CITY OF REDDING

STORM WATER QUALITY IMPROVEMENT PLAN

Submitted To:
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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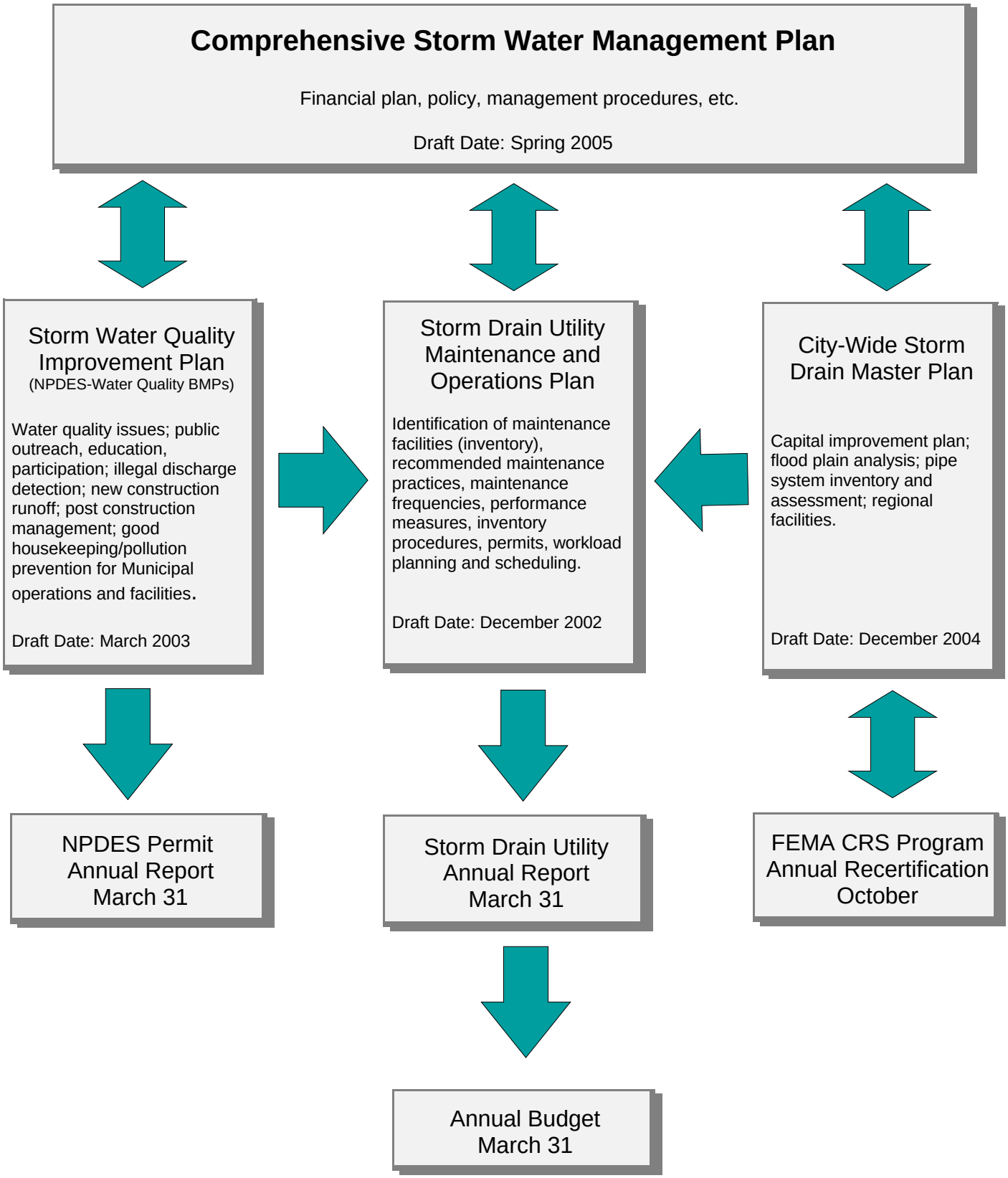
Section 1
Introduction

This document presents the City of Redding Storm Water Quality Improvement Plan (SWQIP) section of the City of Redding Comprehensive Storm Water Management Plan. The Comprehensive Storm Water Management Plan also includes the Storm Drain Utility Maintenance and Operations Plan and the City-Wide Storm Drain Master Plan. Figure 1-1 presents the relationship of the various elements of the City of Redding Comprehensive Storm Water Management Plan. The Storm Water Quality Improvement Plan provides a comprehensive plan that will outline and direct the City of Redding storm water quality improvement priorities and activities necessary to meet regulatory requirements for the years 2003-2008. It has components that may overlap and that are currently or will be integrated into the Storm Drain Maintenance and Master Storm Water Drainage sections of the Storm Water Management Plan as those components develop. This plan is a dynamic tool expected to change over time with assessment of effectiveness of various components, improvements in available technology, or changes in regulatory environment. It is expected that by the year 2008 changes in this plan may result in a vastly different document than the one presented herein.

Table 1-1
Comprehensive Storm Water Management Plan Sections

Title	Function
Storm Water Quality Improvement Plan	Improve water quality pursuant to requirements of the Clean Water Act and Porter Cologne Act
Storm Drain Utility Operations and Maintenance Plan	Provide direction for maintenance of the City Storm Drain system and provide support for Permits from California Department of Fish and Game and U.S. Army Corps of Engineers.
Storm Drain Master Plan	Identify capital improvements necessary to provide flood protection through efficient conveyance of storm water within the City.
Additional Plans with components assisting and complementing these efforts	
City of Redding General Plan	
Subdivision, Zoning and Floodplain Ordinance	
Building Codes	
Other Health and Safety Codes	

Figure 1-1
Comprehensive Storm Water Management Plan Structure



1-1 Setting

The City of Redding is located in Shasta County in Northern California. It is approximately 100 miles south of the Oregon border and 160 miles north of Sacramento. Redding's population in 1999 was approximately 78,000, which makes Redding the largest City in Shasta County and the largest City in California north of Sacramento. Redding also serves as the county seat of Shasta County. Figure 1-2 shows the City of Redding limits and location in California.

Redding is situated at the far north end of the Sacramento Valley at the point where the valley meets the foothills of the Cascade mountain range. Redding is surrounded by mountains to the west, north, and east. The most distinctive geographical feature in the area is the Sacramento River, which flows through the City in a general north-south direction. Several creeks also run through the Planning Area from the west and east. These creeks function as tributaries to the Sacramento River. Some have carved gullies and ravines with depths of up to 200 feet, mainly in the western part of the Planning Area.

The climate in the northern portion of the Sacramento Valley is characterized by hot, dry summers and moderately cool, wet winters. Average annual rainfall in Redding is approximately 40 inches. Redding usually experiences the majority of storm events from early November through early April. Snowfall is infrequent, seldom lasting more than 24 hours. Winds are predominantly from the northwest or the southeast, are gentle, with velocities over 16 miles per hour occurring only five percent of the time. Summer temperatures rise above 100 degrees an average of 39 days per year, but discomfort is alleviated by relatively low humidity. In winter, temperatures fall below freezing an average of 27 days, from November through March. Peak rainfall intensity for a one-hour duration reaches approximately 2.5 inches in a 100-year event. The intensity of rainfall in the area is elevation dependent and the most intense precipitation is the result of localized cloudburst activity.

Elevations range from about 400 feet in the lowlands adjoining the river near Anderson to over 1,100 feet on the hilltops in the western part of the City Limits. East of the river, land is generally flat, and is broken only by the courses of Churn, Clover, and Stillwater Creeks. The Churn Creek Bottom, lying between the river and Churn Creek, has excellent soils, but agriculture here has declined as large parcels have been split for rural home sites and small "weekend farmers" estates. East of Churn Creek, soils are generally poor for farming, although growing of strawberry plants is practical north of the Municipal Airport. West of the river, the flatter lands are suitable for cultivation, but here the pattern of urbanization is firmly set, and the few remaining farms merely constitute holding uses until the time the land is ripe for development.

With few exceptions, soils in the rest of the planning area are rocky with considerable amounts of red loam. Subsurface drainage is poor, and the land principally supports manzanita, scrub vegetation, and smaller trees. During the winter months much of the land is suitable for grazing.

The higher terrain along the western edge of the planning area is intersected by local creeks that have carved deep ravines and lesser gullies, ranging from a few feet to as much as 200 feet deep.

Oregon Gulch and Canyon Hollow are typical. Similar land forms are found north of the river in the Buckeye area. The steep side slopes of these ravines, many exceeding 30 percent, are undevelopable; but they have the potential of providing trail locations and visual open space that will become increasingly

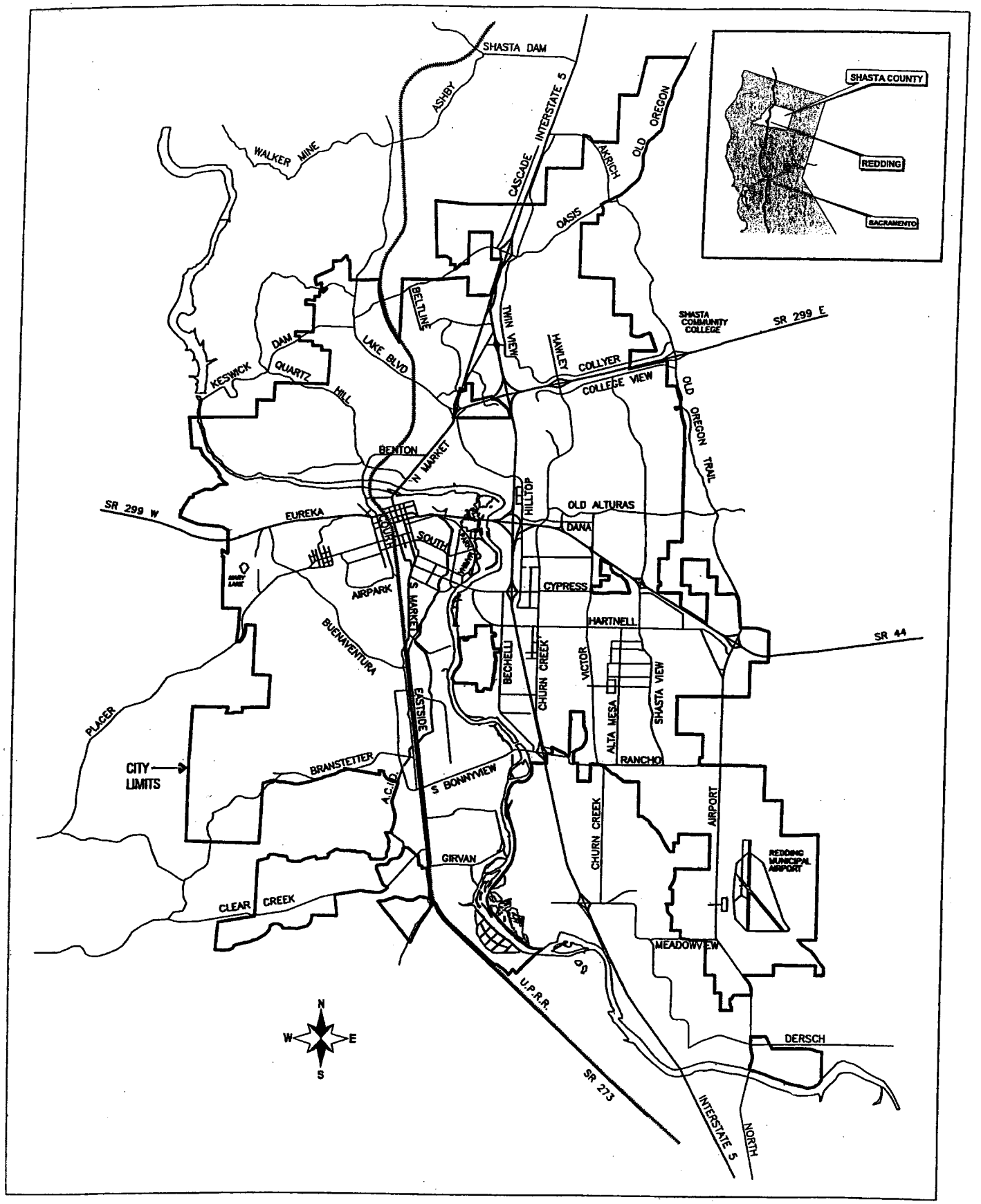
valuable as the area urbanizes. At the same time, the ravines tend to increase street and utility construction costs, and to foster a scattered development pattern that increases the cost of providing urban services.

Several quarrying and rock crushing operations have utilized gravel deposits along the Sacramento river in past years. Because of potential flooding, these lands are not suitable for development. Other low lying lands along the Sacramento River also are subject to flooding during infrequent periods of maximum water release from Shasta Dam.

The City's storm drain infrastructure currently includes approximately 130 miles of storm drain pipe, 174 miles of open channels, 5,230 catch basins and 45 detention basins. The City also has 431 miles of streets assisting in storm water drainage for approximately 33,000 residences, and 5,720 commercial and industrial businesses. The City has several programs that provide water quality protection including much of the Natural Resources Element of the General Plan, a grading ordinance that addresses erosion and sediment control, a rigorous floodplain management program addressing storm water peak-flow impacts and a storm drain maintenance plan that incorporates best management practices (BMPs).

The City's limits include 16 primary drainage basins ranging in size from 1.0 to 48.9 square miles and numerous smaller local tributaries to the Sacramento River. The types of streams range from flat series of ponds draining the east side of Redding (Clover Creek) to slot canyon creeks carved into the Sacramento River Bluffs north and east of the Redding Downtown area.

Figure 1-2: City of Redding Location Map



1-2 Plan Organization

Chapter 1: Introduction

This chapter contains a brief overview of the plan, its contents and approach. It also contains general information about the process of preparing the plan.

Chapter 2: Program History and Regulatory Setting

This chapter provides a brief history of the storm water quality program and measures already in place in the City of Redding and a summary of legislation, regulatory requirements and programs providing oversight and enforcement of the plan.

Chapter 3: Program Management

This chapter provides a detailed description of Program structure, staffing, and funding. It also includes information on the relationship of Program efforts to activities of Permittees; County agencies and departments; and regional, statewide, and national storm water initiatives.

Chapter 4: Receiving Water Description

This chapter provides a brief description of the water bodies that receive storm water drainage from the City's urban infrastructure. It also contains a listing of the primary drainage basins along with basic drainage basin characteristics.

Chapter 5: Program Element Implementation

This chapter presents the core elements of the City's Plan. A complete description of the Core Elements and minimum control measures they address is provided. The Core Elements are Community Teamwork and Partnership, Illicit Discharge Detection and Elimination, New Development, Pollution Prevention and Good Housekeeping for Municipal Operations and Industrial Discharge. Element-specific activities, BMPs, and effectiveness and performance measures are identified. This chapter will contain tentative schedules and milestones for accomplishing the outlined tasks for the five year period beginning March 10, 2003. Annual Work Plans based on the tentative schedule will be prepared to further refine and prioritize activities and allocate resources.

Chapter 6: Program Evaluation and Reporting

This chapter provides the conceptual approach to Plan effectiveness evaluation. Evaluation activities are a required and important aspect of the Plan; conducting assessments and obtaining feedback allow for continued improvement of Plan activities, including modification of existing activities and allocate funds and staff resources. This chapter also outlines the process for preparation and contents of the annual report.

Appendices

A City Storm Drain System Maps

B Annual Departmental Work Plans (when developed and available)

C City of Redding Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit Notice of Intent (when completed and available)

D City of Redding Storm Water Ordinance (if and when completed and available)

E City of Redding Grading Ordinance

F City of Redding Floodplain Ordinance

G City of Redding Storm Drain Utility Operations and Maintenance Plan

H General Plan Natural Resources Element Excerpt

I Future Storm Drain Master Plan (as developed)

1-3 Plan Development and Assessment Process

This Plan contains approaches and guidance for activities, Best Management Practices (BMPs), and effectiveness evaluation for the permit term. The approved Plan will be in effect until it is replaced or updated in the future. This Plan serves to provide organization general description of activities and approach to effectiveness evaluation. Annual Work Plans will provide the specific activities and effectiveness evaluations to be accomplished for each fiscal year, based on the direction and targets for the Plan.

The effort to prepare the Plan started in July 2001 with research and training of staff, collecting written materials and copies of storm water management plans and other Phase 1 permit materials. A local area storm water task force was formed for all agencies in the contiguous urban area to discuss and formulate strategy. Meetings and workshops were attended on a regional and State level to learn about other programs and share information and plan approaches.

In February 2002 the City determined that due to time constraints it would file for participation in the General Permit independently of the adjacent, contiguous urban area governments. City staff will continue to work with the other urban area governments towards a common approach and plan, with the intent to revisit the area-wide permit option in the future.

Activities to obtain input included:

- Conducting meetings with the Regional Board and other urban area government representatives
- Announcing availability of the Plan
- Holding a workshop on the Plan
- Addressing comments and revision of plan as appropriate

The intent of the City is to have a current, relevant, and adaptive Plan and participate in the State of California General NPDES Small MS4 Storm Water Discharge Permit. In order to remain proactive and effective, the Plan should reflect the most recent information and needs. The Plan will continue to evolve and improve through evaluations and feedback from various sources and activities. Input from regulators and the public throughout the permit term can be used to modify specific portions of the Plan. Effectiveness evaluations and Annual Progress Reports are also used to facilitate review and adjustments to the Plan.

This Plan will be used to ensure that program activities stay on target. The Plan will be revised as needed to adjust to future needs. As a living document, modification may be made directly to the Plan or through the Annual Work Plans, subject to Regional Board approval. These work plans will be prepared yearly to meet long-term objectives and to represent the next year of implementation. The Annual Progress Reports include the detailed, prioritized Annual Work Plans. When an Annual Work Plan is accepted by the Regional Board, the document may provide additional specific tasks, priorities, and short-term schedules for the program and becomes a part of or an extension of the Plan.

1-4 Acronyms and Terms as Used in this Document

The definitions below are intended strictly for clarification purposes, and may not contain the full legal definition as per regulation.

Annual Report. A yearly report to the CRWQCB on the permittee's compliance with the permit requirements, including an accounting of progress made towards each of the permittee's measurable goals.

BMPs. Best Management Practices - physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of storm water.

City. City of Redding.

CORMC. City of Redding Municipal Code.

CORMUD. City of Redding Municipal Utilities Department.

CORDSD. City of Redding Development Services Department.

CRWQCB. California Regional Water Quality Control Board.

CFR. Code of Federal Regulations.

CRS. Community Rating System used by FEMA to determine the level of protection offered through ordinance and policy to the residents of a municipality.

CSMP. Comprehensive Storm Water Management Plan.

CWRCB. California Water Resources Control Board - the statewide version of the Regional Water Quality Control Board a division of the California Environmental Protection Agency.

EPA. United States Environmental Protection Agency.

FEMA. Federal Emergency Management Agency.

HOA. Homeowners' Association.

Measurable Goals. A municipality's Storm Water Program goals, which are intended to gage permit compliance and program effectiveness.

MEP. Maximum Extent Practicable - the standard for evaluating permit compliance.

Minimum Measures. Storm water management programs that are required under the NPDES MS4 permit. They include public education and outreach, public participation and involvement, illicit discharge detection and elimination, construction site storm water runoff control, post-construction storm water management, and pollution prevention and good housekeeping for municipal operations.

MS4. Municipal Separate Storm Sewer System.

Municipality. A city, town, county, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes.

NPDES. National Pollutant Discharge Elimination System - Section 404 of the Federal Clean Water Act.

Permittee. The MS4 operator to whom the NPDES Storm Water Discharge Permit is issued.

Phase II. The second stage of the State and Federal storm water permit regulations.

Plan. The document providing organization, management activities, goals, strategy and direction for the activities associated with this effort.

Program. The entire storm water quality effort including:

SDMP. Storm Drain Master Plan

SDUOMP. Storm Drain Utility Operations and Maintenance Plan

SWQIP. Storm Water Quality Improvement Plan

Section 2
Program History and Regulatory Setting

2. PROGRAM HISTORY AND REGULATORY SETTING

2.1 Program History and Overview

The City of Redding Storm Water Quality Improvement program is comprised of various program elements and activities designed to reduce storm water pollution to the maximum extent practicable (MEP) and eliminate prohibited non-storm water discharges in accordance with Federal and State laws and regulations. These laws and regulations are implemented through National Pollutant Discharge Elimination System (NPDES) municipal, industrial and construction storm water discharge permits. In 1990, pursuant to the initial NPDES regulations, the City initiated coverage under the industrial and construction discharge permit process.

The City recognizes the importance of effective storm water management and has allocated resources to administer and implement the Program. Management and administration of the Program is provided by the Development Services Department Engineering Division along with all aspects associated with new development and construction site runoff control. However, the Municipal Utilities Department is responsible for streets, storm drain maintenance, and wastewater system maintenance activities. As such additional management resources have been dedicated to coordinate and manage efforts assigned to Municipal Utilities.

Since the City has numerous creeks and flood control facilities, much of the storm runoff within the City limits is already being managed in some type of detention facility prior to discharge to a major creek or the Sacramento River. Drainage facilities include gutters, swales, ditches, culverts, storm drain inlets, catch basins, storm drainage pipes, canals, detention basins, and pump stations.

The core elements of the Plan cover the following:

- Community Teamwork and Partnership which includes activities associated with the EPA's minimum control measures *Public Education and Outreach* and *Public Participation and Involvement*
- Illegal Discharge Detection and Elimination
- New Development which includes the activities associated with the EPA's minimum control measures *New Construction Runoff Control* and *Post-Construction Storm Water Management*
- Municipal Operations and Facilities
- Industrial Discharge Permitting

2-2 Regulatory Background

Phase I

The 1972 amendments to the federal Clean Water Act (CWA) prohibited the discharge of pollutants from point source to waters of the United States, unless the discharge was authorized by a permit issued under the NPDES permitting program. The 1987 amendments to the CWA added Section 402(p), which defined storm water discharges from certain defined municipal and industrial activities as point sources required to be permitted by a NPDES permit. The amendments directed the U.S. Environmental Protection Agency (EPA) to adopt regulations establishing permitting requirements for municipal and industrial storm water discharges. The amendments also required

storm water discharges from municipal separate storm sewer systems (known as MS4 systems) serving populations greater than 100,000 to obtain coverage under a national surface water permit program. In California, the federal NPDES permitting program is implemented through the Porter-Cologne Act, a part of the California Water Code, administered by the State Water Resources Control Board (State Board) and the Regional Water Quality Control Boards (Regional Boards).

The EPA promulgated the federal storm water regulations on November 16, 1990. These regulations, which were to be implemented in two phases, contained permitting application requirements and a schedule for phased implementation and permit issuance for municipalities and industries. Municipalities to be addressed in Phase I were defined in terms of size: (1) large for urbanized areas with populations greater than 250,000; (2) medium for urbanized areas with populations greater than 100,000; and (3) small for other municipalities with populations less than 100,000 that are designated by the permitting authority.

The regulations established a two-part municipal permit application process. The first part required the compilation and submittal of information about existing legal authorities and activities that address storm water quality. The second part required municipalities to develop and implement a comprehensive storm water management plan that described the BMPs to be implemented to reduce the discharge of pollutants in storm water runoff to the MEP. The plan would include descriptions of:

- BMP programs to address specific activities identified in the regulations such as illicit discharges.
- How implementation of the plan would be prioritized.
- Staff and equipment available to implement a program

Phase II

In 1999 the rules governing Phase II of the NPDES program were published extending the program to cover an extensive list of smaller urban areas and construction projects of one acre or more and those construction projects on or adjacent to sensitive areas. The City of Redding was specifically listed (automatically designated) by USEPA as a participant in Phase II.

Phase II requires that the City of Redding develop a Storm Water Management Plan to address specifically identified minimum control measures to address storm water pollution, submit a Notice of Intent (NOI) to participate in the statewide general permit and an annual permit fee by March 10th 2003. The contents of the storm water management plan follow much the same format as Phase I communities in terms of specifying BMPs, measurable goals and responsible parties, however, to a lesser level of detail and extent than required in Phase I.

2-3 Program History

This document represents the City's initial formal storm water quality improvement effort under the NPDES requirements. Some of the necessary components have already been established by practice and are part of other programs including General Plan Policy, Redding Municipal Code, Floodplain, Subdivision and Grading Ordinances.

2-4 The Current Plan

The Redding MS4 NOI, Storm Water Management Plan (this document), and permit fee are scheduled to be submitted to the Regional Board for the initial, implementation term in March 2003. Under the Plan, the City will continue with basic storm water management activities while expanding efforts

to evaluate and tackle the most significant water quality problems. The City will be instituting a larger structure for managing storm water runoff as outlined in Chapter 1: Introduction. This structure includes adequate legal authority and funding; standard procedures such as development review and spill response; methods to characterize and evaluate runoff and program performance; and an ongoing commitment to advance and contribute to storm water pollution prevention. This Plan builds upon the basic storm water management activities and shifts focus to reducing pollutants that are causing or may cause significant water quality impacts, referred to as "target pollutants."

Along with traditional Maximum Extent Practicable (MEP) storm water management techniques and core program elements, the City will utilize a watershed-based approach to identify the most controllable sources of pollutants and implement cost-effective control measures for the highest priority sources in major watersheds. The number and variety of creeks and watersheds in the City promotes this approach and allows encouragement of adoption of creeks by volunteer organizations as stewards. The watershed-based approach also allows incorporation of aquatic habitat protection and restoration to optimize resources and improvement of beneficial uses in urban creeks.

Other agencies within the City that have potential to impact the City pollution reduction efforts include:

- State of California - roads, facilities on the Sacramento River
- School Districts
- Shasta County - facilities and development of roads and infrastructure prior to annexation
- Union Pacific Railroad - North South Main Line

3. PROGRAM MANAGEMENT

3.1 Introduction

This chapter presents the City of Redding Storm Water Quality Improvement Plan strategy, vision, and mission; priorities and management activities for the 2003-2008; legal authority; organization; planning and reporting activities; and budget/staff resources.

3.2 Program Strategy

The 1987 amendments to the Clean Water Act added Section 402(p), which established National Pollutant Discharge Elimination System (NPDES) permit requirements for municipalities to develop and implement storm water management plans addressing specific water quality control measures. The storm water management plans were required to describe the best management practices (BMPs) to reduce the discharge of pollutants in storm water runoff to the maximum extent practicable (MEP). The MEP standard for municipal storm water management programs is also required by U.S. Environmental Protection Agency (EPA) Phase I storm water regulations promulgated on November 16, 1990 and the Phase II regulations.

CITY OF REDDING STRATEGY

Develop and implement programs to reduce or eliminate discharges of pollutants and non-storm water discharges entering the City storm drainage system to the maximum extent practicable, thereby protecting local receiving waters and complying with Federal and State laws and regulations.

This program reflects the following vision and mission statements:

VISION

Improve behaviors and attitudes that contribute to the reduction of urban runoff pollution and promote community stewardship of local creeks and rivers, thus improving the health of local waterways.

MISSION

Provide resources and direction toward achieving reduction of storm water pollution to the maximum extent practicable, elimination of non-storm water discharges in accordance with the City of Redding MS4 Permit, and ultimately, protection of beneficial uses, including meeting applicable water quality objectives.

This strategy is pursued through the implementation of the City's Storm Water Quality Improvement Plan. The Plan is a living document with periodic modifications to ensure that it is effectively carrying out activities to accomplish its mission. If it is determined that the Plan is not adequately addressing the general permit goals, minor modifications and additions will be identified in the Annual Work Plans, which are submitted to the Regional Water Quality Control Board, Central Valley Region (Regional Board) for review and approval.

Significant changes in the scope or direction of the Plan will be accomplished through a Plan revision or update process in accordance with the Regional Board procedures. Modifications to the Plan will generally be made in response to effectiveness evaluations and to incorporate new Best Management Practices (BMPs). It is important that the Plan reflects current and improved BMPs and includes activities that have been shown to be successful in other storm water programs.

BMPs will be selected and revised based on the following criteria:

- Pollutant Removal: Will the BMP address

the target pollutant?

- Regulatory Compliance: Is the BMP compatible with environmental regulation?
- Public Acceptance: Does the BMP have public acceptance?
- Implementation: Is the BMP compatible with land uses, facilities, or the activity in question?
- Technical Feasibility: Is the BMP technically feasible considering soils, geography, etc.?
- Cost Effectiveness: Is the cost for the BMP commensurate with the environmental benefit?
- Financial Feasibility: Does the BMP meet a reasonable cost/benefit ratio and are the funds available for implementation?

The City is committed to the continual expansion of the core elements of the Plan to further incorporate pollutant reduction activities. These strategies explore opportunities for participation in regional, State, and national efforts to address storm water pollution issues that are beyond the City's ability to control at the local level.

Implementing and expanding core program activities will require increasing program efficiency, utilizing experience from other programs, and participating in local and regional coordinated efforts.

It also requires sources of funding in an already restrictive tax climate.

3-3 Priorities and Management Activities

Plan priorities for 2003-2008 include implementing the Plan and achieving regulatory compliance. Staff will continue to develop, implement and improve activities to reduce storm water pollution to the MEP and eliminate prohibited non-storm water discharges, while facilitating understanding and involvement in storm water management by various City departments. Another high priority for staff will be to keep abreast of the latest technology and approaches to storm water management. Activities will also strive to encourage environmental stewardship and continue to build partnerships with other agencies and the community for active participation in accomplishing the Plan mission.

3-4 Legal Authority

Legal authority and responsibility to implement a municipal storm water management plan is provided in the Federal Clean Water Act (CWA), California Water Code, and associated regulations. The California Environmental Quality Act (CEQA) and Subdivision Map Act also provide municipalities with authority to establish conditions for development projects. This legislation, coupled with the City's local ordinances, provides sufficient legal authority to implement the Plan. The City's Grading Ordinance (Appendix E) and Floodplain Combining District Ordinance (Appendix F) will be provided, along with any future ordinance developed to support this program. In addition, sections of the General Plan specifically address water quality protection and enhancement in the Natural Resources Element, Goals NR1, NR3, and NR4 (Appendix H).

3-5 Plan Organization

The Plan is a storm water quality improvement program that includes the traditional core elements necessary to comply with Federal and State regulations. The core elements include Community Teamwork and Partnership, Illicit Discharge Detection and Elimination, New Development, Pollution Prevention/Good Housekeeping for Municipal Operations, and Industrial Discharge. The City seeks innovative, proactive activities to tackle the most significant local problems. Public education and resultant changes in behavior are necessary to bring about long-term

improvements to urban runoff quality and protection of the environment.

Another important aspect of the Plan is that each core element includes ongoing development in an interactive feedback process, resulting in a suite of activities tailored to meet Plan goals. It is important to strive to measure or assess the effectiveness of activities and BMPs, so they can meet current conditions and be improved as needed.

The City as a whole, including elected officials, department heads, and City employees, is responsible for compliance with the City MS4 Permit requirements and the Plan. The City owns a municipal separate storm sewer system. The Development Services Department is the City agency responsible for oversight of construction of the storm drain system and development review to ensure that public and private projects include the necessary control measures to address the storm water pollution concerns. The review process also ensures that construction projects have the necessary permits and that on-site regional control measures are considered for new development projects. Figure 3-5 shows City of Redding departmental organization.

The Municipal Utilities Department is the City agency responsible for maintenance of the storm drain system, illicit discharge detection and elimination, community teamwork and partnership, good housekeeping for municipal operations, and Industrial Discharge components of the program.

Both the Development Services and Municipal Utilities Departments have staff assigned to the various aspects of the program. Staff from several other City departments and regional agencies also provide significant levels of resource and support services to ensure successful implementation.

