

CITY OF DELTA
STORMWATER MANAGEMENT MANUAL

SUBMITTED TO:

CITY OF DELTA
360 MAIN STREET
DELTA, COLORADO 81416

April, 2004

SUBMITTED BY:

RHINO ENGINEERING, INC.
1334 UTE AVENUE
GRAND JUNCTION, COLORADO 81501

CITY OF DELTA
STORMWATER MANAGEMENT MANUAL

APRIL 2004

TABLE OF CONTENTS

PREFACE	4
ACKNOWLEDGEMENTS	5
SECTION 1.0 GENERAL PROVISIONS	6
SECTION 2.0 STORMWATER POLICY	7
Purpose	7
Stormwater Law	7
Floodplain Administration	7
Irrigation Facilities	8
Qualitative Conformance to Policy	9
Major Drainage System	9
Grading and Drainage Plans	10
Master Drainage Plans	10
SECTION 3.0 STORMWATER LAW	11
Introduction	11
Law of Watercourses and Surface Water	11
Local Agency Control	12
Water Pollution Control	14
Local Requirements	15
Legal Aspects	15
SECTION 4.0 STORMWATER PLANNING	16
Master Plans	16
Project Planning	16
Multiple Use Facilities	17
SECTION 5.0 STORMWATER DESIGN CONSIDERATIONS	18
Purpose	18
Regulations	18
SECTION 6.0 STORMWATER DESIGN CRITERIA	22
Drainage Report Preparation	22
Elements of a Drainage Report	23
Drainage Report Submittal Checklist (2 pages)	29
SECTION 7.0 STORMWATER MANAGEMENT PLANNING	31
Regulations	31
Stormwater Pollution Prevention Plan	32
Erosion and Sediment Control, Stabilization, and Revegetation	32

PREFACE

The City of Delta Stormwater Management Manual was prepared to provide direction and guidance for the proper management of stormwater as it affects existing and future developments within the incorporated limits of the City of Delta.

Upon adoption of the Stormwater Management Manual, the City of Delta's City Council and Planning Commission is better able to enforce sound stormwater drainage principles. In addition, the manual also provides a consolidation of existing hydrologic and hydraulic technical information for the Public Works staff to review and/or prepare stormwater drainage plans and reports. Stormwater consultants will also use this manual as they prepare drainage design for new developments.

This manual is comprised of two parts. The first part deals with stormwater policy, law, and planning, drainage ordinances, drainage design considerations, and stormwater quality. This part will interest all parties involved with stormwater management, from planning concept to design, and finally through the planning approval processes.

The second part deals specifically with technical information. It deals with estimating peak runoff flows, stormwater facilities design, hydraulic analysis, and best management practices. This section is especially important to Public Works personnel and consultants preparing drainage designs and solutions for future projects within the City of Delta.

ACKNOWLEDGEMENTS

This stormwater management manual was prepared from many existing stormwater management manuals. The manual is a consolidation of many stormwater management policies, drainage criteria, and technical information from different municipalities that are currently in use, and then tailored to the special needs and conditions within the City of Delta.

Special recognition should be extended to the existing Mesa County and the City of Grand Junction Stormwater Management Manual (SWMM) and its preparers/reviewers. This manual was adopted by Mesa County and City of Grand Junction in 1996 and is currently in use at the time of this manual's preparation. It is one of the most thorough storm water management manuals within the State of Colorado. Much of the material within the above manual is derived from Maricopa County's (Arizona) stormwater drainage guidelines. Maricopa County has a forerunner in stormwater management for years. The preparer of the City of Delta's Stormwater Management Manual is also familiar with Maricopa County's drainage criteria from past professional assignments.

Numerous other contributors and references also comprise this manual and these contributors are listed in the Bibliography.

SECTION 1.0 GENERAL PROVISIONS

The City Council of Delta adopted and approved the City of Delta Stormwater Management Manual at a regular public meeting held May 18th, 2004. The City of Delta's Stormwater Management Manual will provide guidance, direction, and authority to enforce stormwater management issues within the City of Delta.

The Stormwater Management Manual shall apply to all developments that may result in a change in the existing stormwater runoff. Changes in the runoff quantity, quality, or characteristics within the City of Delta shall be addressed for new and existing developments, infrastructure improvements that will become the property of the City of Delta, and to systems that the City of Delta manages or maintains.

The Public Works Department and the Community Development Department of the City of Delta has the responsibility to enforce the provisions of the Stormwater Management Manual. If criteria contained within the Stormwater Management Manual conflict with any existing City ordinances, policies, or manuals, the provision in the ordinance, policy, or manual that has the latest adoption date shall take precedence.

Over time, amendments and/or revisions will likely be necessary to update current law, policy, or technical direction. The City Manager or Designee has the administrative authority to make any changes or revisions that may become necessary.

SECTION 2.0 STORMWATER POLICY

Purpose

The purpose of policy regarding storm water runoff and its regulation is to provide a standard which encourages sound drainage practices that may maintain, if not improve, the quality of life to the public, and protect them from detrimental stormwater impacts that could potentially occur due to development.

Stormwater Law

State and federal laws have been enacted for the purpose of providing general guidelines for stormwater regulation. City of Delta policy does not conflict with these laws, but uses them as the basis for establishing a more complete and tailored local policy. Stormwater law is discussed in more detail in Section 3.0, and is briefly summarized below:

Quantity - Property owners shall not be unwillingly subjected to damages or inconvenience due to an increased runoff caused by others that is over and above existing or historic conditions.

Quality - Property owners shall not be unwillingly subjected to damages or inconvenience to a decrease in stormwater quality caused by others that is worse than existing or historic conditions.

Location and Form of Discharge - Property owners shall not be unwillingly subjected to damages or inconvenience due to a changed location or form of discharge onto their property.

Floodplain Administration

Stormwater regulations and floodplain regulations are interrelated. Generally, changes in stormwater regulations may affect existing (designated) floodplains. Floodplain administration is briefly summarized below.

Delineation - 100-year floodplains that have been mapped by Federal Emergency Management Agency (FEMA) or a Flood Insurance Study (FIS), shall be shown on drainage maps that accompany a drainage report for all proposed developments. Other 100-year floodwater surface limits (elevations and/or extent), as determined by previous analyses and considered to be valid, shall also be shown on drainage maps that accompany a drainage report.

Finish Floor Elevation - Finish floor elevations must be at or above the 100-year flood elevation.

Encroachment and Fill – Although there are circumstances where encroachment and/or fill into a floodplain may be acceptable, such would not be the normal situation. All development activities must meet Article III Administration of Chapter 15.56 Flood Damage Prevention of the City of Delta Ordinances. Development permits must be obtained prior to any construction or development within any area of special flood hazard.

