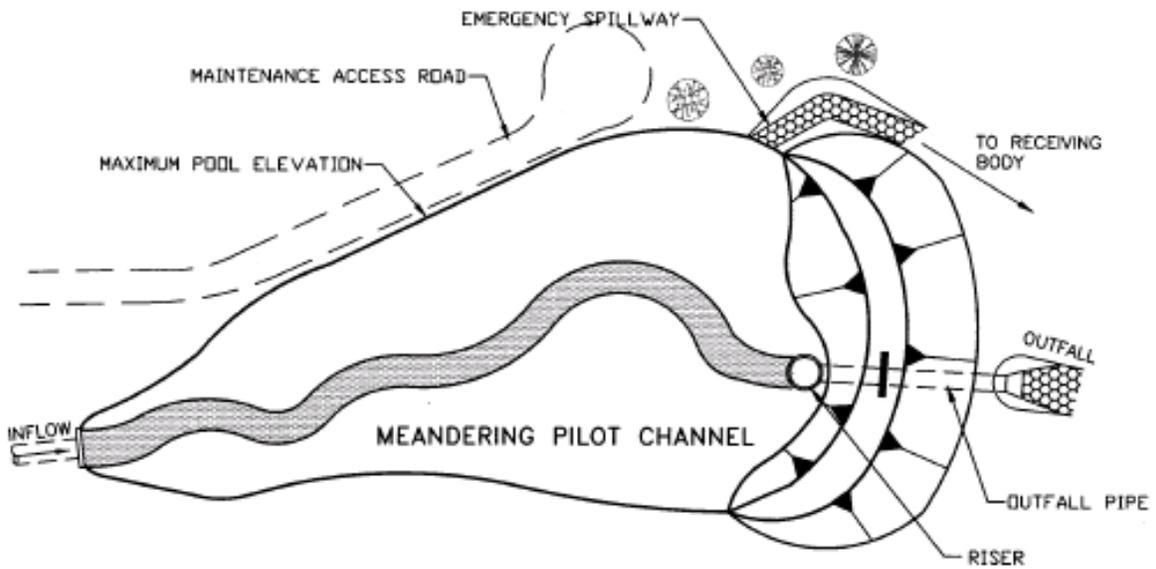
Minimum forebay size shall be equal to 15% of the water quality treatment volume. Optimal volume should be equal to 25% of the water quality treatment volume. Forebay volume shall be in addition to permanent pool volume, where applicable, and shall be separated from permanent pool, if possible. A weir flow structure or physical separation with pipes may be utilized. A rock or an earthen berm shall be constructed with a minimum top width of 4' and side slopes no steeper than 3:1 to provide separation from the permanent pool. A drainpipe should be included in the forebay to dewater the pool area for maintenance purposes.

H. Inlet Protection

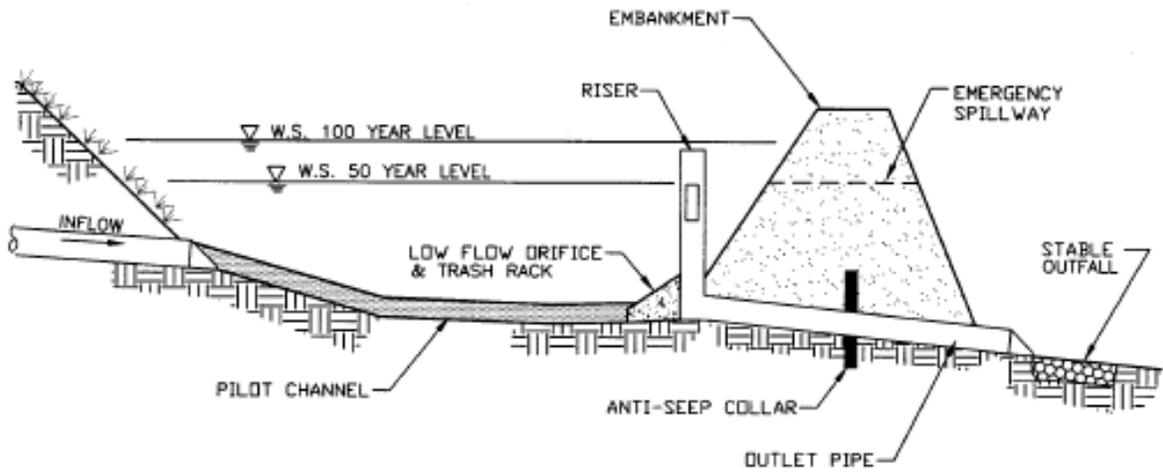
The inlet shall be protected against erosion or scour. Riprap or other material may be required at the inlet to provide for energy dissipation.

I. Stabilization

Wet detention ponds shall be stabilized with vegetation to control dust and improve pond aesthetics. A landscaping plan for a pond and surrounding area should be prepared to indicate how aquatic and terrestrial areas will be vegetatively stabilized, established, and maintained. Whenever possible, wetland plants should be used in a pond design, either along the aquatic bench or within shallow areas of the pool.



PLAN VIEW



SECTION

Figure 4.1. Detention Pond.

BMP4.2: EXTENDED DETENTION PONDS

A. Definition

An extended detention pond is a constructed pond designed to detain a volume of water for a minimum time to allow for the settling of particles and associated pollutants. This type of pond can also be utilized for flood control by including additional temporary storage for peak flows. A wet extended detention pond incorporates both a permanent pool and extended detention. Dry extended detention ponds do not maintain a permanent pool between storm events.

B. Applicability

Ponds should not be used where storm water has the potential to contain soluble metals or toxic organics. In addition, ponds placed in areas where high sediment loads may occur, require frequent maintenance but still may be the most cost-effective treatment method. A wet extended detention pond is suitable in residential, commercial, and industrial sites. It is appropriate in areas where nutrient loadings are expected to be high. Dry extended detention ponds do not maintain a permanent pool between storm events.

C. Pond Geometry

The pond shall be designed to lengthen the flow path, thereby increasing detention time and limiting peak flow rates to pre-development rates. Shallow basins with large surface areas also provide better removal efficiencies than small deep basins. The pond geometry shall meet the following criteria:

- Permanent pool depth shall not exceed 12' with an average depth between 4-6'.
- Length from inlet to outlet should be as far apart as possible.
- Length to width ratio should be approximately 3:1 and side slopes should be 4:1.

D. Sizing

Size the pool according to the design storm criteria in Appendix A, Section 3.B(6). The critical parameters in determining the size of the basin are the storage capacity and the maximum rate of runoff released from the basin. The design shall provide an average of 48-72 hours detention time. This design objective can be achieved by setting the maximum detention time for the greatest runoff volume at approximately 40 hours. The average detention time for very small storms should be at least 6 hours.

E. Forebay

Each pond shall have a sediment forebay or equivalent upstream pretreatment. The forebay shall have a separate cell formed by an acceptable barrier. A fixed vertical sediment depth marker shall be installed in the forebay to measure sediment accumulation.

Minimum forebay size shall be equal to 15% of the water quality treatment volume. Optimal volume should be equal to 25% of the water quality treatment volume. Forebay volume shall be in addition to permanent pool volume, where applicable, and shall be separated from permanent pool, if possible. A weir flow structure or physical separation with pipes may be utilized. A rock or an earthen berm shall be constructed with a minimum top width of 4' and side slopes no steeper than 3:1 to provide separation from the permanent pool. A drainpipe should be included in the forebay to dewater the pool area for maintenance purposes.

F. Outlet Design for a Wet Extended Detention Pond

The outlet shall be designed to pass a flow rate necessary for extended quantity attenuation. The outlet design shall incorporate a multi-stage riser that will allow water to be drained over a minimum of 48-72 hour period depending upon the design storm.

Ponds may be constructed with safety benches. The perimeter of all deep permanent pool areas (at least 4' deep) shall be surrounded by two safety benches with a combined minimum width of 15'. The benches should be designed as follows:

- A safety bench that extends landward from the normal water level edge to the toe of the pond side slope. The maximum slope of the safety bench shall be 12%.
- An aquatic bench that extends from the normal shoreline and has a maximum depth of 18" below the normal pool water surface elevation. Pond slope between the top of the bank and bench shall not exceed 2:1.

G. Outlet Design for a Dry Extended Detention Pond

A perforated riser can be used to slowly release the water over a prolonged period. A cutoff collar should be considered for the outlet pipe to control seepage.

H. Construction Guidelines

Wet extended detention ponds should be excavated in a manner that will minimize disturbance and compaction of the pond. Sediment measuring gauges should be installed at opposite ends of the bottom of the basin to measure sediment accumulation.

I. Stabilization

A landscaping plan for a wet extended detention pond and its buffer shall be submitted to indicate how aquatic and terrestrial areas will be vegetatively stabilized and established. Whenever possible, wetland plants should be used in a pond design, either along the aquatic bench or within shallow areas of the pool. Bottom and banks of all dry extended detention ponds shall be stabilized with gravel, rock, vegetation, or other acceptable material to control dust and prevent erosion.

