SECTION 13 – CONSTRUCTION SITE SEDIMENT AND EROSION CONTROL
TABLE OF CONTENTS

SECTION 13.0 CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL

13.1 INTRODUCTION

Construction activities that disturb the natural soil and vegetation have the potential to increase soil erosion and sediment movement. The forces of rainfall, concentrated runoff, and even strong winds easily erode the disturbed, loose soil. Erosion and sediment control practices, also known as Best Management Practices (BMPs), shall be required to the maximum extent practicable, on all developing or redeveloping lands within the City of Greeley. BMPs are "schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States (40 CFR 122.2). Implementation of BMPs for erosion and sediment control and stormwater management are required by the CPDS stormwater regulations, and other regulatory guidance (see section 12.0). BMPs are to be included in the SWMP drawings prepared for construction projects. They shall be designed to prevent disturbed soils from entering stormwater runoff and maintain stormwater quality at a level comparable to the historic runoff conditions, which existed prior to the construction activities.

Part of the NPDES program consists of reducing the amount of silt and erosion from construction sites, as well as the proper handling and storage of fuels, lubricants, chemicals and other waste, debris and slurry commonly found in construction areas.

These Criteria are developed from information and design guidelines presented in the Urban Storm Drainage Criteria Manual (USDCM), Volume 3, "Best Management Practices." The reader is referred to the USDCM for an extensive discussion of the development of erosion and sediment control BMPs.

In accordance with the City of Greeley Ordinance No. 15, 1996 - an ordinance amending the Greeley Municipal Code by addition of Chapter 9.18 "Grading and Soil Erosion Control" requires that a grading permit be obtained for construction activities on sites equal to or greater than 1 (one) acre, or a site that is a part of a larger common plan of development (which would include phased development of sites less than 1 (one) acre).

Other sites smaller than one acre but, due to the nature of their topography or location, provide a potential for significant negative impact on the City's stormwater facilities, streets, or receiving waters, also must use BMPs during construction activity. The City shall identify such sites and provide written notice to the property owner with instructions to obtain a grading permit and prepare a SWMP plan prior to beginning or continuing grading activities.

In accordance with the requirements of the Federal Clean Water Act, the State of Colorado requires that a stormwater discharge permit be obtained for construction activities on sites equal to or greater than 1 (one) acre, or a site that is part of a larger common plan of development (which would include phased development of sites less than 1 (one) acre). Information on the requirements and forms necessary for obtaining a stormwater discharge permit from the State of Colorado may be obtained from the Stormwater Unit, Water Quality Control Division, of the Colorado Department of Public Health and Environment.

Common Construction site violations:

1. Failure to maintain silt fence, inlet protection or tracking pads
2. Un-contained Concrete slurry or masonry wash-out

3. Wanton disregard for erosion control devices by contractors/subcontractors, i.e. driving over, moving or removing BMPs
4. Dirt and/or mud tracked onto streets
5. Stockpiling of dirt, manure, rocks or other products on street or parking lots
6. Use of Detention ponds as stock-pile areas.

13.2 OBJECTIVES FOR EROSION AND SEDIMENT CONTROL PRACTICES

The following objectives and principles of erosion and sediment control shall be used by the City to determine if a site undergoing land disturbing activities has proposed and implemented adequate BMPs.

1. Fit development to the existing terrain and retain existing vegetation. The goal of this objective is to minimize the overall land disturbance, and maintain stormwater quality in a condition more similar to natural historic levels.
2. Schedule construction, grading, and land disturbing activities to minimize soil exposure, and avoid heavy runoff seasons. The best protection is prevention; therefore, effective scheduling should be used to minimize soil exposure between initial grading and completion of final grading or installation of improvements.
3. Manage stormwater flows to minimize erosion and sediment movement. This objective would include diverting concentrated flows from disturbed slopes, minimizing the length and steepness of disturbed slopes, keeping runoff velocities low, and preparing or reinforcing drainage ways and outlets to receive runoff flows.
4. Do not allow increased sediment movement off of the site. All sediment disturbed on site should be contained and either redeposited in a more stable location, or removed from the site.
5. Inspect, maintain, and remove all measures when appropriate. Scheduling will be highly dependent on the selection of BMPs, the rainfall/runoff events occurring during the land disturbance period, and the establishment of permanent stabilization.