Applications for encroachment and fill must meet all of the following applicable requirements:

- In urban areas, proposed changes will not raise the 100-year water surface elevations to areas outside of existing or proposed tracts or easements dedicated for drainage or detention/retention purposes;
- Proposed changes will not raise 100-year water surface levels in violation of finish floor freeboard requirements specified above;
- Proposed changes will not result in an increase of more than 1.0 foot of the floodway;
- Proposed changes will not adversely affect existing drainage facilities that would likely have an adverse impact on other property owners;
- Proposed changes must be shown to have merit over other possible alternatives, including the no encroachment alternative;
- Proof of the above by way of an engineered drainage report (and signed by a licensed Professional Engineer in the State of Colorado) which must be submitted; and,
- Governmental review by appropriate agencies must agree with the provided proof, and approve the proposed changes.

Floodproofing – In order to be eligible for federal flood insurance, structures must have finish floor freeboard as specified above. There may be times, particularly with an existing building for which insurance is sought, when it would be more desirable to floodproof the building. Floodproofing processes are explained in Army Corps of Engineers and FEMA literature.

Permits – A floodplain permit must be obtained prior to commencing with floodplain fill and/or encroachment, and prior to approval of floodproofing. Also, an Army Corps of Engineers 404 permit may be required if fill or dredging within wetlands is proposed. Possible coordination is also likely with the US Fish and Wildlife Service. It is the responsibility of the petitioner to coordinate with all parties/agencies.

Irrigation Facilities

Stormwater Conveyance - Historically, irrigation ditches and pipelines have intercepted stormwater runoff from rural and agricultural areas. Urbanization has resulted in an increased runoff rate and quantity that irrigation facilities typically cannot handle nor expect to handle. It is reasonable to assume that design storms occur during use of the irrigation season and therefore little, if any, capacity is available for stormwater.

Therefore, ditches and irrigation conveyance facilities shall be assumed to be full with no additional capacity for stormwater. This assumption should coincide with hydrologic assumptions used for predicting peak discharges in master plans and site-specific drainage reports.

Current policy with the existing ditch companies delivering irrigation water within the incorporate limits of the City of Delta state that runoff from new developments cannot be discharged into any irrigation delivery system. Should such a situation occur or circumstance dictate a direct discharge into an irrigation conveyance, written authorization and approval must come from the respective Board of Directors of the subject canal company.

Stormwater Detention - Irrigation ponds and reservoirs cannot be assumed to provide stormwater detention unless:

- They were originally designed for stormwater detention; or
- Analysis shows that they are adequate for stormwater detention and permission is granted from the irrigation company that has jurisdiction over the subject canal/ditch.

Stormwater Discharge - As a general rule, stormwater may **not** be discharged into irrigation facilities. The only exception is where water rights require it or an agreement exists from the owner of the irrigation facility to receive the storm runoff. In the case where no irrigation company exists, permission from all users of the water downstream of the discharge will be required. In either case, an engineered analysis must be provided showing adequacy of the receiving facility to handle the discharge stormwater. In addition, written authorization and approval must come from the respective Board of Directors of the canal company.

Qualitative Conformance to Policy – The quality of stormwater leaving the site may not be diminished due to development. Various means may be used to conform to this policy, which includes the following:

Best Management Practices (BMPs) – There are many practices which may and shall be implemented that help mitigate development impact on water quality, especially during construction of the project.

NPDES Permit – All construction activity, which disturbs one (1) acre of surface area, requires an NPDES permit. This permitting is discussed in detail in Section 7.0 Stormwater Management Planning.

Detention/Retention – These facilities are generally intended for stormwater quantity conformance, but their use may also improve water quality.

Grease and Sand Traps – Some land uses produce significant amounts of hydrocarbons or grit/sand-sized materials that should be removed before discharging to downstream drainage systems.

Major Drainage System – Whenever possible, natural channels and existing watercourses shall be preserved, maintained, or improved to have the 100-year storm runoff capacity. They may be dedicated as drainage easements. Watercourses that are dedicated shall have 100-year water surface elevations that meet minimum finish floor plus freeboard requirements addressed earlier.

Special consideration shall be given for large watercourses to preserve riparian habitat and vegetation, plus possible open space/greenbelt with pedestrian uses.

Grading and Drainage Plans – Grading and Drainage Plans are required for all site development projects to insure that adequate consideration has been given to stormwater drainage issues. Roadways must properly drain with minimum slopes.

Master Drainage Plans – Although development may occur in several phases (or filings), surface drainage does not. If a site is to be developed in more than one phase, a preliminary drainage report is required for the entire development. The preliminary drainage report must address stormwater for all phases and how management of the stormwater will be achieved. Then a Final Drainage Report is required for each phase prior to development. It may be required, depending on the area and the nature of development, that a final drainage report is required at the initial phase.

Preliminary and Final Drainage Reports must conform to any Master Drainage Plans that have been prepared and approved for the area.

SECTION 3.0 STORMWATER LAW

Introduction

This section presents an overview of legal concerns and issues and does not cover all situations and variations that may govern actions, potential duties, and liabilities of a particular agency or individual. The advice and opinion of competent legal counsel should be obtained when applying general legal principals to a specific area or project.

It is essential that hydrologists and engineers work within the prevailing legal framework. Such cooperation makes it possible to implement plans and minimize potential liability. Awareness of federal, state, and local requirements, the common law and statutory schemes and objectives articulated in regulations, drainage planning, design, and implementation criteria will foster effective and efficient programming.

This chapter presents a general discussion of important aspects of stormwater law. Key features of City of Delta stormwater management ordinances are featured as well.

Law of Watercourses and Surface Waters

Basic Distinction

A basic distinction exists between surface waters and waters in a watercourse. A watercourse is defined as a channel with a defined bed and banks. The law of watercourses also includes lakes, ponds, marshes and swamps. Surface water, on the other hand, is diffused water running over land to a watercourse or defined channel. The law of watercourses, also governs flood water that overflows the banks of a watercourse and follows the course of a stream. The law of surface waters, however, governs flood waters that entirely lose connection with a lake or stream, spread out over the adjoining countryside and settle in low places. While the distinction is clear in the law, the physical distinction of when a depression or gully qualifies as a watercourse, or when floodwater has left the watercourse never to return, may not be nearly as clear. Liability has and has not been found based on such distinctions.

Law of Watercourses

Watercourse law is based on the rights and duties of riparian property owners---that is, owners of land along the banks of a river, stream, drainage way, or lake. A riparian owner must reasonably exercise his rights so as not to interfere unnecessarily with the corresponding rights of others.

The general rule is that a riparian owner does not have the right to construct an embankment or dike to protect his land from ordinary floods if, in doing so, he causes damage to the lands of others. Some courts have stated this rule is slightly different but consistent terms. A riparian owner has the right to protect his land, but only if in exercising that right, no damage is caused to other riparian lands.