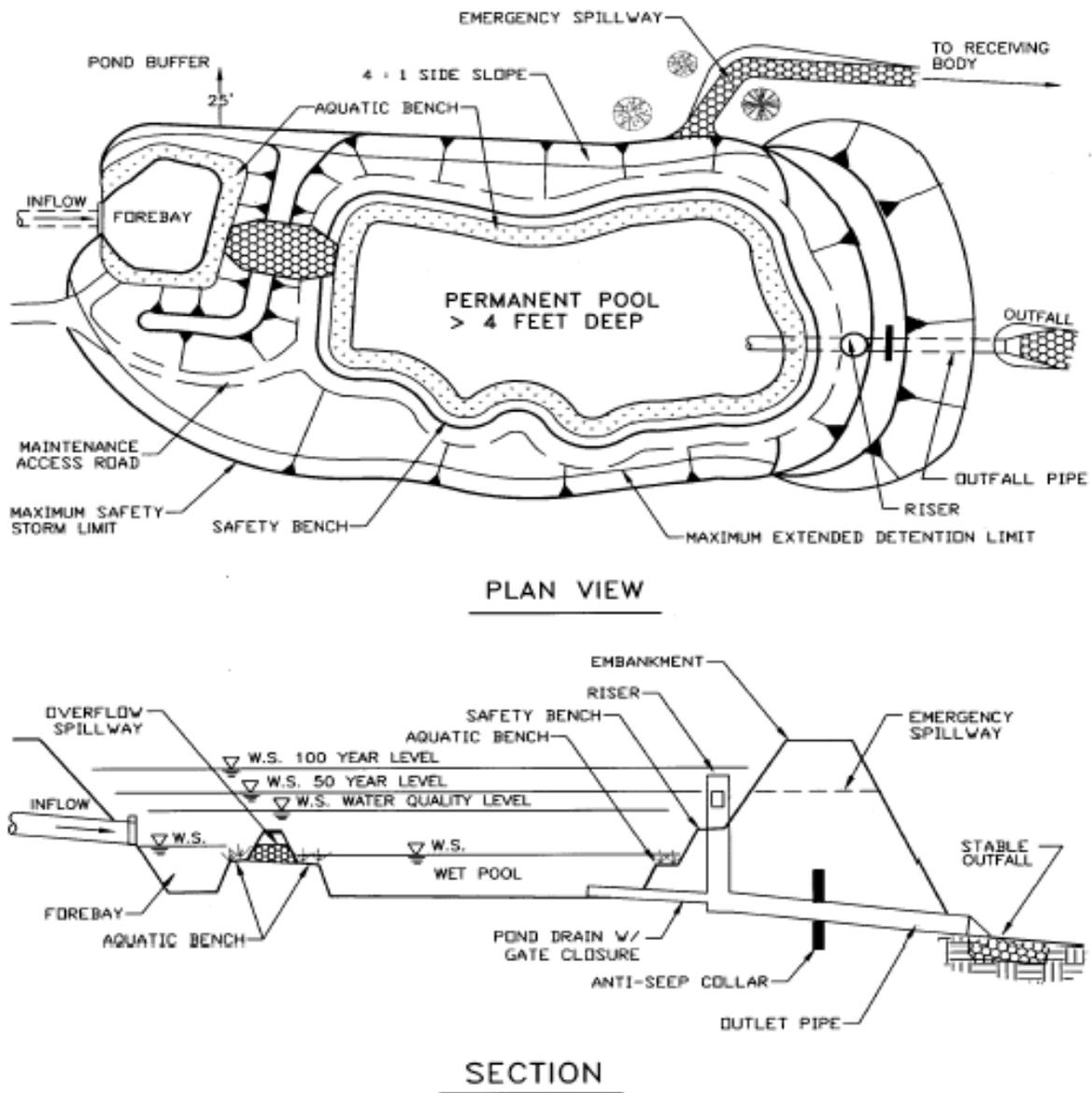


Figure 4.2. Extended Detention Pond.

BMP5: BIOFILTRATION SYSTEMS

A. Introduction and Purpose

This section includes requirements that apply to biofiltration swales (Figure 5.1) and grass buffer strips (Figure 5.2). These BMPs are pre-treatment systems that utilize plant materials for various physical and biological processes in the water quality treatment of runoff. These systems should not be used alone to treat storm water runoff. Rather, they should be used in combination with other structural and nonstructural BMPs to improve water quality.

B. Plan Submittal Requirements

The applicant will be required to provide a written report that includes the Plan Submittal Requirements and a Landscape Plan.

C. Sizing

Unless a bypass is included, the biofilter must be sized as both a treatment device and to pass the peak hydraulic flows. The depth of the storm water should not exceed the height of the grass.

D. Landscaping

Vegetate biofilters with fine, close-growing, water-tolerant grasses that can withstand seasonally saturated soils. Biofilters shall not be used to manage storm water until the vegetation is established. The side slopes of a biofilter should be vegetated to prevent erosion. Barrier shrubs, such as barberry, planted around the biofilter should be considered when there is a high potential for people to damage the biofilter or hinder the biofilter's function. Other grasses or nonaggressive ground covers are appropriate if recommended by a landscape professional.

If trees will be planted near the biofilter, then minimize shading the vegetation in the biofilter treatment area. A spacing of at least 20' (6 meters) is appropriate for trees planted close to a biofilter. Avoid planting trees that would continuously shade the entire length of the biofilter. In addition, avoid using bark, mulch, fertilizers, and pesticides in these areas. These materials tend to run off the planted area and into the biofilter reducing its treatment effectiveness.

E. Operation and Maintenance

Systems should be inspected during regular semi-annual inspections. This inspection schedule applies to all biofiltration systems unless otherwise noted.

Grass shall be mowed to maintain an average grass height between 3 -9", depending on the site situation. Monthly mowing is needed from May through September to maintain grass vigor. Grass clippings should be removed from the swale and composted on site or disposed of properly off site.

Sediment deposited at the head of the swale shall be removed if grass growth is being inhibited for more than 10% of the biofilter length or if the sediment is blocking the even spreading or entry of water to the rest of the facility. Annual sediment removal and spot reseeding should be anticipated.

If flow channelization or erosion has occurred, the facility shall be regraded, then reseeded as necessary.

Access for mowing equipment and maintenance shall be provided. Consideration should be given to providing wheel strips in the bottom of the swale if vehicular access (other than grass mowing equipment) is needed.

BMP5.1: BIOFILTRATION SWALES

A. Description

Biofiltration swales are storm water runoff systems which treat and then discharge storm water runoff to another system.

B. Design

- A hydraulic residence time for the storm water runoff of 9 minutes is required.
- Water velocity, as determined by Manning's "n", should not exceed 0.9 feet/second.
- The Manning's "n" for grass shall be in the range between 0.02 and 0.024.
- Swales shall be sloped as necessary to obtain the desired design velocity and residence time.
- If flow is to be introduced to the swale via curb cuts, then curb cut pavement elevation shall be no higher than 6" above swale. Curb cuts should be between 12-36" wide.
- Install a flow spreading device at the swale inlet. Appropriate devices include shallow weirs, stilling basins, and perforated pipes. Provide a sediment clean-out area. A sediment catch basin or a larger pre-settling device would control sediments at the swale inlet and allow for easy maintenance.
- Provide for energy dissipation at the inlet. Appropriate means are stilling basins and rip rap pads.
- Swale using rip rap should be sized for the expected runoff velocity.
- Swale side slopes shall be no steeper than 3:1. Swale bottom width shall be no greater than 8'. The maximum depth of flow through the biofiltration swale shall be 3.0".

C. Setbacks and Separation Distances

Perimeter slope of the swale must be a minimum of 2' from property line.