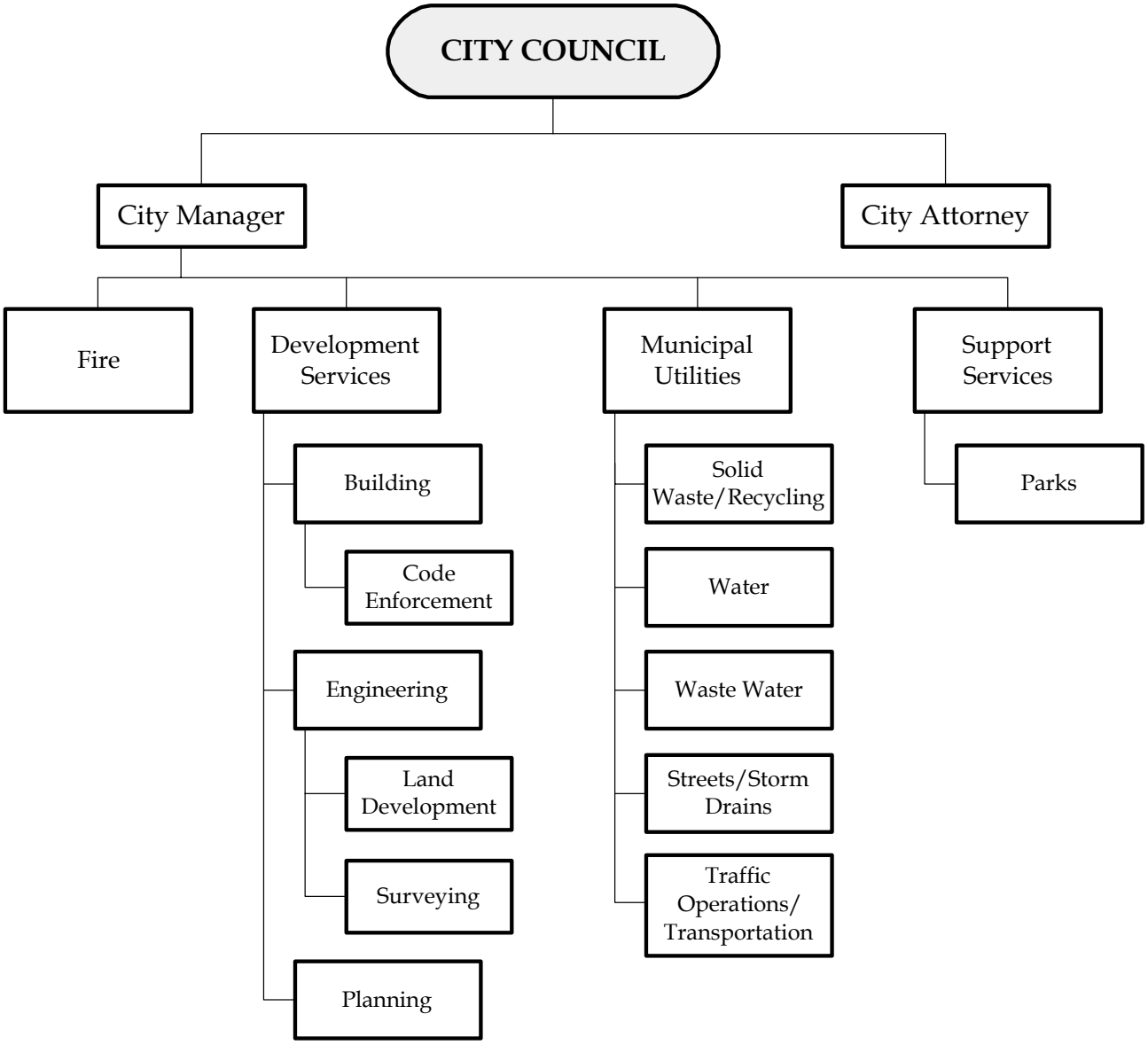
Staff assignments include responsibilities associated with the program activities as well as assistance with management activities such as coordination with other agencies. The Plan will establish several control programs, procedures, and policies aimed at identifying and reducing sources of storm water pollution and water quality degradation caused by discharges, in both wet and dry weather, from the storm drain system. Cost effectiveness is obtained by integrating the Plan with existing resources, programs, and functions whenever possible.

The Development Services Department provides education, training, and technical assistance to other City departments; reviews new development projects; provides inspections; develops guidance; and implements multiple activities and BMPs.

Through its various departments, the City provides a full range of municipal activities. These activities include projects and programs that require pollution prevention measures such as construction projects and operation and maintenance of facilities like corporation yards, offices, and parks. Some City departments have direct responsibilities for pollution prevention programs. For example, the Municipal Utilities Department provides recycling and household hazardous waste collection through its solid waste division duties.

One of the goals of the Program is for the City's employees to be concerned and knowledgeable as well as responsible for protecting the quality of storm water. Implementation of the Program requires the participation and assistance of several City departments. For example, the City of Redding provides hazardous waste disposal investigations through the Fire Department.

Figure 3-5
City of Redding Departmental Organization



3-6 Annual Planning and Reporting Activities

City of Redding will perform annual planning and prepare annual reports to comply with the NPDES Permit requirements.

3-7 Staff/Budget Resources

The City recognizes the multi-department commitment to this effort. The managers of the Development Services Department and Municipal Utilities Department have identified the City Engineer and his staff as the program coordinators. An Associate Engineer with extensive hydrology, hydraulic and regulatory experience has been assigned as the Storm Water Program Manager. Together this team will integrate the program information, City operations and projects.

In addition to the Storm Water Program Manager, the Departments of Municipal Utilities and Development Services resources include Managers, Supervisors, Management Analysts, Code Enforcement Officers, Laboratory Technicians, Industrial Waste Analysts, GIS Analysts, Engineering Technicians, CAD technicians, and field personnel. The program will also use volunteer organizations to the extent they are available and students from the local community college on a part-time or internship basis. The program will be integrated into regulatory enforcement through the Land Development Division and in additional levels of maintenance of public facilities.

The City budget consisting of staff salaries for initial preparation of the Plan is $30,000 for Development Services Department. Estimation of budget resources required to implement the program can only be provided following review of the Plan and issuance of the NPDES Permit by the Regional Board. Departments will budget according to their role in the program and the City Council's authorization to fund the level of effort stipulated. An increase in storm water utility fee or some other source or sources of funds will be required to fund and implement the program. The City expects that the cost of the program will necessitate additional funding mechanisms be determined.

Implementation of the Storm Water Quality Improvement Plan will have a significant financial impact. It may require the addition of equipment (street sweepers, backhoes, trucks), materials/supplies and staff (equipment operators, data entry, maintenance workers and administrative personnel) for the Municipal Utilities Department and increased staffing (inspectors, GIS staff, plan check engineers, planners for additional CEQA review, and administrative staff) for Development Services. Unfortunately, the exact work tasks have not been reviewed or approved by the permitting agency. Therefore, an order of magnitude number is being used to estimate program costs based on discussions with other agencies, reports prepared by the American Public Works Association (APWA) and discussions with consulting firms specializing in water quality permitting. The number has been estimated as low as $1.39 per capita year for a permit meeting federal requirements to $19.00 per capita year meeting California Phase I permitting requirements. The range of cost reflects differences in meteorology, topography, existing programs with other departments, State requirements, presence or absence of sensitive habitat, species or aggressive regulatory agencies. The City of Redding has significant annual rainfall and topography resulting in numerous creeks. However, we also have existing programs that cover some of the permit requirements. Without further direction from the State and additional budget analysis, the only reasonable estimate is to assume the average, account for inflation, and add a safety contingency factor. The average annual cost within this range is $10.20 per capita. These numbers are approximately one year old. Implementation within Redding would occur approximately two years after the numbers were developed. Therefore, including inflation and contingency factors, the per capita annual cost estimate is $13.00 for implementation of the Storm Water Quality Plan. Table 3-5 reflects citywide implementation cost estimates based on the $13.00 per capita year estimate.

Table 3-5
Projected Storm Water Quality Improvement Plan Costs

	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008
Population	85,573	87,028	88,508	90,012	91,542
Citywide NPDES Implementation	$1,112,455	$1,131,366	$1,150,600	$1,170,160	$1,190,052

Funding Options

Funding for the Storm Drain Utility is currently received from two sources. Maintenance revenues are derived from the monthly charge assessed against each developed parcel as provided in the 1993 City-Wide Master Storm Drain Plan and any contract labor, such as the street sweeping agreement with Caltrans. Capital improvements needed to offset development impacts are funded through developer impact fees assessed at the time of each new development.

City General Fund - These are discretionary funds available to the City of non-utility based services. Typically, these funds are used to support Police, Fire, Streets, Parks, Administrative departments and other projects not covered under utility based fee structures.

Transfer of duties - Another approach may be to review specific functions currently within the Storm Drain Utility to determine if they would be more appropriately served by another utility. For instance, the underground piping system maintenance and inspection may be shifted to the Wastewater Utility. Wastewater currently maintains a piping collection system and analyzes the condition of wastewater. Shifting of such tasks into their operations plan may allow the use of Storm Drain Utility funds to continue channel maintenance, while using the Wastewater Utility funds to monitor the storm water pipe system. Another possible shift would be to transfer street sweeping and catch basin cleaning to the Solid Waste Division using the destination and state of the materials collected as a nexus.

Sales Tax - One funding option that is used for a variety of programs is a Sales Tax addition. Typically, the amount is one-quarter of a percent, which is then dedicated to a specified program or list of projects. This option would require a vote.

Increase Storm Drain Utility assessment rates - This option would increase the assessment on each developed parcel by an amount necessary to meet the current financial requirements and the additional water quality program required under the Clean Water Act. This option is subject to Proposition 218 requirements which specifies:

- Both property owner and voter approval where, if a majority of property owners object, the measure requires a 2/3 majority voting public decision.
- Revenues from the fee may not exceed the funds required to provide the property-related services.
- Revenues may not be used for any purpose other than that for which the fee was imposed; and
- The amount of the fee may not exceed the proportional cost of the service attributable to the parcel.

Inspection Fees - Some NPDES requirements include inspection of a

variety of commercial uses to determine compliance with conditions, including prohibition of illegal discharges to the municipal storm sewer system. It is possible to impose fees relative to the actual cost of inspecting and determining compliance that is based on actual use instead of property related and therefore not subject to Proposition 218. This can be applied to new development inspections as well as discharge compliance.

Developer Impact Fee - It may be possible to adopt a developer fee to pay for the cost of new developments' impact on the City's storm water management system including water quality concerns. A study would need to be conducted to determine whether the findings required under the Mitigation Fee Act can be made.

CEQA Review Fee - All projects that are subject to CEQA review need to perform analysis of whether the project will have an impact on "any water quality standards or waste discharge requirement." Because of the new water quality requirements implemented in this Plan project review workload will increase. A review fee relative to the cost of providing review of water quality issues may be appropriate.

3-8 Implementation and Interaction with Other Agencies

In order to be most effective and utilize resources most effectively, it is important for the Program to implement various programs and efforts through other agencies. This section describes the relationship of the Program to joint activities of the Permittees; implementation of certain activities through City agencies; and participation in regional, statewide, and national activities.

The City's Storm Water Quality Improvement Plan is being developed independent of the plans for the adjacent urban area communities of City of Shasta Lake, City of Anderson and Shasta County due to time constraints on development of the storm water management plan. This approach is limited to the development phase and the first five year implementation phase permit document. An area wide permit may be pursued upon the next five-year permit cycle starting in 2008. The City storm water management team is working with the other urban area community team members in attempt to unify the components and approaches of the storm water quality plans. Because of the difference in areas and populations of the adjacent urban communities there is a substantial difference in the magnitude of the efforts involved and opportunity to cost share is limited, however, runoff from other jurisdictions does flow into the City waterways.

Representatives from the adjacent urban areas regularly attend Redding Area Storm Water Task Force meetings to share information and consult on various storm water management plan issues. Although participation or attendance in this organization is not mandatory the Plan will attempt to use the organization as a vehicle for information sharing and cooperation between the Cities of Redding, Shasta Lake, Anderson, the County of Shasta and other interested or involved organizations and parties.

3-9 Relationship of Program Elements to City Agencies/Departments

Development of this program necessitates coordination between numerous City agencies and departments. In order to be most effective and utilize resources most efficiently, it is important for the Program to implement various programs and efforts through departments that are already performing similar tasks. Table 3-9 lists the various departments involved in accomplishing the goals of the program, a brief summary of their activities, and related program elements. Figure 3-9 provides graphical representation of the departmental interaction and program structure.

Table 3-9
Departmental Activities

CITY DEPARTMENT	SUMMARY OF ACTIVITIES	*APPLICABLE MINIMUM CONTROL MEASURE**
CITY ATTORNEY	Guidance on legal authority and enforcement, approval of maintenance agreements for new development control measures, guidance on ordinance language to provide enforcement mechanism.	Illicit Discharge, Industrial, New Development
FIRE	Hazardous material spill response, vehicle maintenance, erosion control for fuel reduction program.	Illicit Discharge, Industrial
POLICE	Enforcement, referrals, and investigations, as needed.	Illicit Discharge, New Development
DEVELOPMENT SERVICES		
Planning Division	Incorporation of construction mitigation and new development criteria into CEQA reviews and entitlements, issuance of entitlements, participation in creek restoration planning.	New Development, Industrial, Municipal
Engineering Division	Development of program, incorporation of construction and post-construction control measures into City projects, development permits.	All Elements, New Development, Industrial, Municipal
Code Enforcement Section	Inspection of existing non-public storm water quality BMPs, notification of non-compliance, enforcement.	New Development
Construction Services Section	Inspection of public and private projects for construction and new development controls, public facilities design, issuance of grading permits.	New Development
Building Division	Plan check for new construction not requiring CEQA processing or use permit.	New Development
MUNICIPAL UTILITIES		
Administrative Utilities	Storm water quality web site development.	Public Ed, Public Participation, Illicit Discharge
Water	Integration of storm water pollution elements into educational presentations for elementary school classrooms.	Public Ed, Public Participation

CITY DEPARTMENT	SUMMARY OF ACTIVITIES	*APPLICABLE MINIMUM CONTROL MEASURE**
Solid Waste	Recycling, hazardous material collection and disposal, oil recycling.	Municipal, Illicit Discharge
Streets	Street sweeping, inspection.	Municipal
Storm Drains	Catch basin cleaning, development of educational materials, organization of event participation, volunteer groups and watershed groups, volunteer stenciling program, distribution of educational materials, development and execution of educational programs.	Illicit Discharge, Public Ed Public Participation, Municipal
Wastewater	Illicit discharge reporting, illicit discharge investigation and response, sewer system monitoring, water quality hotline.	Illicit Discharge, Public Ed, Public Participation
COMMUNITY SERVICES		
Parks	Pesticide & herbicide management, public education for responsible pesticide/herbicide/fertilizer management and application.	Municipal, Public Ed, Public Participation

* Public Ed = Public Education and Outreach
Public Participation = Public Participation and Involvement
New Development = Construction Site Runoff Control or Post-Construction Storm Water Management
Illicit Discharge = Illicit Discharge Detection and Elimination
Municipal = Pollution Prevention and Good Housekeeping for Municipal Operations
Industrial = Industrial Discharge

Figure 3-9: City of Redding Storm Water Quality Improvement Plan Departmental Interaction and Structure

City Manager

EPA Minimum Control Measure	Minimum Measure I Public Education and Outreach	Minimum Measure II Public Participation and Involvement	Minimum Measure III Illegal Discharge Detection and Elimination	Minimum Measure IV New Construction Runoff Control	Minimum Measure V Post-Construction Storm Water Management	Minimum Measure VI Pollution Prevention/Good Housekeeping for Municipal Operations and Facilities	Phase I Requirement
Core Element	**Community Teamwork and Partnership** Municipal Utilities Director		**Illicit Discharge Detection and Elimination** Municipal Utilities Director	**New Development** Development Services Director		**Pollution Prevention and Good Housekeeping for Municipal Operations** Municipal Utilities Director	**Industrial Discharge** Municipal Utilities Director
Department Activities	Municipal Utilities - Storm Water Coordinator - Stenciling Program - Business Relationships - Community Event Coordination - Multi-Ethnic Outreach - Billing Stuffers - Classroom Visits - Providing Materials to Schools for independent instruction - Redding Area Storm Water Task Force - Web Site Development - City Council Outreach - Departmental Outreach - Employee Outreach - Regional Outreach - Additional Statewide Outreach - Stream Corridor Identification		Municipal Utilities - Storm Water Coordinator - Educational Materials - Web Site Development - Ordinance Wastewater Division - Sanitary sewer inspections Fire Department - Spill Response for Illegal Dumping or Emergency Spills Solid Waste - Spill and Illegal Dumping cleanup and or subcontracting cleanup. - Household waste disposal GIS - Storm Drain Mapping City Attorney - Ordinance	Development Services - Storm Water Coordinator Land Development - Grading Permits - Erosion Control Plans - Construction Inspections - BMP Compliance & Maintenance - Plan Check - BMP Construction Inspection - Erosion Control Inspection - Enforcement - Developer/Contractor Outreach Engineering Design - Municipal Construction Projects - Redding Area Storm Water Task Force Surveying - BMP Easement mapping - Map Review City Attorney/Development Services - Ordinance Planning - CEQA review of water quality improvements - Plan Check Building - Plan Check for water quality BMPs		Municipal Utilities - Storm Water Coordinator - Vehicle Maintenance - Pest Control - Hazardous Materials Storage - Catch Basin Cleaning - Storm Drain Cleaning Support Services - Pesticide, Fertilizer and Herbicide storage and usage - Vehicle Maintenance Police Department - Vehicle Washing and Maintenance Fire Department - Vehicle Washing and Maintenance Streets Department - Street Sweeping Airports (Covered under Industrial Permit) Electric Utility (Covered under Industrial Permit)	Municipal Utilities - Storm Water Coordinator Wastewater - Business license tracking - Industrial Permit coverage - Inspection - education of business licensees - training of inspectors - continuing education of businesses and inspectors

Section 4
Receiving Water Description

4. RECEIVING WATER DESCRIPTION

4-1 Sacramento River

The Sacramento River, with a watershed encompassing 27,210 square miles, is the largest river system in California and accounts for an average annual discharge of 21.6 million acre-feet (AF) into the Sacramento-San Joaquin Delta. The City of Redding is located in the upper Sacramento River 14 miles downstream from Shasta Dam, 1.5 miles downstream of Keswick Dam and 167 miles north of Sacramento, which drains approximately 6,500 square miles and has an average annual discharge rate of 7.1 million AF. The Sacramento River bisects the City.

Hydrology

The Bureau of Reclamation Central Valley Project controls the hydrology of the Sacramento River through the Redding area. Shasta Dam is the primary controlling facility with a storage capacity of 4.5 million AF. Keswick Dam is an afterbay power generation facility with minimal storage capacity and serves to regulate releases from Shasta Dam and water transfers from the Trinity River via Carr Powerhouse and Whiskeytown Lake. Following construction of Shasta Dam, the 100-year flood release from Shasta and Keswick Dams has been restricted to approximately 79,000 cubic feet per second (cfs). Prior to construction of the Central Valley Project facilities the 100-year peak flow was estimated to be 280,000 cfs (FEMA, 1989).

Operation of the Central Valley Project has changed the seasonal hydrology of the Sacramento River by storing high winter flows and increasing discharges later in the year to support downstream agricultural, municipal and industrial and environmental demands. Analysis of the historic flow records since construction of Shasta Dam has revealed two high flow periods: January-February and July-August. The January-February period corresponds with winter peak flow events, while the July-August period represents peak agricultural and environmental water deliveries.

Beneficial uses of the Sacramento River from Shasta Dam to Colusa Basin Drain are listed in the Water Quality Control Plan (Basin Plan) for the California Water Quality Control Board Central Valley Region. The Sacramento River water has beneficial use designations of Municipal and Domestic Supply, Agriculture, Irrigation, Stock Watering, Industrial Service Supply, Power Generation, Contact Recreation, Canoeing and Rafting, Non-contact Recreation, warm and cold Freshwater, Spawning and Migration Habitat and Navigation. The Sacramento River is listed as a navigable waterway as far north as Redding under control of the State Lands Commission.

4-2 Local Streams

Local hydrology consists of 16 primary drainage basins and numerous smaller creeks tributary to the Sacramento River within the City. The largest stream with substantial drainage area within the City Limits, Churn Creek, has five significant tributary sub-basins. Table 4-1 provides a basic characterization of the receiving water, listing the basins, approximate tributary areas, primary channel length, and land uses. Figure 4-1 shows the major City of Redding drainage basins.

The only water, other than the Sacramento River, within the City of Redding sphere of influence with specifically listed beneficial uses

is Clear Creek. The vast majority of Clear Creek is located in Shasta County, with a small percent of the low end of the basin passing through the City prior to reaching the Sacramento River. The waters of Clear Creek have the beneficial use designations Municipal and Domestic Supply, Irrigation, Stock Watering, Contact Recreation, Canoeing and Rafting, Noncontact Recreation, Warm and Cold Freshwater Habitat, Cold Water Migration, Warm and Cold Spawning Habitat, and Wildlife Habitat.

However, State policy provides that upstream waters inherit the beneficial uses of the downstream waters. Therefore, all water in the creeks in the City of Redding have the same beneficial use designations as the Sacramento River. Beneficial uses of the waters in a given creek do not infer beneficial uses of the creek corridor itself. For instance, the water of the Sacramento River has the designated beneficial use of navigation. The waters of every creek within the city limits therefore inherit the navigation beneficial use designation. This does not imply that the creek corridors are considered navigable, only that the waters from these creeks support, at some location downstream, navigation.

Designated uses of various creek corridors and riparian buffer zones are identified in the City of Redding General Plan Natural Resources Element (Appendix H).

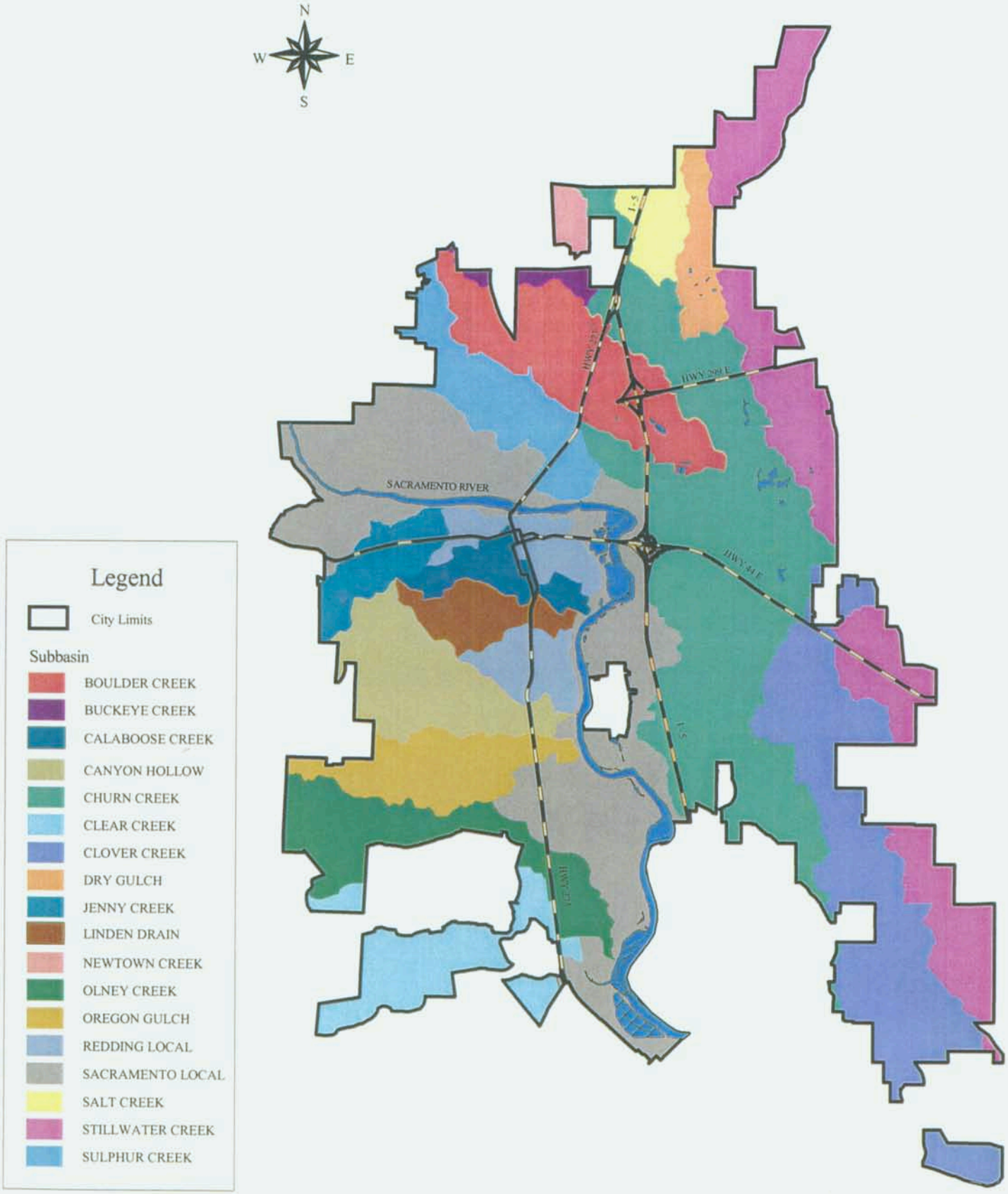
Additional work will be performed as the plan develops over time to add to the Receiving Water Description section through discussion with various resource agencies and watershed groups. Thorough watershed assessment is a time-consuming and costly undertaking and was not required as part of this plan nor provided for within the scope of the plan preparation.

Table 4-1
Basic Watershed Characteristics

Watershed	Watershed Area, sq mi	Main Channel Length, mi	Area in City, sq mi	Land Use, % (1)			
				Open	Residential	Commercial	Industrial
Sacramento River	27210	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Boulder Creek	3.53	5.02	3.39	25	57	1	17
Buckeye Creek	1.99	0.13	0.3	6	33	13	48
Calaboose Creek	(N/A)	3.03	0.98	41	47	12	0
Canyon Creek	3.22	3.26	2.83	38	56	1	5
Churn Creek	38.23	8.07	10.8	24	73	2	1
Clear Creek (lower)	48.91	1.24	0.67	23	68	0	9
Clover Creek	6.84	5.46	5.02	27	48	0	25
Dry Gulch Creek	1.0	2.09	0.98	1	99	0	0
Jenny Creek	1.69	2.52	1.21	29	64	7	0
Linden Drain	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Newtown Creek	2.15	0.87	0.34	0	100	0	0
Olney Creek	14.18	4.08	2.87	7	91	0	2
Oregon Gulch Creek	3.85	3.57	2.16	56	43	0	1
Salt Creek	4.85	0.97	0.83	48	50	2	0
South Bonnyview Drain	(N/A)	1.46	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
Stillwater Creek	66.0	2.31	6.3	33	54	2	11
Sulphur Creek	4.42	3.94	2.28	35	64	1	0

1. Percent of watershed within City Limits. 100% represents the entire watershed within City Limits.
(N/A) Not available or developed at the time of publication of this report

Figure 4-1: City of Redding Drainage Basins



Section 5
Program Implementation

5. PROGRAM IMPLEMENTATION

5-1 Introduction

Implementation of the City of Redding Storm Water Quality Improvement Plan is conducted through the Core Element activities Community Teamwork and Partnership, Illicit Discharge Detection and Elimination, New Development, Pollution Prevention and Good Housekeeping for Municipal Operations and Industrial Discharge. These core elements address the six minimum control measures (Public Education and Outreach, Public Participation/ Involvement, Illicit Discharge Detection and Elimination, Construction Site Storm Water Management, Post-Construction Storm Water Management and Pollution Prevention/Good Housekeeping for Municipal Operations.

The Implementation Plan for the program provides a description of each Core Element's activities/BMPs and corresponding implementation actions. Minimum Performance Standards are also provided for those activities/BMPs that are quantifiable and predictable. These performance standards will be used to demonstrate the City's commitment to the Program and achievement of a reasonable level of implementation. Some activities are not easily quantifiable, and minimum performance standards may not be appropriate. Other activities like spill responses and ordinance revisions are not predictable and will therefore be accomplished as needed.

Table 5-1 provides a summary of BMPs/Activities and measurable goals.

Table 5-1

City of Redding Stormwater Quality Improvement Plan
Program Element Implementation Plan - Summary

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
Community Teamwork and Partnership: Public Education Outreach				
Public Education I: General Public and Target Sector Outreach				
PE I-A: Public Survey	Develop and conduct survey to determine starting point for SWQIP program requirements.	- Develop survey - Distribute survey - Analyze results from survey - Formulate improvements to plan based on outcome - Revise plan in response to survey results	- June 2004 - December 2004 - June 2005 - June 2006 - June 2008	- Complete development of survey - Complete distribution of survey - Complete analysis of results - Complete report of survey to include with annual report - Complete revision for next permit term
PE I-B: Storm Drain Labeling	The City will sponsor a volunteer storm drain labeling program and will consider the possibility of requiring new development to implement labeling programs.	- Continue the volunteer program and address the question of new development implementation of this BMP	- Ongoing and throughout permit	- 200 inlets/year
PE I-C: Event Participation	Participate in community events where stormwater educational material can be presented and distributed.	- Develop display boards—probably 3 boards - Develop brochures and flyers three initially and more as the program develops - Obtain promotional materials - Designate staff - Attend events	- June 2004 - December 2005 - June 2005 & ongoing - June 2005 & ongoing - June 2005 & ongoing	- Completion of Display boards - Completion of task - Completion of task - Completion of task - Attend 3 events per year
PE I-D: Multi-Ethnic Outreach	Translate and reprint educational materials in languages appropriate for addressing non-English speaking demographics.	- Make contacts with representatives of the non-English speaking communities - Develop partnerships to work on translating efforts - Seek reprinting resource and print materials - Research distribution listing and develop distribution list/strategy - Distribute information - Explore additional demographics	- December 2005 - December 2006 - June 2007 - December 2007 - June 2008 & ongoing - Ongoing	- Completion of task - Completion of task - Completion of task - Completion of task - Completion of task
PE I-E: Clean Water Business Partners	Address carpet cleaners and landscapers regarding stormwater pollution concerns and develop listing of other industries of concern.	- Develop listing of operators of carpet cleaning and landscaping businesses - Develop industry specific educational materials - Develop workshop materials - Hold class or workshops annually	- June 2004 - June 2005 - June 2006 - June 2007 & ongoing	- Completion of task - Completion of task - Completion of task - Completion of Workshop
PE I-F: Mass Mailing	Develop mass mailing flyer or include storm water quality message in existing flyers for distribution with utility billings.	- Develop flyer or sequence of messages catered to address concerns identified in Public Survey - Print and include flyer or messages in billing	- June 2006 - Summer 2007 & annually	- Completion of task - Completion of task and ongoing

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
PE I-G: Storm Water Website	Develop a storm water section on the City website.	- Identify specific staff for development of the website - Identify website content - Program the website - Maintain website	- June 2005 - December 2005 - June 2006 & ongoing - Ongoing	- Completion of task - Completion of task - Completion of task - N/A
PE I-H: Media Campaigns	Develop multimedia campaigns and partnerships to target large sectors of the population. Explore opportunities and funding for radio, newspaper, television and billboard adds.	- Research costs - Perform cost/benefit analysis or research - Research Funding opportunities - Research partnering opportunities with other communities or agencies. - Implementation of campaigns	- December 2005 - June 2006 - December 2006 - December 2006 - June 2007	- Completion of task - Completion of task - Initiation of ongoing task - Initiation of dialogue - Initiation of ongoing program
PE I-I: Service Club Presentations	Develop presentation and make presentation to service clubs educating and instructing them on how they can assist or participate.	- Develop presentation - Develop list of service groups - Hold presentations	- December 2005 - December 2005 - June 2006	- Completion of task - Completion of task - One new service group per year
PE I-J: Pet Waste Control	Post pet waste information and collection bags at public trails.	- Expand program to include any new trails.	- New trails starting in 2004	- Completion of task
PE I-K: Waste Recycling	Develop and distribute educational materials that explain the benefits of waste recycling. Record and report the amounts of recycled materials.	- Develop or obtain educational materials - Distribute educational materials - Track amount of materials distributed - Record and report amount of recycling	- June 2006 - December 2006 - Ongoing - Annually	- Completion of task - Completion of task
PE I-L: Stream Corridor Identification	The City of Redding assists local volunteer organizations in installing stream corridor identification signs by providing the signs.	- Continue providing signs for volunteer organizations as requested	- Ongoing	- As requested
Public Education II: School Outreach				
PE II-A: Classroom Visits	The City currently conducts classroom education to elementary school children for water conservation, watershed protection, solid waste disposal and recycling. Inclusion of storm water quality messages in these programs will be simple and efficient.	- Develop storm water quality message - Supplement current curricula with storm water quality message. - Continue classroom visits and participation.	- December 2005 - June 2007 - December 2007	- Completion of task - Completion of task - 12 classrooms per year
PE II-B: Storm Water Quality Curricula	Provide storm water quality-specific instructional units to K–8 grade schools to encourage teachers to include a science unit on storm water quality or storm water management.	- Obtain curricula materials - Write lesson plans for specific target age groups - Schedule meetings with various school representatives to discuss acceptance of the materials and voluntary participation in the program - Deliver curricula packages to schools - Continuously update materials.	- June 2004 - December 2004 - June 2005 - June 2006 - June 2006+	- Completion of task - Completion of task - Completion of task - Initiation of distribution - N/A
Public Education III: Public Official Outreach				

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
PE III-A: City Council Update	City Council will be updated at a minimum frequency of once per year with progress and status reports for the Comprehensive Storm Water Management Plan, including information on Storm Water Quality Improvement Plan section. Additionally, issue papers are sent to Council on a regular basis to ensure they are informed of the concerns and challenges faced by the program.	- Continue information stream to Council Members	- Annual	- Completion of task
PE III-B: Departmental Outreach	Encourage department administration to participate in public events that include water quality improvement education or benefit water quality. Encourage department managers to support employee participation in such events.	- Provide information to department managers and supervisors regarding upcoming events to encourage staff participation.	- June 2005 & ongoing	- Completion of task - 3/year following June 2005
PE III-C: Employee Outreach	Publish storm water quality message in departmental newsletters.	- Contact department newsletter editors - Develop messages - Distribute department-specific storm water quality message	- June 2005 - Annually - Annually	- Completion of task for two newsletters plus one per year until all available newsletters are covered - 1/year/newsletter - 1/year/newsletter
Public Education IV: Regional and Statewide Outreach				
PE IV-A: Redding Area Storm Water Task Force	Continue participation in the Redding Area Storm Water Task Force to share information, goals, concerns and issues.	- Continue to attend or host meetings - Consider formalizing the venue		- Attend as many meetings as possible
PE IV-B: Additional Outreach Activities	Continue to look for opportunities to develop and foster relationships with volunteer organizations, other agencies, regional groups, statewide groups and other parties interested in improving storm water quality.	- Continue dialogue with Chico and Butte County - Continue dialogue with other resource agencies - Continue to participate in California Storm Water Task Force (or whatever it turns into) - Continue participation and leadership in California Water Environment Association (CWEA)		- Circulate Draft to City of Chico and Butte County when available - Invite Caltrans and other agencies to occasional meetings - Continue leadership and participation in CWEA
Community Teamwork and Partnership: Public Participation and Involvement				
PP I-A: Public Meetings	Public meetings will be held to encourage citizen participation and allow additional viewpoints to be considered for incorporation in subsequent modifications to the SWQIP.	- Schedule and advertise a public meeting annually	- June 2004	- At least one meeting per year
PP I-B: Community Water Body Cleanups	Allow citizens to participate in the cleanup of different water body drainage areas under direction of City departments and watershed groups.	- Schedule, advertise, and participate in cleanup efforts	- April 2004 & annually	- At least one cleanup effort per year
PP I-C: Pet Waste Control	Post sineage and make containers available to City Trails to encourage pet owners to police their own pet waste.	- Continue providing sineage with new trail projects	- Ongoing	- All new trail projects
Community Teamwork and Partnership: Watershed Stewardship				