Law of Surface Waters

There are three basic legal doctrines regarding surface waters. These are 1) the common enemy rule and 2) the civil law rule. The third doctrine has evolved in recent years and is called the reasonable use rule. Colorado follows a modified civil law rule.

Under the civil law rule, the upper landowner has an implied easement for the natural drainage from his property over the lower property and the lower landowner must receive such water. The upper land is the dominant estate; the lower land is the servient estate. The key to the rule is that the drainage must be natural; meaning those waters that flowed from the land before alteration or development. Under the modified rule, the owner of upper lands has an implied easement over lower lands for drainage of surface waters, and in fact natural drainage conditions can be altered by an upper proprietor provided the water is not conveyed in a manner or quantity to do more harm than formerly.

It follows from the rule that the point and nature of discharge onto lower property may not normally be changed without the approval of the affected lower landowner(s) and that peak discharge generally may not be increased, except that there may be instances where it is determined that augmented flows would not tax the watercourse beyond its capacity and cause flooding of lower lands.

Violation of the modified common enemy or civil law rules creates liability (for a discharger) without showing of negligence. There are recognized defenses to the strict liability of drainage law. These defenses include proving that the flood which caused the damage was an act of God, that there was an intervening act of a third party which the defendant had no reason to anticipate, or that the damage was the plaintiff's own fault.

Local Agency Control

Stormwater Management

Local governments bear the greatest responsibility for stormwater management. They can best determine the community needs and approaches through local regulation. Local governments, however, are constrained by their resources and the powers permitted them.

Enabling legislation authorizes various legal methods for managing stormwaters. Zoning ordinances and subdivision regulations are the most important methods available to local governments, followed by building regulations and building codes. Stormwater management may also be carried out by drainage districts, local governments having "home rule" powers, such as the City of Delta and by government agencies having authority to regulate floodplains.

Stormwater Detention/Retention

Ordinances adopted for requiring and regulating detention/retention storage of excess runoff on land development sites or a drainage fee (if and when a drainage fee is implemented within the City of Delta) may fall into one or several of the following categories: subdivision regulations, zoning ordinances, building codes, environmental control ordinances, plumbing and sewer ordinances, and general police powers expressed in resolutions or ordinances adopted by local governing bodies.

Storage Facility Maintenance

Stormwater detention/retention basins are engineered facilities provided for the purpose of controlling stormwater quantity and/or quality. It follows that in order for private development to remain in conformance with public policy, required detention/retention basins must be maintained and function as intended by design. Private and public agencies must maintain their respective basins and outfall works and structures.

Continuance of Facilities

Detention/retention facilities which are constructed as required by public policy must be maintained and must also have continuance; that is, the facilities shall not be removed, bypassed, or otherwise be made or rendered ineffective, unless approval is received from the public entity which originally required the basin.

Facility Failures and Property Damages

Although not a settled legal position, the general trend is that if failure of a drainage facility is caused by faulty design, the facility owner would likely be liable for damages. If, however, the failure were caused by factors other than faulty design, such as a rainstorm event larger than that specified in local design requirements, the disaster would fall into the category of an act of God. In that case, the owner of the stormwater detention facility probably would not be liable if the court determining a specific case adopts past decisions not finding liability in such circumstances.

Flooding From a Stormwater Storage Facility

It may happen that the detention/retention of stormwater runoff may intrude onto the land of others. Liability for damages in such situations is then dependent on whether or not the design, construction, or operation of the facility was faulty or whether damages resulted because of other factors such as an extremely intense rainfall. Usually, the amount of a judgment will be based upon the incremental increased damage caused by the drainage system.

Safety Features

One of the big questions facing public officials contemplating the construction of detention/retention facilities is the potential safety hazard that the facility may present, especially to children. There is a natural concern that a stormwater detention pond could be considered an attractive nuisance. If found to be an attractive nuisance, the facility owner might be held liable for any harm to humans. Safety features may be required as part of the approval process.

Water Impoundment

Laws governing water rights can be of importance with respect to detention/retention storage in arid and semiarid regions, or in places that practice irrigation.

Drainage Fee

In addition to or in lieu of detention/retention basins, stormwater utilities similar to water and sewer utilities and/or drainage impact fees may be utilized to fund drainage projects which may include collection, conveyance, outfall, or detention/retention facilities. The City of Delta has **not** adopted a Drainage Fee that allows, under acceptable conditions, payment of a fee in lieu of providing on-site detention/retention facilities. As municipal infrastructure improvements advance, drainage fees may become an option.

Flood Hazard Delineation

Applications for a floodplain permit and Grading and Draining Plans shall show the delineation of all Flood Insurance Studies (FIS) and other designated 100-year floodplain limits that are not within a designated drainage tract or easement.

Flood Hazard Regulation

Flood hazard legislation and regulation restricts both private and public lands. The public policy served by such legislation is the allocation of flood-prone lands to their most appropriate uses. Private and public landowners can and do unnecessarily burden other landowners and the public by improper use of flood-influenced lands. Flood hazard regulations are only one of many devices – such as dams, levees, floodproofing, flood insurance and tax adjustment – which may be used in a floodplain management program to reduce damages from flooding. Because such programs often involve the use of engineered structures, legal constraints, and other complicated techniques, the lawyer and the engineer have important complementary roles to play in the design of effective floodplain management programs.

Water Pollution Control

Federal Law

On November 16, 1990, the EPA issued regulations on the control of stormwater from municipal and industrial stormwater discharges. The National Pollutant Discharge Elimination System (NPDES) and includes stormwater management and discharge requirements and regulations, and is a part of the Federal Clean Water Act. The Stormwater Management regulation was developed to reduce the amount of pollutants entering streams, lakes and rivers as a result of runoff from residential, commercial and industrial areas. Regulations are found in 40 CFR 122.26, and are industry specific. Storm sewer regulations are, as of the date of this section, presently applicable only to municipalities with over 100,000 population. Industrial stormwater permits, however, are required within Counties that have a total population greater than 100,000. There are also regulations regarding runoff from construction sites where surface areas are disturbed. Section 7.0 has additional information on stormwater regulations.

State Law

In Colorado, the Water Quality Control Division of the Colorado Department of Health and Environment (CDPHE), formerly the Colorado Department of Health (CDH) regulates the NPDES stormwater program. The Colorado program may be referred to as the Colorado Discharge Permit System, or CDPS, instead of NPDES. The CDH program of CDPS has been approved by the EPA to be in conformance with federal regulations and is authorized by the EPA and administered by CDH. Water quality discharge permitting has become a state requirement as of October 1, 1992 for all regulated activities, including: certain light and heavy industry; metal, sand, gravel, and coal mining; and for construction activity where disturbed surface areas involve or will involve more than five acres for a project. A project is defined as encompassing the total parts, phases, or filing of a development. As part of the Phase II stormwater permitting process, construction activity that disturbs more than one acre requires a CDPS permit.