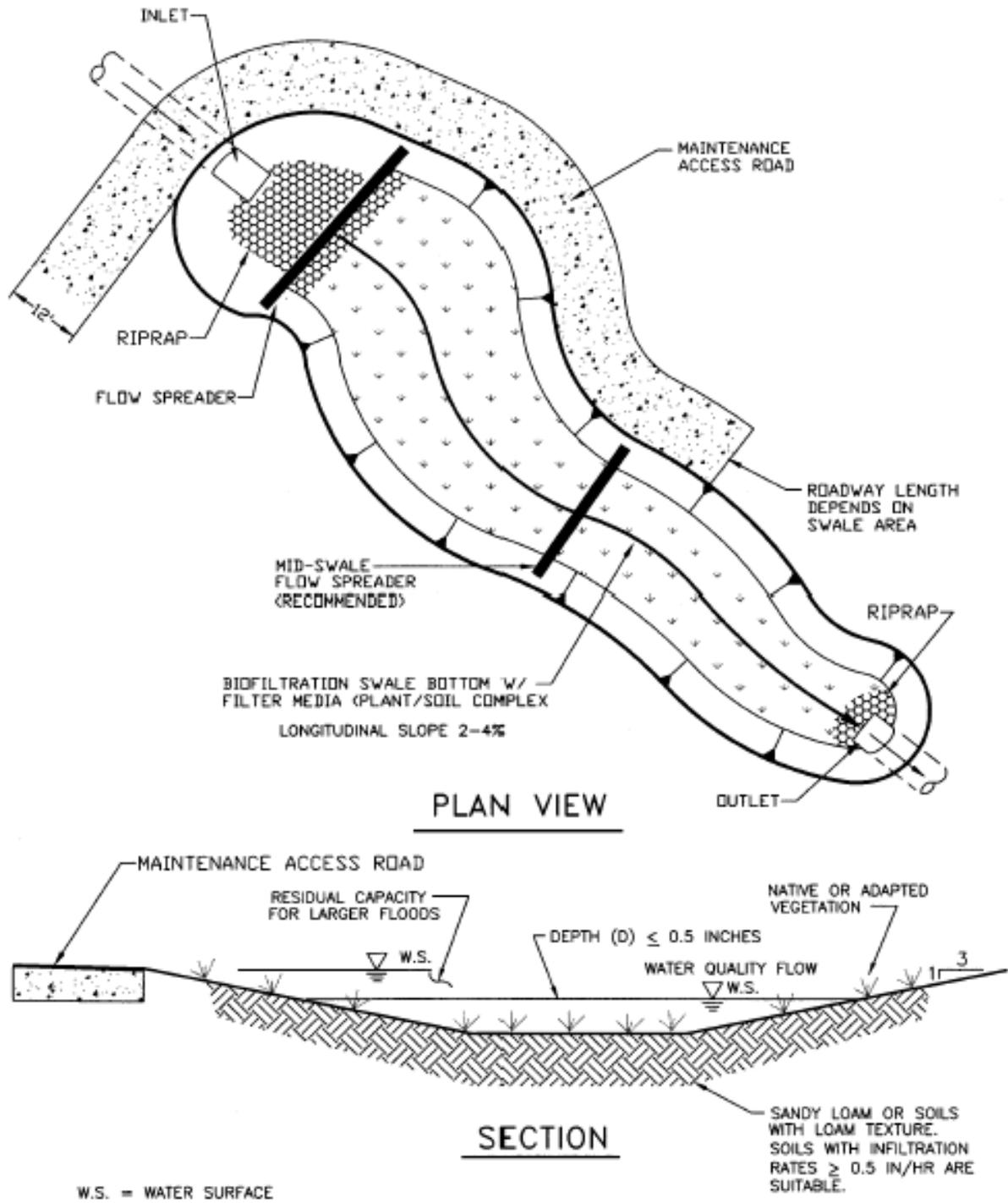


Figure 5.1. Biofiltration Swale.

BMP5.2: GRASS BUFFER STRIPS

A. Introduction

Grass buffer strips are used as a water quality pretreatment system for smaller sites.

B. Design

- The longest flow path from the area contributing sheet flow to the filter strip shall not exceed 150 feet.
- The lateral slope of the contributing drainage (parallel to the edge of pavement) shall be 2% or less.
- A hydraulic residence time of 9 minutes is required.
- A stepped series of flow spreaders installed at the head of the strip may be used to compensate for drainage areas having lateral slopes of up to 4%.
- The longitudinal slope of the contributing drainage area (parallel to the direction of flow entering the filter strip) shall be 5% or less.
- Grass buffer strips shall not be used when the contributing drainage areas has a longitudinal slopes steeper than 5% or energy dissipation and flow spreading should be provided up slope of the upper edge of the filter strip to achieve flow characteristics equivalent to those meeting the above criteria.
- The longitudinal slope of the strip (along the direction of flow) shall be between 1 - 20%. The lateral slope of the strip (parallel to the edge of pavement, perpendicular to the direction of flow) shall be less than 2 percent.
- The ground surface at the upper edge of the filter strip (adjacent to the contributing drainage area) shall be at least 1 inch lower than the edge of the impervious area contributing flows.
- Manning's roughness coefficient (n) for flow depth calculations shall be 0.04.
- The maximum depth of flow through the filter strip for optimum water quality shall be 1.0 inch.
- The maximum allowable flow velocity for the water quality design flow (WQ_v) shall be 0.5 feet per second.

- Runoff entering the filter strip must not be concentrated. If the contributing drainage area is not smoothly graded to prevent concentrated flowpaths, a flow spreader shall be installed at the edge of the pavement to uniformly distribute the flow along the entire width of the filter strip. At a minimum, a gravel flow spreader (gravel-filled trench) shall be placed between the impervious area contributing flows and the filter strip. The gravel flow spreader shall be a minimum of 6" deep and shall be 18" wide for every 50' of contributing flowpath. Where the ground surface is not level, the gravel spreader must be installed so that the bottom of the gravel trench is level.
- Energy dissipaters are needed in the filter strip if sudden slope drops occur, such as locations where flows in a filter strip pass over a rockery or retaining wall aligned perpendicular to the direction of flow. Adequate energy dissipation at the base of a drop section can be provided by a rip rap pad.

C. Landscaping

Trees and shrubs should not be located within a grass filter strip.

D. Maintenance

Inspections should occur semi-annually to determine maintenance needs. Access shall be provided at the upper edge of the filter strip to enable maintenance of the inflow spreader throughout the strip width and allow access for mowing equipment.

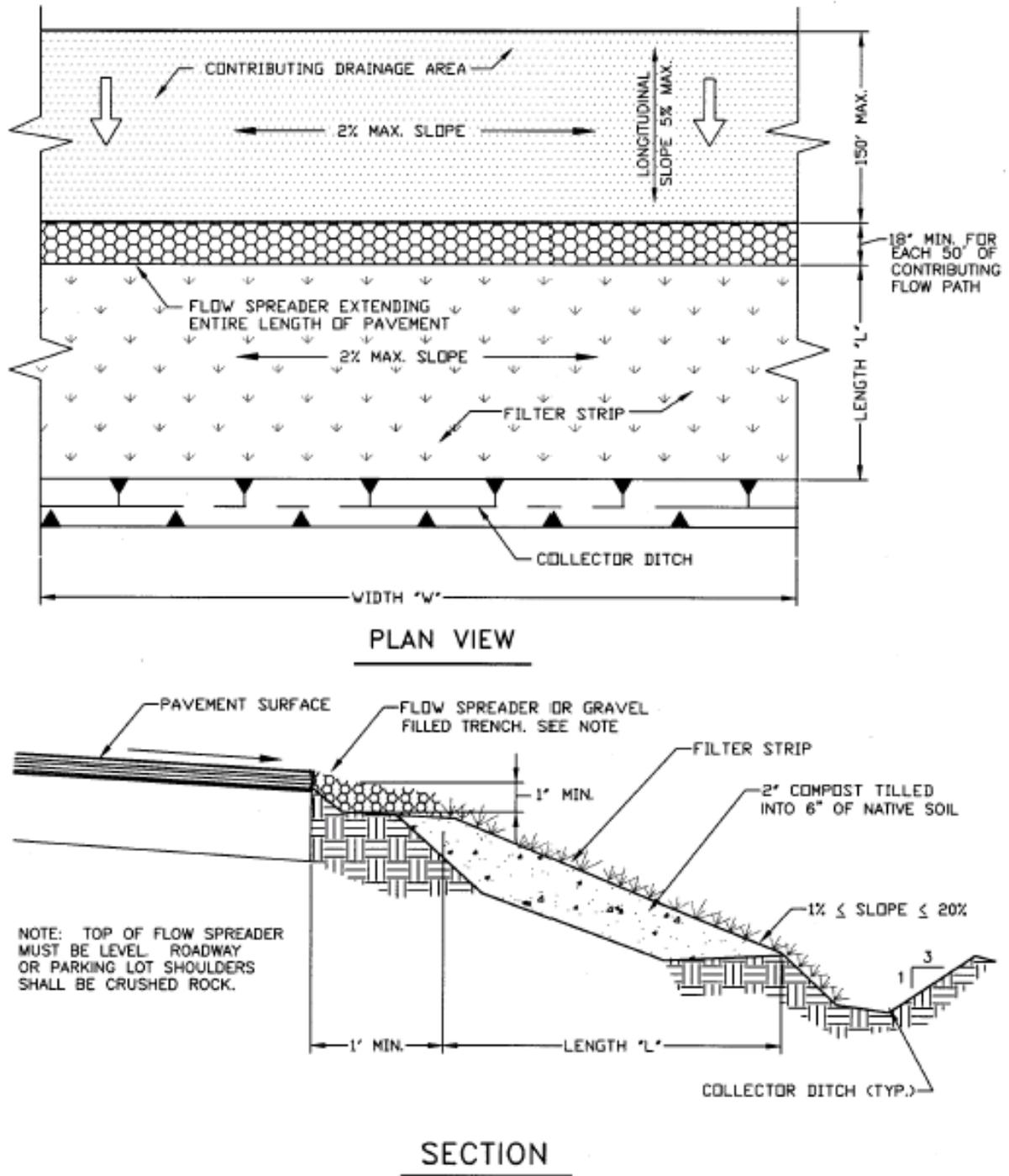


Figure 5.2. Grass Buffer Strip.

BMP6: SAND FILTERS

A. Introduction

Sand filters consist of self-contained beds of sand either underlain with underdrains or cells and baffles with inlets/outlets. Storm water runoff is filtered through the sand, and in some designs may be subject to biological uptake. The four most commonly used sand filter systems are the Austin Sand Filter, the Delaware Sand Filter, the Trench Filter, and the Pocket Sand Filter.

- Austin Sand Filter

The Austin sand filter (Figure 6.1), or surface sand filter, consists of a sedimentation chamber or pond followed by a surface sand filter with collector underdrains in a gravel bed. Filtered runoff is conveyed to a storm sewer or channel by gravity flow or pumping.

- Delaware Sand Filter

The Delaware sand filter (Figure 6.2), or perimeter system, consists of parallel sedimentation and sand filter trenches connected by a series of level weir notches to assure sheet flow onto the filter. Filtered runoff is conveyed to a storm sewer by gravity flow or pumping.