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
WS I-A: Clover Creek Preserve	Clover Creek preserve is a multi-function facility initially proposed to provide flood control to protect downstream residents. The project has been designed to include wetland, park and water quality features in addition to flood control.	- Continue on schedule to construct the Clover Creek Preserve	- Currently under construction	- Completion of project
WS I-B: Flood Control and Drainage Projects	City flood control and drainage projects will incorporate restoration and habitat improvement features, as feasible.	- Coordinate and assist project managers during design of projects	- Already implemented	- All applicable projects
WS I-C: Strategy and Work Plan	Develop a strategy and work plan for additional watershed projects.	- Develop strategy - Obtain input/feedback from local watershed groups	- June 2005	- List of projects
WS I-D: Prioritize Projects	Local creeks will be assessed and opportunities/needs for future watershed improvement projects will be ranked.	- Develop strategy and work plan	- June 2007	- Completion of task
Illicit Discharge Detection and Elimination Element				
Illegal Discharge I: Ordinance Enforcement				
IDE I-A: Ordinance Enforcement	Review and revise, as necessary, ordinance pertaining to grading and storm water quality. Develop and implement administrative enforcement procedures.	- Review ordinance - Consult Legal Services Department - Revise Ordinance as necessary	- June 2004 - December 2005 - June 2005	- Completion of task - Completion of task - Completion of task
IDE I-B: Agency Coordination/ Database	Program staff ensures that all agencies involved in spill response are aware of storm water regulations and work together to minimize release of discharges.	- Distribute storm water program information - Incorporate storm water protection in response procedures - Develop website information resource	- December 2004 - June 2006 - December 2007	- Completion of task - Completion of task - Completion of task
Illegal Discharge II: Spill Response				
IDE II-A: Website Reporting	An illegal discharge reporting form will be made available on the City storm water website that will automatically notify storm water personnel of a reported discharge.	- Respond to reports of illegal dumping - Add reporting ability to storm water website - Establish tracking of reporting and response procedure	- Already implemented - December 2007 - June 2008	- Already in place - Completion of task - Completion of task
IDE II-B: Telephone Reporting	Develop and set up a 24-hour telephone procedure for receiving and responding to reports of illicit discharges.	- Document response procedure - Set up phone number - Establish tracking of reports and responses	- June 2006 - December 2006 - June 2007	- Completion of task - Completion of task - Completion of task
IDE II-C: Spill Response	Department of Municipal Utilities or Fire Department will have trained response personnel available 24 hours to respond to spills and prevent release to receiving waters.	- Continue staffing of 24-hour response personnel and implementing spill appropriate response procedures - Establish tracking of reports and responses	- Already done - June 2005	- Ongoing - Completion of task
Illegal Discharge III: Illegal Discharge Prevention				
IDE III-A: Storm Drain Stenciling	The City sponsors volunteer storm drain labeling program and will consider requiring all new development to label storm drain inlets.	- Continue the volunteer program and consideration of new development requirements.	- Ongoing and throughout permit	- 200 inlets/year

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
IDE III-B: Hazardous Waste Collection	Continue to promote the availability of household hazardous waste disposal efforts.	- Continue support of HOW programs - Record and report quantities	- Ongoing - Annually	- Ongoing - Completion of task
IDE III-C: Waste Oil Collection	Continue to support the used oil recycle program performed by the Solid Waste Division.	- Continue support of oil recycling program	- Ongoing	- Ongoing
IDE III-D: Illicit Connection Detection	The Illicit Connection Detection activity will be performed primarily as a coordinated effort between the GIS department and the activities associated with the City-wide Storm Drain Master Plan. Additional efforts are included in the City of Redding Storm Drain Utility Maintenance and Operations Plan during regularly scheduled inspections of storm drain outfalls and catch basins.	- Continue to pursue mapping and inspection of storm water drainage pipe system with the Storm Drain Master Plan. - Continue to follow the Maintenance and Operations Plan inspection schedule.	- Already implemented	- 20% annually N/A
IDE III-E: Illicit Connection Elimination	Identification by field staff or Storm Drain Master Plan consultant of apparent illicit connections or abnormal discharges as part of routine drainage system maintenance or system evaluation will be pursued by mechanism provided by ordinance.	- Continue to inspect and pursue Master Storm Drain Plan		- Monitoring/disconnection as needed
New Development Element: Construction				
Construction-I: Outreach and Education				
CE I-A: Developer Outreach	Educate and provide guidance to the construction and development community.	- Provide assistance to developers in the form of one-on-one consultations, workshops, printed materials or other means	- June 2004	- Annual workshop
CE I-B: City Staff Outreach	Educate and provide guidance to City staff on local and state requirements and new technology.	- Provide information on new standards and requirements	- June 2007	- Completion of task
Construction-II: Ordinance and Standards				
CE II-A: Update Ordinance	Review and revise ordinance as necessary to provide mechanism for enforcement of provisions of this plan.	- Review ordinance - Consult Legal Services Department - Revise ordinance as necessary	- June 2004 - December 2005 - June 2005	- Completion of task
CE II-B: Revise Standards	Evaluate and revise erosion, sediment, and pollution control standards and specifications as necessary.	- Evaluate standards - Revise standards - Adopt standards - Circulate standards	- June 2004 - June 2005 - June 2006 - December 2006	- Completion of task - Completion of task - Completion of task - Completion of task
Construction-III: Inspection and Enforcement				
CE III-A: Entitlement Review	Ensure projects adequately address requirements during CEQA process by reviewing and commenting on storm water quality improvement features.	- Review and revise standard BMPs for implementation with new projects - Develop plan check procedure and paper trail for reporting - Educate environmental review staff - Implement conditioning of storm water quality improvement BMPs	- June 2004 & annually - June 2005 - June 2006 - June 2007	- Completion of task - Completion of task - Completion of task - Completion of task

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
CE III-B: Plan Review and Approval	Ensure that all projects utilize BMPs to address erosion, sediment, and pollution control requirements through development approval process and municipal procedures by requiring each project to have adequate erosion control plans and, if necessary, show proof of coverage under State Construction General Permit.	- Continue review process for erosion and sediment control plans - Review and revise standards as necessary - Train plan checkers and inspectors on any new standards or requirements - Develop plan check procedure and paper trail for reporting - Continue to inspect construction sites	- Ongoing - June 2004 - June 2005 - June 2005 - Ongoing	- Ongoing - Completion of task - Completion of task - Completion of task - Ongoing
CE III-C: Inspection	Continue to inspect construction sites for adequate erosion, sediment, and pollution control measures.	- Formalize inspection procedure/parameters - Provide education for inspection staff - Assign inspection staff - Provide enforcement mechanism	- December 2004 - June 2005 - December 2005 - December 2005	- Completion of task - Completion of task - Completion of task - Completion of task
CE III-D: Record Keeping	The City will develop a database for tracking inspection and violations on construction sites.	- Develop inspection forms and data tracking procedures - Assign task - Develop database - Maintain database	- December 2005 - June 2006 - December 2006 - Ongoing	- Completion of task - Completion of task - Completion of task - Ongoing
New Development Element: New Development and Redevelopment				
New Development and Redevelopment- I: Technical Assistance				
NDE I-A: Developer Assistance	The City continues to offer assistance and guidance to developers to ensure that appropriate water quality controls are incorporated into new developments.	- Continue providing assistance to developers in the form of one-to-one consultations, workshops, printed material or other means - Develop flyers - Develop distribution list - Distribute flyers	- Ongoing assistance and distribution of information - December 2005 - June 2006 - December 2006	- One workshop per year - Completion of task - Completion of task - Completion of task
NDE I-B: City Staff Assistance	Assistance is available for City project managers designing new city facilities, and development staff review. Provide training in new design requirements to all staff involved in review of projects where storm water quality BMPs may be required. Establish standard condition(s) of approval to require water quality BMPs on private developments.	- Continue providing consultation services on a project-by-project basis - Train staff in new requirements - Write conditions - Build consensus and review proposed condition - Adopt standard condition	- Ongoing - June 2005 & ongoing - December 2005 - June 2006 - June 2006	- Ongoing - Completion of task - Completion of task - Completion of task - Completion of task
New Development and Redevelopment - II: Design Standards				
NDE II-A: Revise Standards	Local urban runoff design standards for both regional and on-site control measures will be reviewed, revised or established to optimize pollutant removal to the MEP. Design standards will include, as a minimum, all the BMPs listed in Attachment 4 of the State of California General Permit Appendix J.	- Evaluate standards - Revise standards - Adopt standards	- Ongoing - Annually - As necessary	- Ongoing - Annual updates - Adopt as necessary

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
NDE II-B: BMP Research	Existing, alternative, and innovative control measures are evaluated through literature reviews and BMP studies.	- Evaluate local and nationwide research and information to ensure standards result in optimum pollutant removal - Participate in efforts to research effectiveness of BMPs by reporting effectiveness	- Ongoing - Ongoing	- Continuous review - Participation as opportunity arises
New Development and Redevelopment - III: Regional Storm Water Controls				
NDE III-A: Development Review Process	The City requires all development to submit drainage studies that assure local numeric design standards are met. Such studies will include BMP criteria in addition to flood control criteria. Regional facilities are being pursued with the next revision of the Storm Drain Master Plan.	- Develop review protocol - Assign staff for review - Review design for compliance with criteria	- December 2006 - June 2006 - December 2007	- Completion of task - Completion of task - Ongoing all projects
NDE III-B: Maintenance Protocols	Upon construction of regional water quality BMPs, maintenance protocols and activities will be developed and included in the Maintenance and Operations Plan	- Develop maintenance protocol and schedule	- Pending construction of Regional water quality BMPs	- Completion following or during planning and design of future regional projects
NDE III-C: Record Keeping	The City is developing a database of regional storm water controls to document size, pollutant removal, maintenance, design criteria, and other key data. Record enforcement, complaints and violations.	- Continue development and maintenance of the database as regional facilities come on line - Develop protocol for addition of existing private facilities and new facilities as they are constructed - Develop database tool and protocol for tracking and recording complaints and violations	- Ongoing - June 2006 - December 2007	- Ongoing - Completion of task - Completion of task
New Development and Redevelopment - IV: On-site Storm Water Control				
NDE IV-A: Development Review Process	The City will require commercial and multifamily developments to incorporate source and structural controls in accordance to design standards and BMP criteria. Note: Industrial development will be required to obtain an Industrial NPDES permit as follows in the Industrial Element section.	- Develop review protocol - Assign staff for review - Review design for compliance with criteria	- December 2006 - June 2006 - December 2007	- All applicable projects - Completion of task - Ongoing
NDE IV-B: Maintenance Protocols	As the last resort in enforcement of maintenance of private storm water quality BMPs, the City of Redding may, if appropriate, perform maintenance under code enforcement procedures.	- Develop code/enforcement authority - Develop protocol - Develop inspection procedures - Develop database - Develop inspection schedule - Begin inspections - Begin enforcement	- December 2006 - June 2007 - June 2007 - December 2007 - June 2008 - June 2008 - June 2008+	- Completion of task - Completion of task - Completion of task - Completion of task - Completion of task - Completion of task - Ongoing
NDE IV-C: Record Keeping	The City will maintain a database of on-site, structural controls to document type, pollutant removal, maintenance, design criteria and other key data.	- Assign staff - Develop database - Maintain database	- June 2007 - June 2006 - June 2006+	- Completion of task - Completion of task - Ongoing
NDE IV-D: Ordinance Enforcement	Review and revise municipal code as necessary to provide legal authority and enforcement mechanism to require construction and maintenance of On-site Storm Water Quality Control BMPs	- Review ordinance - Consult Legal Services Department - Revise ordinance as necessary	- June 2004 - December 2005 - June 2005	- Completion of task - Completion of task - Completion of task

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
Pollution Prevention and Good Housekeeping for Municipal Operations				
Municipal -	I: Technical Assistance			
ME I-A: Municipal Facility SWPPPs	Conduct inspections and prepare SWPPPs and BMPs for City Facilities.	- Provide service for all industrial-type City facilities	- Start in 2005	- 2 facilities per year
ME I-B: Municipal Activity Surveys	Survey City departments on municipal activities that may contribute to target pollutants and general storm water pollutants.	- Conduct Survey - Develop database of activities - Develop BMPs to address as necessary - Implement BMPs to address	- June 2005 - December 2005 - June 2006 - June 2007	- Completion of task - Completion of task - Completion of task - Completion of task
ME I-C: New Facility BMPs	Major new City facilities will be required to incorporate structural and nonstructural BMPs to reduce storm water pollutants to the.	- Develop review protocol - Assign staff for review - Review design for compliance with criteria	- December 2006 - June 2006 - December 2007	- Completion of task - Completion of task - Ongoing all projects
ME I-D: Facility Inspection	Inspection and maintenance of municipal facilities.	- Develop protocol - Develop inspection procedures - Develop database - Develop inspection schedule - Begin inspections - Perform corrective action or maintenance as necessary	- December 2005 - June 2006 - December 2006 - June 2007 - December 2007 - June 2008+	- Completion of task - Completion of task - Completion of task - Completion of task - Completion of task - Ongoing
Municipal -	II: Pollutant Removal Activities			
ME II-A: Street Sweeping	Continue Street Sweeping activities as outlined in Appendix G, City of Redding Storm Drain Utility Maintenance and Operations Plan	- Continue street sweeping	- Ongoing	- Completion of task
ME II-B: Drainage System Maintenance	Continue drainage system maintenance pursuant to the Storm Drain Utility Maintenance and Operations Plan and obtaining the appropriate permits from other regulatory agencies. This document addresses storm drain channel cleaning, street sweeping and catch basin cleaning procedures and frequency.	- Perform maintenance as provided in the Maintenance and Operations Plan	- See M&O Plan	- Completion of tasks in M&O Plan and ongoing.
ME II-C: Structural Control Operation and Maintenance	Inspect and clean structural control devices such as settling and treatment facilities at regional detention basins and low-flow control measures to design functions are being maintained.	- Develop inspection procedure - Develop schedule for inspection - Perform inspections	- June 2005 - December 2005 - Annually	- Completion of task - Completion of task - 100% of facilities
Municipal -	III: BMP Retrofit and Improvement Projects			
ME III-A: Retrofit of Existing Facilities	The Drainage Master Planning effort will include the concept of addressing retrofitting of existing regional detention facilities with BMPs to address storm water pollution to the MEP.	- Evaluate water quality features in the next Master Planning Effort	- June 2006	- Completion of task
Municipal -	IV: Employee Training Program			

Activity/BMP	Description	Implementation	Time Schedule	Measurable Goals
ME IV-A: Employee Training Program	Attend tailgate meetings and conduct specific training sessions to provide City of Redding Storm Water Quality Improvement Program information on appropriate municipal control measures.	- Develop program - Develop training schedule - Implement training program	- December 2006 - June 2007 - December 2007	- Completion of task - Completion of task - 2 sessions per year
ME IV-B: Employee Feedback Program	This program will formalize a system to receive feedback from all City employees regarding issues related to storm water management.	- Develop and implement feedback system - Summarize and report responses in annual reports.	- December 2006 - Annually	- Completion of task
Industrial Element				
The City of Redding Industrial Element is a mirror of the existing program in place through the Solid Waste Division. No additional requirements or BMPs are expected to be added with this document except to bring the remaining industrial license holders into the program. Subsequent versions of this document will elaborate on the BMPs already in place for that program to provide completion of this element.				

BMP	Task	2003							2004												2005												2006												2007												2008						Ongoing
		June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	
COMMUNITY TEAMWORK AND PARTNERSHIP:																																																												
Public Education I: General Public and Target Sector Outreach																																																											
PE I - A	Develop Survey																																																											
	Distribute Survey																																																											
	Analyze Results																																																											
	Formulate Improvements																																																											
	Revise plan																																																											
PE I - B	Continue Stenciling																																																											
PE I - C	Develop Display Boards																																																										
	Develop other materials																																																											
	Obtain promo materials																																																											
	Designate Staff																																																											
	Attend Events																																																											
PE I - D	Make Contacts																																																											
	Develop partnerships																																																											
	Seek reprinting resource																																																											
	Research distribution																																																											
	Distribute Info																																																											
	Explore future of BMP																																																											
PE I - E	Develop listing of operators																																																											
	Develop industry specific educational materials																																																											
	Develop workshop materials/curricula																																																											
	Hold Cless or workshop annually																																																											
PE I - F	Develop flyer or sequence of messages																																																											
	Print and distribute																																																											
PE I - G	Identify specific staff for website development																																																											
	Identify website content																																																											
	Program website																																																											
	Maintain Website																																																											
PE I - H	Research costs																																																											
	Perform Cost/benefit																																																											
	Research funding ops																																																											
	Research partnering ops																																																											
	Implementation																																																											
PE I - I	Develop presentation																																																											
	Develop list of service groups																																																											
	Hold Presentations																																																											
PE I - J	Expand current program																																																											
PE I - K	Develop or obtain materials																																																										
	Distribute educational materials																																																											
	Track amount of materials																																																											
	Record and report recycling																																																											
PE I - L	Stream Corridor Identification																																																										
Public Education II: School Outreach																																																											
PE II - A	Develop storm water quality message																																																										
	Supplement curricula																																																											
	Continue classroom visits																																																											
PE II - B	Obtain curricula materials																																																										
	Write lesson plans for specific age groups																																																										
	Schedule meetings with school officials																																																										
	Deliver curricula																																																										
	Update materials																																																										
Public Education III: Public Official Outreach																																																											
PE III - A	Continue information stream to City Council																																																										
PE III - B	Proivde information to department managers…																																																										
PE III - C	Contact Newsletter editors																																																										
	Develop messages																																																											
	Distribute messages																																																											
Public Education IV: Regional and State Outreach																																																											
PE IV - A	Continue to attend or host																																																										
	Consider formalizing the organization																																																										
PE IV - B	Continue dialogue with other local communities																																																										
	Continue dialogue with resource agencies																																																										
	Continue participation in CASQA																																																										
	Continue participation in CWEA																																																										
Public Particpation and Involvement																																																											
PP I - A	Schedule and advertiese meetings																																																										
	Hold meeting annually																																																											
PP I - B	Schedule, advertise and participate in clean up																																																										
Watershed Stewardship																																																											
WS I - A	Continue to schedule and construct…																																																										

BMP	Task	2003							2004												2005												2006												2007												2008							Ongoing
		June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	
WS I - B	Coordinate and assist project managers…																																																								
WS I - C	Develop strategy and work plan																																																								
ILLICIT DISCHARGE DETECTION AND ELIMINATION																																																									
Illegal Discharge I: Ordinance Enforcement																																																									
IDE I - A	Review Ordinance																																																								
	Consult Legal Services																																																								
	Revise as necessary																																																								
IDE I - B	Distribute storm water program information																																																								
	Incorporate in response procedures																																																								
	Develop web site																																																								
Illegal Discharge II: Spill Response																																																									
IDE II - A	Respond to reports																																																								
	Add web page material																																																								
	Establish tracking and reporting																																																								
IDE II - B	Document response procedure																																																								
	Set up phone number																																																								
	Establish tracking and reporting																																																								
IDE II - C	Continue staffing response team																																																								
	Establsih tracking																																																								
Illegal Discharge III: Illegal Discharge Prevention																																																									
IDE III - A	Continue volunteer support																																																								
IDE III - B	Continue support of HOW programs																																																								
	Report quantities																																																								
IDE III - C	Continue support of program																																																								
	Report quantities																																																								
IDE III - D	Pursue Mapping																																																								
	Follow maintenance and operations plan																																																								
IDE III - E	Continue efforts to map and inspect for illicit connections																																																								
NEW DEVELOPMENT																																																									
Construction I: Outreach and Education																																																									
CE I - A	Provide assistantce to developers																																																								
	Host workshop/class																																																								
CE I - B	Provide information on new standards																																																								
Construction II: Ordinance and Standards																																																								
CE II - A	Review Ordinance																																																								
	Consult Legal Services																																																								
	Revise as necessary																																																								
CE II - B	Evaluate Standards																																																								
	Revise Standards																																																								
	Adopt Standards																																																								
	Circulate Standards																																																								
Construction III: Inspection and Enforcement																																																								
CE III - A	Review and revise standard BMP's for implementation with new projects																																																							
	Develop plan check procedure and paper trail for reporting																																																							
	Educate environmental review staff																																																								
	Implement conditioning of storm water quality improvement BMPs																																																							
CE III - B	Continue review process for erosion and sediment control plans.																																																							
	Continue to inspect construction sites																																																							
	Review and revise standards as necessary																																																							
	Train plan checkers and inspectors on any new standards or requirements																																																						
	Develop plan check procedure and paper trail for reporting																																																						
CE III - C	Formalize inspection procedure/parameters																																																						
	Provide education for inspection staff																																																							
	Assign inspection staff																																																							
	Provide enforcement mechanism																																																						
CE III - D	Develop inspection forms and data tracking procedures																																																					
	Assign task																																																							
	Develop Database																																																						
	Maintain Database																																																						
New Development and Redevelopment I: Technical Assistance																																																							
NDE I - A	Continue providing assistance																																																							
	Develop flyers																																																							
	Develop distribution list																																																							
	Distribute flyers																																																							
NDE I - B	Continue providing consultation services on a project-by- project basis																																																						
	Train staff in new requirements																																																							
	Write Conditions																																																							
	Build consensus and review proposed condition																																																						
	Adopt standard condition																																																						
New Development and Redevelopment II: Design Standards																																																						

BMP	Task	2003							2004												2005												2006												2007												2008							
		June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	July	August	September	October	November	December	Jan	Feb	Mar	April	May	June	Ongoing
NDE II - A	Evaluate Standards																																																									
	Revise Standards																																																													
NDE II - B	Evaluate local and nationwide research																																																													
	Participate in efforts																																																													
New Development and Redevelopment III: Regional Storm Water Controls																																																													
NDE III - A	Develop review protocol																																																													
	Assign staff for review																																																													
	Review design for compliance with criteria																																																													
NDE III - B	Pending construction of regional water quality BMPs																																																													
NDE III - C	Continue development and maintenance of the Database																																																													
	Develop protocol for addition of existing private facilities																																																												
	Develop tracking and recording of complaints and violations.																																																												
New Development and Redevelopment II: On-site Storm Water Control																																																													
NDE IV - A	Develop review protocol																																																												
	Assign staff for review																																																												
	Review design for compliance with criteria																																																											
NDE IV - B	Develop code/enforcement authority																																																											
	Develop protocol																																																											
	Develop inspection procedures																																																											
	Develop Database																																																											
	Develop inspection schedule																																																										
	Begin inspections																																																										
	Begin enforcement																																																										
NDE IV - C	Assign staff																																																										
	Develop Database																																																										
	Maintain Database																																																										
NDE IV - D	Review ordinance																																																									
	Consult Legal services Department																																																										
	Revise ordinance as necessary																																																									
POLLUTION PREVENTION AND GOOD HOUSEKEEPING FOR MUNICIPAL OPERATIONS																																																												
Municipal I: Technicial Assistance																																																											
ME I - A	Provide service for all industrial type City facilities																																																											
ME I - B	Conduct Survey																																																											
	Develop Database of activities																																																											
	Develop BMP's to address as necessary																																																										
	Implement BMP's to address																																																										
ME I - C	Develop review protocol																																																										
	Assign staff for review																																																										
	Review design for compliance with criteria																																																									
ME I - D	Develop protocol																																																									
	Develop inspection procedures																																																									
	Develop Database																																																									
	Develop inspection schedule																																																								
	Begin inspections																																																							
	Perform corrective action or maintenance as necessary.																																																							
Municipal II: Pollutant Removal Activities																																																											
ME II - A	Continue street sweeping																																																										
ME II - B	Perform maintenance per M&O plan schedule																																																									
ME II - C	Develop inspection procedure																																																									
	Develop schedule for inspection																																																									
	Perform inspections																																																									
Municipal III: BMP Retrofit and Improvement Projects																																																										
ME III - A	Evaluate water quality features in the next Master Planning Effort																																																									
Municipal IV: Employee Training Program																																																								
ME IV - A	Develop program																																																								
	Develop Training schedule																																																								
	Implement Training program																																																								
ME IV - B	Develop and Implement feedback system																																																							
	Summarize and report responses in annual reports.																																																							

5-2 Program Element Implementation Introduction

Performance and effectiveness evaluations are key to ensuring that the Program implements activities, which are successful in changing behaviors and reducing storm water pollution. Performance measures are intended to describe the level of effort and involve enumeration of activities or the number or percentage of participation in a Program activity. Examples of performance measures include the number of public events attended, training sessions conducted, or media spots in the form of public service announcements. This information is used by Program Staff for purposes of planning and scheduling resources required to conduct the Program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the maximum extent practicable or eliminate non-storm water discharges. This information is used to focus and modify activities to maximize environmental benefits. Effectiveness measures include quantifying the effectiveness of a particular effort; for example, the percentage increase in public awareness is measured by public opinion surveys. Specific goals and level of efforts for specific activities and BMPs to provide effectiveness evaluations will be included in the Annual Work Plans. The results of these effectiveness evaluations, including performance and effectiveness measures, will be provided in the Annual Progress Reports. Annual Progress Reports will quantify the previous fiscal year (where possible), including the performance and effectiveness of activities, BMPs, and specific tasks. This annual evaluation will assess how well the Annual Work Plan goals were achieved and whether the Minimum Performance Standards were accomplished. Activities and specific BMPs may also be modified, added, or deleted as needed to meet Program Element goals. In-depth evaluation of each Program Element will be conducted at least once during this five-year span.

5-3 Community Teamwork and Partnership Element

The focus of the Community Teamwork and Partnership Element is to include the community in the goal reducing pollution. It contains all activities that promote or involve participation from volunteer organizations, the general public or other agencies. The goals of the Community Teamwork and Partnership Element are to:

1. Promote participation throughout all sectors of the community.
2. Increase the water quality ethic.
3. Provide organization for participation and promote a sense of watershed ownership in the community.
4. Increase understanding of the effects of pollution.

5-3.1 Public Education and Outreach

The Public Education and Outreach Element is a critical element in the City's Storm Water Quality Improvement Program. Within the City limits are numerous creeks of diverse nature. Some are fully urbanized and some are virtually native in condition. Because of the number and diversity of creeks, the most substantial impact a program can have is to educate the public regarding storm water quality concerns and as the level of awareness increases so will the storm water ethic and behavior changes will follow accordingly.

The goal of the Public Education and Outreach Element is to raise the storm water ethic in all segments of our society including the general public, local industry, developers, the construction industry and City of Redding officials and departments. The Program plans to accomplish this by; (1) generating awareness of storm water pollution prevention by educating people about the storm drain system and its relationship to the health of local waterways; (2) educating the public on the sources of pollution that may impact storm water quality and how everyone can contribute to prevention or elimination of

sources; (3) promoting awareness of the value of maintaining storm water quality and the costs associated with a polluted watercourse; and (4) changing behavior patterns through education and encouragement of active participation in water pollution prevention.

Outreach activities can be grouped into four categories:

- General Public and Target Sector Outreach
- School Outreach

1-1 Public Official Outreach

1-1 Statewide and Regional Outreach

It has become evident over the years that an important component of a successful outreach program is a commitment to building lasting relationships and partnerships. These partnerships assist in promoting the strategic plan's key messages and expand the City resources. In the next permit term, the Public Education and Outreach Element will continue to actively seek opportunities to work with others to promote water quality protection. Since the partnerships will be aggressively targeted, efforts will be directed at educating the media to recognize storm water pollution prevention as an important factor in protecting the environment and quality of life in the City of Redding. The goal of these partnerships will be to expand the role of the media in use of non-city means to reach the public such as museums.

The expanded role will include the media as partners in promoting storm water issues as worthy topics of interest to the general public. Because City staff are highly visible in the community, City department activities are another vital target for partnerships. The coordinated efforts of the Public Education and Outreach and Municipal Operations and Facilities Elements will result in knowledgeable City staff that can implement appropriate control measures and serve as role models for water quality protection.

The Public Education and Outreach Element will continue and expand its active presence in classrooms through elementary school classroom presentation on water quality curricula. The long-range goal is to work with local School Districts, Shasta Community College, Cities of Anderson and Shasta Lake, museums, fisheries groups, and numerous watershed action groups in the region to participate in developing the classroom lesson plan developed for each school year. By educating the children about the importance of water quality protection, a new generation will have the necessary tools to make informed decisions on how to best protect the City of Redding's natural waterways.

Public Education and Outreach Best Management Practices

Public Education I: General Public and Target Sector Outreach

PE I-A: Public Survey

A public survey is an integral part of the entire Storm Water Quality Improvement Plan. The survey will be conducted early in the implementation phase of the program and provide guidance for refinement of the plan prior to the second permit term. It will also serve as a baseline for determination of effectiveness and evaluation of numerous elements of the Program. Simply by asking the questions the survey initiates public education.

The City will perform an analysis to determine the minimum necessary population to survey to yield a statistically representative analysis at an acceptable level of confidence. The survey will then be distributed to a random selection of the City residents. From the survey, the City expects to determine the level of knowledge and concern the public has regarding storm water pollution and where to focus education and other efforts.

PE I-B: Storm Drain Labeling Program

Promote volunteer storm drain labeling through volunteer organizations. Storm drain labeling is currently being pursued by one of the local Rotary Club chapters using permanent markers provided by the City as an effective way to educate the general public about storm water pollution and get citizens involved.

PE I-C: Participation in Community Events

The City of Redding currently either hosts or participates in at least six public events appropriate for providing storm water quality education by distributing materials and exposure to informational displays. The existing informational materials (usually in brochures) are free to the public. They cover multiple environmental issues and City programs regarding monitoring of and data on water quality, water conservation and rebates, wastewater pollution and pretreatment, residential litter collection and abatement, and the recycling of residential waste oils, electronic wastes, and hazardous wastes. The Program will expand on these events by creating additional displays and expanding the quantity and quality of information presented.

PE I-D: Multi-Ethnic Outreach

The Program will work towards distributing water quality and pollution prevention materials in languages corresponding to the primary local ethnic groups.

PE I-E: Clean Water Business Partners

Annually, the City Parks Department is involved with an integrated pesticide management training course for area landscapers, to meet on going continuing education requirements set by the State of California. Periodically, this City Department partners with the Shasta County Agricultural Commission to present integrated pest management classes to interested parties in both the residential and business sectors.

Develop industry specific educational materials for landscaping and carpet cleaning contractors along with a list for distribution of such materials. Develop and hold annual workshops or classes to provide assistance to and education for these specific industries. Develop a list of additional industries to pursue similar programs.

PE I-F: Mass Mailing

Existing Municipal Utilities monthly billing includes a flyer such as the Redding-Waste Stream and the Redding Connections, as a public outreach service. Both of these flyers provide a perfect vehicle for periodic distribution of specific public information dealing with issues and City programs regarding monitoring of and data on water quality & water conservation and rebates, wastewater pollution and pretreatment, residential litter collection and abatement, and the recycling of residential waste oils, e-wastes, and hazardous wastes. The intent is to keep the general public up to date on pertinent utility services and to answer questions common to the services provided. As such, they provide a means to deliver future storm water pollution prevention information and promote desired behavioral changes.

PE I-G: Storm Water Website

The City will pursue development of a storm water section on the City web site. The section will provide educational material, downloadable and printable materials on storm water quality and pollution prevention as well as opportunity for public feedback and comment.

PE I-H: Media Campaigns

Develop multimedia campaigns and partnerships. Look for ways to partner with business or industries. Research mass media opportunities and partnerships. Perform cost

benefit analysis, seek funding, prepare and run campaigns. Possible areas are newspaper adds, television, radio, or billboards.

PE I-I: Service Club Presentations

Develop presentations for service clubs to encourage their participation and provide instruction on means for their participation in pollution reduction efforts.

PE I-J: Pet Waste Control

City of Redding Parks Department has posted signs along one major public trail to educate and remind the public as to their responsibility in cleaning up wastes from their pets. This BMP will be extended to all City trails.

PE I-K: Waste Recycling

Develop and distribute educational materials that explain the benefits of waste recycling. Record and report the amounts of recycled materials.

PE I-L: Stream Corridor Identification

Provide assistance to community volunteer organizations in installing creek corridor signs at bridge crossings.