Local Requirements

Development and construction activity must proceed in such a way that state and federal stormwater management laws are upheld. Dust and erosion control must be provided as a minimum among other water quality control measures. The City is not an enforcer of CDPS or NPDES regulations for CDH or the EPA, so consultation with the CDH/EPA is advised. Developers/contractors must submit a copy of the permit to the City upon final approval.

Legal Aspects

Legal Complaints

Legal problems in urban stormwater management often arise as a result of some action by a land developer, builder, public agency, or individual. Difficulties usually involve changes in natural drainage flows, flood stages, topography, vegetative cover, and environmental quality concerns including quality of natural or man-made water bodies. Complaints may relate to specific issues, such as public agency requirements for temporary storage of excess runoff, responsibility for maintenance of drainage facilities, liability for failure of facilities, property damage, injuries and loss of life, soil erosion and sedimentation, depreciation of the value of property, and many other issues.

Caution

This chapter provides a broad overview of the legal aspects, problems, trends, and issues of drainage/stormwater law. The topic is too broad and the application of legal principles too fact dependent for the foregoing information to be exclusively relied upon. Many more questions could be raised. The advice and opinion of competent legal counsel should be obtained when applying general legal principles to a specific area or project.

SECTION 4.0 STORMWATER PLANNING

Master Plans

Development usually occurs with consideration of many variables, including location, land cost, traffic accessibility, and available utilities. However, the drainage component is often overlooked. Ignoring drainage as a component of the overall system results in undesirable conditions, thereby causing potential amenities to be aesthetic, functional, and maintenance liabilities. Drainage issues should not be an afterthought but as an essential part to the entire urban system, and thus should be considered throughout the planning process.

Comprehensive Approach

Master planning at various levels, including community, neighborhood, and subdivision, is important to insure that drainage issues are not overlooked, but are properly addressed. Issues to be considered include soils, topography, and vegetation; onsite and upstream drainage and water quality; transportation and parking; utilities; irrigation; easements; cultural, archaeological, and historical sites; parks and recreation; wildlife and environment; schools; and other public and community services and facilities.

Drainage Basins

When master planning for drainage, the entire drainage area (watershed basin) must be included. Natural drainage ways should be preserved and capable of conveying 100-year storm runoff from the upstream drainage area. Additionally, any proposed changes within the drainage area should not adversely impact downstream properties. This planning concept and other considerations of stormwater law covered in Section 3.0 limit the ability to cause transfers of stormwater from one drainage basin to another.

Land Use Planning

Land use, densities and site layout of development should accommodate drainage rather than encroach upon existing drainage ways. Wetlands, natural channels, and adjacent floodplain areas not only receive and convey runoff, but also store stormwater runoff as well. Therefore, natural drainage features should be considered as nature's natural easements. When development occurs, these areas ought to be designated as drainage easements whenever possible.

Project Planning

The emphasis of project drainage planning should be on preserving natural waterways and artificial channels, incorporating other drainage facilities into the design, and working with the topography of the land rather than force-fitting a drainage system upon a pre-determined layout of development. Filling, straightening, and narrowing drainage ways generally causes or intensifies problems, and should be avoided.

Project planning shall involve all phases and filings of a proposed development. Otherwise, "quilt patchwork" designs occur, which generally results in reduced quality and level of service to property owners. With this approach, drainage problems are not foreseen or occur until full build out occurs. At this point, field corrective measures are generally very expensive.

Preliminary layout of the drainage system, which consists of streets, channels, and storm sewers, may result in significant savings and improved drainage. For example, the longer storm runoff can be kept from concentrating in one street (i.e., increasing the time of concentration), the less extensive may be the resultant storm sewer system.

Multiple Use Facilities

Facilities that can be cooperatively used for more than one purpose are usually more cost-effective.

Drainage ways may be incorporated into greenbelt/open space tracts and made a part of a larger trail system for pedestrians. Where properly planned and designed, such facilities provide an amenity to adjacent properties and landowners while maintaining riparian areas, improving water conveyance capacities, and providing maintenance accesses along the channels.

Detention basins are very adaptable to multi-use facilities. With proper planning, design, and construction, these may be used for year-around activities, thereby maximizing use of space and minimizing capital cost of facilities. Even maintenance costs for multiple-use facilities are usually much less than for separate single purpose facilities. A detention basin that is dry between runoff events can be used for field sports and other recreational activities. Wet ponds may be developed for aesthetically pleasing settings and for irrigation water storage.

It may be difficult to finance or receive approval of costly recreational facilities, but when a portion of the capital improvement costs are shared with drainage facility costs, otherwise unacceptable projects may be possible.

SECTION 5.0 STORMWATER DRAINAGE ORDINANCES

In order to manage and administrate stormwater activity for the City of Delta, stormwater policy (Section 2.0), plus appropriate design criteria and guidelines (procedures) must be adopted. This section outlines drainage ordinances. Section 6.0 addresses drainage design criteria.

Purpose

The purpose of stormwater drainage ordinances is to establish requirements and regulations for stormwater management pertaining to the use and development of land within the City of Delta incorporated limits. The ordinances will minimize the occurrence of losses, hazards, and conditions adversely affecting the public health, safety, and general welfare, as a result of flooding caused by the surface runoff of rainfall.

Regulations

Prohibited Development

A development is prohibited if it would create hazards to life or property by increasing the potential for flooding either on the property to be developed, adjacent property, or to any other property.

A water course may not be altered. Alteration within the meaning of this section includes, but is not limited to, encroachments, fill, new construction, substantial improvements to existing developments, and other construction within a water course, unless a Professional Engineer licensed in the State of Colorado certifies that the alterations do not increase the flood levels, and will not increase flooding hazards within, upstream, or downstream of the altered portion of the water course. Stormwater law requirements identified in Section 2.0 must be met.

Development requirements to be met for permit issuance.

Prior to issuance of a permit by the City of Delta for development on private property or for work in the public right-of-ways, the applicant shall furnish the Public Works Department and the City project review manager information as required in Section 6.0 to determine that all proposed building sites will be reasonably safe from flooding. The applicant shall supply sufficient data to enable the city staff to determine that the proposed work will comply with subparagraph (1) and (2) of this section. Reports, construction plans, and other data submitted in support of an application for a permit shall comply with the following criteria.