The objective of erosion control is to limit the amount of erosion occurring on disturbed areas until the site is stabilized. The objective of sediment control is to capture the eroded soil before it leaves the construction site.

13.3 PERFORMANCE AND DESIGN CRITERIA

The City shall require that BMPs for construction site or land disturbing activities be designed and implemented for each site in a manner that addresses the objectives and principles of erosion and sediment control (see Section 13.2). Given that the land use, topography, soils, and runoff flows will vary from site to site, it is expected that the proposed BMPs for each site will also vary.

The BMPs for a construction site are usually comprised of five major elements:

Erosion Control

Sediment Control

Materials Handling and Spill Prevention –See Section 12.0

Waste Management – See Section 12.0

General Pollution Prevention Measures – See section 12.0

The City of Greeley recommends the use of the following stormwater quality management BMPs, as presented in the USDCM, Volume 3, "Best Management Practices" and listed below:

1. Erosion Control:

   Erosion controls are surface treatments that stabilize soil exposed by excavation or grading. Erosion control measures are referred to as source controls.

   Erosion and sedimentation processes during and after construction or maintenance activities can result in adverse impacts to the environment. These adverse impacts can be minimized through the proper application of BMPs. Some of the most common erosion control BMPs are presented in following table.

TABLE 13.3(1) - EROSION CONTROL BMPS	
Soil Stabilization	Re-vegetation & Waddles
Surface Roughening	Erosion Control Blankets
Mulch Tackifier	Turf Reinforcement Mats (can be harmful to wildlife, see Section 5), & Terra Cell
Outlet Protection	Grading Techniques & Rip Rap
Drainage Way Protection	Design Techniques, Rip Rap, & Concrete

2. Sediment Control:

   Sediment controls capture soil that has eroded. Soil particles suspended in runoff can be filtered through a porous media or deposited by slowing the flow and allowing the natural process of sedimentation to occur.

   Sites exposed to wind, rain and snow can be susceptible to soil erosion and subsequent sedimentation. Sedimentation results when soil particles are suspended in surface runoff or wind and are deposited in streams and other water bodies.

   Erosion can be accelerated by vegetation removal, earthwork activities, changing natural drainage patterns, and by covering the ground with impermeable surfaces. It is important to recognize that the optimal BMP is to prevent or minimize erosion by proper planning and the use of the erosion control practices identified above. However, erosion is inevitable to some extent on construction sites. Therefore, anticipating sedimentation and providing for a secondary line of defense by implementing sediment control is good planning. Sediment control BMPs are intended to intercept, slow, or detain the flow of stormwater to allow sediment to settle and be trapped. Some of the most common sediment control BMPs are listed in table below:

TABLE 13.3(2) - SEDIMENT CONTROL BMPS	
Sediment Basins & Traps	Vehicle Tracking Pads
Slope Drains & Dikes	Silt Fence Mirafi 100x or equivalent
Storm Drain Inlet Protection	Inlet Filters
Brush Barrier	Erosion Bale or Logs

   NOTE: If Silt Fencing is used to delineate the site, it will be inspected for operation and maintenance. It is suggested that silt fence be used only where it is needed to keep stormwater runoff from running off the site in a rain event.

   If wind erosion is a suspected problem the use of orange safety fence 15 – 20’ upwind of the silt fence is recommended. There shall be a ‘Tee’ post every 15’ minimum. Periodic maintenance of the safety fence will be required. Occasional removal of sediment will be re-

quired between the orange safety fence and the silt fence. This procedure shall be followed until the threat of erosion has elapsed.

3. Materials Handling & Spill Prevention

   Materials Handling and Spill Prevention are measures implemented to minimize or prevent contamination of the natural resources present from materials stored on construction sites.