- Underground Sand Filter

The underground sand filter (Figure 6.3) is placed underground but maintains essentially the same components as the Austin sand filter. The filter consists of a 3 chamber vault. A 3' deep wet sedimentation chamber is hydraulically connected by an underwater opening to provide pretreatment by trapping grit and floating organic material. The second chamber contains an 18-24" sand filter bed and an under drain system including inspection/cleanouts wells. A layer of plastic filter cloth with a gravel layer can be placed on top of the sand bed to act as a pre-planned failure plane which can be replaced when the filter surface becomes clogged. The third chamber collects the flow from the under drain system and directs flow to the downstream receiving drainage system.

- Pocket Sand Filter

The Pocket sand filter (Figure 6.4) is a simplified and low cost design suitable for smaller sites. Runoff is diverted within a catch basin. Pre-treatment is provided by a concrete flow spreader, a grass filter strip, and a plunge pool. The filter bed is a shallow basin and contains the sand filter layer. The surface of the filter bed may contain either a soil layer or grass cover crop.

B. Application and Limitations

Sand filters may be designed as trench systems to receive and treat parking lot runoff, and have been used to replace oil/water separators for pre-treatment. The storm water runoff is discharged or conveyed to another BMP for further treatment or disposal. Depending on soil types, sand filters may be designed as a stand-alone BMP to infiltrate all or a portion of treated runoff. Subsurface disposal restrictions will apply to this application.

The typical drainage area to be served by a sand filter should range from 0.5 to 10 acres. Depending on design, the contributing drainage area may be up to 50 acres.

C. Sizing

Sizing should be based on anticipated sediment accumulation and maintenance. Sand filters shall be sized using the following criteria:

- The sand filter shall be sized for water quality design storm requirements if it will be used as an off-line treatment facility.
- The maximum depth of water over the sand shall be 1'.
- Calculate the sand filter surface area using Darcy's Law or the filtration rate.
- The sand filter shall be designed to completely drain in a 24 hours or less.
- The filtration rate shall be 2" per hour.

D. Pretreatment

Sand filters should be preceded by pretreatment to allow for the settling of coarse sediment that may clog the sand filter and reduce its effectiveness. Pretreatment systems that may be used are sedimentation basins, grass buffer strips, biofiltration swales, or catch basin inserts.

E. Design

The sand bed shall include a minimum of 18" of 0.02-0.04" diameter sand or ASTM C-33 sand. If infiltration into the underlying soil is not desired, the bottom of the system shall be lined with one of the following impermeable layers:

- a minimum 12" thick layer of clay
- a concrete liner with approved sealer or epoxy coating, at least 5", reinforced with steel wire mesh (use 6 gauge or larger wire and 6" x 6" smaller mesh, or a geomembrane layer).

The bed of the filter should be composed of gravel, measuring at least 4-6"; 2" drain rock may also be used.

When sand filters are designed as off-line BMPs, they should be sized for the water quality design storm and the storm water conveyance should be fitted with flow splitters or weirs to route runoff to the sand filter. Excess runoff bypasses the sand filter and continues to another BMP for water quantity control. The inlet structure should be designed to spread the flow uniformly across the surface of the filter; use flow spreaders, weirs, or multiple orifices.

F. Design Life

Final ownership of the system may affect the design, layout and materials used in a system. The designer should specify the materials for the system and at a minimum, the system should be designed for a 50-year life.

G. Setbacks and Separation Distances

When sand filters infiltrate to the subsurface, the following requirements apply:

- Sand filters must be a minimum of 100' from public and private wells.
- There shall be a 5' vertical separation distance between the infiltration surface and bedrock.
- There shall be a 100' separation distance from surface water supplies used as drinking water and a 50' separation distance from surface water supplies not used as drinking water.
- There shall be a minimum 3' vertical separation distance from the infiltration surface and the seasonal high ground water table.

H. Maintenance

- For the first few months after construction, the sand filters should be inspected after every storm. Thereafter the sand filters should be inspected semi-annually to determine maintenance needs.
- The sand filters should be raked periodically to remove surface sediment, trash, and debris.
- Sediments shall be disposed of in accordance with local, state, and federal regulations.
- The top layer of sand should be replaced annually, or more frequently when drawdown does not occur within 36 hours after the presettling basin has emptied.
- The water level in the filter chamber should be monitored on a quarterly basis and after large storms during the first year.
- The sedimentation chamber should be pumped out or extracted when the sediment depth reaches 12".
- Oil on the surface should be removed separately and recycled. The remaining material may be removed by a vacuum pump and disposed of according to local, state, and federal regulations.

I. Maintenance Access

- Unobstructed access shall be provided over the entire sand filter by either doors or removable panels.
- Access to the sand filter should be provided for maintenance, including inlet pipe and outlet structure.
- Ladder access is required when vault height exceeds 4'. Access openings should have round solid locking lids with ½" diameter allen head screw locks.

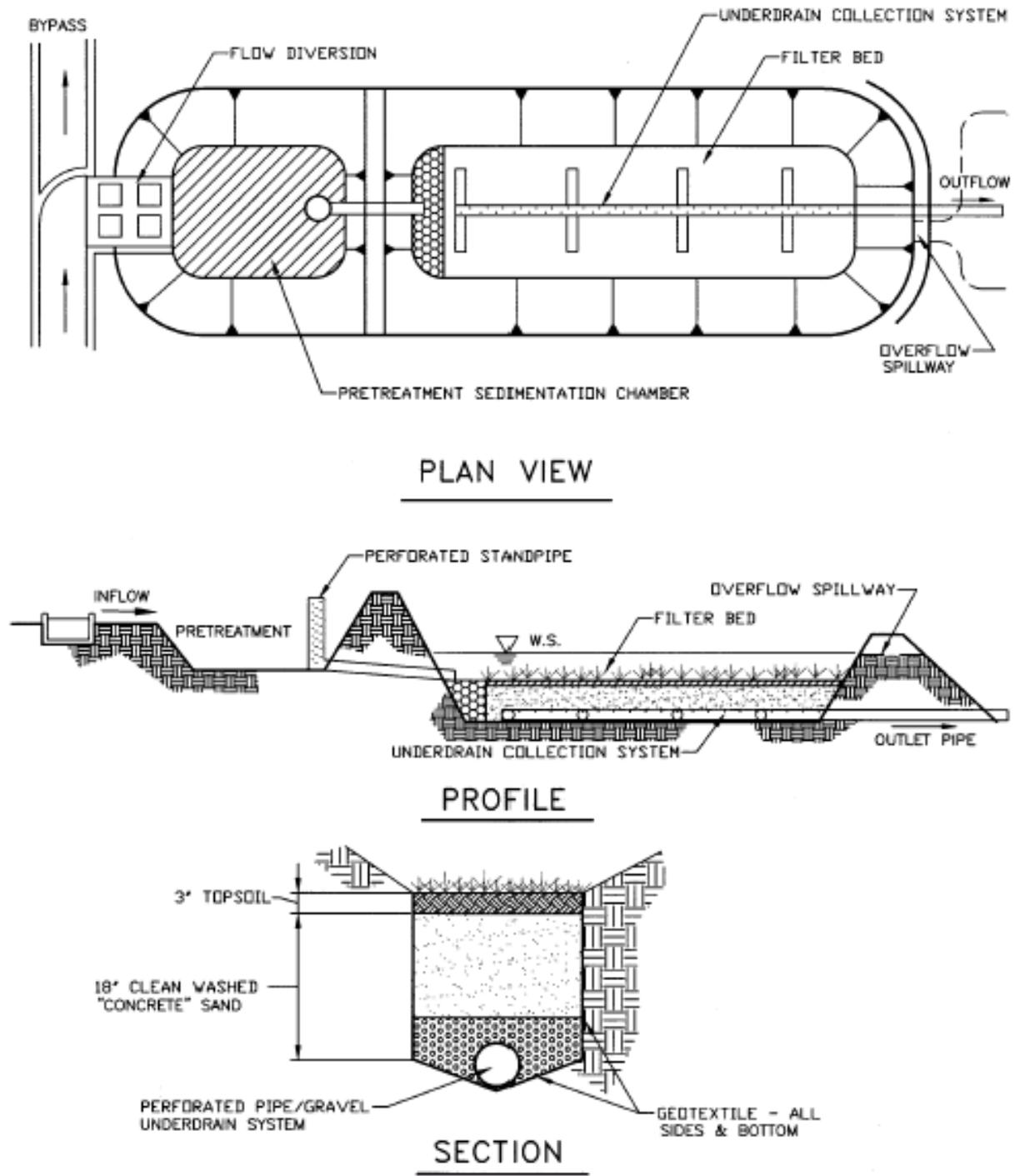


Figure 6.1. Austin Sand Filter.