- (1) *Drainage reports.* When a drainage report is required, it must be prepared and sealed by a registered civil engineer in the State of Colorado. It must be prepared in accordance with the criteria established by the city. The purpose of the report is to analyze the effect that a proposed development will have on the runoff in the vicinity of the development, to provide data to insure that the development will minimize any flooding potential, and to provide data supporting the design of facilities to be constructed for the management of runoff. Each drainage report must consider rainfall runoff from storms with a return frequency up to and including the one hundred year storm. The complexity of the report depends upon the nature of the development and the site where the development will occur. A drainage report shall be submitted by an applicant requesting one of the following:

- a. Approval of a subdivision plat, condominium, townhouse, or a land split.
 - b. A permit for grading, unless the Public Works Department waives the requirement.
 - c. A permit to construct right-of-way improvements.
 - d. A permit to construct any structure, except a single-family residential structure outside of the 100-year floodplain or where the Public Works Department has determined will not be in the vicinity of a water course where runoff might be hazardous to the structure or its occupants.
- (2) *Drainage characteristics.* Runoff of all return frequencies shall enter and depart from the property (post development) in substantially the same manner as under pre-development (existing) conditions. Any proposals to modify drainage characteristics must be fully justified by engineering data, which shall demonstrate to the Public Works Department that hazards to life and property will not be increased by the proposed modifications. As a minimum, drainage and flood control easements will be dedicated to the city to the extent of the estimated one-hundred year flood for all water courses having a capacity of fifty (50) cubic feet per second or greater, and the development shall be responsible for the maintenance of the water course. Exceptions to this regulation include environmentally sensitive lands and other areas covered by master drainage plans, council stipulations or other provisions of this section that insure that the standards established by this section are met.
- (3) *Streets as water carriers.* It is expected that streets (with curb and gutter) will carry water from adjacent property and from local areas, but they are not to be used as major water carriers in lieu of natural washes or man-made channels. The maximum depth for water flowing in any street shall be eight (8) inches during the peak runoff from a 100-year frequency storm. The 8-inch depth shall be measured at the gutter flowline. The above requirements imply that water may flow deeper than a normal vertical curb height over a short distance, but the flow shall always be confined to the public right-of-way or to drainage easements. Particular care must be exercised in street sag locations to insure that these requirements are met. Catch basins, drain troughs (scuppers), or similar facilities must be provided at appropriate locations to remove water flowing in the streets so as not to exceed the above described depth limit.
- (4) *Design procedures and criteria.* The design procedures and criteria to be used shall be in accordance with those prepared and published by the City of Delta. They are described in Section 7.0 Stormwater Design Criteria.

(5) *Stormwater storage facilities.*

- (a) Except as noted below, development of all land within the city must include provisions for the management of stormwater runoff. This management shall consist of constructing stormwater storage facilities, including detention and retention basins. Stormwater storage facilities will reduce peak rates of outlet flow from the developed property onto downstream property in comparison to the natural conditions with no development (pre-development). As a minimum, all developments will make provisions to store runoff for the difference between the pre and post development conditions, up to and including the 100-year storm. If a suitable outlet for a detention basin is not available, or if engineering analysis indicates that available outlet systems would be overtaxed by a detention basin outflow, a retention basin shall be constructed in lieu of a detention basin.

The requirement for the construction of a detention/retention system may be waived in the following situations:

1. The runoff has been included in a storage facility at another location.
2. The application is for a building permit to construct a single-family residential structure. This situation depends upon existing drainage conditions and approval is at the discretion of the Public Works Department.
3. Development is adjacent to a water course drainage that has been determined by the project review manager (using engineering analysis provided by the development) to handle the additional runoff without increasing the potential for flood damage on any other downstream property. Should this occur, the development may be required to pay a drainage fee to the City of Delta in lieu of detention/retention. **At the present time, a drainage fee option is not in place.**
4. Residential development of a parcel under one-half acre where it can be demonstrated by engineering analysis that no significant increase in the potential for flood damages will be created by the development.
5. Unless approved by the City of Delta, no site shall discharge at a rate that exceeds the historic stormwater discharge rate.

If the storage requirement is waived, the development shall be required to contribute to the cost of drainage improvements on the basis of runoff contribution.

- b. Stormwater storage facilities shall be designed and constructed according to the procedures and criteria established by the City of Delta as follows:
 - 1. The area to be used to estimate development storage requirements includes the entire proposed development, including streets, easements, and right-of-ways.
 - 2. Where possible, storage facilities are to be located so the facility can intercept the flow from the entire development.
 - 3. If portions of the area cannot drain to a primary storage facility, then additional facilities will be added for these areas as approved by the project review manager.
 - 4. No stormwater storage facility shall detain or retain standing water longer than 48 hours unless the facility was constructed as a permanent body of water.
- c. Stormwater storage facilities, other than retention, are to be drained by either a controlled bleed-off release or a discharge pump system.

(5) *Finished floor elevations.* All determinations for finished floor elevations of residential and commercial structures shall comply with stormwater policy addressed earlier and per guidelines and regulations set forth in Section 2.0.

All structures proposed within the 100-year floodplain must have finished floor elevations certified by a professional registered engineer in the State of Colorado.

- (6) *Special consideration in environmentally sensitive areas.* (Environmentally sensitive areas are defined by the Public Works Department).
- (a) Existing water courses with a capacity of fifty (50) cubic feet per second or greater shall be maintained in their natural state unless it is determined that alterations are required to meet other provisions of this ordinance.
 - (b) A drainage easement will be dedicated to the city that encompasses the area required to convey the 100-year base flood in the water course.
 - (c) Stormwater storage facilities may not be required in areas zoned for environmentally sensitive development if the city staff determines that such facilities can not be constructed without conflicting with the city's environmentally sensitive lands ordinance requirements. If onsite storm water storage facilities requirements are waived, the development may be required to contribute to the cost of drainage works on the basis of runoff contribution at another point on the affected system.
 - (d) All drainage structures and detention facilities shall be constructed in such a manner as to minimize the impact on the natural environment, and shall be revegetated to be compatible with nearby natural areas.

- (6) *Conformance with state laws.* No construction within the limits outlined in these ordinances shall be permitted which would violate prevailing water law of the State of Colorado, whether statutory or by the courts of the state.

SECTION 6.0 STORMWATER DESIGN CONSIDERATIONS

This section describes the City's design considerations concerning hydrologic and hydraulic analysis procedures to be used in the City of Delta for the planning and design of stormwater management and the preparation of accompanying drainage reports. The drainage report must include enough information for the City's Public Works Department staff to fully evaluate the applicability of the methods, data, and results/conclusions.

Hydrology is a discipline that includes *both* technical competence *and* experience and good judgement. The City of Delta does not warrant or guarantee the reliability of the hydrologic methods or techniques described in Part II (the appendices). The user of the following design criteria is expected to validate the reasonableness of the predicted values by applying alternative methods or other appropriate checks as necessary.

Drainage Report Preparation

The City of Delta requires a drainage report for the following specific reasons:

- to document the effect of a proposed project on future stormwater runoff within the project boundaries and also in the vicinity of the project,
- to provide data to insure that the project design will be protected from the 100-year design storm; and
- to provide data to support the design of proposed facilities for the management of stormwater runoff.

Each drainage report must consider runoff from storms with a return frequency up to and including the 100-year storm. Analysis must include, as a minimum, the 5-year and 100-year design storm frequencies. The complexity of the report depends upon the nature of the project and the site on which the project will occur.