   Material management is important, because the optimal approach to reduce pollution potential is to prevent it at the source. Material storage areas are a major source of risk due to possible mishandling of materials and accidental spills. Developing protocols for materials storage and handling, and response procedures for handling spills, are necessary measures to minimize the contamination impact to stormwater runoff. Developing and incorporating these measures will increase awareness and minimize the opportunities for mishandling and spills.

   The following BMPs provide guidance on material management and spill prevention and control.

TABLE 13.3(3) - MATERIALS HANDLING & SPILL PREVENTION BMPS
Stockpile Management
Material Management
Material Use
Spill Prevention & Control

4. Waste Management
   Waste Management BMP's are measures implemented to minimize or prevent contamination of the natural resources present from waste materials.

   Stormwater runoff from areas where construction wastes are stored or disposed of can be polluted. Wastes leached or spilled from management areas may build up in soils or on other surfaces and can be carried by stormwater runoff. There is also the potential for liquid wastes from lagoons or surface impoundments to overflow, soak the surrounding area, or be washed to receiving waters. Solid wastes improperly stored can contribute stormwater runoff and contribute pollutants. Possible contaminants include toxic compounds, oil and grease, oxygen-demanding organics, paints and solvents, heavy metals and high levels of suspended solids.

   The optimal approach to reduce the potential for stormwater contamination from wastes is to reduce the amount generated and, consequently, the amount stored on site. The BMPs listed below can provide guidance on dealing with the management of wastes.

TABLE 13.3(4) - WASTE MANAGEMENT BMPS
Concrete Wastes
Solid Waste
Sanitary & Septic Waste (Port-A-Potty's)
Liquid Waste
Hazardous Waste
Contaminated Waste

5. General Pollution Prevention:

   General Pollution Prevention BMP's are implemented to minimize or prevent general contamination of the construction site and natural resources present.

The objective of General Pollution Prevention BMPs is to reduce the discharge of materials other than stormwater to drainage systems or receiving waters. Some BMPs to consider for this application are listed below:

TABLE 13.3(5) - GENERAL POLLUTION PREVENTION BMPS
Non-stormwater Discharge Management
Wind Erosion Control
Paving Operations
Street Sweeping & Vacuuming
Vehicle & Equipment Management

Design criteria and construction details for the selected BMPs are presented in the USDCM, Volume 3, "Best Management Practices". The City encourages the innovative use and application of measures to adequately and efficiently control erosion and sediment movement due to land disturbing activities. Methods and applications of BMPs designed to meet the objectives for erosion and sediment control are expected to grow, improve, and expand. Owners of land undergoing land-disturbing activities are encouraged to utilize the newest technology available and incorporate the design data for these new methods in the Stormwater Management Plan (SWMP).

13.3.1 MINIMUM PERFORMANCE AND DESIGN CRITERIA

The City shall evaluate the adequacy and appropriateness of the proposed BMPs based on their fulfillment of the previously stated objectives, as well as the satisfaction of the following minimum performance and design criteria:

1. Erosion Control Plan approved by the City.
2. Adjacent properties are protected from increased erosion and/or sediment deposition.
3. Construction access routes protect adjacent properties from sediment and mud tracking through either immediate placement of street base or construction of mud pads.
4. Timing and stabilization of sediment trapping practices is scheduled before site grading and construction.
5. Sediment traps/basins must be constructed if one (1) acre, or greater, of disturbed land drains to a common outfall.
6. All disturbed areas shall be adequately stabilized as defined in the USDCM, Volume 3, "Best Management Practices". Permanent or temporary soil stabilization shall be required within 7 days after final grade is reached. If disturbed areas or stockpiles are not brought to final grade within 30 days following the initial disturbance, or re-disturbance, temporary stabilization measures shall be required.
7. All storm drain inlets shall be protected from the entry of sediment-laden water.
8. The landowner shall be held responsible for the long-term stability of cut and fill slopes and the successful establishment of permanent vegetative cover on exposed soil as defined in the USDCM, Volume 3.
9. Inspection of all erosion and sediment control BMPs shall be required at the end of each day's work, with necessary maintenance and repairs provided immediately.