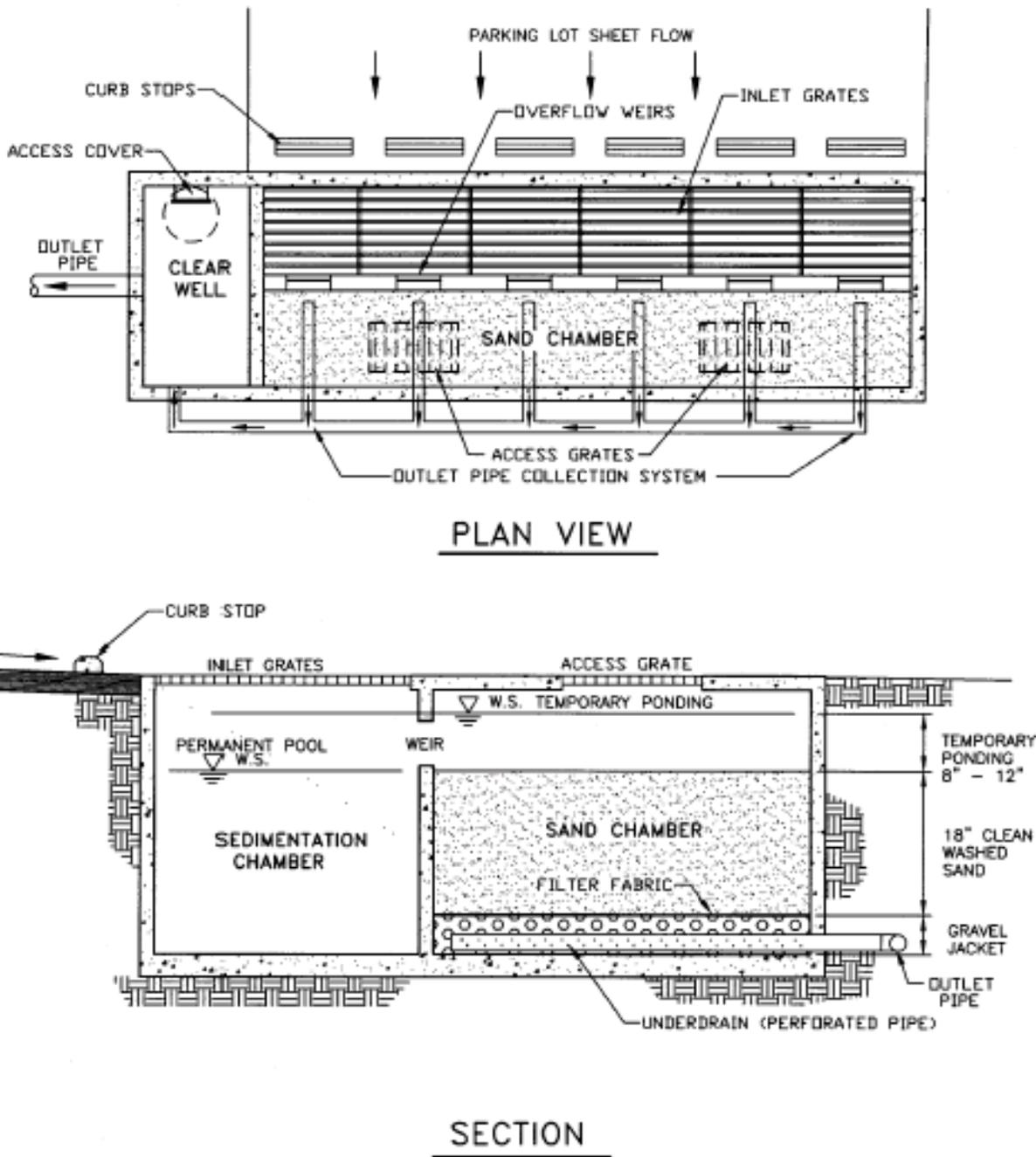


Figure 6.2. Delaware Sand Filter.

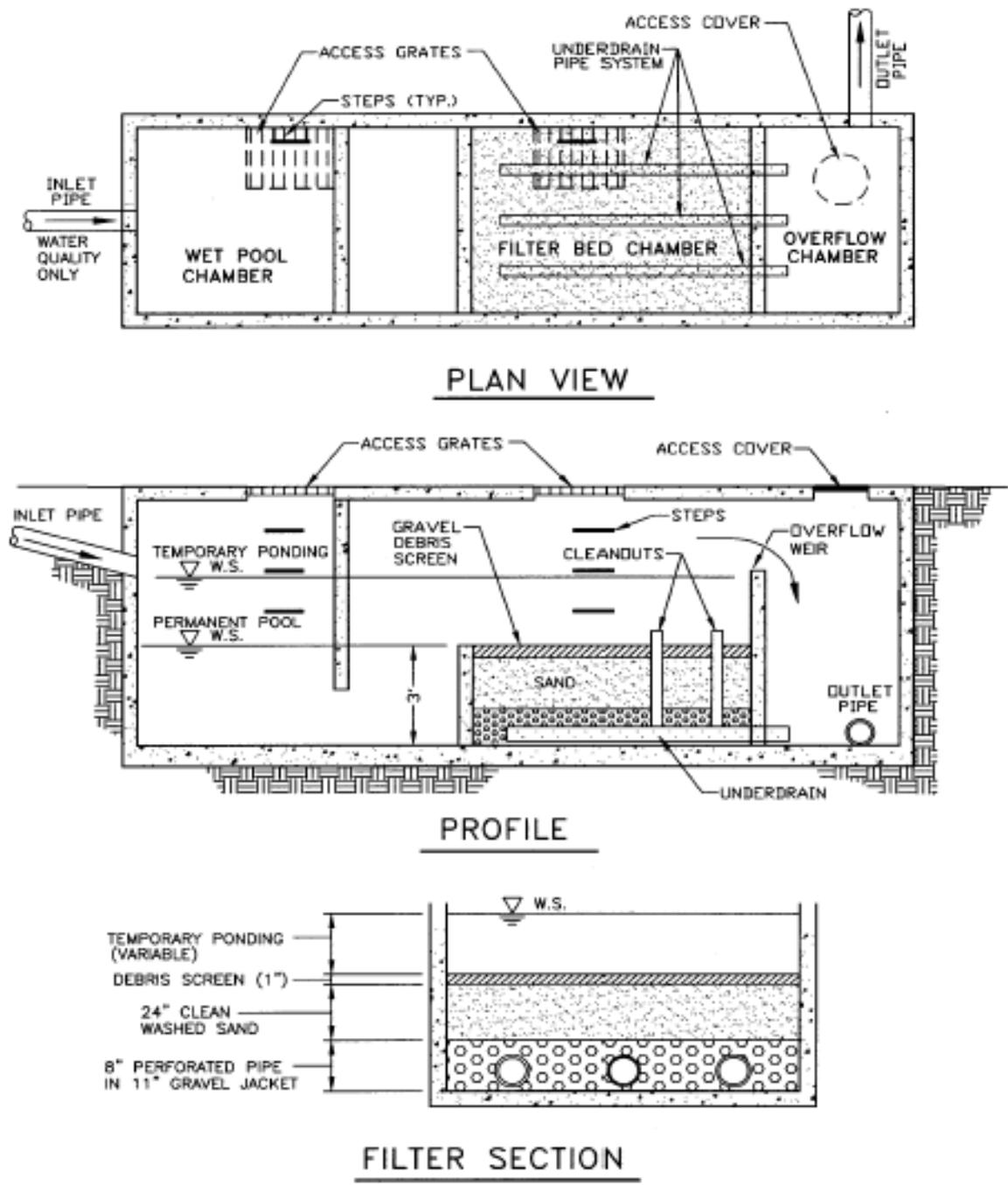


Figure 6.3. Underground Sand Filter.