Public Education II: School Outreach

PE II-A: Classroom Visits

COR currently visits elementary school classrooms to distribute material and educate our children on both water and solid waste. The water presentation already includes storm water quality elements. Modifying or adding to these presentations to include Phase II materials will represent an insignificant additional effort.

PE II-B: Storm Water Quality Curricula

Provide storm water-specific instructional units to K–8 grade schools to encourage teachers to include a science unit on storm water management.

Public Education III: Public Official Outreach

PE III-A: City Council Update

Provide regular feedback to City Council regarding Storm Water Management issues both in issue papers, annual status reports, and budget proposals.

PE III-B: Departmental Outreach

Many of the City Departments hold some sort of annual event for public involvement and participation. Such events can be the focus of one of the Public Education BMPs listed above. Public officials currently participate in such events and will be encouraged to continue doing so and will be encouraged to link storm water pollution to their programs.

PE III-C: Employee Outreach

Several of the City departments publish a monthly employee newsletter. These newsletters are distributed to all staff within each department and provide opportunity to circulate educational material.

Public Education IV: Regional and Statewide Outreach

PE IV-A: Redding Area Storm Water Task Force

City of Redding currently participates in an area wide task force organized for the purpose of working on plans to improve storm water quality. The City will continue to participate in this organization as a venue for communication and shared education with other municipalities and permit holders.

PE IV-B: Additional Outreach Activities

Continue to look for opportunities to develop and foster relationships with volunteer organizations, businesses, service clubs, other agencies, and interested parties in improving storm water quality.

Effectiveness Evaluation

There are many methods of evaluating the effectiveness of the Public Education and Outreach Element. The success of some BMPs, such as participation in community events and the volunteer storm drain labeling program may be evaluated through public response or the amount of information that is distributed. The number of people reached or the frequency of the message may measure media campaigns. However, the best tool for measuring the effectiveness of overall outreach efforts will be the public opinion survey developed as part of the original strategic plan. The survey provides information on whether or not the public is receiving and accepting the outreach information in the format in which it has been presented. The information indicates whether or not there is a trend toward behavioral change and stewardship, while providing an update base for continuing outreach efforts.

Performance and Effectiveness Measures

The following are examples of the types of performance measures (P) and effectiveness measures (E) that may be used to measure the degree of Program Element implementation and activity effectiveness. Performance measures involve enumeration of activities or the number or percentage of participation in a Program activity. This information is used by staff for purposes of planning and scheduling resources required to conduct the Program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the maximum extent practicable (MEP) or eliminate non-storm water discharges. This information is used to focus and modify activities to maximize environmental benefits. The specific goals and level of effort for effectiveness evaluation activities, as well as the results of the performance and effectiveness measures, will be provided in the Annual Progress Reports.

Public Education I: General Public and Target Sector Outreach

PE I-A: Public Survey

- Number of Survey Responses (P,E)
- Survey Process (P,E)
- Survey Results (E)

PE I-B: Storm Drain Labeling Program

- Number of catch basins labeled (P)
- Number of groups participating in the program (P,E)

PE I-C: Participation in Community Events

- Number of Events attended (P)
- Interest of public (E)

PE I-D: Multi-Ethnic Outreach

- Number of materials distributed (P)

PE I-E: Clean Water Business Partners

- Number of industries and businesses contacted with storm water message (P,E)
- Interest from industries for initiating effective BMPs (E)
- Comments from customers (E)

PE I-F: Mass Mailing

- Number of fliers distributed(P)
- Number of responses (P,E)

PE I-G: Storm Water Web Site

- Number of web site viewings (P)
- Number of responses (P,E)

PE I-H: Media Campaigns

- Number of advertisements placed (P)

PE I-I: Service Club Presentations

- Number and types of participants attending (P,E)
- Number of presentations (E)

- Feedback and subsequent participation by service groups (E)

PE I-J: Pet Waste Control

- Number of additional signs posted (P)

PE I-K: Waste Recycling

- Amount of waste recycled (P,E)

PE I-L: Stream Corridor Identification

- Number of signs posted (P)

Public Education II: School Outreach

PE II-A: Classroom Visits

- Number of classrooms participating (P)
- Number of classroom presentation (P)
- Response from teachers and students (E)

PE II-B: Storm Water Quality Curricula

- Number of schools participating (P)
- Response from teachers and students (E)

Public Education III: Public Official Outreach

PE III-B: Departmental Outreach

- Pollution prevention participation (P)
- Number of department representatives participating (P)

PE III-C: Employee Outreach

- Number of departments using storm water program plan (P)
- Departments incorporating messages into newsletters (P,E)

Public Education IV: Regional and Statewide Outreach

PE IV-A: Redding Area Storm Water Task Force

- Number of meetings attended (P)

PE IV-B: Additional Outreach Activities

- Number of new contacts made (P)

The following is an example of measurable goals for a Public Education and Outreach plan for the initial permit term.

Target Date	Activity
March 04	Develop partnerships to make presentations to local watershed groups, water users and volunteer organizations. Develop locally appropriate brochure.
March 05	Distribute brochure. Create Web site with links based upon information in brochure. Continue partnership programs.
March 06	Implement target audience-based program (school, industry, general population-based). Continue partnership programs.
March 07	Revise and redistribute brochure. Continue targeted program(s). Continue partnership programs.
March 08	Continue partnership and targeted programs. Evaluate and revise program for next permit term.

5-3.2 Public Participation and Involvement

The Public Participation/Involvement element of the City Plan will allow the public to provide valuable input and assistance to the municipal Storm Water Plan.

Due to time constraint generated by the timing of release of the Draft Phase II Small Municipal Separate Storm Sewer General NPDES Permit relative to the required date of submission of the initial Storm Water Quality Improvement Plan public participation and involvement in this version of the document will be limited to one workshop and a public

comment period. The City expects to expand public participation and involvement before the next permit to include a much more rigorous and integrated public participation and involvement program as described in the following section.

Benefits of a Public Participation and Involvement Program

Since it is the activities of the public within the urban landscapes that produce non-point source pollution it is imperative that the public be given opportunities to play an active role in both the development and implementation of the program. An active and involved community is crucial to the success of a storm water management program because it allows for:

- Broader public support, since citizens who participate in the development and decision making process are partially responsible for the program and are more likely to take an active role in its implementation;
- A broader base of expertise and economic benefit, since the community can be a valuable, free, intellectual resource;
- A conduit to other programs, as citizens involved in the storm water program development process provide important cross-connections and relationships with other community and government programs. This benefit is particularly valuable when trying to implement a storm water program integrated on a watershed basis.
- A means to demonstrate a need for funds to meet program requirements.

To satisfy this minimum control measure, the City of Redding will:

- Comply with applicable State and local public notice requirements using an effective mechanism for reaching the public; and
- Determine the appropriate BMPs and measurable goals for this minimum control measure.

Guidelines for developing and implementing public involvement will include public participation in developing, implementing, and reviewing each minimum measure of the storm water quality improvement program. The public participation process should make every effort to reach out and engage all economic and ethnic groups.

The best way to handle common notification and recruitment challenges is to know the audience and think creatively about how to gain its attention and interest. Since traditional methods of soliciting public input, such as advertising in local newspapers to announce public meetings and other opportunities for public involvement are not always successful in generating interest, and subsequent involvement, in all sectors of the community, alternative advertising methods may be used whenever possible, including radio or television spots, postings at bus stops, announcements in neighborhood newsletters, announcements at civic organization meetings, distribution of flyers, mass mailings, door-to-door visits, telephone notifications, and multilingual announcements. These efforts, of course, are closely tied to the efforts for the Public Education and Outreach minimum control measure. The City of Redding will also advertise and solicit help from specific population sectors, such as ethnic, minority, and low-income communities; academia and educational institutions; neighborhood and community groups; outdoor recreation groups; and business and industry. The goal is to involve various community groups who can offer a multitude of concerns, ideas, and connections. Watershed groups that encompass all or part of the drainage within the permit areas will be included in this effort.

Public Participation and Involvement Best Management Practices

PP I-A: Public Meetings

Allow citizens to discuss various viewpoints and provide input concerning appropriate storm water management policies and program actions and activities. Watershed groups will be an excellent venue for this type of discussion as well as existing boards and commissions within governmental agencies, such as the planning commission or other City commissions, etc. "Adopt A Storm Drain" programs encourage individuals or groups to keep storm drains free of debris and to monitor what is entering local waterways through storm drains.

PP I-B: Community Water Body Cleanups

For the past ten years Redding has sponsored the Redding Clean-A-Thon. This is a community event where the whole city is targeted for intense litter abatement by hundreds of citizen volunteers. This BMP will be continued, stressing storm water pollution prevention as an additional theme and concept of this event. This allows citizens to participate in the clean up of different water body drainage areas under the direction of City departments and watershed groups. This partnering of governmental and citizen groups will foster good working relationships throughout the community. Service clubs or fishery groups will be encouraged to adopt creeks or watersheds.

PP I-C: Pet Waste Control

This BMP allows owners of pets, using the City trails, to participate in maintaining the public trails they use in an appropriate manner, through the immediate collection of their own pets' wastes for proper disposal.

Effectiveness Evaluation

Measurable goals are intended to gauge permit compliance and program effectiveness. At a minimum, the measurable goal for this program would be to provide adequate public notice of all public hearings, published in community publication or newspaper of general circulation, when implementing the storm water quality improvement programs required under the permit.

PP I-A: Public Meetings

- Number of notices for public meetings (P)
- Permit and Storm Water Quality Improvement Plan review comments (E)

PP I-B: Community Water Body Cleanups

- Number of cleanups performed (P)
- Amount of public participation increases (P,E)

PP I-C: Pet Waste Control

- Number of collection containers distributed (E)

The following are examples of measurable goals used for a Public Participation and Involvement minimum control measure during

Target Date	Activity
March 04	Notice of a public meeting in several different print media, Permit and Storm Water Quality Improvement Plan made available for review and comment.
March 05	Promote participation in program activities using varying media resources.
March 06	Community participation in watershed cleanup activities.
March 07	Review of initial program implementation and advising future program actions.
March 08	Revise program and plan activities for following permit term.

the initial permit term:

5-3.3 Watershed Stewardship

The City of Redding Storm Water Quality Improvement Plan includes a Watershed Stewardship Program to emphasize, prioritize, and allocate resources for local watershed stewardship efforts, including specific improvement or enhancement projects. The City is interested in developing solutions that improve urban creek health through direct improvements to the creek system and habitat. By improving beneficial uses directly, the environment can be improved in ways that storm water control could not solely effect. The watershed stewardship approach provides the opportunity to protect and enhance the beneficial uses of urban creeks by considering a variety of factors and alternatives in order to arrive at best solutions.

The overall goal of the Watershed Stewardship Element is to maintain, improve, and promote the health and quality of urban creeks in the City. The specific goals of the Watershed Stewardship Element are to: (1) initiate and support efforts to improve creek habitat, preserves, and natural areas; (2) protect beneficial uses; (3) compensate for areas where conventional maximum extent practicable (MEP) approaches to storm water pollutant reduction may not be adequate to protect all beneficial uses; (4) support and utilize citizen involvement and other community partnerships to identify problems and implement solutions; and (5) increase public understanding and awareness of the value of protecting local creeks and rivers.

Watershed stewardship involves a process of stakeholder participation, problem identification, and development of appropriate strategies and solutions. Stakeholders can provide a variety of experience and expertise required to identify problems and develop solutions. Furthermore, public support and community participation in stewardship is key to achieving comprehensive, long-term improvements in the local environment. Problem identification focuses on the physical, chemical and biological health of waterways. It is important to note that for any given watershed, problems will vary and may involve storm water to a lesser or greater extent.

The overall approach is to maximize resources to improve or preserve water quality and beneficial uses. For example, the reduction of residential pesticides is a complex challenge; despite aggressive public outreach efforts, it may not be possible to totally eliminate pesticide related toxicity in urban creeks. Creek habitat restoration, stream buffer zones or reserves, environmentally sensitive planning, and improved channel maintenance practices may provide benefits that compensate to some degree for pesticide impacts.

The strategy for this element is to increase local watershed stewardship efforts, especially habitat improvement or enhancement projects, through partnerships with City departments, other agencies, neighborhood groups, environmental groups, schools, and other interested parties. Efforts are to be coordinated with Public Education and Outreach Element, Monitoring Program, and Drainage Master-Planning activities.

Watershed Stewardship Element Overview

The City has invested in protection of many of the streams in the City by setting aside 100-year floodplains as open space and steep slopes to prevent erosion in General Planning policy.

Watershed Stewardship Element Best Management Practices and Activities

WS-1: Watershed Improvement Projects

Identification of funding opportunities and partnerships for watershed stewardship projects, prioritization of projects, and support or implementation, including current and newly identified projects. Further development of

the Watershed Stewardship Element to expand current watershed stewardship efforts. The objective of this element is to provide a mechanism to identify and implement selected projects that will assist in reduction or prevention of pollution and restoration of urban watershed habitat. It will also work towards development of a specific strategy and obtaining necessary information to prioritize and focus resources on specific watershed stewardship projects.

WS I-A: Clover Creek Preserve

The Clover Creek Flood Prevention project, scheduled for construction in the Summer of 2003, was also designed to function as an enhanced wetland project and water quality improvement project. The City has obtained funding for this project and completed the permit process for construction. It is expected that this project will improve water quality by reducing the sediment load in the creek and provide some bioremediation capacity for other potential pollutants.

WS I-B: Flood Control and Drainage Projects

Implement General Plan floodplain and steep slope policies. Incorporate creek restoration and habitat features in the design of flood control and drainage projects.

WS I-C: Strategy and Work Plan

Develop strategy and work plan for additional watershed improvement projects. This BMP includes identifying local groups involved or interested in watershed stewardship, additional information needs and an approach to obtaining information and funding opportunities.

WS I-D: Prioritize Projects

Summarize available information on urban creek health in the City and identify opportunities for preservation and restoration projects. Prioritize and implement or support candidate projects for habitat restoration, improvement, or preservation.

WS-2 Watershed Assessment

Support and develop citizen volunteer and interest groups. Foster community watershed stewardship, increase public understanding and awareness of the value of protecting local creeks and rivers, and generate information on creek health.

WS II-A: Watershed Adoption

Develop relationships with local volunteer groups and parties interested in watershed maintenance and foster adoption of specific creeks as projects to protect and restore. Volunteer efforts will be monitored and regulated by the City to assure that projects are environmentally responsible and sensitive.

Effectiveness Evaluation

Specific activities in this element will evolve as the level of interest and participation from the community is determined. As the magnitude of the activity is clarified the specific activities will determine the means of evaluating success and effectiveness.

Performance and Effectiveness Measures

The following are examples of the types of performance measures (P) and effectiveness measures (E) that may be used to measure the degree of Program Element implementation and activity effectiveness. Performance measures involve enumeration of activities or the number or percentage of participation in a Program activity. This information is used by staff for purposes of planning and scheduling resources required to conduct the Program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the MEP or eliminate non-storm water discharges. This information is used to focus and modify activities to maximize environmental benefits. The specific goals and level of effort for effectiveness evaluation

activities will be included in the Annual Work Plans. The results of the performance and effectiveness measures will be provided in the Annual Progress Reports.

Watershed Stewardship-I: Watershed Improvement Projects

- Clover Creek Preserve project implementation and results (P,E)
- Number and success of creek restoration or preservation projects (P,E)
- Strategy and work plan for Program involvement in watershed stewardship (P)
- List of local groups that are involved or interested in creek and river protection and/or restoration efforts (P)
- Completion of summary of information on urban creek health in the City (P)
- List of candidate projects, prioritization for restoration, habitat improvement, or preservation (P)
- Amount of community participation and support of projects (P,E)
- Feedback from community (E)

Watershed Stewardship-II: Watershed Assessment

- Number of training sessions and workshops on citizen creek restoration (P)
- Feedback received from training sessions and workshops (E)

5-4 Illicit Discharge Detection and Elimination Element

The goal of the Illicit Discharge and Elimination Element is to prevent pollutants that are intentionally negligently poured, dumped, discharged or accidentally spilled into the City of Redding drainage system from reaching waterways in the City of Redding and the Sacramento River. Achieving the goal of the Illicit Discharge Element depends on the coordinated efforts of all City departments and other agencies; the Public Education and Outreach Element, Solid Waste, Code Enforcement, and Hazardous Materials Spill Response Section to assist in preventing, identifying, and correcting illegal discharges.

The public also plays an important role in identifying and reporting incidents of spills or illegal dumping. In addition to the established activities currently being implemented, additional planned activities are: (1) continued development of structured enforcement policy and guidance procedures, with appropriate monetary penalties and/or cost recovery for violations of the City of Redding Municipal Code; (2) development of an electronic illegal dumping report form that can be accessed via the City web pages; and (3) identification of high priority watersheds or drainage areas for targeted investigation/enforcement/correction efforts.

Strategy

Coordinate with the Public Education and Outreach Element and other agencies to educate the public and business sectors about proper waste disposal alternatives. Develop guidance and enforcement policy for application of the City's Municipal Code water quality sections. Maintain adequate measures for reporting, spill response, investigation, and cleanup.

Illegal Discharge Element Activities and Best Management Practices

Illegal Discharge I: Ordinance Enforcement

Municipal Code enforcement periodic review and revisions to applicable ordinance, which provides the legal authority for regulating illegal discharges. Development of enforcement policy, procedures, and guidance for Program staff and other City departments in accordance with the Municipal Code.

IDE I-A: Ordinance Enforcement

Periodically review and, as necessary, revise the Storm Water Ordinance. Develop and implement administrative enforcement procedures and guidance for violations of the Municipal Code. Maintain compatibility with

related ordinances, federal and state law.

IDE I-B: Agency Coordination/Database

Provide a shared database for information and assistance to facilitate inclusion of any new ordinance with enforcement activities of various agencies including Code Enforcement, Building Inspection, Construction Inspection, Hazardous Materials, and the City Attorney.

Illegal Discharge-II: Spill Response

Spill response reporting and responding to spills and prohibited discharges to the storm drain system using efficient procedures. Help the public and other agencies to report, contain, or clean up illegal discharges, and assist Program staff to identify, eliminate, and prevent prohibited discharges.

IDE II-A: Website Reporting

Develop and maintain an electronic illegal discharge report form on the City Web site pages for use by the public to report observed illegal discharge activities. Program staff will monitor and respond to reports.

IDE II-B: Telephone Reporting

Develop the operation of the Storm Water Hotline and the 24-hour operator.

IDE II-C: Spill Response

Continue to support a 24-hour, on-call Departmental response of the drainage maintenance staff and Fire Department staff responsible for hazardous materials.

Illegal Discharge-III: Illegal Discharge Prevention

Illegal Discharge prevention identification and promotion of correct disposal alternatives and preventative measures for both the public and private sectors, in conjunction with the Public Education and Outreach Element message of storm water pollution prevention. Reduce the amount of pollutants that may be improperly disposed of into the storm drain system.

IDE III-A: Storm Drain Stenciling

Develop and maintain the volunteer storm drain stenciling program and new development inlet labeling program.

IDE III-B: Hazardous Waste Collection

In conjunction with the Solid Waste Division, continue to promote the availability of the small quantity household hazardous waste collection center.

IDE III-C: Waste Oil Collection

Continue to support the residential and used oil recycle program performed by the Solid Waste Division.

IDE III-E: Illicit Connection Detection

To address deteriorating storm drain pipe replacement cost and schedule, the next City of Redding Storm Drain Master Plan (expected for completion in 2004 or 2005) will entertain an extensive storm drain pipe network inventory, evaluation and mapping effort. Such an effort will be accomplished using a programmatic approach that may take several years due to economic and temporal factors involved in televising underground pipe networks. By the end of this effort the City will have eliminated all existing illicit connections and future efforts will focus on visual inspections of facilities by storm drain division staff during routine maintenance and scheduled inspections.

IDE III-E: Illicit Connection Elimination

Identification by field staff of apparent illicit connections or abnormal discharges as part of routine drainage system maintenance. Illegal Discharge Element staff will continue activities for follow-up investigation and removal of confirmed illicit connections.

Effectiveness Evaluation

The effectiveness of the Illicit Discharge Detection and Elimination Element is measured in the number of discharge incidents and the quantity of pollutants discharged to the drainage system as well as continued control of illicit connections. Efforts to measure effectiveness through quantification methods (e.g., "number of discharge incidents" or "pounds of pollutants") are not valid because they actually measure the effectiveness of identification and reporting programs that are continuing to develop and improve.

In addition, counting the number of reports of spills, illicit discharges and illegal dumping as a measure of program effectiveness is not appropriate. Initially it is expected that the public education combined with the new avenues for responding will result in an initial high response and reporting rate. However, as the storm water ethic in the community increases and general social behavior improves with respect to water quality issues the number of incidents reported should decrease.

Other quantification efforts such as the gallons of waste oil collected might indicate a quantity of pollutants that were potentially kept out of the storm drains, but the annual increase or decrease might also be attributed to better record keeping or the availability of other collection or disposal alternatives. Assessments will include feedback from drainage maintenance inspectors and other City staff, and public comment.

Performance and Effectiveness Measures

The following are examples of the types of performance measures and effectiveness measures that may be used to measure the degree of Program Element implementation and activity effectiveness. Performance measures involve enumeration of activities or the number or percentage of participation in a Program activity. This information is used by staff for purposes of planning and scheduling resources required to conduct the Program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the maximum extent practicable (MEP) or eliminate non-storm water discharges.

This information is used to focus and modify activities to maximize environmental benefits. The specific goals and level of effort for effectiveness evaluation activities will be included in the Annual Work Plans. The results of the performance and effectiveness measures will be provided in the Annual Progress Reports.

Illegal Discharge-I: Ordinance Enforcement

- Review and revise current Municipal Code, as necessary (P,E)
- Development and implementation of enforcement procedures and guidance (P,E)
- Support for enforcement activities (P,E)
- Number of incidents for which penalties are assessed and successfully collected (P,E)
- Number of illegal discharges eliminated (P,E)
- Revise the City litter and solid waste ordinance, as necessary (P,E)

Illegal Discharge - II: Spill Response

- Number of illegal discharges reported via City Web sites (P,E)
- Number of illegal discharges reported via telephone (P,E)
- Total number of spills reported to City Staff (P)
- Number of illegal discharges identified by City Staff (P)
- Training for field staff, number of workshops, and attendance (P)
- Feedback from field staff (E)
- Support for spill response (P,E)
- Number of spills responded to, contained, or cleaned up by City Staff (P,E)
- Number and magnitude of spills that are prevented from reaching area creeks or rivers (E)
- Development of a database for reporting

illegal discharges (P)
- Evaluation of occurrences of common types of illegal discharges and locations (P,E)
- Annual analysis of data for types, frequencies, and locations and updating of database (P,E)

Program Element Implementation Illegal Discharge Element

- Number of groups, participants, and storm drains stenciled per year (P,E)
- Number of new development projects and storm drains labeled per year (P,E)
- Amount of used motor oil collected via the used oil recycle program (P,E)
- Amount of hazardous materials collected at the solid waste transfer station (P,E)

Measurable Goals

The measurable goals, as well as the BMPs, should reflect the needs and characteristics of the MS4 operator and the area served by the MS4. The minimum measurable goals for the permit term may include activities such as the following:

Target Date	Activity
March 04	Design Criteria, Standard Operating Procedures for Storm Water Control Site Plan Review and Monitoring developed; procedures for information submitted by public in place.
March 05	Ordinance or other regulatory mechanisms in place.
March 06	Number of site plans reviewed and approved, number of inspections performed. Enforcement Program developed and implemented.
March 07	Increase in number of site plans reviewed and approved, number of inspections performed.
March 08	Evaluate, review and revise plan for following permit term.

5-5 New Development Element

The New Development Element contains all activities related to new development or significant redevelopment. These activities include construction site management, incorporation of element into projects that have long-term water quality improvement aspects and mechanism for assuring maintenance of long-term improvement features.

5-5.1 Construction Site Storm Water Runoff Control

The goal of the Construction Site Storm Water Runoff Control is to reduce the discharge of storm water pollutants to the maximum extent practicable (MEP) by: (1) requiring construction sites to reduce sediment in site runoff; and (2) requiring construction sites to reduce other pollutants such as litter and concrete wastes through good housekeeping procedures and proper waste management.

Excessive erosion and sediment transport can harm creek habitat through both scour and smothering of spawning areas. The Construction Element conducts outreach activities, development reviews and approvals, and inspections and enforcement at construction sites. This Program Element also develops and maintains standards for erosion and sediment control. Development reviews and approvals include reviewing California Environmental Quality Act (CEQA) documents, applying standard conditions during the entitlement process, and reviewing and approving improvement plans. Appropriate standards are based on research into best management practice (BMP) effectiveness and maintenance requirements.

The Construction Element also assists in educating the development community and municipal project managers about the State General Permit for Discharges of Storm Water Associated with Construction Activities (State Construction General Permit) requirements. Applicable projects must provide proof to the

City of Redding that a Notice of Intent (NOI) has been submitted to the State Water Resources Control Board (State Board) and a Storm Water Pollution Prevention Plan (SWPPP) has been prepared. This outreach is conducted as part of a slate of outreach activities that also address the City's own requirements for construction projects.

The development review process will incorporate storm water requirements for private development projects from the planning process to completion of construction. Resources will also be focused on ensuring that all municipal projects have the tools and procedures in place to effectively comply with City and State requirements. This may include items such as the development of activity-specific BMPs.

Construction-I: Outreach and Education

CE I-A: Developer Outreach

Educate and provide guidance to the construction and development communities on local and state requirements and new technology and practices. Outreach may take the form of fact sheets on regulations, workshops, preconstruction meetings, brochures for specific practices (e.g., landscapers), etc. Target audiences include Development Engineers, Construction Contractors, and any other contractor participating in the development of a new project.

CE I-B: City Staff Outreach

Educate and provide guidance to City staff (e.g., inspectors, project managers, development review staff) on local and state requirements and new technology and practices. Outreach may take the form of fact sheets on regulations, training sessions, staff meetings, preconstruction meetings, brochures for specific practices (e.g., landscapers), etc.

Construction-II: Ordinance and Standards

CE II-A: Update Ordinance

Review and revise the municipal code to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) General Permits as defined in the California State Water Resources Control Board Water Quality Order No. 2003-0005-DWQ. Review should find, or revision provide, that a tiered strategy for enforcement of water quality requirements and penalties.

CE II-B: Update Standards

Evaluate and revise erosion, sediment, and pollution control standards and specifications, as necessary. These standards will be updated based on the latest technology, practices and economic feasability.

Construction-III: Inspection and Enforcement

CE III-A: Entitlement Review

Ensure projects adequately address requirements during the CEQA process by reviewing and commenting on items such as Environmental Impact Reports, Declarations of Negative Impact and mitigation monitoring plans, and conditioning projects to comply with City and State requirements during the entitlement process.

CE III-B: Plan Review and Approval

Ensure that all projects utilize BMPs to address City erosion, sediment, and pollution control requirements though the development approval process and municipal procedures by requiring each project to have an adequate Erosion and Sediment Control Plan and, if applicable, provide proof of coverage under the State Construction General Permit. During plan review, the developer or builder will submit a written statement to the City as to the total amount of land disturbance their project proposes to cover, thereby certifying if the threshold of disturbing more than one acre has been reached. If more than one acre of land will be disturbed, the City will require the submitting of a Notice of Intent and a Storm Water Pollution Prevention Plan to the

State Water Quality Control Board.

CE III-C: Inspection

Ensure that construction sites comply with erosion and sediment control plans. Inspection and enforcement staff will ensure that control measures and practices are implement, properly installed, and maintained during the construction of a project, beginning with rough grading and ending with building construction. As applicable, inspectors will verify that SWPPPs are on-site at private development construction sites or being implemented at municipal project construction sites.

CE III-D: Record Keeping

Update and maintain record keeping and data management procedures for evaluation of Construction Element Activities and reporting. Data will be maintained in an electronic format.

Effectiveness Evaluation

The effectiveness of the Construction Element will be based on the quality of the Erosion and Sediment Control Plans submitted, the level of contractor compliance with the plans, and the adequacy of public agency procedures for plan check and inspection. These items will be assessed by the City of Redding Storm Water Quality Improvement Program (Program) Staff by conducting plan quality and field implementation assessments. Erosion and Sediment Control plan quality assessments will measure the combined effectiveness of several nonstructural BMPs, including standards and specification development, staff training, construction industry education, and agency plan checking procedures. Field implementation assessments will measure combined effectiveness of several nonstructural BMPs, including standards and specification development, inspection staff training, construction industry education, and site inspection procedures.

5-5.2 New Development and Redevelopment

The goal of the New Development Element is to protect local creeks and rivers by reducing the discharge of storm water pollutants that can result from new developments to the maximum extent practicable (MEP). Generally, new developments may result in: (1) an increase in the total urbanized area, with an attendant increase in the overall load of pollutants discharged into local creeks and rivers; and (2) an increased impervious area, with an attendant increase in the volume of storm water runoff flows. These effects of new development are mitigated with the installation and maintenance of source controls and structural control measures on both a regional scale such as detention basins and on individual properties (termed on-site controls) such as vegetated swales. Control measures referred to as treatment control measures in this report are essentially pollutant removal best management practices (BMPs).

The New Development Element establishes review and approval procedures to require regional control measures and on-site source and treatment control measures for new and redevelopment projects. This Program Element also provides outreach to ensure that these procedures are understood and followed, and develops and maintains appropriate standards to guide the selection of possible permanent devises and alternative measures. To date, regional control measures consist primarily of wet and dry detention basins that mitigate excessive sediment transport into local creeks and attenuate peak flows. Detention basins also remove litter and pollutants attached to sediment, including some metals. In addition to particulate removal, wet detention basins may remove some dissolved contaminants. Various on-site controls address different pollutants, depending on their particular objective and design.

Redevelopments are also part of the New Development Element, because they offer opportunities to incorporate on-site controls using the same procedures established for new

developments. Appropriate standards and requirements are based, at least in part, on research into BMP effectiveness and maintenance requirements and experience. The emphasis of the New Development Element has been to develop ordinances, design standards, guidance manuals, and maintenance protocols; and incorporate these requirements into the development review process. Currently, the development review process successfully conditions projects during the entitlement process, incorporates control measures during the plan approval process, and requires maintenance agreements for selected on-site treatment control measures.

City of Redding will develop and implement strategies which include a combination of structural and/or non-structural BMPs appropriate for the community; use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State or local law; and ensure adequate long-term operation and maintenance of BMPs. The Program calls for the implementation of comprehensive and detailed planning procedures and enforcement controls to reduce the discharge of pollutants after construction is complete, from areas of significant new development and redevelopment.

New Development and Redevelopment Management Program

City of Redding will establish an ordinance or other regulatory mechanism requiring the implementation of post-construction runoff controls. New development and significant redevelopment will be required to provide nonstructural and structural BMPs.

Review and Approval Procedures

The Program requires the post-construction program controls to determine if new development and redevelopment designs incorporate adequate structural and/or nonstructural BMPs. City of Redding's Program will include elements required in the regulation and develop a standard operating procedure for the new development or redevelopment plan reviews and approval. The standard operating procedure will identify the department(s) to be included in the process, and will summarize minimum nonstructural and structural BMP requirements. Also there will be a system to track the status of plans that will be combined with existing tracking systems.

New Development and Redevelopment Design Criteria and Standards (BMPs)

A standard operating procedure will be used for the selection and design of appropriate non-structural BMPs. The design criteria and standards will be provided by reference to existing criteria manuals. Runoff problems will be addressed effectively with sound planning procedures.

Structural BMP Practices

These controls are intended to reduce the amount of pollutants that enter state waters. They include:

- Storage Practices - Storage or detention BMPs control storm water by gathering runoff in wet ponds, dry basins, or multi-chamber catch basins and slowly releasing it to receiving waters or drainage systems. These practices control storm water volume and settle out particulates for pollutant removal.
- Infiltration Practices - Infiltration BMPs are designed to facilitate the percolation of runoff through the soil to groundwater, thereby reducing both storm water quantity and mobilization of pollutants. Examples are infiltration basin or trenches, and porous pavement.
- Vegetative Practices - Vegetative BMPs are landscaping features that, with optimal design and good soil conditions, enhance pollutant removal, maintain and improve natural site hydrology, promote healthier habitats, and increase aesthetic appeal.

Regional BMP Practices

These controls are usually implemented downstream of a large drainage area. They can be in stream (located in the state waters), or off stream (prior to entering state waters). In general, where regional BMPs, such as detention ponds, exist some onsite BMPs will not be necessary. If the regional BMPs are being placed prior to discharging into state waters, then the regional BMPs can be used to meet the post-construction requirement, and additional on-site BMPs may only be needed to assist in the function of the regional BMPs. However, if the regional BMPs are located after storm water runoff has discharged into state waters, including natural drainage ways being utilized by the municipality as part of their MS4, this may be a violation of the regulation's requirement to protect state waters, and additional on-site BMPs must be considered to protect the state waters.