A drainage report must be prepared by a qualified professional drainage designer and sealed by a professional Civil Engineer registered in the State of Colorado. The design and drainage report must be prepared in accordance with the City's current Storm Water Policy and the Storm Water Drainage Ordinances described in Sections 2 and 5, respectively.

An applicant requesting one of the following actions shall submit a drainage report to the City of Delta:

- ❖ Approval of a subdivision plat (preliminary and final).
- ❖ A permit for grading, unless Public Works Department staff waives the requirement.
- ❖ A permit to construct any structure in the 100-year floodplain, designated as Zone A of the FEMA Flood Hazard Boundary Map.
- ❖ Zoning case approval, unless Public Works Department staff waives the requirement.

The purpose of the drainage report is to document that stormwater runoff has been considered in the planning of the project *and* the public and its property will be protected from damage by runoff flows and flooding. The requirement for this protection applies not only to those who will own and/or use the proposed project, but also to those who own or occupy property adjacent or near (upstream or downstream) the proposed project.

Elements of a Drainage Report

There are six elements of a drainage report that will normally be addressed to demonstrate that stormwater runoff has been evaluated and runoff will be properly managed by the project. There will be situations when one or more of these elements would not be applicable. Likewise, there may be special projects requiring analysis or information beyond these elements. The six elements are described in the following paragraphs and are interrelated.

Description of the Property and the Watershed(s)

Each drainage report must have a section that includes a narrative, topographic maps, and aerial photographs (where possible) that describe the location and condition of the property the proposed development occurs (onsite conditions) and the upstream (offsite) watersheds, as well as any downstream constraints which affect the property.

Onsite Conditions: An essential part of each report is a topographic map showing the location of the project area. As a minimum, the USGS 7.5-minute topographic must be used as a base map. The map must show the location of the property with respect to the adjacent streets. The narrative description should include the following basic information about the property:

- Description of existing drainage patterns including natural and manmade channels and drainage boundaries on the property.
- Description of the existing ground cover or other surface conditions and the identification of the NRCS hydrologic soil group(s).
- Description of how the existing development on the property affects drainage.
- Description of how existing and/or proposed developments on adjacent properties affect drainage on the project area.

Offsite Drainage Conditions: Watersheds upstream of the project that stormwater runoff enters or affects the project's property must be delineated on topographic map(s). This map(s) should be prepared at a scale that will clearly show the drainage areas for watershed boundaries can be drawn with accuracy.

The narrative description should include the following items:

- Existing upstream and downstream drainage patterns on the watersheds.
- The natural ground cover and the NRCS hydrologic soil group(s).
- Existing development on the watersheds and how this affects drainage.
- The location and type of development that exist on the watersheds if the land was developed in accordance with the current Land Use Plan for the City of Delta.
- Any condition that would significantly affect the way the runoff from the watershed would be analyzed.

Estimation of Stormwater Runoff

The report must provide estimates for the 5-year and 100-year (and any other design storm events Public Works Department requests) storm return frequencies of peak stormwater runoff rates at concentration points entering and leaving the property, plus offsite watershed areas. Peak runoff rates must be determined for the pre-development (existing) condition and the post development conditions. It is generally assumed that the existing condition is the pre-development condition. There may be instances that these two conditions, however, may not be the same.

Estimation of the Effects of the Project

The report must show how stormwater runoff will be handled when the project has been completed and how the project will affect stormwater runoff.

Depicting Pre- and Post-Project Topography: Before development, topographic conditions exist that influence and direct the flow of drainage on the property and entering the property. After the project development is completed, topographic changes occur that influence new drainage flows. It is necessary that the drainage report address the changes in the topographic conditions to demonstrate the effects of the project. This information should be depicted on contour maps. In addition to showing the developer's property, the map should also show adjacent properties to provide sufficient detail if the proposed development would affect offsite drainage. Information about adjacent property includes such items as significant differences in elevation, walls, drainage structures, and buildings with finished floor elevations.

Pre- and Post-Project Stormwater Runoff: The amount of stormwater runoff that exits the project before and after development must be depicted for the 5-year and 100-year design storm. If drainage flows will be reduced by facilities such as retention or detention basins, the effect of these facilities should be described on appropriate maps. Construction of roads, parking areas, roofs, channels, and other project features generally increases the runoff volume and peak discharge and reduces the time of concentration.

Presentation of the Basis for Design of Facilities to Manage Runoff

This presentation includes a summary of the selected design criteria, as well as a brief description of the design approach and methods used for analysis. The sketches, data, and calculations supporting the selection of materials, the locations, and design of facilities should be included in the appendix of the drainage report.

Presentation of the Basis for Selecting Elevations for the Lowest Floor

Elevations must be selected to provide protection from flooding. The basis for the selection of a floor elevation or the design of protection for the interior of the building must be presented.

Description of the Provisions for Project Phasing

Any project may have stormwater runoff, flooding, and erosion problems during the construction phases that may not exist after the project is completed. The report must indicate how the phasing will occur, what interim drainage problems are anticipated, and what action is recommended to alleviate these problems.

A recommended outline for the drainage study to discuss the six elements includes the following format:

Preliminary (and Final) Drainage Report Contents

All reports shall be typed on 8½” x 11” paper and bound. The drawings, figures, design calculations, and tables shall be bound with the report. The report shall include a cover letter presenting the preliminary (or final) design for review and shall be prepared or supervised by an engineer licensed in the State of Colorado. The report shall contain a certification sheet as follows:

“I hereby certify that this report for the preliminary (final) drainage design of NAME OF DEVELOPMENT was prepared by me or under my direct supervision.”

Registered Professional Engineer
State of Colorado, Number _____
(Affix Seal)

The preliminary (or final) drainage report shall be in accordance with the following outline and contain the applicable information listed.