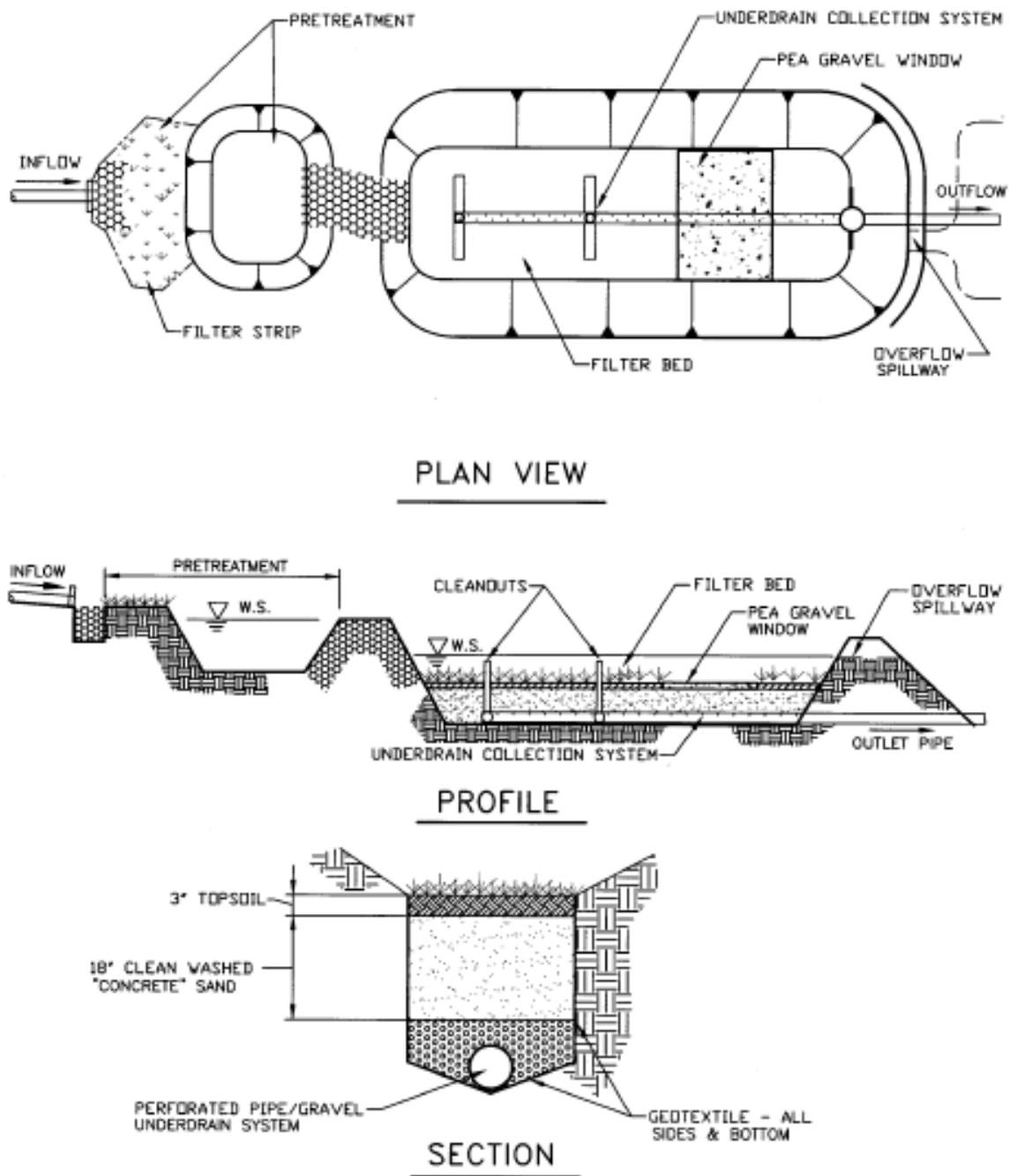


Figure 6.4. Pocket Sand Filter.

**APPENDIX F: CALCULATING PEAK DISCHARGE
AND VOLUME**

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This appendix describes methods for calculating pre- and post- development runoff volumes and peak discharge rates. These calculations should be performed in order to help select, size, and design stormwater BMPs to meet the peak flow rate, water quality, and groundwater recharge criteria described in Section 3.B.(6) of Appendix A. This Appendix provides steps for performing these calculations using the rational method, which is only applicable for sites 200 acres or less in size. For larger sites, areas with significant flood storage effects/features, highly complicated sites, or for BMP designs that require complete design hydrographs, calculations should be performed using the NRCS TR-55 method. A description of this method is not provided in this appendix; however, detailed TR-55 documentation and a free Windows-based download of the TR-55 program can be obtained on-line at:

<http://www.wcc.nrcs.usda.gov/water/quality/hydro/>

Hydrologic methods for determining runoff rate and volume other than the rational method or TR-55 may be acceptable, but the applicant must obtain prior approval from Summit County before beginning hydrologic studies and calculations using alternative methods.

Calculating Peak Runoff

Use the rational formula:

$$Q_p = CiA$$

| | | |
|-------|---|---|
| Q_p | = | peak discharge (cfs) |
| C | = | dimensionless runoff coefficient |
| I | = | rainfall intensity (in./hr) for a duration equal to the time of concentration and for the recurrence interval chosen for design |
| A | = | site area (acres) |

- 1) **Calculate site area (A).** This can be determined from USGS topographic maps, site surveys, and other available information.
- 2) **Determine the runoff coefficient (C).** This value is obtained from the tables below, and is based on land use type (s) for developed areas, and soil hydrologic group/ slope characteristics for undeveloped areas. For areas with mixed land uses, the area should be divided into subareas with similar characteristics (A_1 , A_2 , etc.), and a weighted coefficient should be determined using the following formula:

$$C = [(A_1 * C_1) + (A_2 * C_2) \dots + (C_n * A_n)] / A$$

where C_1, C_2 , etc. are the runoff coefficients for each individual subarea. Information on slope and land use can be obtained from USGS topographic maps, site surveys, air

photos, and other available data. Summit County soil maps and hydrologic group information can be obtained from local Soil Conservation Districts, or on-line at:

<http://soildatamart.nrcs.usda.gov/>

Soil hydrologic group information can be obtained by selecting the “generate reports - water features” function at this website. The different soil hydrologic groups are defined as follows (definitions taken from USDA Technical Release-55 “Urban Hydrology for Small Watersheds, 1986):

- Group A: These soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).
- Group B: These soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).
- Group C: These soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).
- Group D: These soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

Table F1. Recommended Rational Method “C” Coefficients for Developed Areas.

| Land Use Category | Runoff Coefficient “C” |
|--|------------------------|
| Business | |
| Central business areas | 0.70-0.95 |
| Neighborhood areas | 0.50-0.70 |
| Residential | |
| Single-Family | 0.35-0.45 |
| Multi-family, detached | 0.40-0.60 |
| Multi-family, attached | 0.60-0.75 |
| Low Density - 0.5 acre lots or larger | 0.25-0.40 |
| Industrial and Commercial | |
| Light areas | 0.50-0.80 |
| Heavy areas | 0.60-0.90 |
| Parks, cemeteries | 0.10-0.25 |
| Playgrounds | 0.20-0.35 |
| Railroad yard areas | 0.20-0.40 |
| Roofs | 0.90-0.95 |
| Streets, Drives, Walks (asphalt or concrete) | 0.90-0.95 |
| Streets, Drives, Walks (brick, gravel, or disconnected pavers) | 0.70-0.85 |

Table F2. Recommended Rational Method “C” Coefficients for Undeveloped/Pervious Areas.

| Slope | Runoff Coefficient “C” ^a | | | |
|----------------|-------------------------------------|-----------|-----------|-----------|
| | A soils | B soils | C soils | D soils |
| Flat (0-2%) | 0.04-0.09 | 0.07-0.12 | 0.11-0.16 | 0.15-0.20 |
| Average (2-6%) | 0.09-0.14 | 0.12-0.17 | 0.16-0.21 | 0.20-0.25 |
| Steep (>6%) | 0.13-0.18 | 0.18-0.24 | 0.23-0.31 | 0.28-0.38 |

^avalues should be selected from the high or low end of the given ranges based on the condition of ground cover/vegetation.

- 3) **Calculate the time of concentration (T)** to use in determining the appropriate rainfall duration and intensity to use in the rational formula. T is the time required for water to travel the longest watercourse within the drainage area (i.e., the time for water to travel from the hydrologically most remote point of the basin to the location being analyzed). T can be determined graphically using Figure F1 or calculated using the FAA formula below. For small and/or highly impervious areas with very short times of concentration, the default minimum T value to be used for design purposes is 10 minutes.

$$T = 1.8 * (1.1 - C) D^{0.5} / S^{1/3}$$

T = time of concentration (minutes)

C = dimensionless runoff coefficient (same as used in rational formula)

D = length (in feet) of longest watercourse

S = % slope of longest watercourse

The variables D and S can be determined from USGS topographic maps, site surveys, and other available information. Care should be taken to field-verify flow path information to ensure that any existing graded swales, ditches, gutters, or other constructed drainage systems that intercept the natural contours are accounted for when determining slope and flow length for the purposes of these calculations.

For small and/or highly impervious areas with very short times of concentration, the default minimum T value to be used for design purposes is 10 minutes.

Additional information and an automated T calculator can be found on-line at:

<http://www.lmnoeng.com/Hydrology/TimeConc.htm>

- 4) **Determine the average rainfall intensity (I).** This value should be obtained for the recurrence interval of interest and a duration equal to the time of concentration T calculated in (3) above using the NOAA Atlas 14 intensity-duration-frequency (IDF) curve for an appropriate nearby climate station. Table F3 and Figure F2 provide IDF data for the Park City climate station; additional IDF curves and tables can be obtained online at:

http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html

Table F3. NOAA Atlas 14 Precipitation Intensity Estimates for Station “Park City Radio, Utah” (Station #42-6648). Values are in inches per hour.

| duration | Frequency | | | | | | | | |
|----------|-----------|------|-------|-------|-------|--------|--------|--------|---------|
| | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 200-yr | 500-yr | 1000-yr |
| 5 min | 1.90 | 2.62 | 3.26 | 4.36 | 5.36 | 6.56 | 8.00 | 10.31 | 12.44 |
| 10 min | 1.45 | 1.99 | 2.48 | 3.32 | 4.09 | 5.00 | 6.09 | 7.84 | 9.47 |
| 15 min | 1.19 | 1.64 | 2.05 | 2.74 | 3.38 | 4.13 | 5.03 | 6.48 | 7.83 |
| 30 min | 0.80 | 1.11 | 1.38 | 1.85 | 2.27 | 2.78 | 3.39 | 4.36 | 5.27 |
| 60 min | 0.50 | 0.69 | 0.85 | 1.14 | 1.41 | 1.72 | 2.10 | 2.70 | 3.26 |
| 120 min | 0.31 | 0.41 | 0.50 | 0.65 | 0.78 | 0.95 | 1.15 | 1.46 | 1.75 |
| 3 hr | 0.24 | 0.30 | 0.36 | 0.45 | 0.54 | 0.64 | 0.77 | 0.98 | 1.18 |
| 6 hr | 0.16 | 0.19 | 0.22 | 0.27 | 0.31 | 0.36 | 0.41 | 0.50 | 0.60 |
| 12 hr | 0.10 | 0.12 | 0.14 | 0.17 | 0.19 | 0.21 | 0.24 | 0.28 | 0.31 |
| 24hr | 0.07 | 0.08 | 0.09 | 0.10 | 0.11 | 0.13 | 0.14 | 0.15 | 0.17 |
| 48 hr | 0.04 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.09 | 0.10 |
| 4 day | 0.02 | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 |
| 7 day | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 |
| 10 day | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 |
| 20 day | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |
| 30 day | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 45 day | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 60 day | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

5) **Calculate the peak discharge (Q_p).** For storm events with recurrence intervals more frequent than 25 years, use the following formula:

$$Q_p = C \cdot I \cdot A$$

For storm events with recurrence intervals of 25 years or greater, the runoff coefficient should be adjusted by the factor C_f because infiltration and other abstractions have a proportionally smaller effect on runoff. Values for C_f are provided in Table F4. Once the C_f is determined, peak discharge is calculated using the following formula:

$$Q_p = C \cdot C_f \cdot I \cdot A$$

Q_p should be calculated for both pre- and post-development land use conditions. In order to meet the peak flow rate criteria outlined in Appendix A, Section 3B(6), non-structural and structural BMPs should be designed to control the post-development rate Q_p to the pre-development rate. Non-structural methods that reduce the post-development runoff coefficient and lengthen the time of concentration (e.g., preservation of natural areas with type A or B soils, minimizing impervious areas, using vegetated swales instead of storm sewers, etc.) will be the most effective techniques to meet the peak flow rate criteria.