10. All temporary erosion and sediment control measures shall be removed as soon as their function has been fulfilled. Sediment traps/basins shall be cleaned and removed, or stabilized, when all upstream areas are permanently stabilized.
11. Construction work in or directly adjacent to a watercourse shall require adequate bed and bank stabilization as defined in the USDCM, Volume 3. Construction work within a defined channel shall require a stream crossing structure for bed and bank protection.
12. Construction work in flowing channels is prohibited in the months of May and June.
13. The construction of underground utilities shall be included as a land disturbing activity. All excavated material shall be placed where sediment will erode back into the trench. All trenches shall be backfilled by the end of the days work; backfill shall be permanently stabilized before construction is considered complete.

13.4 EROSION CONTROL PLAN

A site specific Erosion Control Plan shall be submitted to the City for review and approval.

NOTE: The Construction Permit from the Colorado Department of Public Health, Water Quality Control Divisions requires a Stormwater Management Plan (SWMP) be prepared. The Erosion Control Plan may or may not meet this requirement. It is up to the design engineer to determine if they have developed an adequate SWMP to meet the state requirements.

The link to the permit and the rational are provided below:

http://www.cdphe.state.co.us/wq/PermitsUnit/stormwater/SWConstructionApplication.pdf

The Erosion Control Plan shall consist of two components: the first component shall be a narrative report describing the site, the proposed land disturbing activities, and the recommended BMPs for erosion and sediment control, materials handling and spill prevention, waste management and general pollution prevention BMPs; the second component of the Erosion Control Plan shall be a site plan.

The Erosion Control Plan should be consistent with the site's drainage report, and shall be included within the required drainage report for the project.

13.4.1 PRELIMINARY EROSION CONTROL PLAN

The submittal for the Preliminary Erosion Control Report (which shall be submitted with the Preliminary Drainage Report as described in Section 2.3 of these Criteria) shall consist of the following information:

13.4.1.A NARRATIVE REPORT (PRELIMINARY)

1. Name, address, and telephone number of the applicant and the Professional Engineer preparing the report.
2. A project description briefly describing the nature and purpose of the land disturbing activity, the total area of the site, and the project location including township, range, and section.
3. The existing site conditions should be described, including existing topography, vegetation, and drainage. If wetlands are present on the site they must be described: location, aerial extent, and type. It is the applicant's responsibility to deter-

mine and comply with all other federal or state regulations regarding the disturbance of wetlands.

4. A vicinity map indicating the general area and property lines for the site should be included. Acceptable scales range from 1" = 1000' to 1" = 2000'.
5. Neighboring areas must be described as to land use and existing features such as streams, lakes, structures, roads, etc.
6. Soils information for the site should include soil type and names, mapping unit, erodibility, permeability, hydrologic soil group, depth, texture, and soil structure. This information may be obtained from the soil report for the site, from soil reports available for adjacent sites, or from Soil Conservation Service information. The source of information must be indicated.
7. Area and volume (in cubic yards) of the estimated quantity of excavation and fill on the site, and the surface area (acres) of the proposed disturbance.
8. A discussion of the approach to stormwater management on the site, including the erosion and sediment control measures to be used during construction. Briefly indicate the post-construction stormwater quality control measures to be included in the site development, or refer to the site's Stormwater Management Plan, if applicable.

13.4.1.B EROSION CONTROL DETAILS (PRELIMINARY)

1. The site plan shall be presented on a 24" x 36" drawing, at scales ranging from 1" = 20' to 1" = 200'. The information required on this site plan may be placed on the site drainage plan, if it can be clearly presented.
2. Existing and if available proposed topography shall be shown at one or two-foot contour intervals. Topography information shall extend at least 100 feet beyond the property line.
3. Show the location of all on-site existing structures and hydrologic features on the site. All off-site existing structures or hydrologic features within 100 feet of the property boundaries shall also be shown. The path of both existing and proposed developed stormwater runoff flows leaving the site shall be identified.
4. Indicate the preliminary location of the proposed structures and development of the site.
5. Indicate the proposed limits of clearing and grading.
6. If required for the proposed construction or development activity, indicate preliminary locations of the following: temporary roads, soil stockpiles, and construction storage areas.