- I. Location and description of property
 - A. Property location
 - 1. City, county, and local streets within and adjacent to the development
 - 2. Township, range, section, and quarter section
 - 3. Names of surrounding developments
 - 4. Parcel tax identification number
 - B. Description of property
 - 1. Area in acres
 - 2. Ground cover type(s)
 - 3. Soil type(s)
 - 4. Irrigation facilities

- II. Drainage basins and sub-basins location and evaluation
 - A. Major basin description
 - 1. Reference to existing major drainage way studies
 - 2. Show 100-year floodplain, if known and reference study
 - 3. Major basin drainage characteristics
 - 4. Identification of all nearby and contributing irrigation facilities within 100 feet of the property boundary, which will influence or be influenced by the local drainage
 - B. Sub-basin description
 - 1. Historic drainage patterns of the property being developed
 - 2. Offsite drainage flow patterns and impact on development

- III. Drainage basin criteria
 - A. Regulations: Optional criteria selected or the deviation from the manual, if any
 - B. Development criteria reference and constraints
 - 1. Previous drainage studies that influence or are influenced by the drainage design and how the plan will affect drainage design for the site
 - 2. Drainage impact of site constraints such as streets, utilities, existing structures, and development or site plan

- C. Hydrological criteria (narrative)
 1. Design rainfall
 2. Runoff calculation method
 3. Detention discharge and storage calculation method
 4. Justification of other criteria or calculations methods used that are not presented in or referenced in the manual
 - D. Hydraulic criteria, discussion and method reference
 1. Capacity references
 2. Detention outlet type
 3. Check drop (energy dissipater) criteria
 4. Other drainage facility design criteria used as presented in the manual
- IV. Drainage facility design
- A. General concept (narrative)
 1. Concept and typical drainage patterns
 2. Compliance with offsite runoff considerations
 3. Existing and proposed drainage patterns
 4. Content of tables, charts, figures, or drawings presented in the report
 - B. Specific details (narrative)
 1. Drainage problems encountered and solutions proposed
 2. Detention storage and outlet configuration
 3. Maintenance access
 4. Ownership and maintenance responsibility (signed maintenance agreement if applicable)
- V. Conclusions
- A. Compliance with standards
 - B. Drainage concept
 1. Effectiveness of drainage design to control damage from storm runoff
 2. Has post-development peak discharge control been provided
 - C. Hydrologic impact of proposed project, including summary of results
 - D. Impact mitigation plans
- VI. References
- Reference all criteria, master plans, and technical criteria used in support of the site plan.
- VII. Appendices
- A. Hydrologic calculation summary
 1. List of assumptions for entire drainage basin being studied
 2. 5-year and 100-year storm runoff at concentration points entering and leaving the site under study
 3. Historic and developed runoff calculations at design points
 4. Hydrographs at critical design points
 5. Example calculations, if appropriate
 - B. Hydraulic calculations summary
 1. Culvert capacities
 2. Storm sewer capacity
 3. Street capacity
 4. Storm inlet capacity
 5. Hydraulic grade line determination
 6. Open channel design

7. Check or channel drop design
8. Erosion control design due to excessive flow velocity
9. Detention area/volume capacity and outlet capacity calculations

Preliminary (or final) Drainage Plan Drawing Contents

Sheet 1 General Location Map

This drawing shall be provided in sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns. The map should be at a minimum scale of 1" = 1000 feet to 1" = 2000 feet and show the path of all drainage from the upper end of any offsite basins to a defined downstream major drainage way. The map shall identify any major construction proposed and the entire path of drainage.

Sheet 2 Drainage Plan (existing and proposed conditions should be separate maps)

Drawing(s) of the proposed development at a scale of 1" = 20' to 1" = 200' on a 24" x 36" sheet shall be included. This plan(s) shall show the following:

1. Existing topographic contours at 1 or 2-foot intervals. In terrain where the slope exceeds 15%, the maximum contour interval is 10 feet.
2. Location of benchmarks and benchmark information.
3. Property lines and easements with purposed noted.
4. Existing and proposed streets, names, and grades.
5. Existing drainage facilities and structures, including irrigation ditches, roadside ditches, drainage ways, gutter flow directions, and culverts. All pertinent information such as material, size, shape, slope, and location shall be included.
6. Existing and proposed overall drainage area boundary showing drainage sub-area boundaries, including soil types, time of concentration paths and slopes, and ground cover type.
7. Proposed type of gutter, roadside ditch, gutter flow directions, and cross pans.
8. Proposed storm sewers and open drainage ways, including inlets, manholes, culverts, and other appurtenances.
9. Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
10. Routing and accumulation of flows at various critical points for the 5-year and 100-year storm runoff.
11. Details of detention storage facilities and outlet works.
12. Location and elevations of all defined floodplains affecting the property.
13. Location and elevations of all existing and proposed utilities affected by or affecting the drainage design.
14. Routing of offsite drainage flow through the development.
15. These shall be signed, sealed, and dated by a professional engineer registered in the State of Colorado.

Final Drainage Report

The purpose of the final drainage report is to update the plans in order to address review agency comments of the preliminary drainage report. The final drainage report is to be prepared and submitted in the same format as detailed above for the preliminary drainage report.

Record Drawings (As-Constructed)

Record drawings showing the as-constructed improvements are required for all public improvements. These shall be signed, sealed, and dated by a professional engineer registered in the State of Colorado. These drawings are to be submitted to the review agency before the improvements are accepted and any securities being held are released.

A drainage report submittal checklist is shown on the following page.

DRAINAGE REPORT SUBMITTAL CHECKLIST

REVIEWED BY: _____ DATE: _____

The drainage report for the development as noted below has been reviewed and found to lack the information noted. This information must be submitted before the report will be accepted for review. Please provide the required information and return the checklist with your next submittal.

DEVELOPMENT: _____

LOCATION: _____

SUBMITTED BY: FIRM: _____

CONTACT: _____ PHONE: _____

SUBMITTED DATE: (1) _____ (2) _____ (3) _____

DATE APPROVED: _____

DESCRIPTION	RECEIVED OR NOT APPLICABLE	NEEDED TO BE SUBMITTED
1. Typed, Bound Report	_____	_____
2. Professional Engineer's Seal and Signature	_____	_____
3. General Location and Description	_____	_____
a) Location map	_____	_____
b) Existing site description	_____	_____
c) Description of existing drainage patterns and facilities	_____	_____
4. Drainage Basin and Sub-basins	_____	_____
a) Major basin description	_____	_____
b) Sub-basin description	_____	_____
5. Design Criteria	_____	_____
a) Development master plan discussion	_____	_____
b) Hydrologic criteria discussion	_____	_____
c) Hydraulic criteria discussion	_____	_____
d) Summary of results	_____	_____
Q _{5h} Q _{100h}	_____	_____
Q _{5d} Q _{100d}	_____	_____
6. Drainage Facility Design	_____	_____
a) Proposed facilities discussion	_____	_____
b) Drainage pattern discussion	_____	_____
c) Impact on offsite facilities	_____	_____
d) Impact on master plan	_____	_____
7. Drainage Plan	_____	_____

- a) Existing and proposed contours _____
- b) Property lines and easements _____
- c) Delineation of drainage basins _____
- d) Existing drainage basins and facilities _____
- e) Proposed drainage patterns and facilities _____
- f) Proposed outfall points _____
- g) Routing of offsite drainage _____
- 8. Detention/Retention Pond _____
- a) Minimum 2% slopes across bottom (grass) _____
 1% slopes (asphalt) or 0.5% (concrete) _____
- b) Minimum 1 foot freeboard above 100-year _____
- c) Maximum 4:1 side slopes unless special _____
 engineered walls, etc. _____
- d) Minimum 3 foot offset from all tract lines _____
- e) Maximum 48 hours to drain _____
- f) Safety compliance _____
- 9. Other requirements _____
- a) _____
- b) _____
- c) _____
- d) _____
- e) _____

SECTION 7.0 STORMWATER MANAGEMENT PLANNING

Regulations

In 1970, the U.S. Environmental Protection Agency (EPA) was formed and quickly began efforts to reduce pollutant discharges to streams. The Federal Water Pollution Control Act Amendments (FWPCA) mandated an improved permit program in 1972. Title IV of the FWPCA Amendments established the National Pollutant Discharge Elimination System (NPDES). The first NPDES permits regulated direct discharges from non-municipal industrial facilities.