Table F4. Runoff Coefficient Adjustment Factors for Rational Method.

| <u>Recurrence Interval (years)</u> | <u>Adjustment Factor C_r</u> |
|------------------------------------|---|
| 25 | 1.1 |
| 50 | 1.2 |
| 100 | 1.25 |

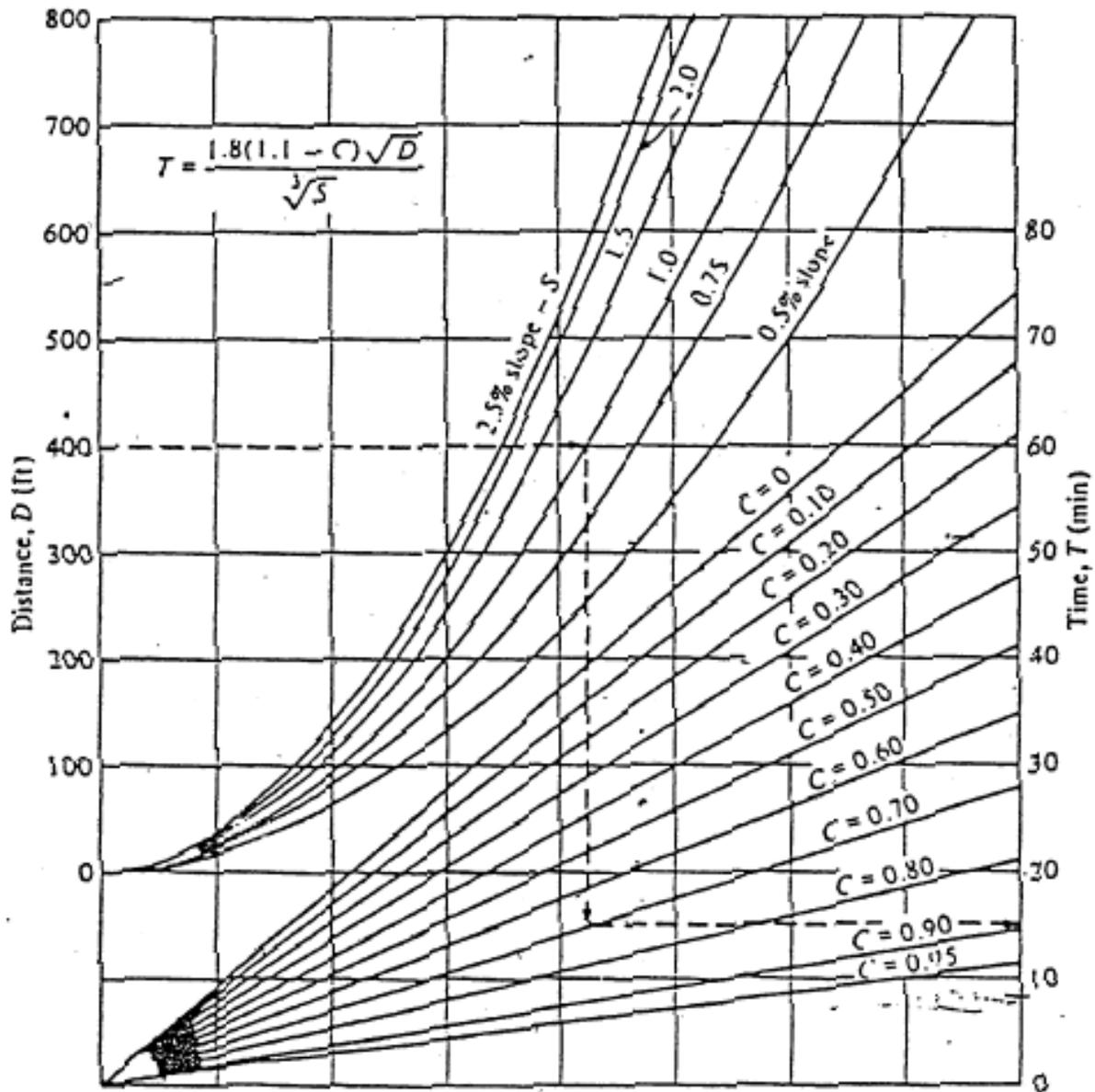
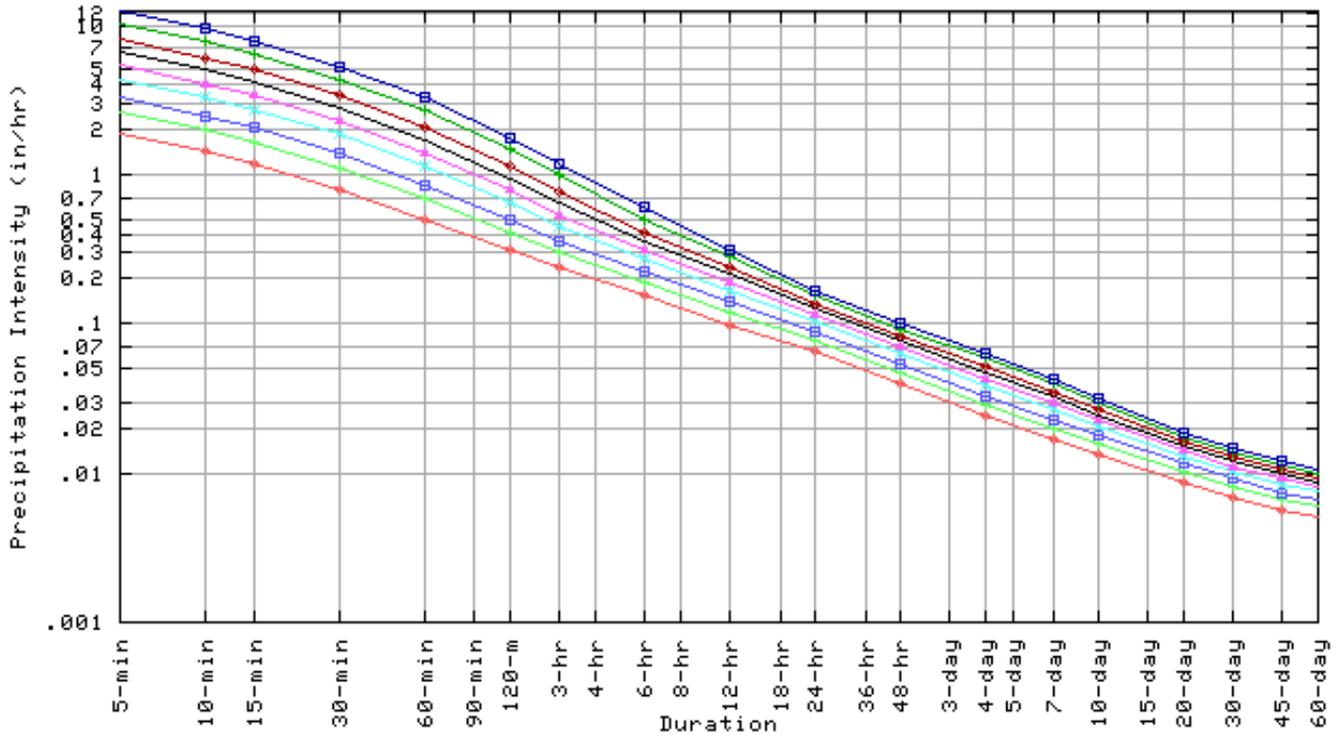


Figure F1. Time of concentration curves based on the FAA (1965) method.

Partial duration based Point IDF Curves
40.65 N 111.5 W 6998 ft



Thu Jul 15 18:45:48 2004

| Average Recurrence Interval (years) | |
|-------------------------------------|-----------|
| 2-year | 100-year |
| 5-year | 200-year |
| 10-year | 500-year |
| 25-year | 1000-year |
| 50-year | |

Figure F2. NOAA Atlas 14 precipitation intensity-duration-frequency curves for station "Park City Radio, Utah" (Station #42-6648).

Calculating Water Quality Volume

To meet the water quality and groundwater recharge criteria outlined in Appendix A, Section 3B(6), the runoff volume associated with a storm event of 0.5" in 1 hour must be calculated for pre- and post-development conditions.