Ensure Adequate Long-term Operation and Maintenance of BMPs

City of Redding will ensure an adequate long-term operation and maintenance of Post Construction BMPs. BMPs must be maintained to operate properly and the responsibility for operation and maintenance of structural controls, such as a storm water detention basin, should remain with the private-property owner. City of Redding normally requires a drainage easement that precludes modification of the BMP and allows legal access to the property for inspection and actions as necessary to maintain the operation of the BMP as originally intended. As part of the approval process for any development, certain conditions must be met prior to receiving its approval to proceed with construction of the development. Usually, the most important of those conditions are contained on the recorded plat. In all instances, City of Redding will require that, as part of the plat, it be noted that the legal title holder to the property is responsible for maintaining the BMPs, and that the municipality has the legal right to enforce that obligation, either by legal action to obtain compliance, or by performing the maintenance itself and then collecting those expenses by recording a lien on the property. However, in addition to the above procedure, the municipality should require each approved development, prior to the approval of the plat, to create either a Homeowners' Association (HOA) or Storm Drain Maintenance District (SDMD).

For residential areas, the land area in a subdivision where a BMP is located is usually held in common by an HOA or a SDMD. The HOA is a legal entity that can levy assessments on developed properties within the subdivision to raise funds for expenditures to operate and maintain infrastructure held in common. The formation of the HOA can encompass various terms, conditions, responsibilities and authorities. The City will ensure that these include legal responsibility to maintain the BMPs installed in the development, as well as the legal authority to levy an assessment on each owner to pay for that maintenance. In addition, the HOA should have the right to impose a lien on an owner's property for failure to pay the assessment. All of these powers should be set forth in the articles of incorporation of the HOA, its bylaws, and the covenants, conditions and restrictions, which affect all of the property in the development. The covenants are recorded with the City Clerk, and are enforceable by the HOA. The SDMD is also a legal entity that can levy assessments on developed properties within a subdivision to raise funds for expenditures to operate and maintain infrastructure held in common.

For commercial developments, such as a shopping mall, a relatively large area of land is involved that would be developed by one individual (or corporation), and subsequently sold or leased to relatively few tenants or property owners. It is likely that this land would be built at one time with one or two structural BMPs comprising a system for the entire site. Individual lots for industrial,

commercial, or residential use would also follow this model where on-site BMPs would be designed and constructed. For these properties, the requirements for operation and maintenance of on-site BMPs will identify the responsible party as part of the development agreement and be recorded for the property. In addition, City of Redding will consider requiring the formation of an owners' association or SDMD in those instances in commercial development where there will be multiple owners of the real property. An ordinance or other regulatory mechanism will indicate that, regardless of whether the owner or tenant is responsible for the maintenance, the City would enforce on the owner if the maintenance were not performed.

HOAs have not always remained diligent in their responsibilities, and they have at times provided notification of dissolution. Under a strict interpretation of "ensure" as contained in the regulation, the City could be held liable for the responsibility of operation and maintenance of BMPs on private property. Therefore, by assuring through the development approval process that the owner of the real property will ultimately be legally responsible for the maintenance of the BMPs, City of Redding will do all in its power to "ensure" that the BMPs will be maintained as agreed. To this end, the City will not only provide for the performance of the needed maintenance by itself, if necessary, but also includes a process whereby a lien of record (or similar legal action) can be placed on the owner's property. The lien would be used to assure collection of the owner's share of the maintenance costs expended by the City. City of Redding will consider the following measures for inclusion in the Program:

- Regular inspections of BMPs and a report sent to the owner or operator noting compliance or deficiencies.
- Requirement of a surety bond, letter of credit, or other financial instrument to be held by the City in case of default on maintenance responsibility.
- "Charge-back" provisions where City of Redding will perform the required maintenance of a BMP and invoice the owner for repayment.
- Establish a maintenance contract with a private subcontractor for maintenance of the City-owned BMPs.
- Establish a fee system whereby privately owned BMPs are maintained under a contract with a private subcontractor, but the City administers the contract.

Monitoring Compliance During Construction

The City will develop procedures to determine if the BMPs required by the Site Plan Review are being installed according to specifications. This will be developed in conjunction with the Construction Program. City of Redding will determine if BMP construction variances are the result of ignorance of the requirements, a change in site conditions, or a general disregard for the requirements. Ordinances or other control mechanisms will be in place to allow measures to be taken to ensure the BMPs are installed correctly, such as not allowing release of development bonds until the proper BMPs are in place and operating.

Monitoring Long-Term Compliance

In order to ensure adequate long-term operation and maintenance of BMPs, inspection and enforcement programs are required. The elements of the programs will include the following:

a. The City will develop a database of all new post-construction BMPs in its jurisdiction. In addition to being an important tool for other elements of the Post-Construction minimum measure, such as inspections and enforcement, the database could be used for annual mailings done prior to the rainy season to remind BMP owners to perform necessary maintenance.

b. The Post-Construction Inspection Program is a continuation of the Construction

Program and contains the same program elements. A standard will be developed for performing inspections, and will include inspection forms applicable to residential, commercial, and municipal developments. The program will include the following:

i. Compliance Inspections. Compliance inspections are routine inspections conducted to ensure that the BMPs are receiving proper maintenance. The inspector verifies that the BMPs are functioning according to design and confirms that the required documentation of inspection and BMP maintenance is occurring. This should include an appropriate level of follow-up when deficiencies are discovered.
ii. Complaint Response Inspections. The City will have the ability to respond to third party concerns regarding malfunctioning or poorly maintained BMPs. This will include a point of contact, response protocol (either a telephone call to owner/operator, inspection of site by representative of reviewing authority, or some other means of follow-up with the construction site), or reviewing authority, or some other means of follow-up with the construction site), or review of the site plan, as appropriate. A suitable level of follow-up will be included when deficiencies are discovered.

c. Failure to Maintain BMPs. It is important to ensure that the BMPs implemented are maintained. It is also necessary to determine the cause of any noncompliance. Corrective actions include the following:

i. Document the need for maintenance on the inspection report. Provide time for the developer or property owner to address the concerns. A follow-up inspection will need to be conducted.
ii. If the developer or property owner fails to take the necessary measures, meet with the developer or property owner to discuss the necessary measures and time frames for addressing the problems.
iii. If actions are not taken in the specified time frame, begin enforcement procedures.

d. Enforcement Program. An enforcement program will be developed and implemented if BMP maintenance procedures are not performed within required time frames. The program will address appropriate responses to common noncompliance issues with developers and property owners. The program will also specify when and how items such as summons to appear before the court will be used, and how these activities would be tracked. Several options for formal action are available. They include:

i. Verbal warning to the developer or property owner.
ii. Letter of noncompliance
iii. Notice of violation and order
iv. Charge back to owner for work completed by the City
v. Municipal summons

New Development Element Activities and Best Management Practices

New Development-I: Technical Assistance

NDE I-A: Developer Assistance

Conduct outreach to the development community to provide information and serve as a technical resource on policies, requirements, and new technology and practices. This may be accomplished through workshops, presentations at professional organizations, newsletters, or user-friendly fact sheets and web sites.

NDE I-B: City Staff Assistance

Provide training and serve as a technical resource for staff, including City project managers and development review staff, on proper design, installation, inspection, and maintenance of both on-site and regional control measures and on new technology and practices. Training will ensure that agency staffs are aware of their responsibilities. This may be accomplished through workshops, training sessions, staff meetings, user-friendly fact sheets, brochures, and memos.

New Development-II: Design Standards

NDE II-A: Update Standards

Evaluate and revise development standards, as necessary. Development standards include planning practices, site design, regional control measures (e.g., wet and dry detention basins), source control measures, on-site treatment control measures, and maintenance requirements. These standards will be updated based on new technical information, new innovative technologies, and control measure effectiveness. The State of California has dictated design standards for cities with populations greater than 50,000, which includes the City of Redding. These design standards are included in Appendix J and will be used as a minimum requirement for development of future, more specific design guidance for the engineering community.

NDE II-B: BMP Research

Identify and evaluate alternative and innovative control measures through networking with other programs, product research, literature reviews, and BMP performance studies.

New Development-III: Regional Storm Water Controls

NDE III-A: Development Review Process

Ensure projects adequately address requirements during the California Environmental Quality Act (CEQA) process by reviewing and commenting on items such as Environmental Impact Reports and funding for mitigation monitoring plans. Condition projects to incorporate minimum design standards and comply with post-construction requirements during the entitlement process. Utilize the development approval process (i.e., plan check) or municipal procedures (i.e., City project managers) to ensure projects incorporate regional control measures that meet design standards.

NDE III-B: Maintenance Protocols

Develop and implement maintenance protocols for watershed control measures.

NDE III-C: Record Keeping

Update and maintain record keeping and data management procedures for tracking regional control measures and their maintenance.

New Development- IV: On-Site Storm Water Control

NDE IV-A: Development Review Process

Ensure projects adequately address requirements during the CEQA process by reviewing and commenting on items such as Environmental Impact Reports and mitigation monitoring plans. Condition projects to comply with post-construction requirements during the entitlement process. Utilize the development approval process (i.e., plan check and inspection process) or municipal procedures (i.e., City project managers) to ensure projects adequately incorporate and construct on-site control measures that meet design standards. Inspection staff will ensure that on-site control measures are properly installed.

NDE IV-B: Maintenance Protocols

Develop and implement maintenance protocols for on-site control measures; develop an inspection program to ensure control measures are maintained. Maintenance protocols

include requiring maintenance agreements for select on-site control measures installed on private property.

NDE IV-C: Record Keeping

Update and maintain record keeping and data management procedures for tracking on-site control measures and their maintenance.

Effectiveness Evaluation

The effectiveness of the New Development Element will be based on whether on-site and regional storm water quality control measures have been designed, constructed, and maintained according to the developed criteria. Maintenance records, inspection records, and visual monitoring will provide verification that the control measures are working.

In addition to collecting and evaluating data on control measures that have been installed, literature reviews and special studies on the effectiveness and maintenance requirements of specific control measures will be conducted as needed. Special studies may be conducted by the City of Redding, other public agencies, manufacturers, or property owners. Information from the special studies and literature reviews will be used to develop and revise selection requirements, design criteria, and maintenance protocols.

Performance and Effectiveness Measures

The following are examples of the types of performance measures (P) and effectiveness measures (E) that may be used to measure the degree of Program Element implementation and activity effectiveness. Performance measures involve enumeration of activities or the number or percentage of participation in a Program activity. This information is used by staff for purposes of planning and scheduling resources required to conduct the Program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the MEP or eliminate non-storm water discharges. This information is used to focus and modify activities to maximize environmental benefits. The results of the performance and effectiveness measures will be provided in the Annual Progress Reports.

New Development-I: Technical Assistance

- Type and number of outreach materials (P)
- Number of workshops and workshop attendance (P)
- Workshop evaluations (E)
- Feedback from municipal staff (E)

New Development-II: Design Standards

- Number of BMP designs incorporated into new development projects (P)
- Number of hits to Web site (P)
- Results of BMP performance studies (E)

New Development-III: Regional Storm Water Controls

- Number of projects conditioned (P)
- Number of projects constructed or approved (P)
- Number of inspections and maintenance activities performed (P)

Measurable Goals

The measurable goals, as well as the BMPs, will reflect the needs and characteristics of the City of Redding and the area served by the MS4. City of Redding's approach for this minimum measure will include the following goals.

5-6 Pollution Prevention and Good Housekeeping for Municipal Operations

The City of Redding conducts numerous municipal operational and maintenance activities, some of which have the potential to result in discharges of pollutants in runoff or be sources of non-storm water discharges. The goal of the Municipal Operations and Facilities Element is to reduce these discharges of pollutants in runoff and control non-storm water discharges.

The Municipal Operations and Facilities Element evaluates activities to identify those that could be significant sources to the maximum extent practicable (MEP); and identifies and controls discharges of non-storm water from facilities owned or operated by the City. This Program Element also conducts operation and maintenance activities that remove pollutants. Several existing routine, conventional municipal activities provide the additional benefits of pollutant removal. City operation and maintenance activities for sediment traps and detention basins result in the collection and removal of significant quantities of pollutants from storm water runoff. The City's street sweeping program also will remove sediment and associated pollutants from roadways and gutters that would otherwise enter the storm drains. Furthermore, planning efforts provide the opportunity to incorporate water quality features in the design of regional detention basins to provide treatment and removal of pollutants as well as flood and drainage control.

Major proposed activities include continued efforts to identify and improve municipal operations that are potentially significant sources of pollutants. Outreach and training are essential to ensure that municipal employees are aware of and able to implement the Municipal Operations and Facilities Element. Surveys and facility inspections will be conducted. Areas of focus include: (1) equipment maintenance and washing; (2) pesticide application practices; and (3) waste storage and disposal. Development of fact sheets, performance standards, and procedure manuals for common municipal activities will help ensure that pollutant prevention practices are followed. Street sweeping and catch basin cleaning activities will be evaluated to determine effectiveness, and alternatives will be considered to improve pollutant removal.

Municipal Operations and Facilities Element Activities and Best Management Practices

Municipal-I: Technical Assistance

ME I-A: Municipal Facility SWPPPs

Conduct inspections and prepare Storm Water Pollution Prevention Plans (SWPPPs) and best management practices (BMPs) for City facilities. Provide follow-up consultation as necessary.

ME I-B: Municipal Activity Surveys

Survey City departments on municipal activities that may contribute to target pollutants and general storm water pollutants.

ME I-C: New Facility BMPs

Review design plans for proposed municipal facilities and provide guidance on pollutant and non-storm water discharge control.

ME I-D: Facility Inspection

City of Redding facilities will be inspected according to time frames and actions specified in the specific SWPPPs prepared for each facility under BMP ME I-A. Facilities will be inspected at a minimum frequency of annually.

Municipal-II: Pollutant Removal Activities

ME II-A: Street Sweeping

Continue City street sweeping program and evaluate alternative equipment and sweeping schedules to optimize pollutant removal. Roadside sanitation programs will be enhanced.

ME II-B: Drainage System Maintenance

Continue maintenance activities to remove accumulated sediment and excessive vegetation from storm drainage systems to assure conveyance adequate to provide for health, welfare and safety of our citizens. Storm drain maintenance activities and associated BMPs are identified in the Storm Drain Utility Maintenance and Operations Plan

(Appendix 1).

ME II-C: Structural Control Operation and Maintenance

Operate and maintain structural devices such as settling and treatment facilities at regional detention basins and low-flow control measures to ensure optimum pollutant removal.

Municipal-III: BMP Retrofit and Improvement Projects

ME III-A: Retrofit Existing Facilities

Incorporate water quality features (e.g., detention basins) in drainage system improvement projects where necessary as part of drainage master planning.

Municipal-IV: Employee Training Program

ME IV-A: Employee Training Program

Attend tailgate meetings and conduct specific training sessions to provide City of Redding Storm Water Quality Improvement Program information on appropriate municipal control measures.

ME IV-B: Employee Feedback Program

Solicit information on City activities and suggestions for improvement of Municipal Operations and Facilities Element activities.

Effectiveness Evaluation

The effectiveness of the Municipal Operations and Facilities Element is dependent on adequate training, resources, and staff to ensure that City operations and facilities are reducing storm water pollution and controlling non-storm water discharges. Assessments will include evaluation of inspections, site visits, improved procedures for managing target pollutants, review of feedback from City staff, and public comments. Public comments may be useful indicators of the consistency and fairness of storm water requirements being established for businesses and residents. Quantitative measurements of effectiveness include evaluation of sediment removed from sump maintenance and street sweeping as well as estimated reductions in pollutant loadings. In addition, special studies on the effectiveness of control measures will be conducted as needed in coordination with the New Development Element and Monitoring Program.

Performance and Effectiveness Monitoring

The following are examples of the types of performance measures (P) and effectiveness measures (E) that may be used to measure the degree of Program Element implementation and activity effectiveness. Performance measures involve enumeration of activities or the number or percentage of participation in a Program activity. This information is used by staff for purposes of planning and scheduling resources required to conduct the Program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the MEP or eliminate non-storm water discharges. This information is used to focus and modify activities to maximize environmental benefits. The specific goals and level of effort for effectiveness evaluation activities will be included in the Annual Work Plans. The results of the performance and effectiveness measures will be provided in the Annual Progress Reports.

- Number of SWPPPs and BMPs prepared for City facilities (P)
- Revision to SWPPPs and BMPs prepared for City facilities (E)
- Results of surveys on municipal activities that may contribute pollutants and general storm water pollutants (P)
- Number of procedures developed and implemented to control use of pollutants in City activities (P,E)
- Reduction in activities and use of products that contribute pollutants to runoff; estimated load reduction (E)
- Number of City construction projects with NOI and SWPPPs (P)

- Number of site inspections of City facilities to ensure that appropriate control

measures are implemented (P)
- Literature reviews and special studies on the effectiveness and maintenance requirements of specific control measures (E)
- Feedback from City staff on SWPPPs and BMPs (E)
- Actions taken to correct problems (E)

Municipal-II: Pollutant Removal Activities

- Amount of street sweeping conducted and estimation of pollutant removal (P,E)
- Number of facilities and amount of estimated pollutant removal from maintenance of storm drain facilities (P,E)
- Number of structural devices operated and maintained for settling and treatment (P,E)
- Types of recycling programs and amount of materials recycled (P,E)
- Modifications to municipal operations to optimize pollutant removal (E)
- Amount of roadside litter removed (E)

Municipal-III: BMP Retrofit and Improvement Projects

- Number and effectiveness of regional storm water control measures incorporated into drainage facilities for new development areas (P,E)
- Number and effectiveness of post-construction control measures for new municipal facilities (P,E)

features incorporated into design of projects for drainage system maintenance and improvement (P,E)

Municipal-IV: Employee Training Program

- Number of tailgate meetings and training sessions (P)
- Feedback from tailgate meetings and training sessions (E)
- Number of fact sheets, brochures, procedural manuals, and other outreach materials to describe BMPs for municipal activities (P,E)
- Feedback from City staff for improvement to Municipal Operations and Facilities Element activities (E)

Measurable Goals

Measurable goals are meant to gage permit compliance and program effectiveness. The measurable goals, as well as the BMPs, should consider the needs and characteristics of the operator and the area served by its MS4. The measurable goals should be chosen using an integrated approach that fully addresses the requirements and intent of the minimum control measure. An integrated approach for this minimum measure could include activities such as the requirements and intent of the minimum control measure. An integrated approach for this minimum measure could include activities such as the following:

Target Date	Activity
March 04	A certain percentage or number of facilities or operations covered under a runoff control plan (a set percentage or number can be assigned to each permit year); employee training materials gathered or developed.
March 05	Training for appropriate employees completed; recycling program fully implemented.
March 06	Some pollution prevention BMPs incorporated into master plan; a certain percentage reduction in pesticide and sand or salt use; maintenance schedule for BMPs established.
March 07	A certain compliance rate with maintenance schedules for BMPs; controls in place for all areas of concern.
March 08	Revise plan to provide guidance for the following permit term

- Number and effectiveness of water quality

5-7 Industrial Element

Program Element Implementation

Introduction

Storm water discharges from business or industrial activities have been documented to be significant potential contributors of pollution to municipal storm water systems. The goal of the Industrial Element is to reduce or eliminate the discharge of pollutants into the City of Redding (City) storm drainage system from business and industrial activities through education, inspection, and enforcement of the City's Storm Water Ordinance.

Current industrial and commercial inspections, performed by City pretreatment program staff, generally cover only sewer-connected customers. These inspections will be expanded to cover the industrial and commercial businesses covered under existing Phase I NPDES permits. The Regional Board has provided staff with a list of such permittees.

The Industrial Element will use several methods to educate and assist business and ensure compliance with the Storm Water Ordinance and if applicable identify other industrial and commercial entities that lack coverage of a State General Permit for their storm water discharge associated with industrial activities. These methods include outreach to business owners and facility inspections programs, and enforcement procedures. The identification of industries with the potential to contribute pollutants into urban runoff will be accomplished through program inspection activities and public complaints.

The main focus of the Industrial Element will be to incorporate storm water inspections within the existing inspection program. Analysis of the inspection reports will help provide information on specific areas within the City or on types of industry that may need a more concentrated effort, a specific control program or educational outreach.

The Industrial Element will emphasize the following activities:

1. Developing control programs for industries that have determined to conduct activities or store materials identified as sources of target pollutants

2. Developing focused outreach and inspection programs for businesses that conduct vehicle, equipment, and facility washing operations to ensure that wastewater is properly pretreated and routes to the sanitary sewer system.

3. Initiate efforts to identify and notify industries in the City that may need coverage under the State Industrial General Permit.

Industrial Element Activities/Best Management Practices

Ind-I

Objective One: Significant Industrial Control Programs

BMP. Identification of industries, conducting activities determined to be common sources of storm water pollutants, through facility inspections, business license and practice information, monitoring, or target pollutant source identification efforts. Implementation of outreach, inspection, and/or control programs to reduce or eliminate industry pollutant sources.

Measurable Goals. The number of new sites, so identified will be tracked, to provide an assessment of its impact to changes in future business operations that maintain non-storm water discharge compliance

Justification. The City is required to monitor sites conducting activities determined to be common sources of storm water pollutants within its MS4s. A City program to identify these sites will start by expanding upon an existing list, provided by the local Regional Board of previously identified industries, already having an NOI with the Regional

Board. The city will use various means to identify additional unregulated sites. The objective of this activity is to reduce the amount of pollutant loading and eliminate prohibited non-storm water discharges from industrial/business facilities.

Ind-II

Objective Two. *Evaluations of existing industrial/commercial business facility or work site compliance with respect to non-storm water discharges.*

BMP. Facility and work site inspections, which will evaluate and identify actual or past industrial/commercial business sources of illicit discharges to MS4s.

Measurable Goals. The number of periodic City inspections at industrial/commercial business sites will be tracked. These will provide an assessment of changes made in past or current business operations/practices to establish and maintain non-storm water discharge compliance.

Justification. The assumption within this objective is that *illicit storm drain or MS4s discharges may also originate from direct surface discharges to storm drain inlets* or to natural drainage ways. The City contains multiple MS4s, which drain directly into culverts, ditches, or natural waterways before reaching the river. City pretreatment program staff, routinely inspect industrial facilities on a year round basis regarding wastewater to the sanitary sewer system. These inspections will be extended to address non-storm water discharges, since periodic or regular business practices producing non-storm water surface discharges to MS4s, are easily detected during dry weather. New guidelines will be established to incorporate storm water inspection tasks into routine inspections. Specific exposed industrial/commercial business operations and practices are known to or have the potential to produce polluted discharges during wet weather. In addition to monitoring for wet discharges, inspections will be expanded to include identification of such outside 'exposed' industrial/commercial business operations and practices.

The effectiveness of this minimum measure can be tracked by reporting an annual list of the industrial and commercial sites inspected, sites where visual surface evidence disclosed illicit/unauthorized discharges and connections to MS4s, hotline reports received/ investigated, the number of these that resulted in terminated connections. In addition, staff will track the number of facility operations that move outside work to inside work locations, provide roof/wall covers over outside work areas, and seek conditional exclusion from storm water permitting based on "No Exposure" to industrial-activities to storm water.

Ind-III

Objective Three: Industrial Assistance Program
BMP. Provision of information to business and industrial communities regarding storm water regulations, the City's Storm Water Quality Improvement Plan, appropriate BMPs, and control-programs. The City will provide information and training for City and other agency personnel, involved in inspection/enforcement activities. In addition, Industrial Waste staff, will coordinate these efforts with the Public Education and Outreach Element to the business community.

Measurable Goals. The number of businesses contacted, fact sheets distributed, work shops held, BMPs placed into use etc., will all form an indirect measure of assessing the level of interest and effectiveness of this outreach and industrial assistance program.

Justification. The business community will require assistance in the form of information explaining Phase II requirements, their compliance options and means of eliminating noncompliant activities. This measure is intended to provide that information through

educational fact sheets, workshops, SWPPPs, brochures, etc., thus helping the general business community as well as City and other agency staff to obtain consistent compliance with local and state requirements.

Effectiveness Evaluation

The Industrial Element will be effective if the element's activities result in tangible reductions in the amount of pollutants and prohibited non-storm water discharges from all business and industrial activities. Since it is not possible to directly monitor all discharges from all business and industrial activities, effectiveness must be based upon limited observations or monitoring and on measurements of the degree of implementation, performance, of Industrial Elements activities. The results of inspection reports and feedback from inspection staff will provide the best opportunity to evaluate actual improvements. Therefore, it is important that the degree of implementation for inspection program activities be high. Similarly, the success of the inspection program is dependent on: (1) the performance of activities to identify and prioritize businesses and industries to be inspected; (2) development of effective BMPs and control programs; and (3) implementation of corrective actions.

Performance and Effectiveness Measures

The following are examples of the types of performance measures (P) and Effectiveness measures (E) that may be used to measure the degree off Program Element implementation and activity effectiveness. Performance measures involve enumeration of activities or the number or percentage of participation in a Program Activity. This information can then be used by staff for purposes of planning and scheduling resources required to conduct the program. Effectiveness measures provide assessments of the degree to which activities reduce pollutants to the MEP or eliminate non-storm water discharges. Such information can be used to focus and modify activities to maximize environmental benefits. The specific goals and level of effort for effectiveness evaluation activities will be included in the Annual Work Plans. The results of the performance and effectiveness measures used will be provided in the Programs Annual Progress Reports.

Industrial - I: Significant Industry Control Programs

- Yearly review of business license databases to identify new businesses that should be included in an existing control program (P, E)
- Annual review of storm water inspection results to identify number and types of violations, number of corrective actions and yearly trends (P, E)
- Number of storm water inspections performed per year (P, E)
- Number of inspectors trained (P)
- Number and effectiveness of control programs focused on reduction of sources of target pollutants (P, E)
- Percentage of eligible businesses notified of control program requirements (E)
- Percentage of eligible businesses implementing required BMPs (E)
- Identification and notification of facilities that may need coverage under the State Industrial General Permit (non-filers) annually (P)
- Activities to assist the Regional Board with identification and notification of potential non-filers (P)
- Number of existing or new businesses in the City acquiring a State Industrial General Permit (E)
- Percentage of businesses that filed for State Industrial General Permit coverage after notification from the City (E)
- Number of businesses identified to need coverage under the State Industrial General Permit per year (E)

Industrial - II: Inspection and Enforcement Programs

- Completion of guidelines, training and incorporation of storm water inspection tasks into existing inspection programs (P)

- Continued coordination of storm water inspection training for inspectors (P)
- Continued coordination and review of inspection reports and identification of successes and areas for improvement (P, E)
- Number of facilities inspected per year (E)
- Reinspection of all facilities with noted problems within 60 days (P, E)
- Percentage of State Industrial General Permit facilities in the City inspected per year (E)
- Feedback from inspectors on improvements or problem sites (E)
- Number of referrals for discharge problems (P)

- Number of prohibited storm and non-storm water discharges eliminated (E)

Industrial - III: Industrial Assistance Program

- Number of businesses sent outreach material (P)
- Number of fact sheets, workshops, SWPPPs, brochures, etc. prepared (P)
- Feedback from businesses on usefulness of outreach materials and suggestions for additional information or improvements (E)

The following are examples of measurable goals for the Industrial Element. The industrial element of this program was a requirement under Phase 1 of the NPDES program instigated in 1990. Much of the work associated with development and ongoing operations of this program are already in place.

Target Date	Activity
March 04	Inform remaining industrial license owners that do not currently have a Phase I - NPDES Industrial permit or exemption under non-exposure criteria that they need to obtain a permit.
March 05	Work with the remaining industrial license owners to educate them on what is required and how to obtain a permit.
March 06	Have all industrial license owners covered or exempted under non-exposure.
March 07	Address additional industrial licenses owners as necessary.

6. PROGRAM EVALUATION AND REPORTING

6-1 Introduction

Program evaluation is an important part of the interactive process for improvement of the City of Redding Storm Water Improvement Program. Selection of appropriate activities and best management practices (BMPs) to reduce pollutants to the maximum extent practicable (MEP) includes evaluation of pollutant removal capabilities, compatibility with environmental regulations, applicability for the City of Redding, and cost effectiveness. The successes and challenges faced by other California locales, including public acceptance, will also be reviewed. Regular evaluations are required and are critical for a variety of reasons:

- Obtain feedback the will allow the City to continually improve the Program.
- Measure whether Program activities are making progress towards reducing pollution in storm water discharges to the MEP and protecting the beneficial uses of local receiving waters.
- Provide information useful to the City of Redding and adjacent urban areas for modifying joint efforts and evaluating area-wide effectiveness of the Program.
- Ensure compliance with the requirements of the City of Redding MS4 Permit.
- Demonstrate that an appropriate level of effort is being expended to implement pollution prevention activities to the MEP.
- Verify the public funds are being utilized appropriately by targeting limited resources for the most significant local environmental problems.

Evaluation activities will always be a part of the City's Program. The City will be evaluating Program activities consistently over the years. Evaluations will generally be done as State law defines beneficial uses of California's waters that may be protected against degradation to include (and not be limited to) "domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" - (California Water Code Section 13050(f)).

6-2 Records Management

In order to document existing and new activities to satisfy that the City is meeting the requirements of this program all BMPs, both existing and new, require documentation activities. Both Development Services and Municipal Utilities Departments will need to implement procedures and or employ personnel to track existing activities, document progress on new activities, develop annual work plans and write annual reports . The City does not currently have staffing or resources dedicated to this task and will be seeking mechanism to fund these activities along with other activities mandated with this program. The City is currently investigating operations management software to track storm drain utility activities, however, the software's ability to serve as a tracking tool for this program is unknown.

6-3 Evaluation Strategy

The City recognizes that the ultimate goals of the Program are to reduce storm water pollution to the MEP, eliminate prohibited non-storm water discharges, and protect beneficial uses of local receiving waters. However, evaluating whether the Program is accomplishing these goals presents a difficult task. At this point in time, there are no practicable measurements that can directly

correlate Program accomplishments with an improvement in water quality in the receiving waters. There are several factors that preclude a simple evaluation of Program effectiveness. These factors include the following:

- Urban runoff pollution comes from a wide array of diffuse sources in the urban environment.
- There are inherent uncertainties in storm water monitoring, including the variability of storms, data collection and handling techniques, and data analysis. For this reason, a great deal of data is needed to draw statistically valid conclusions about water quality. Due to the difficulty in predicting timing and size of storm events and the resource-sensitive nature of storm water monitoring, the permittees have concluded that a 20-year database would be needed to conduct trend analysis with any degree of statistical certainty.
- The solutions or BMPs used to control storm water pollution are diverse in nature; some act to prevent pollution (e.g., education) and others act to remove pollutants that have already entered the runoff (e.g., detention basins).

It generally takes years to see the impacts of BMPs. For example, many years of implementing recycling programs were necessary before the public began to change its behavior.

To meet this challenge, the City has established specific objectives for the overall Program and Program Elements to make progress toward reducing storm water pollution, eliminating prohibited non-storm water discharges, and protecting receiving waters. On a regular basis the City will evaluate the ability of Program activities to achieve these standards and reach Program goals by using both performance measures and effectiveness measures:

Performance measures are designed to measure level of effort such as the number of staff assigned to the Program, number of public events attended, or number of people reached through media campaigns.

Effectiveness measures are intended to measure the degree to which a particular effort is successful. For example, the percentage increase in public awareness is measured by public opinion surveys. In some cases, effectiveness measures can be used to directly assess an activity's environmental benefit. For example, measuring the amount of sediment or other materials removed by a detention basin can be a measure of pollutants that would have otherwise been discharged downstream to a local creek.

6-4 Program Performance and Effectiveness Evaluation

The City plans to evaluate the Program on three levels:

Overall Program
Program Element
Activities and BMPs

Overall Program evaluation includes assessments of Program progress, adequacy of resources to conduct the Program. Program Element evaluation provides consideration of the combined effectiveness of the various activities of each Program Element. Activity and BMP evaluation includes reporting and assessments specific to the Program Element activities and BMPs. Special studies are also conducted on BMPs, generally as joint efforts of the Permittees, to provide information on pollutant removal capabilities, experience of other storm water management programs, local applicability in the City of Redding, cost effectiveness, and maintenance requirements.

6-5 Reporting Performance and Effectiveness Evaluations

The Annual Work Plans submitted to the Regional Board by the City each year will describe the goals, activities, and performance

and effectiveness measures proposed for the upcoming permit year. The Annual Progress Reports submitted each year will document the City of Redding's accomplishments in the previous permit year and evaluate progress toward reaching the goals and completing the proposed activities. To provide information for these reports, records and data from various internal agency departments and divisions are compiled and analyzed. At the end of each permit year, the compiled data from that year will be reviewed and presented to demonstrate Program performance. Effectiveness will also be reported to the degree possible. It is also anticipated that a significant portion of the performance and effectiveness evaluation will occur in the final year of the five-year permit term in rewriting the Plan and preparing for the subsequent permit term.