In 1977, the FWPCA was amended again. This revision, formally known as the Clean Water Act (CWA), established discharge limits for 65 priority pollutants and extended permit requirements to municipal wastewater treatment facilities. The Clean Water Act of 1987 further expanded the NPDES program to include non-point source discharges, such as *stormwater runoff*. The permitting of the stormwater discharges was to be implemented in two phases. Phase I, promulgated in 1990, required NPDES permits from stormwater discharges from certain industrial categories, large construction sites (more than five acres of land disturbance), and storm sewer systems of medium and large municipalities (populations exceeding 100,000).

As of October 1, 1992, the National Pollutant Discharge Elimination System (NPDES) General Permit for stormwater discharges requires all owners/operators of construction projects disturbing five or more acres to prepare a Storm Water Pollution Prevention Plan (SWPPP) and file a Notice of Intent (NOI). The NOI must be sent to the US Environmental Protection Agency with a copy to the corresponding municipality within 48 hours before construction begins. The municipality must have evidence of this permit before a development permit will be issued. The goal of the NPDES stormwater permit for construction activities is to reduce the erosion potential, minimize sedimentation, and to eliminate non-stormwater discharges for construction sites.

Phase II, published in 1999, increased the regulated industrial categories and required permitting of small construction sites (between one and five acres of disturbance) and storm sewer systems of small municipalities (populations exceeding 10,000).

The NPDES permitting authority is delegated to states having water quality management and pollution control programs approved by the EPA. When a state does not have an approved program, the authority remains at the federal level with EPA. Colorado does have such programs in place and therefore has the permitting authority.

Discharges of Stormwater from Construction Sites

As stated above, construction sites with more than one acre of soil disturbance must be permitted by NPDES. Unlike other permit types, requirements for small construction sites (between one and five acres of disturbance) are not detailed in the NPDES regulations so the permit issuing authority selects the permit requirements.

Operators of construction activities are required to prepare and follow a stormwater pollution prevention plan and install best management practices to control sediment, petroleum, and other pollutants. Monthly monitoring of runoff or receiving waters may also be required along with the preparation of monthly reports.

Stormwater Pollution Prevention Plan

Part of the permitting process requires a Stormwater Pollution Prevention Plan (SWPPP). An SWPPP requires a site description of a construction project along with identifying and implementing BMPs to reduce pollutants in stormwater discharges. In order to achieve these goals, a brief summary of requirements for an SWPPP is presented below. More detailed information can be found in the EPA (1998) publication.

Site Description

- Type of construction activity
- Sequence of construction activities
- Estimates of total area being impacted
- Estimates of the site's runoff coefficient
- Site map
- Description of nonconstruction-related discharges
- Names of receiving waters
- Information on endangered and threatened species

Controls to Reduce Pollutants

- Goals and criteria of erosion and sediment control
- Structural practices - methods that reduce suspended particles in runoff waters
- Non structural practices - methods that reduce erosion
- Stormwater management measures
 - During construction
 - After construction
- Other controls
- State and local controls
- Maintenance
- Inspections
- Nonstormwater discharges
- Additional requirements
- Contractors and subcontractors

A website that also significant information about Phase II permitting is www.cdphe.state.co.us/wq/permits and contains the required permit forms. Another website with Phase II stormwater permitting is <http://cfpub.epa.gov/npdes/stormwater/swphase2>. This website also contains considerable information about watershed management and water resources.

Erosion and Sediment Control, Stabilization, and Revegetation

At the discretion of the Public Works Department, a development plan shall include plans for erosion and sediment control, including slope stabilization and revegetation. Public Works Department shall base any decision to require such plans on the size and slope of the subject property, the amount of soil and vegetation to be disturbed, the extent to which natural topography will be altered and the likelihood of adverse impacts on neighboring properties and on the community as a whole.

Plan for Erosion and Sediment Control

The plan for erosion and sediment control shall be designed to insure:

- That natural drainage patterns are preserved and protected from increased water flows over natural vegetation and soil cover.
- That natural drainage patterns are preserved and protected from increased water flows that may otherwise tend to alter such pattern or subject existing channels and adjacent areas to increased erosion.
- That appropriate consideration of soil types is made in the design of cuts and fills, building sites, septic tanks, and other land uses.
- That structures are provided as necessary to prevent or minimize sedimentation of rivers, streams and drainage structures.

The following practices shall be incorporated into the plan for erosion and sediment control:

- Keep cut and fill operations to a minimum so as to create the least erosion potential.
- Retain and protect natural vegetation whenever feasible.
- Minimize the exposed ground area and the duration of exposure.
- Protect exposed critical areas with temporary vegetation and/or mulching during development.
- Trap sediment in runoff water by use of debris basins, sediment basins, silt traps or similar measures until the disturbed area is stabilized.
- Prevent surface water from damaging cut and fill slopes.
- Locate cuts and fills so as not to endanger adjoining property.
- Avoid fills on natural water courses or constructed channels.
- Develop the grading plan so that water is not diverted onto the property of another landowner unless a written agreement allowing such drainage is received from the other landowner.
- Exercise measures for dust control during earthwork operations.

Slope Stabilization and Revegetation

The plan for slope stabilization shall be designed to insure:

- That adequate provision is made for revegetation and soil stabilization during and after development of the site.
- That all cuts and fills are adequately designed, engineered, and vegetated to control erosion as well as stability of the entire mass.

The following practices shall be incorporated into the plan for slope stabilization and revegetation:

- Stabilize disturbed soils as quickly as practicable.
- Establish and install permanent vegetation and structural erosion control measures as soon as practicable.
- Where cut and fill slopes are to be stabilized with vegetation, design the cut and fill to 3:1 grade or flatter.
- Place and compact fills so as to minimize sliding or erosion of soil and to provide a stable surface for establishment of vegetation.
- Stockpile topsoil and reuse it after final site grading on slopes and other critical areas to be stabilized with vegetation.

Much literature is available to assist in the development of erosion and sediment control plans. One reference that is very useful from Colorado is “Designing for Effective Sediment and Erosion Control on Construction Sites” by Jerald S. Fifield, Ph.D., CPESC, Forester Communications, 2001.

Several websites that contain additional information are www.stormwatercenter.net and <http://cfpub.epa.gov/npdes/stormwater/swphase2>.