Use the rational formula:

$$WQ_v = CItA$$

| | | |
|--------|---|--|
| WQ_v | = | water quality volume (ft ³) |
| C | = | dimensionless runoff coefficient |
| I | = | rainfall intensity = 0.5"/hr = 0.042 ft/hr |
| t | = | storm duration = 1 hour |
| A | = | site area (ft ²) |

$$WQ_v = C * (0.042 \text{ ft/hr}) * (1 \text{ hr}) * A = (0.042 \text{ ft}) * C * A$$

Runoff coefficient (C) values for the water quality volume calculation should be selected using the same tables and guidelines described above in the section on calculating peak runoff.

Calculating Groundwater Recharge Volume

The criteria in Appendix A, Section 3B(6) require that the increase in surface runoff volume from the water quality storm (0.5" in 1 hour) is recharged into the ground rather than discharged off-site as surface runoff. This required groundwater recharge volume (GW_v) is calculated as:

$$GW_v = WQ_v (\text{post-development}) - WQ_v (\text{pre-development})$$

where WQ_v is calculated as described above in the section on calculating water quality volume.

Calculating TSS Removal Rate

Rather than requiring a calculation of the actual real-world TSS load for a site, the application of this standard has been simplified to estimate a site's annual TSS load as 1.0 (i.e., 100%) as it enters the first BMP in the system. Therefore, in addition to performing the calculations below to demonstrate that adequate BMP performance efficiency has been provided, the permittee must also demonstrate compliance by showing that:

- The treatment BMPs have been designed/sized to treat the post-development water quality volume (WQ_v), calculated as described above; and,

- The BMPs are inspected regularly and maintained as needed to perform efficiently. Information on maintenance needs for individual BMPs is included in Appendix E, and sample inspection forms are provided in Appendix G.

Steps to calculate the TSS removal rate:

- 1) From Table 1 in Appendix E, determine the required final TSS removal rate (R) based on the percent of overall site area that is impervious. Use the definition for “impervious surface” provided in Appendix A Section 2. For sites where newly-developed impervious areas lie within 50 feet of a live water body (perennial or intermittent stream, lake, pond, spring, or reservoir), the Table 1 sliding scale does not apply and the default 80% TSS removal standard must be met.
- 2) If appropriate, divide the site into individual drainage areas. It is essential that the final TSS removal rate be calculated separately for each subarea. Isolated impervious areas (e.g., disconnected rooftops) that are serviced solely by their own BMPs, such as swales or seepage beds, should be considered as separate drainage areas. Each individual drainage area must meet the TSS removal rate for the entire site, as determined in step (1).
- 3) For each individual drainage area, list the storm water BMPs and their order in the engineered system, beginning with the first BMP collecting storm water from the site. For example, pretreatment and conveyance BMPs will typically precede the removal BMPs. Using the values from Appendix E Table 2, list the estimated TSS removal rate for each BMP in the treatment system.
- 4) Calculate the final TSS removal rate (R) according to the following formula:

$$R = (L_1 * R_1) + (L_2 * R_2) + (L_3 * R_3) \dots + (L_n * R_n)$$

L_1 = initial TSS load = 1.0 (i.e. 100%)

R_1 = fractional TSS removal rate for the first BMP in the system (e.g., if the removal rate listed in Appendix E Table 2 for BMP1 is 60%, the fractional rate R_1 is 0.60)

L_2 = remaining TSS load after preceding BMP = $L_1 - (L_1 * R_1)$

R_2 = fractional TSS removal rate for the second BMP in the system

L_3 = remaining TSS load after preceding BMP = $L_2 - (L_2 * R_2)$

R_3 = fractional TSS removal rate for the third BMP in the system

L_n = remaining TSS load after preceding BMP = $L_{(n-1)} - (L_{(n-1)} * R_{(n-1)})$

R_n = fractional TSS removal rate of final (n^{th}) BMP in the system

As evident in the above formula, the TSS removal rates are not additive from one BMP to the next; instead, the estimated removal rates are applied consecutively as the TSS load passes through each BMP technology.

- 5) Check that the final removal rate R for each drainage area is greater than or equal to 0.80 (80%) or the applicable sliding scale standard from Appendix E Table 1. If R is less than the standard for any of the drainage areas, the system should be redesigned in order to meet the standards.

APPENDIX G: SAMPLE INSPECTION FORMS

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**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP1: Oil/Water Separators

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Separator Components (General) | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|---|------------------------|---|----------|
| Discharge Quality | | | |
| Inlet Pipe | | | |
| Outlet Pipe | | | |
| Trash and Debris | | | |
| Sediment | | | |
| Bypass Valve | | | |
| Oil Absorbent Pads | | | |
| Item Inspected: Vault Structure | | | |
| Ladder | | | |
| Concrete (inspect when vault cleaned) | | | |
| Maintenance hole | | | |
| Inlet grates | | | |
| Baffles | | | |
| Item Inspected: Coalescing Plates | | | |
| Sediment | | | |
| Plates | | | |
| Item Inspected: Spill Control Separators | | | |
| Tee Section | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP2: Catch Basin Inserts

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Catch Basin Insert Components | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|--|---------------------|--|----------|
| Filter Insert | | | |
| Grate Seal | | | |
| Sump | | | |
| Trash, debris, sediment, vegetation | | | |
| Pollution | | | |
| Access | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP3.1: Seepage Beds (Infiltration Trench)

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Seepage Bed | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|--|----------------------------|---|-----------------|
| Drain rock | | | |
| Filter fabric | | | |
| Surface Inlet (if present) | | | |
| Observation well (ponding should not be present) | | | |
| Surface (ponding should not be present) | | | |
| Surface vegetation | | | |
| Trash, sediment, debris | | | |
| Pre-treatment system (use additional checklist if appropriate, e.g. oil/water separator) | | | |
| Pollution | | | |
| Vegetated buffer strip (if present) | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP3.2: Infiltration Basin

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Infiltration Basin | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|---|--------------------------------|---|-----------------|
| Inlet channel | | | |
| Inflow | | | |
| Outlet channel | | | |
| Outfall | | | |
| Forebay/sediment trap | | | |
| Pretreatment system (use additional checklist if appropriate) | | | |
| Trash, debris, sediment | | | |
| Surface vegetation | | | |
| Emergency spillway (if present) | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP3.3: Infiltration Swale

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Infiltration Swale | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|--|--------------------------------|---|-----------------|
| Inflow | | | |
| Inflow energy dissipation (stilling basin, rip rap pad) | | | |
| Flow spreading device | | | |
| Sediment clean-out area | | | |
| Vegetation | | | |
| Trash, debris, sediment | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP4: Ponds

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Embankment and Spillways | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|---|--------------------------------|---|-----------------|
| Vegetation and ground cover | | | |
| Erosion at inlets/ outlets/ side slopes | | | |
| Animal/rodent burrows | | | |
| Seeps or leaks in embankment or spillway | | | |
| Cracking, bulging, or sliding of dam | | | |
| Spillways clear of obstructions and debris | | | |
| Riser | | | |
| Pipe/ concrete/ masonry condition | | | |
| Trash rack(s) free of debris (low flow & weir) | | | |
| Orifice unobstructed by sediment/ debris | | | |
| Condition of access structures (e.g., ladders) | | | |
| Excessive sediment accumulation inside riser | | | |
| Outflow | | | |
| Evidence of slope or bank erosion | | | |
| Riprap condition | | | |
| Pipe & endwall/headwall condition | | | |

| | | | |
|---|--|--|--|
| Pond (General) | | | |
| Sedimentation level in sediment forebay | | | |
| Undesirable vegetative growth | | | |
| Sedimentation level in pond | | | |
| Evidence of pollution (oil, grease, etc.) | | | |
| Trash/ yard waste | | | |
| Graffiti | | | |
| Public safety hazards | | | |
| Noxious odors | | | |
| Noxious insects | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**
Summit County BMP5: Biofiltration Systems

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Biofiltration system components: Biofiltration swales and grass buffer strips | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|--|------------------------|---|----------|
| Discharge Quality | | | |
| Vegetation height | | | |
| Sediment | | | |
| Flow channelization/erosion | | | |
| Vegetation type | | | |
| Bare spots/need for reseeding | | | |
| Flow spreading device | | | |
| Maintenance access | | | |
| Noxious weeds | | | |
| Pollution | | | |
| Ponding | | | |
| Trash/litter | | | |

**INSPECTION AND MAINTENANCE CHECKLIST
FOR STRUCTURAL POST- CONSTRUCTION BMPs**

Summit County BMP6: Sand Filters

Date: _____ Time: _____ Type of inspection (circle one): Semi-Annual Monthly After major storm

Site Name/Location: _____

Inspector: _____

| Item Inspected: Sand Filter Components (General) | Satisfactory yes/no | Type of Maintenance Needed if Unsatisfactory | Comments |
|--|---------------------|--|----------|
| Discharge Quality | | | |
| Inlet Pipe | | | |
| Outlet Pipe | | | |
| Trash and Debris | | | |
| Sediment depth | | | |
| Bypass Valve | | | |
| Filter Bed | | | |
| Sedimentation Chamber/Pond (use additional checklist if appropriate) | | | |
| Infiltration rate/ponding after 36 hours | | | |
| Oil or other pollutants | | | |
| Vegetation | | | |
| | | | |
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