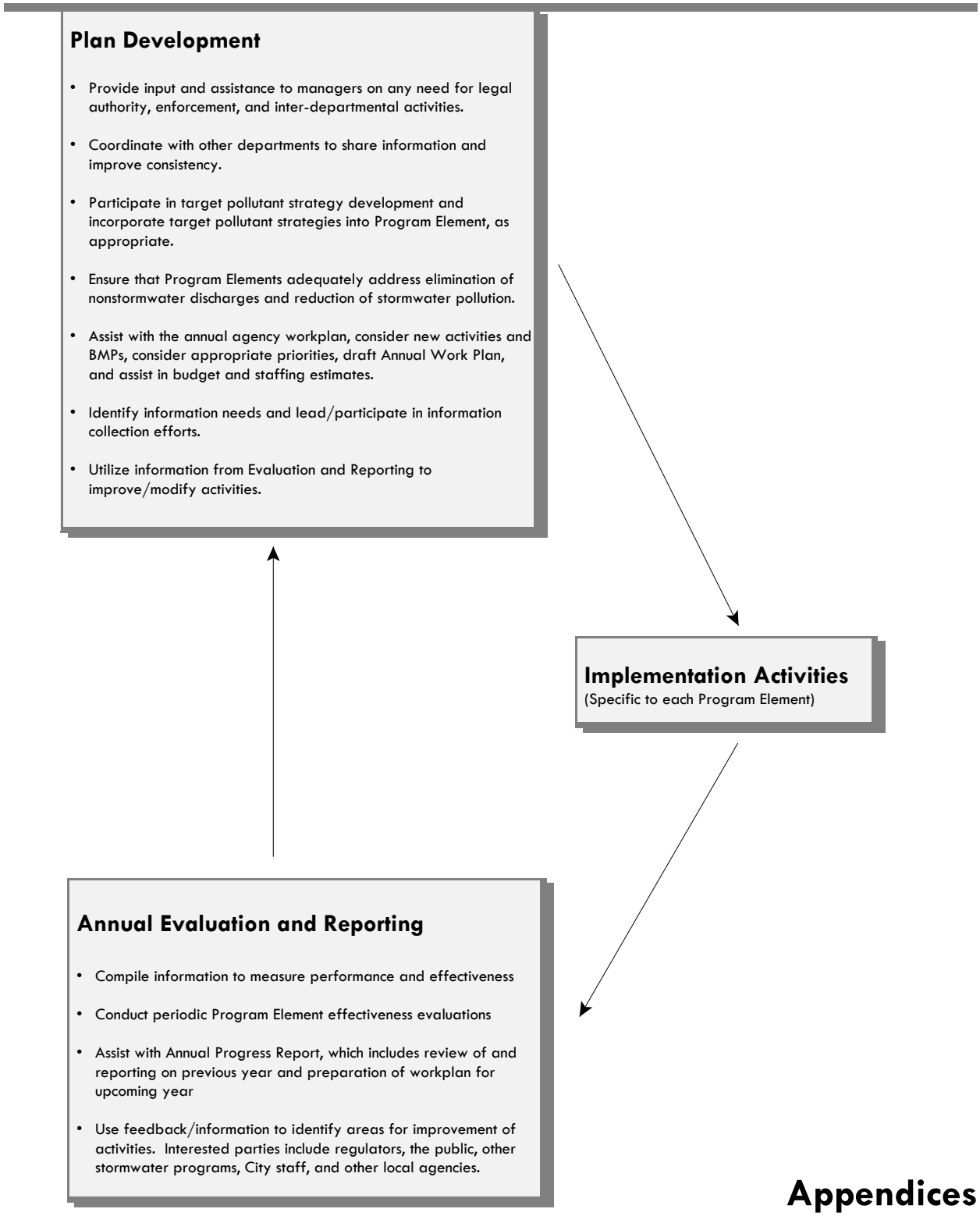
6-6 Continued Program Improvements

On a regular basis, the City networks with other agencies and groups in an effort to stay current about national and statewide storm water efforts and to obtain ideas for continued improvement of the Program. The City and other local urban permittees meet regularly to share information on activities. Refinement of evaluation tools will be accomplished over time using local program experience in addition to that of other agencies and groups including:

- Regulatory agencies such as the State Water Resources Control Board, Regional Board and U.S. Environmental Protection Agency.
- Other storm water management programs
- California Stormwater Quality Association (CASQA)
- National organizations such as Water Environment Federation (WEF)
- California Water Environment Association (CWEA)
- The local community

The various types of data provided by these groups include results of BMP effectiveness studies, public awareness surveys, and program evaluations. The evaluation process will allow the City to benefit from experience and use that experience to improve the Program by modifying activities that did not work well, enhancing those that have proven to be effective, and selecting activities and BMPs to address new areas. Figure 6-6 presents the City of Redding Adaptive Management Cycle for the SWQIP Plan.

Figure 6-6
Adaptive Management Cycle



A	City Storm Drain System Maps
B	Annual Departmental Work Plans (when developed and available)
C	City of Redding Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit Notice of Intent (when completed and available)
D	City of Redding Storm Water Ordinance (if and when completed and available)
E	City of Redding Grading Ordinance
F	City of Redding Floodplain Ordinance
G	City of Redding Storm Drain Utility Operations and Maintenance Plan
H	General Plan Natural Resources Element Excerpt
I	Future Storm Drain Master Plan (as developed)

APPENDIX A

City of Redding Storm Drain System Maps

A1	Churn Creek North
A2	Churn Creek South
A3	Clover Creek
A4	Jenny Creek
A5	Northeast Creeks
A6	Northwest Creeks
A7	Redding Local Tributaries
A8	Sacramento River Local Tributaries
A9	Southwest Creeks
A10	Stillwater Creek
A11	Sulphur Creek

City of Redding Storm Drain System Maps are provided for the purpose of being able to track illicit discharges back from a reported location to potential sources. They may also be used to identify the location of potential outfall from an address reported to be illegally discharging. The maps are intended to supplement information already available to the public over the City of Redding Internet Map Guide system. They do not include specific address information or drainage pathways from every possible location within the City. To fully research a spill pathway requires obtaining very detailed slope information on lots and streets that is not currently available without researching as-built drawings of specific locations or remapping the entire City topography at a resolution and scale that is not economically feasible for any single city project.

APPENDIX B

Annual Departmental Work Plans

(When Developed and Available)

APPENDIX C

City of Redding Separate Storm Sewer System (MS4) National Pollutant Discharge System (NPDES) Storm Water Discharge Permit Notice of Intent

(When Completed and Available)

CITY OF REDDING

ENGINEERING DIVISION
777 Cypress Avenue, Redding, CA 96001-2718
P.O. Box 496071, Redding, CA 96049-6071
530.225.4170 FAX 530.245.7024

March 10, 2003

California Regional Water Quality Control Board
Attn: Carole Crowe
Central Valley Region
415 Knollcrest Drive, Suite 100
Redding, CA 96001

Subject: City of Redding NPDES General Small MS4 discharge permit

Dear Ms. Crowe:

Please find transmitted herein the Draft City of Redding Storm Water Quality Improvement Plan (Storm Water Management Plan for Water Quality), Notice of Intent to participate in the California General Municipal MS4 NPDES Phase II stormwater discharge permit, and a check for $5,000 to cover the first six months of permit coverage.

Please call me if you have any questions or require additional information associated with this permit process.

Sincerely,

David Braithwaite, P.E.
Associate Civil Engineer

State Water Resources Control Board
NOTICE OF INTENT
TO COMPLY WITH THE TERMS OF THE GENERAL PERMIT FOR
STORM WATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS

I. NOI Status

Mark Only One Item 1. [✓] New Permittee 2. [ ] Change of Information WDID #: _____

II. Agency Information

A. Agency: City of Redding			
B. Contact Person: David Braithwaite	C. Title: Associate Civil Engineer		
D. Mailing Address: 777 Cypress Ave	E. Address (Line 2):		
F. City: Redding	State: CA	G. Zip: 96001	H. County: Shasta
I. Phone: 530-225-4473	J. FAX: 530-225-7024	K. Email Address: dbraithwaite@ci.redding.ca.us	

L. Operator Type (check one)
1. [✓] City 2. [ ] County 3. [ ] State 4. [ ] Federal 5. [ ] Special District 6. [ ] Government Combination

III. Permit Area

Limits of City of Redding

IV. Boundaries of Coverage (include a site map with the submittal)

See Attached

V. Billing Information

A. Agency: City of Redding			
B. Contact Person: David Braithwaite	C. Title: Associate Civil Engineer		
D. Mailing Address: 777 Cypress Ave	E. Address (Line 2):		
F. City: Redding	State: CA	G. Zip: 96001	H. County: Shasta
I. Phone: 530-225-4473	J. FAX: 530-225-7024	K. Email Address: dbraithwaite@ci.redding.ca.us	

L. Population 83,000

Please check the appropriate box on the right and submit the corresponding fee. Check(s) should be made payable to the SWRCB.

SWRCB Tax ID is: 68-0281986

[ ] Population greater than 250,000..... $20,000
[ ] Population between 200,000 and 249,999..... $17,500
[ ] Population between 150,000 and 199,999..... $15,000
[ ] Population between 100,000 and 149,999..... $12,500
[✓] Population between 75,000 and 99,999..... $10,000
[ ] Population between 50,000 and 74,999..... $7,500
[ ] Population between 25,000 and 49,999..... $5,000
[ ] Population between 10,000 and 24,999..... $3,000
[ ] Population between 1,000 and 9,999..... $2,000
[ ] Population between 0 and 1,000..... $1,000
[ ] K – 12 School District..... Exempt

VI. Discharger Information (check applicable box(es) and complete corresponding information)

1. [✓] Applying for Individual General Permit Coverage

2. [ ] Applying for a permit with one or more co-permittees

The undersigned agree to work as co-permittees in implementing a complete small MS4 storm water program. The program must comply with the requirements found in Title 40 of the Code of Federal Regulations, parts 122.32. Attach additional sheets if necessary. Each co-permittee must complete an NOI.	
Lead Agency	Signature
Agency	Signature
Agency	Signature
Agency	Signature

3. [ ] Separate Implementing Entity (SIE)

A. Agency			
B. Contact Person	C. Title		
D. Mailing Address	E. Address (Line 2)		
F. City	State CA	G. Zip	H. County
I. Phone	J. FAX	K. Email Address	

H. Operator Type (check one)
1. [ ] City 2. [ ] County 3. [ ] State 4. [ ] Federal 5. [ ] Special District 6. [ ] Government Combination

Minimum Control Measures being implemented by the SIE (check all that apply)

[ ] Public Education [ ] Public Involvement [ ] Illicit Discharge/Elimination
[ ] Construction [ ] Post Construction [ ] Good Housekeeping

"I agree to coordinate with the agency identified in Section II of this form and comply with its qualifying storm water program. I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. Additionally, I certify that the provisions of the permit, including the development and implementation of a Storm Water Management Program, will be complied with."

N. Signature of Official _____ Date _____

VII. Storm Water Management Plan (check box)

[✓] The SWMP is attached.

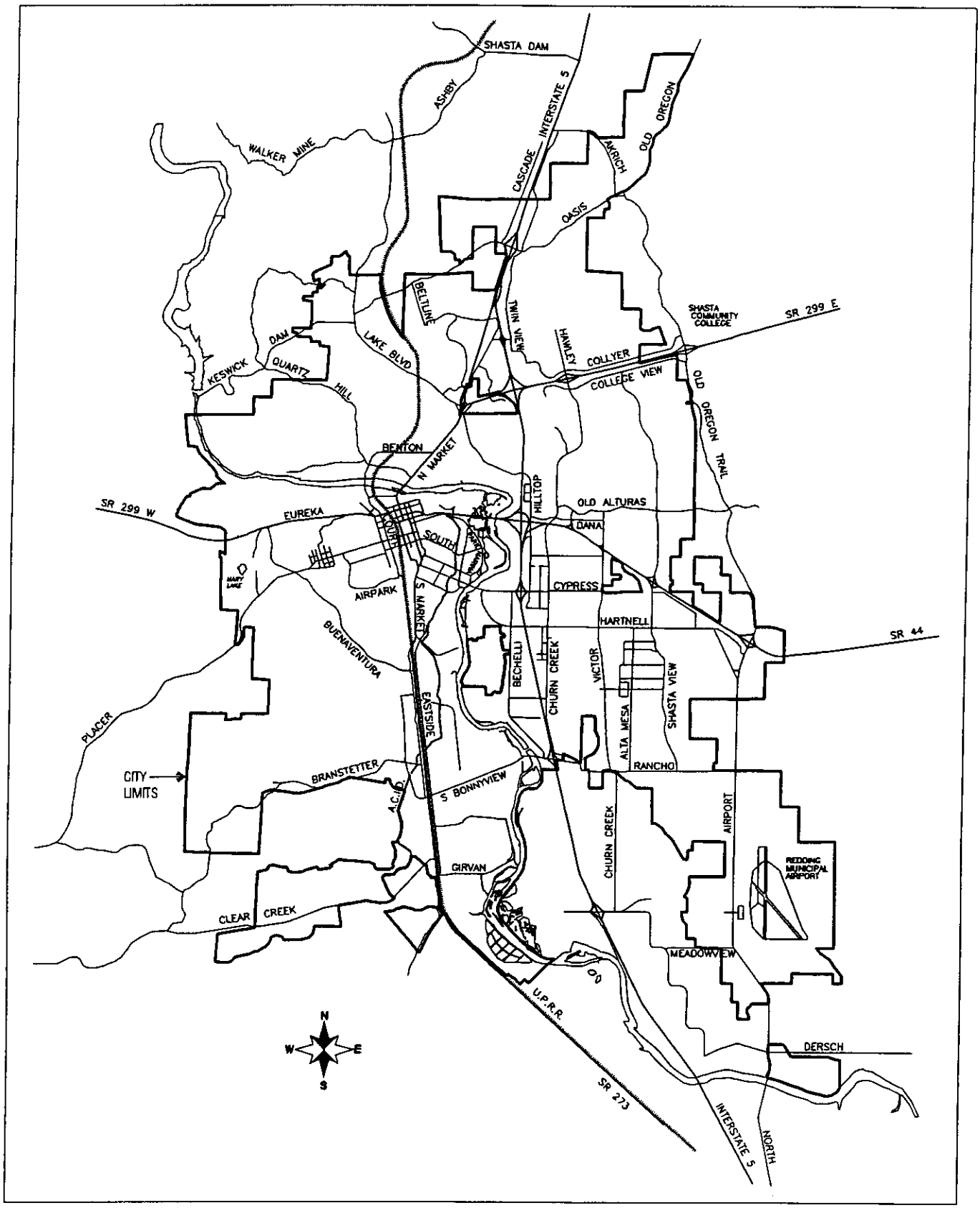
VIII. Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. Additionally, I certify that the provisions of the permit, including the development and implementation of a Storm Water Management Program, will be complied with."

A. Printed Name: David Braithwaite

B. Title: Associate Civil Engineer

C. Signature: _____ D. Date: 3-7-03



City of Redding

APPENDIX D

City of Redding Storm Water Ordinance

(If and When Completed and Available)

Any new ordinance developed to support this plan may be written as either an independent ordinance or a revision to an existing ordinance. Both approaches have advantages and disadvantages and the decision regarding which direction to follow or details of the language is pending issuance of the Permit to the City of Redding by the Regional Water Quality Control Board.

APPENDIX E

City of Redding Grading Ordinance

Chapter 16.12 CLEARING, GRADING, FILLS AND EXCAVATION

16.12.010 Purpose.

1. The purpose of this chapter is to safeguard life, health, property, the environment, and the public welfare by establishing minimum requirements for grading, clearing, and erosion control. (Ord. 2246 § 2 (part), 1999)

1. 16.12.020 Scope.

2. A. This chapter sets forth rules and regulations to control clearing and grading, the prevention of erosion and other environmental damage, establishes administrative procedures for issuance and enforcement of permits, and provides for the approval of plans and inspection of grading and erosion-control operations.

B. The provisions of this chapter shall not be construed as waiving any requirements imposed by state, federal, or other local statutes or regulations or other provisions of this code.

(Ord. 2246 § 2 (part), 1999)

16.12.030 Exemptions.

1. The provisions of this chapter shall not apply to:

A. Work accomplished upon land owned and controlled by the United States of America or by the state and which is performed pursuant to a public program of some agency thereof;

B. Any excavation, removal, fill, or deposit of any earth or other materials within a property which is dedicated or used or to be used for cemetery purposes; provided that such work is performed for burying the dead and does not affect the lateral support or increase the stresses in or pressure upon any adjacent or contiguous property not owned by the cemetery authority;

C. Any grading operation which is conducted during a period of civil emergency or natural disaster and which is directly connected with or related to relief of conditions caused by such emergency or disaster;

D. The depositing of rubbish or other material at any reclamation or rubbish disposal siteoperated by the city and grading work performed as part of such operation;

E. Any work done in city streets, sidewalks, alleys, parkways or easements by the city or pursuant to an encroachment permit issued under provisions of this code; or

F. Excavations for utilities installed pursuant to permits issued by the building division;

G. Reconstruction of paved parking lots that do not alter the existing drainage pattern;

H. Grading, clearing, and the placement of topsoil for landscape purposes on a developed single-family residential parcel which is less than one acre, except as otherwise regulated by Chapter 13.40, Trees and Shrubs.

(Ord. 2246 § 2 (part), 1999)

16.12.040 Definitions.

1. As used in this chapter, unless the context otherwise clearly indicates:

"Abandon" means not actively working on the project and unable to be contacted, or is unwilling to return to the project after reasonable notice.

"Architect" means a professional architect licensed by the state pursuant to Chapter 3 of Division 3 of the Business and Professions Code.

"As-graded" means the surface conditions existing on completion of grading.

"Bench" means a relatively level step excavated into earth material on which fill is to be placed.

"Best management practices" is a technique or series of techniques which, when used in an erosion-control plan, is proven to be effective in controlling construction-related runoff, erosion, and sedimentation.

"Board" means the State Board of Registration for Professional Engineers and Land Surveyors.

"Borrow" is earth material acquired from an off-site location for use in grading on a site.

"Civil engineer" means a professional engineer registered by the state to practice in the field of civil engineering.

"Clearing" means the removal or destruction of vegetation or trees.

"Code" means the Redding Municipal Code.

"Compaction" means the densification of a fill by mechanical means.

"Declaration" means a written statement expressing the professional opinion of the civil engineer, soils engineer or engineering geologist for that portion of the grading work under their control.

"Earth material" means any rock, natural soil or fill and/or any combination thereof.

"Engineering geologist" means a geologist registered by the state as a certified engineering geologist experienced and knowledgeable in engineering geology.

"Erosion" means the wearing away of the ground surface as a result of the movement of wind, water and/or ice.

"Excavation" means any act by which earth material is cut into, dug, removed, displaced or

relocated and shall include the conditions resulting therefrom.

"Existing grade" means the grade prior to the proposed grading.

"Fill" means any act by which earth material is deposited and includes the condition resulting therefrom.

"Final erosion- and sediment-control plan (final plan)" means a set of best management practices or equivalent measures designed to control surface runoff and erosion and to retain sediment on a particular site after all other planned final structures and permanent improvements have been erected or installed.

"Finish grade" means the final grade of the site which conforms to the approved plan.

"Grade" means the vertical location of the ground surface.

"Grading" means any excavation or fill or combination thereof and shall include the conditions resulting from any excavation or fill.

"Interim erosion- and sediment-control plan (interim plan)" means a set of best management practices or equivalent measures designed to control surface runoff and erosion and to retain sediment on a particular site during the period in which pre-construction and construction-related land disturbances, fills and soil storage occur, and before final improvements are completed.

"Key" means a designed compacted fill placed in a trench excavated in existing earth or previously graded material beneath the toe of a proposed fill slope.

"Property owner" as used in this chapter means the owner of the fee title or leasehold interest in real property who has the present rights to possession and control of the property.

"Reasonable notice" means written, telephone, or verbal and includes attempts to notify by mail or telephone, even if actual contact was not made.

"Rough grade" means the stage at which the grade approximately conforms to the approved plan.

"Site" means one or more contiguous lots or parcels of land under the same ownership, whether or not separated by a street or streets.

"Slope" means an inclined ground surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance, i.e., commonly expressed as two to one, one and one-half to one, etc.

"Soil" means the naturally occurring superficial deposits over laying bedrock or hardpan.

"Soils engineer" means a civil engineer registered by the state who has been found qualified as a soils engineer according to the rules and regulations established therefor by the board.

"Terrace" means a relatively level step constructed in the face of a graded slope surface for drainage and maintenance purposes.

"Tree" means any plant which has a trunk six inches or greater in diameter at four feet above the ground.

"Vegetation" means all plants less than six inches in diameter at four feet above the ground, underbrush, weeds, grasses, shrubs, plants, etc.

"Watercourse" means any well-defined channel with distinguishable bed and bank showing evidence of having contained flowing water indicated by deposit of rock, sand, gravel, or soil, including, but not limited to, streams as defined in Public Resources Section 4528(f). "Watercourse" also includes man-made watercourses. (Ord. 2246 § 2 (part), 1999)

16.12.050 Permit--Required.

1. A. Except as otherwise provided in Section 16.40.030 and this section, no person shall commence or perform any clearing or grading and no person shall export or import any earth materials to or from any site unless pursuant to a written permit from the office of the public works director. The permit shall be in the name of the property owner. A separate permit shall be required for each site but may include the entire operation at such site. When grading is to be done within fifty feet of a seasonal watercourse or in the one-hundred-year floodplain of a stream, creek or river, a permit shall be required in all cases.

B. Exceptions. Permits shall not be required in the following instances:

1. An excavation which:

a. Does not exceed one hundred cubic yards of earth material on parcels less than twenty thousand square feet or two hundred fifty cubic yards of earth material on parcels twenty thousand square feet or larger; and

b. Does not exceed two feet in vertical depth at its deepest point measured from the original ground surface; and

c. Does not create a cut slope greaterthan four feet in height and steeper than two horizontal to one vertical; and

d. Does not change the existing drainage pattern.

2. A fill that does not:

a. Exceed fifty cubic yards of earth material; and

b. Is not intended to support structures; and

c. Is less than three feet in vertical depth and is placed on natural terrain with a slope flatter than five horizontal to one vertical; and

d. Does not change the existing drainage pattern.

3. An excavation below finished grade for basements and footings of a building or for a swimming pool, retaining wall, or other structure authorized by a valid building permit. This shall not exempt any fill made with earth material from such excavation nor exempt any excavation having an unsupported height greater than four feet after the completion of such structure.

4. Clearing at a single site, provided that the total area cleared does not exceed one acre and is not in violation of any other applicable ordinance.

5. Clearing for agricultural purposes on land within a special agricultural combining district as set forth in this code.

6. Clearing of vegetation as required by the fire marshal for abatement of a nuisance, to provide safety around structures, or to suppress a fire.

7. Clearing or grading for any project by or under contract with the city or county.

(Ord. 2246 § 2 (part), 1999)

16.12.060 Permit--Applications.

1. Applications for permits required by this chapter shall be made in writing and filed with the public works director. Such applications shall include or be accompanied by the following:

A. Plans, Specifications, Soils Reports, and Interim and Final Erosion and Sediment Control Plans.

1. Two sets of grading plans and specifications prepared and designed by a civil engineer, or a licensed architect, when prepared in conjunction with building design and an application for a building permit, shall be submitted, together with such supporting data as may be necessary to comply with the provisions of this section. The scale of the grading plans shall not be more than one inch equaling fifty feet, nor less than one inch equaling twenty feet. The scale of details or sections shall not be less than one inch equaling one foot.

2. The public works director may waive the requirements for scale plans or drawings if it is found that the information on the application is sufficient to show that the work will conform to the provisions of this chapter.

3. The public works director may waive the requirement that plans and specifications be prepared by a civil engineer or licensed architect when the total quantity of excavation or fill does not exceed five thousand cubic yards and the site is not to be used to support a structure and the property owner on whose land the work is to be done will be in charge of the work and the public works director finds that the work to be performed does not affect the health or safety of the public or the employees of the property owner.

4. For any project which disturbs more than five acres, or where the public works director determines that a project may adversely impact a watercourse, the interim and final plans shall be prepared by a registered civil engineer experienced in erosion control, a certified professional soil erosion- and sediment-control specialist, or a soil scientist certified by the American

Registry of Certified Professionals in Agronomy Crops and Soils.

5. Engineering Geological Report. The public works director, after a visual site investigation, may require an engineering geological report based upon the grading plans. The engineering geological report shall be prepared and signed by an engineering geologist and shall include a description of the geology of the site, conclusions and recommendations regarding the effect of geological conditions on the proposed development, and a geologic map of sufficient detail as to portray the existing field condition. Recommendations included in the report and approved by the public works director shall be incorporated into the grading plans.

6. Soil Engineering Report. Unless it is found to be necessary after a visual site investigation by the public works director, a soils engineering report shall be submitted based upon the grading plans. Such report shall be prepared by a civil engineer or a soils engineer and shall include data regarding the nature, distribution, and strength of existing soils, conclusions, and recommendations for grading procedures, design criteria for corrective measures, or other criteria as may be necessary. Recommendations included in the report and approved by the public works director shall be incorporated into the grading plans or specifications.

B. Plans and Specifications--Clearing.

1. If the ground to be cleared will also be graded, filled, or excavated, then the plans and specifications provided pursuant to subsection A of this section shall be sufficient for clearing.

2. If the ground is to be cleared only, then plans and specifications equivalent to the requirements of subsection A1 of this section shall be submitted, unless after visual site inspection the public works director finds that the work to be performed will not endanger health or safety of the public or endanger property through erosion, siltation, or drainage.

C. Interim Erosion and Sediment Control Plan (Interim Plan). All the following information shall be provided with respect to conditions existing on the site during land-disturbing or filling activities or soil storage:

1. Maximum surface runoff from the site shall be calculated using a method approved by the public works director.

2. The interim plan shall also contain the following information, when applicable:

a. A delineation and brief description of the measures to be undertaken to retain sediment on the site, including, but not limited to, the designs and specifications for sediment detention basins and traps, and a schedule for their maintenance and upkeep;

b. A delineation and brief description of the surface runoff and erosion-control measures to be implemented, including, but not limited to, types and method of applying mulches, and designs and specifications for diverters, dikes and drains, and a schedule for their installation, maintenance, and upkeep;

c. A delineation and brief description of the vegetative measures to be used, including, but not limited to, types of seeds and fertilizer and their application rates, the type, location, and extent of pre-existing and undisturbed vegetation types, and a schedule for installation, maintenance,

and upkeep.

3. The location and detail of all the measures listed by the applicant under subsection C2 of this section shall be depicted on the grading plan or on a separate plan at the discretion of the public works director.

4. An estimate of the cost of implementing and maintaining all interim erosion- and sediment-control measures must be submitted in a form acceptable to the public works director.

5. The applicant may propose the use of any erosion- and sediment-control techniques in the interim plan, provided such techniques are proven to be as or more effective than the equivalent best management practices contained in the Public Works Construction Standards.

D. Final Erosion and Sediment Control Plan (Final Plan). All the following information shall be provided with respect to conditions existing on the site after final structures and improvements (except those required under this section) have been completed and where these final structures have not been covered by an interim plan.

1. Maximum runoff from the site shall be calculated using a method approved by the public works director.

2. The final plan shall also contain the following information, when applicable:

a. A description of and specifications for sediment retention devices;

b. A description of and specifications for surface runoff and erosion-control devices;

c. A description of vegetative measures;

d. A graphic representation and detail of the location of all items in subsections D2 a, b, and c of this section;

e. A schedule of maintenance and upkeep of the final plan.

3. An estimate of the costs of implementing all final erosion- and sediment-control measures must be submitted in a form acceptable to the public works director.

4. The applicant may propose the use ofany erosion- and sediment-control techniques in the final plan, provided such techniques are proven to be as or more effective than the equivalent best management practices contained in the Public Works Construction Standards.

E. Other Information. The application and/or plans shall also include the following:

1. A vicinity sketch or other data adequately indicating the site location;

2. The legal description and street address of the property on which the work is to be performed and the name and address of the owner;

3. The estimated cost of the work;

4. Property lines and dimensions and bearings of the property on which the work is to be

performed;

5. Limits of cuts and fills;

6. Location of any buildings, structures, easements, utilities, and drainage channels on the property where the work is to be performed and the location of any building or structure on land of adjacent property owners which are within twenty-five feet of the property boundary;

7. Contours showing the topography of the existing ground. Contour intervals shall be consistent with the existing terrain and shall be accurate to accepted mapping standards for the map scale. Contours shall extend past the boundary lines of any project where unusual topography exists adjacent to a site, i.e., natural watercourses, etc.; the contours shall be extended to include the same;

8. Elevations, dimensions, location, extent, and the slopes of all proposed grading shown by contours and other means;

9. The quantity of excavation and fill involved and estimated starting and completion dates;

10. Source of material to be used for fill or location to which excavated material will be removed or both;

11. Proposed routes for hauling material, hours of work, and method of controlling dust;

12. Detailed plans of all drainage devices, walls, cribbing, dams, or other protective devices to be constructed in connection with or as a part of the proposed work, together with a map showing the drainage area and calculated runoff of the area served by the drains, subdrain location, and approximate length;

13. Any additional plans, drawings, calculations, or title reports the public works director may require because of special characteristics found to exist upon the grading site;

14. Contour maps submitted pursuant to this subsection shall bear the name of the person responsible therefor and the date they were made;

15. For an application for clearing only, any of the above-numbered items may be omitted if the public works director finds that the information on the application is sufficient to show that the work will conform to the provisions of this chapter;

16. The quantity of acreage of land to be cleared;

17. A description of the vegetation to be cleared;

18. The application shall be signed by the property owner;

19. The name and address of the contractor who will be in charge or control of the work.

F. Revised Plans and Specifications. If the soil, vegetation, or other conditions are not as stated in the application for a permit, the public works director may require the submission of revised plans and specifications.

(Ord. 2246 § 2 (part), 1999)

16.12.070 Permit--Fees.

1. Each application for a clearing or grading permit or appeal of any action or decision of the public works director or hearing body shall be accompanied by a processing fee. The amount of the processing fee shall be as established by the city council by resolution. (Ord. 2246 § 2 (part), 1999)

16.12.080 Permit--Environmental consideration.

1. The public works director shall refer each application for a grading permit to the development services director. If the development services director determines that the grading is not categorically exempt from the provisions of CEQA, then an initial study shall be prepared. After preparation of an initial study, the environmental review process shall be conducted as required in Chapter 18.64 of this code. The board of administrative review shall conduct any necessary public meetings or hearings unless referred to the planning commission by the board of administrative review. When a permit is categorically exempt, the development services director shall report in writing to the public works director on any aspect of the proposed grading that reflects to or affects the General Plan or any elements thereof, or any zoning regulation of the city. (Ord. 2246 § 2 (part), 1999)

16.12.090 Permit--Hearing.

1. A. Notice of Hearing. The development services director shall set a date for a hearing to be held in accordance with state laws applicable to local legislative bodies and commissions in relation to notice of public meetings when the grading or clearing is to be done on a site which:

1. Is intended to be subdivided, or a parcel map or tentative subdivision map has been approved; or

2. Involves five thousand cubic yards or more of excavation or fill; or

3. Involves clearing of five acres or more; or

4. An EIR has been prepared pursuant to the requirements of this chapter.

Unless a tentative grading or clearing plan has been approved as part of a discretionary action which required a hearing. When it has been determined by the public works director that substantial changes in a previously approved grading or clearing plan for a tentative map or other discretionary action has occurred, a rehearing may be required. Whenever the grading involves less than five thousand cubic yards of excavation or fill, or involves less than five acres of clearing, and the public works director determines that the work may affect the property, surrounding property, or the public welfare in a significant way, he may, at his discretion, require the development services director to set a date for a hearing thereon.

B. Hearing. The hearing shall be conducted by the board of administrative review as set forth in

this code. The hearing may be continued from time to time as circumstances may require. Notice of the hearing shall be given in the same manner as for a use permit under Section 18.70.040B of this code.

C. Action of the Board or Planning Commission. After consideration, the board of administrative review may approve, conditionally approve, or deny the application for a grading permit but may, in lieu thereof, forward the matter to the planning commission for decision.

D. Substantial Compliance. No clearing or grading permit issued under the provisions of this chapter shall be held invalid for failure to strictly comply with the provisions of this section if there has been substantial compliance therewith.

E. City Projects. This section shall not apply to any department of the city unless an environmental impact report was required under the provisions of this code.

(Ord. 2246 § 2 (part), 1999)

16.12.100 Permit--Denial grounds.

1. A. Geological or Flood Hazard. If the publicworks director determines by inspection or by soil or geological reports or other means that the land area for which clearing or grading is proposed is subject to geological or flood hazard to the extent that corrective work cannot eliminate or sufficiently reduce the hazard to persons or property, the grading permit and building permits for habitable structures shall be denied.

B. No clearing or grading permit shall be granted in any case in which:

1. The proposed grading will result in removing the lateral and subjacent support of the adjacent land, or otherwise endanger or constitute a hazard to other real property at a higher or lower elevation not necessarily adjacent or contiguous thereto, or to public sewers, drains, watercourses, streets, street improvements or other public property or result in seepage or slides, except upon condition that such damage or hazard shall be eliminated by the erection of necessary walls, cribs or other devices approved by the public works director; or

2. The proposed clearing or grading is inconsistent with the General Plan or in violation of a zoning ordinance; or

3. The proposed clearing or grading will result in a significant adverse environmental impact for which there are no overriding considerations pursuant to CEQA; or

4. Will occur within a one-hundred-year floodplain identified by the Federal Emergency Management Agency and a use permit has not been obtained under Section 18.47.110; or

5. A hearing is required, unless the hearing body has approved the application after conducting the hearing and no appeal is taken.

(Ord. 2246 § 2 (part), 1999)

16.12.110 Permit--Appeal.

1. A. Any person aggrieved by any action or decision of the public works director or the hearing body may appeal that action or decision. Appeals of any actions or decisions of the public works director or the board of administrative review shall be made to the planning commission. Appeals of any actions or decisions of the planning commission shall be made to the city council.