13.4.2 FINAL EROSION CONTROL PLAN

The Final Erosion Control Plan (which shall be submitted with the Final Drainage Report, as described in Section 2.4 of these Criteria) shall be based on the comments and review of the preliminary submittal, and the final construction plans for the project site. In addition to presenting all of the information included in the Preliminary SWMP, the submittal for the Final SWMP Report shall also include the following:

13.4.2.A NARRATIVE REPORT (FINAL)

1. Final summaries of the areas (acres) and volumes (cubic yards) of the excavation and fill on the site, and the total surface area of the proposed disturbance.

2. A description of erosion and sediment control measures which will be used on the site.
3. A construction schedule for all proposed site grading or other construction activities must indicate:
   a. Start and completion dates for all construction.
   b. Construction sequence, including the installation and removal time periods of erosion and sediment control measures.
   c. Period and length of exposure of each area prior to the completion of temporary erosion and sediment control measures, as well as permanent stabilization.
4. Maintenance and inspection schedules for all erosion and sediment control measures during construction should be described.
5. A technical appendix should include all design calculations for determining rainfall and runoff, and sizing any basins, diversions or other conveyance or retention/detention facilities.
6. The report shall include proof of a deposit of security to insure rehabilitation of the disturbed area. A performance bond, letter of credit, or escrow fund acceptable to the City is required. See Section 13.6 for determining the amount of security required.

13.4.2.B EROSION CONTROL DETAILS (FINAL)

1. The final grading for the site, shown at one- or two-foot contour intervals, including ele vations, dimensions, location, extent, and slope of all grading, including building site and driveway grades.
2. Final location of any soil stockpiles, storage areas (including equipment, fuel, lubricants and waste storage) and temporary roads designated for use during the construction period.
3. Plans of all drainage features, paved areas, retaining walls, cribbing, planting, temporary or permanent soil erosion control measures, or other features to be constructed in connection with, or as a part of, the proposed work. The drainage area of land tributary to the site in general, and isolated areas of disturbance, if applicable, should be shown. Tributary areas to all existing or proposed drain inlets should also be shown. All erosion measures should be depicted using the standard map symbols shown in Figure 13-1.
4. Design/detail drawings for any practices or measures not referenced in these Criteria should be included.
5. The following note shall be included on the Erosion Control Details:
6. "These Erosion & Control Details have been submitted to the City of Greeley in fulfillment of the City Criteria. Additional erosion and sediment control measures may be needed if unforeseen problems occur or if the submitted plan does not function as intended. The requirements of this plan shall run with the land and be the obligation of the land owner until such time as the plan is properly completed, modified, or voided. Note: These Erosion & Sediment Control Details in and of themselves do not fulfill the requirements of the Colorado Department of Public Health: Stormwater Construction Permit for a Stormwater Management Plan(SWMP)"
7. A signature block shall be placed below the note. The landowner and/or their legal agent shall affix their signature beneath the above note to acknowledge their review

and acceptance of responsibility. The Professional Engineer responsible for the preparation of the Erosion Control Plan shall also affix their signature and seal.

13.5 REVIEW AND APPROVAL

The City must issue a written approval or signed plans of the Erosion Control Plan prior to the issuance of a grading permit, subdivision plat approval, or site plan approval. The Erosion Control Plan must be consistent with the Drainage Report submitted in accordance with the City of Greeley Criteria. The Drainage Report and Erosion Control Plan can be combined in one submittal package. Approval of the Erosion Control Plan does not imply acceptance or approval of Drainage Plans, Utility Plans, Street Plans or any other aspect of site development.

13.6 SECURITY

The landowner shall establish a security in the form of a performance bond, letter of credit, or escrow account. The value of the surety or other financial arrangement shall be calculated based on the cost to permanently stabilize the proposed disturbed area. Permanent stabilization shall consist of installation of irrigation system and seeding and establishment of native vegetative cover. A minimum of a two-year establishment period shall be used. No monies will be refunded until a certified Agronomist has verified that 85% of the vegetation is established.