B. An appeal of an action or decision of the public works director or the board of administrative review may be taken by filing a written notice of appeal with the development services department. An appeal of the action or decision of the planning commission may be taken by filing a written notice of appeal with the city clerk. The notice of appeal shall state the name and address of the appellant and the basis of the appeal. Appeals of a decision of the public works director shall be filed within three calendar days of the decision on the permit application. Appeals of a decision of the board of administrative review or planning commission shall be filed within ten calendar days of the decision on the permit application.

(Ord. 2246 § 2 (part), 1999)

16.12.120 Permit--Issuance--Conditions-- Revocation.

1. A. Issuance.

1. A permit may be approved but shall not be issued until the appeal period set out in Section 16.40.110 has expired.

2. The permit shall be issued by the public works director except when a hearing on the permit or environmental determination is required, in which case the permit shall be issued by the hearing body.

3. The permit shall be issued in the name of the property owner as permittee, and shall be signed by said permittee in acknowledgment of the responsibilities set forth in subsection B of this section.

4. The issuance of a grading permit shall constitute an authorization to do only that work which is described or illustrated on the application or on the grading plans and specifications approved by the public works director or the hearing body at the time of issuance.

B. Responsibility of Permittee. The permittee shall carry out the proposed grading in accordance with the Standard Specifications for Public Works Construction (Green Book) approved grading and erosion-control plans and specifications, the conditions of the grading permit and the requirements of this chapter, and all other applicable laws and regulations. The permittee shall maintain all required protective devices and temporary drainage devices during the progress of the grading work and shall be responsible for observance of hours of work, dust controls, and methods of hauling. The permittee shall guarantee maintenance of the site for one year after final inspection of the final plan. The permittee shall become subject to the penalties set forth in this chapter in the event of failure to comply with this chapter and other applicable provisions of this

code. No approval shall exonerate the permittee from the responsibility of complying with the provisions and intent of this chapter.

C. Jurisdiction of Other Departments and Agencies. Grading and clearing permits issued under the provisions of this chapter shall not relieve the permittee of responsibility for securing required permits for work to be accomplished which is regulated by any other provision of this code or falls within the jurisdiction of other local, state or federal agencies.

D. Tract Map Requirements. No grading permit or clearing permit for slopes in excess of ten percent shall be issued on any parcel of acreage larger than five acres, unless a tentative subdivision map or parcel map has been approved or an affidavit is filed declaring the grading/clearing is not for subdivision purposes.

E. Access Routes. The public works director or approving body shall approve all access routes and may impose such regulations with respect to access routes to and from grading sites as he shall determine are required in the interest of public safety. Such regulations may include but need not be limited to the following:

1. The size or type of hauling equipment shall be limited in accordance with the width and conditions of the street;

2. Traffic-control devices, including flagmen, signs, and markers, shall be utilized at appropriate places along the designated routes of access to such sites; and

3. Temporary no-parking restrictions shall be imposed as provided along such routes when determined necessary by the public works director; and

4. Condition of access route (dust control).

F. Conduct of Grading Operations. No person shall excavate or fill so as to cause rocks, soil, sediment, or debris in any form to fall, slide, or flow onto adjoining properties or public property. Any debris deposited on adjoining properties or public property shall be removed by the permittee.

G. Conditions. In granting a permit under this chapter, the public works director or the granting body may attach such conditions as may be necessary to prevent unnecessary environmental damage or to protect the health, safety, and welfare of persons or property.

H. Hours of Work. Grading operations shall not begin before seven a.m. or continue later than seven p.m. No work will be allowed on Sunday. Exceptions from these limitations may be granted by the public works director or the approving body.

I. Conformance with Zoning Regulations Required. No permit shall be issued for any clearing or grading or any export or import of earth or materials to or from any grading site except in compliance with the zoning and division of land regulations contained in Titles 17 and 18 of this code, the State Subdivision Map Act, and the General Plan of the city.

J. Order of Work.

1. All erosion-control facilities shall be fifty percent complete by September 1st, eighty percent

complete by October 1st, and one hundred percent complete and fully operational by October 15th of any year. In addition, all facilities should be maintained fully operational until May 15th of the following year. The erosion-control devices should be inspected during and between rainfall events and repaired as necessary. Identified sites experiencing erosion shall be scheduled for corrective action no later than the next day.

2. Between the period May 15th to October 15th of each year, erosion-control measures shall be installed at the construction site at the end of the day or prior to weekend shutdown periods if the U.S. Weather Service forecasts a thirty percent or greater chance of precipitation. All materials necessary to implement the interim plan shall be on site prior to commencement of work.

K. Completion of Work and Extensions of Time. The permittee shall fully perform and complete all the work contemplated to be accomplished pursuant to the grading permit within the time limit specified in the permit. If the permittee is unable to complete the work within the specified time, he may, prior to the expiration of the permit, submit a written request for an extension of time within which to complete the work. The time specified on the grading permit may be extended by the public works director for a period of not more than forty-five days, but no such extension shall release any surety upon a security required pursuant to Section 16.40.130. If the extension of time would carry performance of the work into the rainy season as defined in subsection M of this section, then the extension of the permit shall be subject to the additional provisions of subsection M of this section, including the requirement for cash deposit security, and the permit may be further conditioned in accordance with subsection G of this section by the public works director.

L. Entry upon Premises. In the event of default in the performance of any term or condition of the grading permit, the surety, or any person employed or engaged on behalf of the surety shall have the right to go upon the premises to complete the required work. No application for a permit shall be filed unless such consent is included therein. It is unlawful for the owner or any other person to interfere with the ingress to or egress from such premises of any authorized representative or agent of any surety company or the city engaged in work ordered by the public works director.

M. Consent of Adjacent Property Owner. Whenever any excavation or fill requires entry onto adjacent property for any reason, the applicant shall obtain the written consent of the adjacent property owner or his authorized representative and shall file a signed and notarized copy of such consent with the public works director. No permit for such grading work may be issued unless and until all necessary consent documents are so filed.

N. Restrictions During Rainy Season.

1. That period between the fifteenth day of October and the following fifteenth day of April is found and determined to be the period in which heavy rainfall normally occurs in the city. During this period no clearing or grading in excess of two hundred fifty cubic yards may be commenced on any single site if the public works director determines by visual inspection that such work will endanger the public health and safety or is otherwise prohibited by state or federal regulations.

2. Grading and clearing operations shall be conducted in conformance with the applicable permit

requirements of the State Department of Fish and Game, the Regional Water Quality Control Board, and all other state and federal agencies having jurisdiction.

O. Compliance. No person shall fail, refuse, or neglect to comply with the following provisions:

1. All conditions imposed on permits pursuant to the provisions of this chapter;

2. All of the provisions of this chapter with respect to clearing and grading which were in effect at the time the permit was issued.

P. Notice of Hazard or Nonperformance. Whenever any construction or work is being done contrary to the provisions of this chapter or not in accordance with the plans and specifications submitted and approved as the basis for the issuance of the clearing or grading permit or with any condition imposed in connection with such permit, or if public or private property is or may be endangered, the public works director shall issue a reasonable notice to the permittee or his agent or other responsible employee requiring cessation of work upon that portion of the site where noncompliance, hazard, or other violation has occurred or exists. The notice shall state the nature of the condition and shall contain sufficient information to apprise the permittee of the nature and extent of the correction required. No work shall be performed on said portion of the site unless and until the noticed condition is rectified and approved upon inspection of the public works director or unless, as a condition of continuing the work, special precautions agreeable to the public works director are taken by the permittee. Failure of the permittee to take such precautions or rectify such condition, hazard, nonperformance, noncompliance, or violation shall be grounds for revocation of the permit.

Q. Revocation of Permit. Any permit granted in accordance with the terms of this chapter may be revoked by the public works director if any of the conditions or terms of the permit are violated or if any law or ordinance is violated in connection therewith.

R. Appeal of Revocation of Permit. Any person aggrieved by the decision of the public works director may submit a written appeal to the planning commission within the time and in the manner provided in Section 16.40.110.

S. Retention of Permit at Job Site. The permittee shall keep the grading permit and plans on the job site at all times work is in progress.

(Ord. 2246 § 2 (part), 1999)

16.12.130 Security.

1. A. Security Requirements.

1. Whenever an application for a grading permit is filed for the excavation or fill of five hundred cubic yards or more in volume and the nature of the work is such that if left incomplete it may create a hazard to human life or endanger adjoining property or property at a higher or lower level, or to any street or street improvement or any other public property, the public works director shall, before issuing the grading permit, require the applicant to guarantee faithful performance and payment of labor and material in an amount determined by the public works

director which shall be not less than one hundred percent of the total estimated cost of the work, including corrective work necessary to remove or eliminate geological hazards.

2. Notwithstanding the above, all work depicted on the interim and final plans and all grading performed during the rainy season shall be secured by a security. Additional security may be required by the public works director sufficient to cover the cost of site cleanup and debris removal. Where grading is required on property adjacent to the grading site to complete a project satisfactorily, the owner of the adjacent property need not provide additional security if the original guarantee is of sufficient amount to include such additional grading. Securities shall remain in effect until the work authorized by the grading permit is completed and any debris deposited on adjoining properties or public ways has been removed and such has been approved by the public works director.

B. Type of Security. A guarantee of faithful performance and payment of labor and material, when required under the provisions of this section, shall be provided by one of the following methods:

1. Bonds executed by the applicant as principal and a corporate surety authorized to do business in the state of California as surety, and in a form furnished by the public works director and approved by the city attorney;

2. A cash deposit with the city; or in lieu thereof a certificate of deposit from a federally insured lending institution in the name of the city with interest payable to the permittee;

3. An instrument or instruments of credit from one or more financial institutions subject to regulation by the state or federal government pledging that the funds necessary to meet the performance are on deposit and guaranteed for payment, and an agreement that the funds designated by the instrument(s) shall become trust funds for the purpose of securing faithful performance and payment of labor and material. The instrument(s) of credit and the agreement shall first be approved by the city attorney.

C. Action Against the Security. The public works director may, after reasonable notice, act against the appropriate security if any of the conditions listed in subdivisions 1 through 4 of this subsection exists. The public works director may use funds from the appropriate security to finance remedial work undertaken by the city or a private contractor under contract to the city and to reimburse the city for all direct costs incurred in the process of the remedial work.

1. The permittee ceases land-disturbing activities and/or filling and abandons the work site prior to completion of the grading plan;

2. The permittee fails to conform to the interim plan or final plan as approved or as modified under Section 16.40.200 and/or has had his/her permit revoked under Section 16.40.120;

3. The techniques utilized under the interim or final plan fail within one year of installation or before a final plan is implemented for the site or portions of the site, whichever is later;

4. The public works director determines that action by the city is necessary to prevent excessive erosion from occurring on the site.

D. Release of Security. Security deposited with the city for faithful performance of the grading and erosion-control work and to finance necessary remedial work shall be released according to the following schedule:

1. Securities held against the successful completion of the grading plan and the interim plan, except for interim plans described in Section 16.40.240C, shall be released to the permittee at the termination of the permit provided no action against such security is filed prior to that date.

2. Securities held against the successful completion of the final plan and an interim plan described in Section 16.40.240C shall be released to the permittee either one year after termination of the permit or when a final plan is submitted for the unimproved site, whichever is later, provided no action against such security has been filed prior to that date.

(Ord. 2246 § 2 (part), 1999)

16.12.140 Design standards--Cuts, fills, drainage, and erosion control.

1. Cuts, fills, drainage, and erosion control shall be designed and constructed per the Standard Specifications for Public Works Construction (Green Book), latest edition, and the city of Redding Construction Standards and, if the grading is proposed to support structures, the Uniform Building Code. (Ord. 2246 § 2 (part), 1999)

16.12.170 Excavations.

1. Excavations shall not undercut any natural slope if the stability of a footing or foundation of any building or structure would be adversely affected, unless such footing or foundation is first properly underpinned or protected against failure. (Ord. 2246 § 2 (part), 1999)

16.12.190 Inspection and supervision.

1. A. General. All construction or work for which a permit is required shall be subject to inspection by the city. Certain types of work determined by the public works director to be likely to endanger or create a hazard to other property shall have either continuous or constant inspection and supervision during all critical periods by a civil engineer, soils engineer or engineering geologist as required by the public works director as a condition of issuance of the grading permit. Failure by the permittee to provide required inspections and supervision shall be grounds for revocation of the permit. Prior to closing the clearing or grading permit, a final inspection shall be made of all construction or work for which the permit has been issued.

B. Exposure of Work. Whenever any work on which called inspections are required as specified in this section is covered or concealed by additional work without having first been inspected, such work shall be exposed at the permittee's sole expense for examination.

C. Notice. The permittee or his agent shall notify the public works director twenty-four hours in advance of the time when the grading operation is ready for each of the following inspections:

1. Preconstruction Inspection. When the permittee is ready to begin work but before any grading or brushing is started.

2. Clearing and Grubbing Inspection. After the natural ground is exposed and prepared to receive fill but prior to the placement of any fill.

3. Final Inspection. When all work, including installation of all drainage structures, other protective devices, planting, and slope stabilization, has been completed and the as-graded plan and required 0reports have been submitted.

4. Other Inspection. In addition to the called inspections above, the public works director may make periodic inspections of the grading operations to ascertain compliance with the provisions of this chapter.

D. Responsibility of Permittee. The permittee shall provide sufficient professional supervisory control during the grading operation to insure compliance with the approved plans and specifications and the provisions of this code. When required by the public works director, the permittee shall avail himself of geological and soils engineering services to implement the supervisory control of the permittee's registered civil engineer.

E. Special Inspections. Where determined from the grading plans and site investigation that conditions warrant professional supervisory control, the permittee or his agent shall employ:

I. A registered civil engineer or geotechnical engineer to supervise all grading;

2. An engineering geologist to provide geological inspections. These inspections shall include, but not be limited to, the adequacy of natural ground for receiving fills and the stability of cut slopes with respect to geological matters and placement of subdrains or other groundwater drainage devices. He shall report his findings to the soils engineer and the civil engineer and they shall be submitted to the public works director.

F. Inspections Required. The employment of specialists to supervise the grading operation shall not be deemed to render unnecessary inspections described in this section.

(Ord. 2246 § 2 (part), 1999)

16.12.200 Modifications.

1. A. The permittee and his agents shall not deviate from the grading plans and specifications without the written approval of the official or body which granted final approval to the original permit.

B. The public works director may require permittee to modify the grading plan, interim or final plans, and maintenance methods and schedules. The public works director shall notify the permittee in writing of the requirement and specify a reasonable period of time within which permittee must comply.

(Ord. 2246 § 2 (part), 1999)

16.12.210 Inspecting officials.

1. A. Notification of Noncompliance. If, in the course of fulfilling their responsibilities, the civil engineer, the soils engineer, the engineering geologist, or the testing agency finds that the work is not being done in conformance with this chapter or the approved grading plans, the discrepancies shall be reported immediately in writing to the person in charge of the grading work and to the public works director. Recommendations for corrective measures, if necessary, shall be submitted.

B. On Termination of Services. The civil engineer supervising the grading work shall immediately notify the public works director in writing upon the termination of his services and he shall not be held responsible for work taking place after that time. All work shall immediately stop upon the termination of the services of the civil engineer, soils engineer, or engineering geologist whose name appears on the grading permit as having been approved to supervise the grading work, and it shall not commence again until the new approved civil engineer, soils engineer or engineering geologist certifies in writing to the public works director that he has reviewed all phases of the project and is thoroughly familiar with it. Upon receipt of this notice, the public works director shall immediately give written notice that work may proceed.

C. Transfer of Responsibility. If the civil engineer, the soils engineer, the engineering geologist or the testing agency of record is changed during the course of the work, the work shall be stopped until the replacement has agreed to accept the responsibility within the area of his or its technical competence for submitting a written declaration upon completion of the work.

(Ord. 2246 § 2 (part), 1999)

16.12.220 Safety.

1. If at any stage of work on an excavation or fill the public works director determines that the work is or is likely to become dangerous or is likely to endanger any property, public or private, it shall be his duty to require safety precautions to be immediately taken as a condition to continuing such permit work or to require cessation thereof forthwith unless and until it is made safe and to amend the plans for such work. After receiving such notice, oral or written, it shall be unlawful for the permittee or any person to proceed with such work contrary to said order. As soon as possible the public works director shall make a report outlining the conditions observed and the pertinent soil, geological and engineering information and shall mail or deliver a copy thereof to the permittee, but such order shall not be contingent upon the preparation or delivery of a report in those cases where hazard requires prompt action. (Ord. 2246 § 2 (part), 1999)

16.12.230 Completion of work.

1. A. Letter of Completion. When it is found that the work authorized by the grading permit, including the installation of all drainage structures, planting, and recommendations by the soils engineer and engineering geologist and removal of debris deposited on adjoining properties or

public ways has been satisfactorily completed in accordance with the requirements of this chapter, a letter of completion covering such work shall be sent to the permittee by the public works director. A copy shall be sent to the building official.

B. Final Reports. Upon completion of the work, the following reports and information, unless otherwise specifically waived by the public works director, shall be required:

1. An as-graded grading plan prepared by the civil engineer, including original ground surface elevations, as-graded ground surface elevations, lot drainage patterns and locations and elevations of all surface and subsurface drainage facilities. He shall provide a written declaration that the work was done in accordance with the final approved grading plan and this chapter;

2. A soil grading report prepared by the soils engineer, including locations and elevations of field density tests, summaries of field and laboratory tests and other substantiating data and comments on any changes made during grading and their effect on the recommendations made in the soil engineering investigation report. It shall also provide information as to location and nature of tests, statement related to the expansive nature of soil and rock material, limits of compacted fill shown on the as-graded plan, and adequacy of the site for the intended use;

3. A geologic grading report prepared by the engineering geologist, if an engineering geological report was required by the public works director in accordance with Section 16.40.060A4, including a final description of the geology of the site, including any new information disclosed during the grading and the effect of same on recommendations incorporated in the approved grading plan. He shall provide a written declaration as to the adequacy of the site for the intended use as affected by geologic factors. Where necessary, a revised geologic map and cross sections and any recommendations regarding special building restrictions or foundation setbacks shall be included.

(Ord. 2246 § 2 (part), 1999)

16.12.240 Protective device maintenance.

1. A. The owner of any property on which grading or an excavation or fill has been made pursuant to a grading permit granted under this chapter and any other person or agent in control of such property shall maintain in good condition and repair all retaining walls, cribbing, drainage structures, and other protective devices, including planting, shown in the approved plans and specifications submitted with the application for a grading permit or subsequently required by the public works director.

B. Upon completion of final grading and permanent improvements, where such permanent improvements are planned at the time grading is performed, permittee shall submit executed contract(s) with a qualified contractor for maintenance and upkeep of final plan runoff and erosion-control measures for a one-year period.

C. No Improvements Planned. Where an applicant does not plan to construct permanent improvements on the site or plans to leave portions of the site graded but unimproved, applicant must:

1. Meet all the requirements of this chapter, except that an interim plan designed to control

runoff and erosion on the site for the period of time during which the site, or portions thereof, remain unimproved must be submitted in lieu of a final plan; and

2. Submit executed contract(s) as defined in subsection B of this section after completion of grading.

(Ord. 2246 § 2 (part), 1999)

16.12.250 Hauling.

1. A. Routes. In cases where the public works director designates the haul routes, such designation of routes shall take into consideration the most practical means of transporting the earth materials to and from the grading site consistent with the safety and welfare of residents along the routes.

B. Maintenance of Roadways. All public roadways used by the permittee shall be maintained free from all dust, dirt, and debris caused by the grading operations. The public works director may require a cash deposit from the permittee to cover any costs of roadway maintenance incurred by the city which are directly attributable to the permittee's grading operation. The amount of the cash deposit shall be determined by the public works director. The cash deposit or any unused portion thereof shall be refunded to the permittee after the grading permit has been closed.

C. Spillage. All vehicle loads shall be trimmed and watered or otherwise secured so as to prevent spillage from the equipment.

D. Equipment. In no event shall any export or import of earth materials to and from a grading site over dedicated and improved streets in the area be undertaken or conducted except by use of equipment which complies in all respects with the State Vehicle Code.

(Ord. 2246 § 2 (part), 1999)

16.12.260 Grading violations.

1. The following are expressly declared to be unlawful:

A. Any failure to comply with the provisions of this chapter by any person;

B. Any clearing, grading, excavation, or fill which is done without first having obtained a permit therefor in accordance with the provisions of this chapter;

C. Any failure by the permittee, or his agents, or anyone acting for the permittee, to comply with the terms, conditions, specifications, or limitations contained in a duly issued grading permit;

D. After work has been started by the permittee under a duly issued grading permit, any failure by the permittee to complete the work authorized by the permit;

E. Any quantity of clearing, grading, fill, or excavation upon the property of another without the

property owner's permission;

F. Continuation of a violation described in subsection A, B, C, D, or E of this section, beyond the end of one day, shall be considered a separate violation for each day or portion of the last day on which it is continued.

G. In addition to civil penalties provided for under this chapter, violations of the provisions of this chapter are punishable as misdemeanors.

(Ord. 2246 § 2 (part), 1999)

16.12.270 Nuisance.

1. A. Declaration. The condition of the land which results from any unlawful clearing, grading, excavation, or fill is expressly declared to be a public nuisance. (Government Code Section 38771).

B. Notice. Whenever the public works director is advised that a nuisance exists pursuant to this section, he shall immediately notify the property owner and issue a stop-work order and/or an order providing for abatement of the nuisance and/or may refer the nuisance to the planning commission.

C. Responsibility. The property owner shall be responsible for the control of conduct on the property so as to prevent any unlawful clearing, grading, excavation, or fill. If any unlawful clearing, grading, excavation, or fill takes place on the property, the property owner shall alleviate the nuisance thereby created and (1) restore the land to its preexisting condition to the greatest extent practicable or (2) take such remedial action as may be required by the public works director, the planning commission (after abatement hearing), or city council (after appeal) to remove and abate the nuisance.

D. Relief from Nuisance Abatement Enforcement. The property owner may apply for relief by making a written request to the public works director in conjunction with an application for a clearing or grading permit. If a permit is issued, enforcement remedies to abate the nuisance under Section 16.40.280B shall be stayed pending performance under the permit, provided that (1) the nuisance has not yet been abated by the public works director and (2) any permit issued after an appeal before the planning commission, or city council shall conform to the order of such body without requirement of a further public hearing on the permit, and (3) only one permit may be issued pursuant to this section. Relief from nuisance abatement enforcement remedies shall not stay enforcement or relieve liability for fines under Section 16.40.280A.

(Ord. 2246 § 2 (part), 1999)

16.12.280 Penalties and remedies.

1. The following penalties and remedies are accumulative and not exclusive of any other penalties or remedies allowed by law.

A. Fines.

1. Any persons who are found to have violated the provisions of this chapter with respect to grading, excavation, or fill may be held jointly and severally liable for payment of a fine in accordance with the amount of material or fill which was unlawfully graded, excavated, or filled. The amount of the fine shall be two hundred fifty dollars for the first fifty cubic yards or any fraction thereof, and two hundred fifty dollars for each additional fifty cubic yards or fraction thereof, provided that the total fine imposed for a single violation shall not exceed five thousand dollars.

2. Any persons who are found to have violated the provisions of this chapter with respect to clearing may be held jointly and severally liable for payment of a fine in accordance with the amount of acreage of land which was unlawfully cleared. The amount of the penalty shall be two hundred fifty dollars for the first one-half of an acre or portion thereof, and two hundred fifty dollars for each additional one-half acre or portion thereof, provided that the total fine imposed for a single violation shall not exceed five thousand dollars.

3. Any persons who are found to have violated the conditions of a duly issued permit for grading, excavation, fill, or clearing, such that the magnitude of the violation cannot be measured by the quantities of material moved or land cleared, may be held jointly and severally liable for payment of a fine of five thousand dollars.

B. Denial of Other Permits. No building permit, water, sewer, electrical permit, or any other permit shall be issued by the city to any person for any premises or portion thereof which is in violation of this chapter and which violation is not corrected or approved for correction by the public works director.

C. Nuisance Abatement/Enforcement.

1. Appeal to the Planning Commission. Within ten days following a finding of a nuisance and issuance of an order by the public works director pursuant to Section 16.40.270C and D, an aggrieved property owner may appeal the decision by filing a written request to the clerk of the planning commission. Said appeal does not release the property owner of complying with any stop-work order or order of abatement.

2. Appeal to City Council. Within ten days following a finding of a nuisance and issuance of an order by the planning commission, an aggrieved property owner may appeal the decision by filing a written request with the city clerk detailing the objections to the finding and order, together with a nonrefund-able fee of two hundred dollars for processing the appeal. On appeal, the city council shall receive a report from the planning commission setting forth the basis for the finding and order, together with such relevant evidence as may be allowed on the issues raised by the appeal. Following hearing on the appeal, the city council may uphold or reverse the decision of the planning commission, or modify the remedial action necessary to abate the nuisance; and the city council shall authorize the mayor to immediately issue an order in accordance therewith. The order of the city council shall be final.

3. Resolution Ordering Abatement--Service. If the planning commission or city council orders abatement of the nuisance, a copy of the order directing the public works director to abate the

nuisance after thirty days shall be served upon the owner of the property in accordance with the provisions of this subdivision. Any property owner shall have the right to comply with the order by (1) restoring the property to its preexisting condition to the greatest extent practicable, or (2) taking such remedial action specified in the order to remove or abate the nuisance, at his own expense, provided it is done in conformance with Section 16.40.270C prior to the expiration of the thirty days.

4. Abatement Costs--Accounting. The public works director shall keep an account of the costs, including incidental expenses, of abating the nuisance on each separate lot or parcel of land where the work has been done, and shall render an itemized report in writing to the city council showing the cost of the work on each separate lot or parcel of land; provided that before the report is submitted to the city council, a copy of the report and notice shall be served upon the owner of the property in accordance with the provisions of subsection C3 of this section at least five days prior to submitting the report to the city council. Proof of service shall be made by affidavit or declaration and filed with the city clerk. The term "incidental expenses" shall include, but not be limited to, the expenses and costs of the city in the preparation of notices, service of notices, specifications and contracts, inspecting the work, and the costs of printing and mailing required by this chapter.

5. Abatement Costs--Final Determination. At the date and time fixed for receiving and considering the report referred to in subsection C7 of this section, the city council shall hear and pass upon the report of the public works director, together with any objections or protests which may be raised by any persons potentially liable or property owners liable to be assessed for the work of abating the nuisance and any other interested persons. Thereupon, the city council may make such revision, correction, or modification in the report as it may deem just, after which by resolution the report, as submitted or as revised, corrected or modified, shall be confirmed, provided that a hearing or consideration may be continued from time to time. The decision of the city council on all protests and objections which may be made shall be final and conclusive.

6. Abatement Costs--Assessment. The amount of the cost for abating the nuisance upon the various lots or parcels of land, as confirmed by the city council, shall constitute special assessments against the respective lots or parcels of land, and as thus made and confirmed shall constitute a lien on the property for the amount of the assessments, respectively. After the confirmation of the report, a copy shall be turned over to the county tax assessor and tax collector, acting for city, whereupon it shall be the duty of the assessor and tax collector to add the amounts of the respective assessments to the next regular bills of taxes levied against the respective lots and parcels of land for municipal purposes, and thereafter the amounts shall be collected at the same time and in the same manner as ordinary municipal taxes are collected, and shall be subject to the same penalties and the same procedure under foreclosure and sale in case of delinquency as provided for ordinary municipal taxes.

7. Emergency Abatement. When it comes to the attention of the public works director that a nuisance exists which is determined to be of imminent danger of causing rocks, soil, sediment, or debris in any form to fall, slide, or flow ontoadjoining properties, watercourses, public property, or floodplain (as defined in Chapter 18.47), the department may immediately perform corrective work, either with city crews or by contract, notwithstanding the other provisions of this subsection.

8. Right of Entry. Whenever necessary to enforce the provisions of the chapter, the public works director may enter the premises at all reasonable times in the manner provided by law to perform any duty imposed by this chapter. If such entry is refused, the public works director shall have recourse to every remedy provided by law to secure entry.

(Ord. 2246 § 2 (part), 1999)

APPENDIX F

City of Redding Floodplain Ordinance

Chapter 18.47 FP FLOODPLAIN COMBINING DISTRICT

18.47. 010 Purpose.

1. A. The Federal Emergency Management Agency (FEMA) requires that flood-hazard regulations be adopted by all agencies participating in the National Flood Insurance Program which was established by Congress for the purpose of minimizing flood losses by providing federally subsidized flood insurance for existing structures and reduced premiums for new structures. To participate in the program, the city must adopt and enforce floodplain-management measures to reduce the risk of flood losses. It is the purpose of the FP Combining District to implement this federal mandate, to carry out the city's general plan policies regarding development in floodplain areas, and to provide land-use regulations in areas with properties situated within the designated floodplains of rivers, creeks, streams and water courses in order to:

1. Protect human life and health, safety and welfare.

2. Minimize public and private losses as a product of floods or construction in flood-hazard areas.

3. Require that uses vulnerable to floods be protected against flood damage by incorporating floodproof construction standards in their design or be developed outside flood-prone areas at the time of their initial construction.

4. Protect riparian corridors along waterways by reducing alterations to the natural floodplain and stream channels.

5. Prohibit filling, grading, dredging or development which may individually or cumulatively cause flood damage or danger to life or property.

6. Prevent stream erosion which may adversely affect the fisheries of streams and rivers or cause loss of property.

7. Prevent the construction of flood barriers which may unnaturally direct floodwaters or raise flood levels thereby increasing flood hazards in other areas.

8. Protect areas of pleasing appearance to the community and visitors, enhance the natural environment through the provision of open space, break up the monotony of continuous urban development and increase community pride.

9. Make every effort to preserve and improve public access to and along the Sacramento River and area creeks for riding, hiking, fishing and nature observation.

10. Encourage development to occur outside of flood-prone areas Discourage development within the one-hundred-year floodplain.

11. Reduce public liability and the need for expensive public works projects in flood-prone areas. Minimize damage to public facilities and utilities located in areas of special flood hazard.

12. Preserve wildlife and wildlife habitat along the Sacramento River and area creeks from

erosion, loss of vegetation, degradation of water quality and loss of thermal cooling.

13. Ensure that adequate capacity for future urban runoff is reserved.

14. Recognize the Sacramento River as an economic resource for tourism, commercial recreation, private recreation and public enjoyment.

15. Ensure that as a product of any encroachment into the floodplain, flood levels are not significantly raised on other properties.

16. Ensure that stream velocities are not significantly increased, which could cause erosion above, below, or across from an area of encroachment or realignment.

17. Ensure that proposals to encroach into floodplains fully address the following issues:

a. Size of stream, major or minor.

b. Existing and future volume of water.

c. Existing and future changes in the velocity of water.

d. Impact on adjoining properties.

e. Potential for increased erosion upstream or downstream.

f. Potential for riprap and type of riprap.

g. Riparian habitat.

h. Fisheries and wildlife.

i. Urban trails and fishing access.

j. Water temperature.

k. Aesthetics.

l. general plan consistency.

m. Liability, both public and private.

n. Depth of floodplain and fill needed

o. Amount of existing usable area on parcel and additional area to be created.

p. Maintenance responsibility and costs.

q. Short-term gains versus long-term costs.

r. Future increases in runoff.

18. Protect individuals from buying land by identifying such land that is unsuited for intended purposes because of flood hazards.

19. Minimize prolonged business interruptions.

20. Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public.

(Ord. 2284 § 1 (part), 2001)

18.47.020 Definitions.

1. As used in this chapter, unless the context otherwise requires, the following words and phrases shall have the meanings respectively ascribed to them:

1. "Appeal" means a request for a review of the floodplain administrator's interpretation of any provision of this chapter or a request for a variance.

2. "Area of shallow flooding" means a designated AO or AH Zone on the Flood Insurance Rate Map (FIRM). The base flood depths range from one to three feet; a clearly defined channel does not exist; the path of flooding is unpredictable and indeterminate; and velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

3. "Area of special flood hazard" See "Special flood hazard area."

4. "Base flood" means a flood having a one percent chance of being equaled or exceeded in any given year. Same as the one-hundred-year flood.

5. "Basement" means any area of the building having its floor below ground level on all sides.

6. "Base Floodplain" means the area covered by a base flood which is generally defined by FEMA as Zone A, AO, Al-30, and AE on the Flood Insurance Rate Map or the base flood area or elevation shown on any drainage study approved or adopted by the city (citywide storm drain master plan by Montgomery-Watson Engineers dated October 1993), whichever is highest.

7. "Contiguous to" means property bordering the base floodplain which would have a finished lot level of less than one foot above the base flood elevation, unless otherwise protected.

8. "Design flood" means the flood against which protection is to be provided by means of land-use regulation or flood-protective or flood-control works. The design flood shall be the base flood recurrence interval (See "Base flood" definition).

9. "Development" means any manmade change to improved or unimproved real estate, including but not limited to, buildings or other structures, mining, dredging, filling, grading, landscaping, paving, excavation, drilling operations or storage of equipment or materials.

10. Encroachment" means the advance or infringement of uses, plant growth, fill, excavation, buildings, permanent structures or development into a floodplain which may impede or alter the flow capacity of a floodplain.

11. "Equal conveyance" means an equal amount of encroachment on both sides of a channel and an equal displacement of water or narrowing of the natural channel.