The City shall release the surety or bonding requirement after permanent stabilization for all areas of the site have been achieved and accepted by a Certified Agronomist. If permanent stabilization on the site includes re-vegetated areas, the surety or bonding requirements shall be released after acceptance of the established vegetation by a Certified Agronomist and the City, but no earlier than two year after initial planting. The Agronomist shall submit a letter of approval verifying that 85% of the vegetation is established.

13.7 EXEMPTIONS AND VARIANCES

A variance request should be included with, or submitted prior to, the initial Stormwater Management Plan submittal. Variances may be granted at the time of plan submission or request for plan revision. Variances must be requested in accordance with the subdivision regulations and must define:

1. The criteria from which the applicant seeks a variance.
2. The justification for not complying with the criteria.
3. Alternate criteria or measures to be used in lieu of these Criteria. The practices specified within these Criteria relate to the application of specific erosion and sediment control practices. Other practices or modifications to specified practices may be used if approved by the City of Greeley prior to installation. Such practices must be thoroughly described and detailed to the satisfaction of the City.

RECOMMENDED PLAN SYMBOLS:

EXISTING CONTOUR

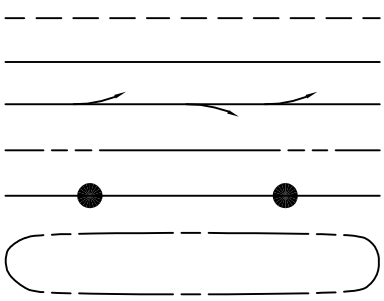
FINISHED CONTOUR

DRAINAGE DIVIDE

LIMIT OF GRADING

STORMWATER

BOUNDARY OF A CONTROL MEASURE



TITLE	KEY	SYMBOL
VEHICLE TRACKING CONTROL WITH WASH RACK	WR	WR
MULCHING	MU	MU
TACKIFIER	T	T
SURFACE ROUGHENING	SR	SR
TEMPORARY SEEDING	TS	TS
PERMANENT SEEDING	PS	PS
CONSTRUCTION ROAD STABILIZATION	CRS	CRS
WATTLE	W	
SILT FENCE	SF	X X X X

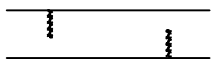
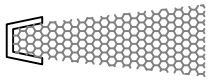
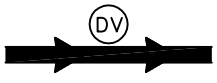
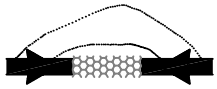
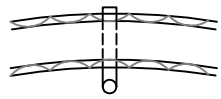
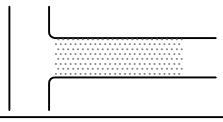
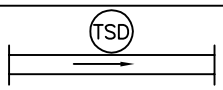
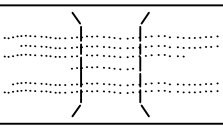
City of Greeley Colorado
Great. From the Ground Up.

MAP SYMBOLS

FIGURE 13-1

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED JUNE 2008

TITLE	KEY	SYMBOL
STORMWATER INLET PROTECTION	IP	
TEMPORARY DIVERSION DIKE	DD	
ROUGH CUT STREET CONTROL	RCS	
OUTLET PROTECTION	OP	
TEMPORARY CHANNEL DIVERSION	DV	
CHECK DAM	CD	
TEMPORARY SEDIMENT TRAP	ST	
TEMPORARY SEDIMENT BASIN	SB	
VEHICLE TRACKING CONTROL	VTC	
TEMPORARY SLOPE DRAIN	TSD	
TEMPORARY STREAM CROSSING	SC	

City of Greeley Colorado
Great. From the Ground Up.

MAP SYMBOLS

FIGURE 13-1 (CONTINUED)

PUBLIC WORKS DEPARTMENT
STORMWATER MANAGEMENT DIVISION
1001 NINTH AVENUE GREELEY, COLORADO 80631

SCALE: NTS
REVISED MARCH 2007