12. "Existing manufactured home park or subdivision" means a manufactured home park, subdivision or planned development for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets and either final site grading or the pouring of concrete pads) is completed before January 19, 1988.

13. "Flood or Flooding" means a general and temporary condition of partial or complete inundation of normally dry land areas from (a) the overflow of floodwaters, (b) the unusual and rapid accumulation or runoff of surface waters from any source, and/or (c) the collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels, or suddenly caused by an unusually high water level in a natural body of water accompanied by a severe storm or by an unanticipated force of nature such as flash flood or by some similarly unusual and unforeseeable event which results in flooding as defined in this definition.

14. "Flood fringe" means the area between the one-hundred-year flood boundary and the floodway shown on the Flood Insurance Rate Maps incorporated in the Flood Insurance Study or on the citywide storm drain master plan, whichever is highest.

15. "Flood Insurance Rate Map (FIRM)" means the official map on which the federal Insurance Administration has delineated the "floodway," the "floodplain" and "risk-premium" zones applicable to the city.

16. "Flood Insurance Study" means the official report, provided by the federal Insurance Administration that includes flood profiles, the FIRM, the Flood Boundary and Floodway Map, and the water-surface elevation of the base flood.

17. "Floodplain" includes the floodway, flood fringe, and means the same as "base floodplain" and the "area of special flood hazard." "Floodplain" or "floodplain area" means any land area susceptible to being inundated by water from any source. (See definition of "flooding.") The elevations and boundaries of flooding within the floodplain are defined by Zones A, AO, Al-30 and AE of the Flood Insurance Rate Map prepared by the Federal Emergency Management Agency or as shown on any drainage study (citywide storm drain master plan by Montgomery-Watson Engineers dated October 1993) approved or adopted by the city, whichever is highest.

For creeks where FEMA or the citywide storm drain master plan has not established floodplain elevations with a detailed study, the elevations shall be determined by a registered civil engineer and approved by the planning commission pursuant to Section 18.47.110. Backwater areas along the Sacramento River or area creeks which rise or fall with the level of water in the adjacent stream are considered to be within the floodplain, unless proven by a licensed hydrologist/engineer that those water levels are not the same as the floodplain of the adjacent stream and have a floodplain of their own.

18. "Floodplain administrator" is the development services director or the designee appointed to administer and enforce the city's floodplain management regulations and the CiWs Community Rating Service (CR5) program.

19. "Floodplain area" means an area having flood, mud slide (i.e., mud flow) and/or flood-related

erosion hazards as shown on a FIRM or Flood Boundary and Floodway Map and also that area shown on any drainage study (citywide storm drain master plan) approved or adopted by the city, whichever is highest.

20. "Floodplain (FP) district " is a zoning district that is combined with other zoning designations of lots that are either wholly or partially within the floodplain.

21. "Floodplain management" means the operation of an overall program of corrective and preventive measures for reducing flood damage and preserving and enhancing, where possible, natural resources in the floodplain, including, but not limited to, emergency preparedness plans, flood-control works, floodplain management regulations, and open-space plans.

22. "Floodplain management regulations" means zoning ordinances, subdivision regulations, building codes, health regulations, special-purpose ordinances (such as floodplain ordinance, grading ordinance, and erosion-control ordinance), and other applications of police power. The term describes such state or local regulations in any combination thereof which provide standards for the purpose of flood-damage prevention and reduction.

23. "Flood proofing" means any combination of structural and nonstructural additions, changes or adjustments to structures which reduces or eliminates flood damage to real estate or improved real property, water and sanitary facilities, and structures and their contents.

24. "Flood protection" means an action taken to protect property and structures from inundation by the base flood or greater event.

25. "Flood protection elevation" means an elevation expressed in feet, which the city requires for elevation of the lowest floor above the one-hundred-year floodplain. The city's required flood protection elevation is a minimum of one foot. The one-hundred-year floodplain is defined by the Flood Insurance Rate Maps prepared by FEMA or the citywide storm drain master plan by Montgomery-Watson Engineers, whichever is highest.

26. "Flood-related erosion" means the collapse or subsidence of land along the shore of a river, creek or other body of water as a result of erosion or undermining caused by currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water accompanied by a severe storm or by an unanticipated force of nature such as a flash flood or by some similarly unusual and unforeseeable event which results in flooding.

27. "Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot. A floodway includes those areas so designated on any drainage study approved or adopted by the city.

28. "Freeboard" means a factor of safety expressed in feet above a flood level for purposes of floodplain management. A freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions such as wave action, bridge openings and the hydrological effect of urbanization of the watershed.

29. "Hydraulic Engineering Center Model 1 (HEC-l) (succeeded by HEC-HMS)" is designed to

simulate the surface runoff response of a stream basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. Each component models an aspect of the precipitation-runoff process within a portion of the basin, commonly referred to as a subbasin. A component may represent a surface-runoff entity, a stream channel or a reservoir. Representation of a component requires a set of parameters which specify the particular characteristics of the component and mathematical relations which describe the physical processes. The result of the modeling process is the computation of stream flow by hydrographs at desired locations in the stream basin. The model can be used in making flood predictions from rainfall runoff for any state of upstream urbanization. In so doing, the model considers time of concentration and detention characteristics of the tributary area. The model can also be used to estimate the velocity of surface water but cannot be used to determine backwater-curve elevations. A hydraulic computer program (HEC-2) is generally used in conjunction with HEC-1 to obtain backwater curves or surface-water profiles. The model can also be used to develop discharge-frequency curve and associated levels of confidence through sensitivity analysis of rainfall and runoff parameter input.

30. "Hydraulic Engineer Center Model 2 (HEC-2) (succeeded by HEC-RAS)" is intended for calculating water-surface profiles for steady, gradually varied flow in natural or manmade channels. Both subcritical and supercritical flow profiles can be calculated. The effects of various obstructions such as bridges, culverts, weirs and structures in the floodplain may be considered in the computations. The computational procedure is based on the solution of the one-dimensional energy equation with energy loss due to friction evaluated with Manning's equation. The computational procedure is generally known as the Standard Step Method. The program is also designed for application in floodplain management and flood-insurance studies to evaluate floodway encroachments and to designate flood-hazard zones. Also, capabilities are available for assessing the effects of channel improvements and levees on water-surface profiles.

31. "Hydraulic Engineering Center Water Resources Council Model CPD-13" is used in calculating the flood-frequency curve from data over a period of time from stream-gauge history of sufficient length (40 years, if available; if only 20 years or less is available, several gauges or other methodologies should be considered). The model is capable of developing confidence limits associated with the frequency curve.

32. "Lowest floor" means the lowest floor of the lowest enclosed area, including a basement. An unfinished or flood-resistant enclosure below the lowest floor that is usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor, provided it conforms to applicable non-elevation design requirements, including, but not limited to:

a. The wet floodproofing standard in Section 18.47.090(D)(3).

b. The anchoring standards in Section 18.47.090(B).

c. The construction materials and methods standards in Section 18.47.090(C).

d. The standards for utilities in Section 18.47.090(E).

For residential structures, all subgrade-enclosed areas are prohibited because they are considered

to be basements. This prohibition includes below-grade garages and storage areas.

33. "Manufactured home" means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

34. "Manufactured home park or subdivision" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

35. "Market value of the structure" shall be determined by estimating the cost to replace the structure in a new condition and adjusting that cost figure by the amount of depreciation which has accrued since the structure was constructed. The cost of replacement of the structure shall be based on a square-foot cost factor determined by reference to a building cost estimating guide recognized by the building construction industry as approved by the floodplain administrator. The amount of depreciation shall be determined by taking into account the age, physical deterioration of the structure and functional obsolescence as approved by the floodplain administrator, but shall not include economic obsolescence. Use of replacement costs or accrued depreciation factors different from those contained in recognized building cost estimating guides may be considered only if such factors are included in a report prepared by an independent professional appraiser and supported by a written explanation of the differences.

36. "New construction" for floodplain management purposes means structures for which the "start of construction" commenced on or after the effective date of floodplain management regulations adopted by this community (July 1, 1985) and includes any subsequent improvements to such structures.

37. "No-rise floodway and flood fringe" refers to maintenance of the city's floodway and floodplain fringe with no rise in floodplain elevations that would adversely affect properties.

38. "One-hundred-year flood" See "base flood."

39. "Recreational vehicle" means a vehicle which is:

a. Built on a single chassis.

b. 400 square feet or less when measured at the largest horizontal projection.

c. Designed to be self-propelled or permanently towable by a light-duty truck.

d. Designed primarily not for use as a permanent dwelling, but as temporary living quarters for recreational, camping, travel or seasonal use.

40. "Remedy a violation" means to bring the structure or other development into compliance with state or local floodplain management regulations or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include:

a. Protecting the structure or other affected development from flood damages;

b. Implementing the enforcement provisions of the ordinance or otherwise deterring future

similar violations; and/or

c. Reducing State or federal financial exposure with regard to the structure or other development.

41. "Riverine" means relating to, formed by or resembling a river (including tributaries), stream, brook, etc.

42. "Scenic or riparian corridor" includes areas that border segments of seasonal creeks and all of the Sacramento River's floodplain which contain vegetation natural to waterways.

43. "Special Flood Hazard Area (SFHA)" means an area having special flood or flood-related erosion hazards and shown on a FIRM as Zone A, AO, A1-30, AE or AH.

44. "Standard project flood" is the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions reasonably characteristic of the geographical region involved. Such a flood provides a reasonable upper limit to be considered in designing flood-control works and in delineating floodplain limits and shall be generally applicable where its occurrence would have high probability of hazard to human life.

45. "Start of construction" includes substantial improvement and other proposed new development and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement or other improvement was within one hundred eighty days from the date of the permit. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

46. "Substantial damage" means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed fifty percent of the market value of the structure before the damage occurred.

47. "Substantial Improvement" means any reconstruction, rehabilitation, addition, or other proposed new development of a structure, the cost of which equals or exceeds fifty percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "substantial damage," regardless of the actual repair work performed. The term does not, however, include either:

a. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to ensure safe living conditions.

b. Any alteration of a structure listed on the National Register of Historic Places or a State

Inventory of Historic Places, provided that the alteration will not preclude the structure's continued designation as a "historic structure."

48. "Variance" means a grant of relief from the requirements of this chapter which permits construction in a manner that would otherwise be prohibited by this chapter.

49. "Velocity of water" is the rate of flow measured in feet per second at specified depths within the floodway, flood fringe, or area immediately adjacent to a proposed floodplain encroachment.

50. "Violation" means the failure of a structure or other development to be fully compliant with the city's floodplain-management regulations. A structure or other development without the elevation certificate, other certifications or other evidence of compliance required in this chapter is presumed to be in violation until such time as that documentation is provided.

18.47.030 Basis for establishing areas of special flood hazard.

1. The areas of special flood hazard identified by the Federal Insurance Administration (FIA) of the Federal Emergency Management Agency (FEMA) in the Flood Insurance Study (FIS) dated September 29, 1989, and accompanying Flood Insurance Rate Maps (FIRMs) with Map Index dated September 29, 1989, and all subsequent amendments and/or revisions, are hereby adopted by reference and declared to be a part of this ordinance. The FIS and attendant mapping are the minimum area of applicability of this ordinance and are supplemented by the citywide Storm Drain Master Plan by Montgomery-Watson Engineers dated October 1993. The FIS, FIRMs and the Montgomery-Watson drainage study are on file at the Development Services Department, 777 Cypress Avenue, Redding, California 96049-6071. (Ord. 2284 § 1 (part), 2001)

18.47.040 General provisions.

1. A. Applicability. The regulations of this chapter provide seven levels of protection within and along waterways of the FP Combining District by:

1. Generally prohibiting development within the floodway,

2. Allowing only limited use and development in the flood fringe,

3. Regulating uses and development on properties contiguous to the flood fringe and outside of the floodplain, which do not meet the minimum protection standards,

4. Reviewing proposed development located in designated scenic corridors,

5. Reviewing all development permits to determine that the permit requirements of this chapter have been satisfied,

6. Reviewing all permits to determine that the site is reasonably safe from flooding, and

7. Reviewing all development permits to determine if the proposed development adversely affects the flood-carrying capacity of the area of special flood hazard.

Accordingly, the regulatory scope of this chapter is as follows:

1. These regulations and standards shall be applied uniformly to all lots which, after considering evidence from flood experience and engineering studies, are deemed subject to inundation by a one-hundred-year flood or are within the FP District of the city limits. These regulations and standards are recommended for all lots meeting the same criteria within the city's sphere of influence.

2. These regulations and standards shall apply to land outside the FEMA floodplain but within the FP District if the planning commission determines that the proposed development or use of the property bears relationship to the floodplain, has an unprotected lowest floor level of less than two feet above the one-hundred-year flood elevation, may adversely affect a designated scenic corridor, or is in an area where a potential of bank undermining exists.

3. Property that is zoned "U" Unclassified District and is determined to be contiguous to, within, or partially within the floodplain subsequent to the adoption of this chapter is automatically subject to the regulations of the FP Combining District without further consideration by the planning commission and city council and shall be considered as if already zoned FP Floodplain District.

4. Ensure that floodplain development does not unnecessarily adversely affect a scenic corridor or riparian habitat.

B. Interpretation

1. Except as provided for in this chapter, all development and uses in the base floodplain, including grading and fill, are prohibited without approval as specified herein.

2. Any development within the floodplain as determined by FEMA or higher floodplain elevation adopted by the citywide storm drain master plan shall comply with the standards of Section 60.3 (a, b, c, and d) and Section 60.6 (a) of the Rules and Regulations of the National Flood Insurance Program (44 CFR 59), incorporated herein by reference; the development standards of this chapter; and any conditions of approval applied to the development.

3. Where there appears to be a conflict between a mapped boundary and actual field conditions and the conflict cannot be attributed to fill material being deposited to alter the elevations, the floodplain administrator and public works director may make interpretations, where needed, as to the exact location of the boundary of the floodway and one-hundred-year floodplain consistent with the purpose of this chapter. Any person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation to the planning commission. Such appeals shall be reviewed consistent with the variance and exception procedures of Title 44, Section 60.6 of the Rules and Regulations of the National Flood Insurance Program (44 CFR 59, etc.). All costs for information necessary to make an interpretation shall be borne by the property owner and shall follow the procedures listed in Section 18.47.110.

4. Backwater areas along streams, which rise or fall with the level of water in the adjacent stream, are considered to be within the base floodplain of the adjacent creek or stream unless proven by a registered hydrologist/engineer that these water levels are not the same level as the

base flood of the adjacent stream and may have a base floodplain of their own.

5. When base flood elevation data has not been provided by federal, state or local agencies, the owner shall be responsible for obtaining the information in accordance with Section 18.47.110.

6. The public works department and development services department will review proposed development to ensure that all necessary permits have been received from those governmental agencies from which approval is required by federal or state law, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972 and CDFG's 1601 or 1603 Agreements.

(Ord. 2284 § 1 (part), 2001)

18.47.050 Uses prohibited in a floodway and flood-fringe area.

1. Structures or insurable improvements other than those listed in Section 18.47.060(A) through(D) and Section 18.47.070(A) through (E) shall not be located within the floodway.

The following uses in a floodway and flood-fringe area are prohibited unless the area is raised to a height of flood protection elevation (one foot above the base floodplain elevation) based upon an approved application for encroachment:

A. The storage or processing of materials that, in time of flooding, are buoyant or explosive; that could be injurious to human, animal, or plant life; or that may affect the capacity of the floodway or increase flood heights.

B. The storage or parking of recreational vehicles as defined in Section 18.47.020 within the floodway or floodplain of local streams.

C. Underground storage of toxic or flammable substances that could be injurious to human, animal or plant life.

D. Fences or walls.

E. Swimming pool equipment.

(Ord. 2284 § 1 (part), 2001)

18.47.060 Permitted uses within the floodway and flood fringe (not requiring a use permit).

1. The following uses are allowed within the floodway and flood fringe, provided they are allowed in the district combined with the FP District, meet FEMA development standards and are approved by all agencies with jurisdiction:

A. Emergency actions approved by the city manager taken to protect existing property or facilities, not including concrete or asphalt riprap or narrowing the existing channel.

B. Removal of water-deposited debris that could result in channel alteration subject to obtaining a grading permit and any permits from the Department of Fish and Game.

C. Maintenance and repair to existing structures and yards pursuant to Chapter 18.58 of this code and normal maintenance of existing channels, ditches, or levees.

D. Bridges with a design capacity to pass a one-hundred-year flood without impedance of base floodwaters (bridges without piers or abutments in the floodway), taking into consideration full urbanization of the tributary area.

(Ord. 2284 § 1 (part), 2001)

18.47.070 Uses requiring a use permit within the floodway and flood fringe.

1. The following uses may be permitted by use permit in the FP District for the area of floodway and flood fringe, provided such uses meet the standards of Section 18.47.090 and Section 18.47.110 and are approved by all agencies with jurisdiction:

In the floodway or flood fringe:

A. Dams or diversions for water supply, flood control, hydroelectric production, irrigation, or fisheries enhancement. Levees and pumping stations.

B. Actions approved by the Department of Fish and Game to enhance riparian or wildlife habitat. Streambank stabilization structures.

C. Gravel- and sand-extraction operations along such waterways as Stillwater Creek, Clear Creek and the Sacramento River when a riparian and fishery reclamation plan has been approved by the planning commission and necessary permits have been obtained from the state Department of Fish and Game and the Army Corps of Engineers, provided such operations will not broaden the floodplain nor direct flood flows out of the natural floodplain.

D. Bridges with piers or abutments in the floodway or flood fringe.

E. Water-related recreational uses not exceeding thirty consecutive days in any one year, excluding recreational uses that create permanent improvements or would result in destruction of banks.

In the flood fringe only:

F. Public parks, picnic areas, playgrounds, boat launch, equestrian, pedestrian and bicycle trails and golf courses which involve only the open use of land without permanent structures and which do not impede flood flows.

G. Underground utilities including sewer, water, electric, telephone and cable lines properly floodproofed. Overhead electric lines greater than 12kV.

H. Agriculture and hobby farming, including field crops, orchards, vineyards and grazing. New residential or substantially improved residential structures, agricultural, commercial and industrial structures permitted by the underlying district regulations involved, provided floodproofing and/or flood-protective measures have been installed in a manner meeting with the approval of the floodplain administrator, city engineer, building official and fire marshal.

J. Mobile homes or manufactured homes.

K. The storage or parking of recreational vehicles within the floodplain of the Sacramento River.

L. Unless otherwise noted, any use allowed by the district with which the FP District is combined may be permitted subject to obtaining a use permit and meeting the standards of Sections 18.47.090 and 18.47.110, provided the following are in evidence:

1. The use meets the provisions of this chapter.

2. The use is consistent with the Redding general plan.

3. The use is consistent with the zoning of the parcel.

4. Adequate floodproofmg and/or flood-protection measures have been installed meeting with the approval of the floodplain administrator, city engineer, building official, fire marshal and planning commission.

(Ord. 2284 § 1 (part), 2001)

18.47.080 Permitted uses within the city's fp district, outside the floodway and the flood fringe.

1. The following use is permitted without a use permit in the FP District for the area outside the flood fringe:

A. Any permitted use in the district combined with the FP District, provided there is not any encroachment into the base floodplain. The minimum setback from the base floodplain lines shall be thirty feet when adjacent to the Sacramento River where there is moving water. The minimum setback from the base floodplain line shall be fifteen feet, when adjacent to any creek. The lowest floor elevation of any habitable structure shall be one foot above the base floodplain elevation, as identified by FEMA or the city's master storm drain study, whichever is highest, and the structure shall have year-round access not subject to inundation by a base flood of a depth of more than one foot.

(Ord. 2284 § 1 (part), 2001)

18.47.090 Construction standards.

1. Any structures or construction activities within the flood fringe shall be subject to the following:

A. Construction, General

1. No construction or grading is to limit the capacity of the floodway or increase the base flood elevation unless the following requirements are met:

a. Revision to the Flood Insurance Rate-Map is prepared by the applicant's engineer and is adopted by FEMA in accordance with 44 CFR 65 to incorporate the increase in the base flood

elevation.

b. Appropriate legal documents are prepared in which all property owners

B. Anchoring.affected by the increased base flood elevations consent to the impacts on their property. All new construction and substantial improvements subject to a one-hundred-year flood shall be anchored to prevent flotation, collapse or lateral movement of the structure.

C. Construction Materials and Methods.

1. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage and flood-resistant materials as specified in FEMA Technical Bulletin 2-93 entitled, Flood-Resistant Materials Requirement, when subject to a one-hundred-year flood.

2. All new construction and substantial improvements shall use methods and practices that minimize flood damage.

3. All nonstructural elements that function as a part of the structure such as furnace, hot-water heater, air conditioner, electrical equipment, plumbing fixtures and other service facilities shall be elevated to one foot above the base flood elevation or to the depth number specified on the Flood Insurance Rate Map (FIRM) or the citywide storm drain master plan (whichever is more restrictive), plus one foot.

D. Elevation and Floodproofing.

1. Residential construction, including new or substantial improvement in flood zones A, AE, AO or A1-30, shall have the lowest floor, including basement, elevated a minimum of one foot above the base floodplain elevation as determined by the FIRM maps, by the method in Section 18.47.110, or by the citywide master storm drain study by Montgomery-Watson Engineers, whichever is more restrictive. The elevation of the lowest floor, including the basement, shall be certified by a registered professional engineer or licensed land surveyor per Section 18.47.040(D)(4) and (5). Said certification shall be submitted to the development services department for approval and to verify that certification requirements have been met.

2. Nonresidential construction, including new or substantial improvement, shall either be elevated consistent with Section 18.47.090(D)(1) or together with attendant utility and sanitary facilities shall be required to do the following:

a. Be floodproofed below the elevation recommended under Section 18.47.090(D)(l) so that the structure is watertight with walls substantially impermeable to the passage of water.

b. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.

c. Be certified by a registered professional engineer, licensed land surveyor or architect that the standards of this subsection and the standards required in FEMA Technical Bulletin 3-93, entitled Nonresidential Floodproofing Requirements and Certification are satisfied. Such certifications shall be provided to the city's development services department.

3. All new construction and substantial improvement with fully enclosed areas below the lowest floor (excluding basements) that are usable solely for parking of vehicles, building access or storage and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must meet the specifications in the FEMA Technical Bulletins 1-93 and 7-93, entitled Openings in Foundation Walls and Wet Floodproofing Requirements, respectively, and/or exceed the following minimum criteria:

a. Be certified by a registered professional engineer or architect.

b. Have a minimum of two openings on different sides of the structure, having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices, provided that they permit the automatic entry and exit of floodwaters.

4. An Elevation Certificate for residential construction (FEMA Form 81-31) of the lowest adjacent grade and lowest floor, based on construction drawings, shall be required prior to issuance of a building permit Prior to pouring a foundation, the engineer shall provide written verification that the foundation form elevations are consistent with elevations shown on approved construction drawings A second certification of the elevation of the lowest floor and utilities is required at the time of finished construction prior to final building permit approval (prior to occupancy) The elevation certificates must be prepared by a licensed land surveyor, registered professional engineer or architect who is authorized by state or local law to certify elevation and shall be approved by the development services department. Failure to submit elevation certification shall be cause to issue a stop-work order for a project.

5. An Elevation Certificate (FEMA Form 81-3 1) or a nonresidential Floodproofing Certificate (FEMA Form 81-65) for nonresidential construction is required prior to issuance of a building permit. Prior to pouring a foundation, the engineer shall provide written verification that the foundation form elevations are consistent with elevations shown on approved construction drawings. A second Elevation Certificate is required at the time of finished construction, prior to the final building permit.

E. Standards for Utilities.

1. All new and replacement water-supply and sanitary-sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the system and discharge from systems into floodwaters.

2. On-site, waste-disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

F. Standards for Levees.

1. Design criteria for levees shall incorporate adequate design, operation, and maintenance systems to provide protection from the base flood. The following requirements must be met:

a. Freeboard-riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within one hundred feet of either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.

G. Standards for Manufactured Homes.

1. All manufactured homes that are placed or substantially improved within Zones A, AO, A1-30, AE or AH on the Flood Insurance Rate Map or in the one-hundred-year floodplain as identified on the citywide storm drain master plan shall be elevated on a permanent foundation such that the lowest floor of the manufactured home is elevated at least one foot above the base floodplain elevation and be securely fastened to an adequately anchored foundation system to resist flotation collapse and lateral movement.

(Ord. 2284 § 1 (part), 2001)

18.47.100 Existing parcels.

1. Existing parcels which, at the time of the effective date of this chapter, fall wholly within a floodplain or which have a residual area outside the floodplain which, by itself, does not meet the minimum lot size for the zoning district in which it is located or is less than five thousand square feet, whichever is less, may seek relief as follows:

A. Petition to encroach into the flood fringe pursuant to Section 18.47.110.

B. Seek a use permit to reduce any required setback by fifty percent, provided the floodplain area is placed in an open-space easement or dedicated to the city.

C. Offer to dedicate the flood-fringe area to the city council in exchange for a dwelling-unit credit at a ratio of one unit per ten acres dedicated. Floodplain areas claimed by the State of California (Reclamation Board's designated floodway) are not eligible for a dwelling-unit credit. If the city council approves the exchange, the dwelling-unit credit could then be added to the density of any unsubdivided residential property of five acres or more in the city subject to the following:

1. Any dwelling-unit credit must be used within five years of the date approved by the city council.

2. The density of the recipient property is not increased by more than twenty percent above what the Redding general plan otherwise would allow.

3. The dwelling-unit credit would not change the intended use shown by the general plan. For example, single family would not become multiple family.

4. The development of the recipient property meets all other standards of the city pertaining to the property.

5. The dwelling-unit credit is not in addition to any other bonus-density provisions sought for the property.

6. Any dwelling-unit credit shall be in the form of a recorded agreement.

7. The fringe area shall be calculated as follows:

The base floodplain elevation and the edge of floodway shall be plotted on a one- to four- foot interval contour map of the property. The area then bounded by the edge of floodway, edge of base floodplain, and property lines shall then be planimetered to calculate the flood fringe. That number shall then be divided by ten and reduced to the nearest whole number. In the event the flood-fringe area is less than ten acres, one dwelling unit credit can be given.

8. Any offer to dedicate flood fringe shall also include any adjacent floodway under the same ownership.

9. Areas that are surrounded by floodway are not considered eligible for density credit.

(Ord. 2284 § 1 (part), 2001)

18.47.110 Application for encroachment into the flood fringe.

1. Property owners requesting permission to encroach into the flood fringe shall submit to the planning commission a hydraulic assessment of the base flood event prepared by a hydrologist who is a registered civil engineer. The cost of evaluating the analysis by the city or its consultant will be the responsibility of the applicant. The assessment shall meet the requirements for surveying, hydraulic analysis and flood-flow frequency analysis, as outlined in the Guidelines and Specifications for Study Contractors prepared by FEMA, dated January 1995, or as subsequently amended. The city shall specify the hydraulic method and model to be used. Acceptable models for water-surface profiles include the latest version of the HEC-2, HEC-RAS, HEC-HMS, HSPF or other identical models. The city shall also require that calculations include the runoff from projected upstream urbanization of the tributary area, which may be obtained from the HEC-1 (HEC-HMS) hydrograph model.

Except along the Sacramento River, the assessment shall include a flood-flow frequency analysis obtained from HECWRC Program Model (CPD 13); and when there is insufficient gauged flood history, then the frequency analysis and associated levels of confidence shall be developed through sensitivity analysis of rainfall and runoff parameters impacts using HEC-1 (HEC-HMS). The results of the estimated frequency curve of the base flood event and resulting surface-water analysis shall be compared with a frequency chart using a ninety percent confidence limit and curves of standard deviations from the mean versus the frequency exceedance range, showing bands of confidence ranging from .05 to .95.

Except along the Sacramento River, the assessment shall also include calculations and cross sections with a minimum interval of one hundred feet or less based on one-foot contour intervals and shall be submitted in a format for review by the city relative to FEMA Flood Insurance Study Guidelines. Additional information may also be required by the city as necessary to make a final determination. (Ord. 2284 § 1 (part), 2001)

18.47.120 Equal encroachment.

1. All requests for encroachments into a floodplain shall, to the greatest extent possible, assume equal encroachment on both sides of a stream, unless it can clearly be determined that the opposite bank above the base floodplain elevation which would be affected is unusable and not subject to erosion or undercutting from increased water velocity or raised flood levels or has been placed in a permanent open-space status to the extent that there would be no impact from an increase in the level of the base flood. (Ord. 2284 § 1 (part), 2001)

18.47.130 Environmental review.

1. Any application for encroachment into a flood-fringe area shall be subject to environmental clearance under the California Environmental Quality Act (CEQA). Any encroachment which significantly raises the projected flood levels on adjacent property or has the potential to increase erosion or diverts the natural flow of water shall be subject to an environmental impact report. The environmental impact report shall evaluate the area needed to make a determination, taking into consideration the cumulative and long-term impact of the proposed encroachment, the relationship of the project to the purpose of this chapter, and alternatives to the proposed project. (Ord. 2284 § 1 (part), 2001)

18.47.135 Whenever a floodway or floodplain is to be altered or relocated.

1. The city will notify adjacent communities and the California Department of Water Resources prior to such alteration or relocation of a floodway or floodplain, submit evidence of such notification to the Federal Emergency Management Agency in a request for a Conditional Letter of Map Revision (CLOMR), and ensure that the flood-carrying capacity of the altered or relocated portion of said watercourse is maintained. Preparation of the Conditional LOMR application by the applicant's engineer and approval of the Conditional LOMR by FEMA will be required prior to issuance of a grading permit or building permit. Approval of the Final LOMR is typically required prior to Final building permit approval (Certificate of Occupancy).

(Ord. 2284 § 1 (part), 2001)

18.47.140 Warning and disclaimer of liability.

1. The degree of flood protection required by this chapter is considered reasonable for regulatory purposes and is based on scientific and engineering considerations It is probable that larger floods can and will occur, that the base flood may occur more often than the one percent frequency, and that flash floods may cause equal or greater damage. Flood heights inside the city limits may also be increased by manmade or natural causes in unincorporated areas. This chapter does not imply that land outside the Areas of Special Flood Hazards or uses permitted within such areas will be free from flooding or flood damage. This chapter shall not create liability on the part of the city or any officer or employee thereof, the State of California, or the Federal Insurance Administration of the Federal Emergency Management Agency for any flood damages that result from reliance on this chapter or any administrative decision lawfully made thereunder.

(Ord. 2284 § 1 (part), 2001)

18.47.150 Nonconforming uses in the floodway or floodplain.

1. If any nonconforming use or structure within the floodway is destroyed by any means, including floods, to an extent of fifty percent or more of its market value as defined in Section 18.47.020, it shall not be reconstructed. Within the flood fringe, a structure may be reconstructed pursuant to the Nonconforming Uses, Structures Section of the city's Zoning code, provided that upon reconstruction, the structure is adequately and safely floodproofed, elevated or otherwise protected in conformity with the requirements of this ordinance.

(Ord. 2284 § 1 (part), 2001)

18.47.160 Prohibitions.

1. No building permit, license, certificate or other approval or entitlement shall be issued or given by the city or any department or employee thereof with respect to any improvement until the design of the improvement has been approved, as provided in this chapter, and the one-hundred-year flood elevation has been determined. No certificate of use and occupancy or similar approval shall be issued or given for any improvement subject to use permit by this chapter, unless and until a representative of the Development Services Department has certified that the improvement has been completed in accordance with the use permit approved pursuant to this chapter.

18.47.170 Nuisance.

1. A. Any improvement constructed, located, repaired, altered or maintained contrary to the provisions hereof, after the effective date of this chapter, is hereby declared to be unlawful and a public nuisance. If any permit is issued based on plans or other submittals by the applicant or his/her representative which are contrary to the chapter or planning commission approval, the applicant shall be responsible for correcting any work done under such permit in order to bring it into conformance with the approved design.

B. Any grading or filling within the floodplain contrary to the provisions of this chapter is hereby declared unlawful and a public nuisance.

C. When the director of public works has been made aware of the unlawful deposit of fill or grading within the floodplain, he shall advise the property owner by registered mail that such material shall be removed within thirty working days and that a riparian reclamation plan must be submitted for approval by the planning commission within the same period of time. Thereafter, the property owner will have nine months to implement the approved plan. The city-approved reclamation plan shall be recorded and shall remain in the title report until the city is satisfied that compliance has been achieved. Within thirty days of planning commission approval, the property owner shall deposit improvement security based on the value of reclamation improvements to ensure that the plan is implemented. Until such time as the

property is restored to its natural conditions, no building, grading or use permit shall be issued for improvement of the property.

(Ord. 2284 § 1 (part), 2001)

18.47.180 Standards for subdivisions.

1. A. Unless encroachment into the flood fringe has been approved by the planning commission or the city council, as the case may be, no subdivision shall be approved which creates lots that extend into any flood fringe or floodway area and no lots shall use areas subject to flooding by a base flood in order to meet minimum area requirements. The surface area of all lots in a subdivision that are not subject to flooding by a base flood shall be a minimum of one foot above the base flood elevation; or all lowest floor elevations, including basements, shall be at least one foot above the base floodplain elevation. Both the tentative and final maps for a subdivision shall show the boundary of the base flood. The boundary shall be certified by the engineer preparing the map. All final maps shall also have a warning note on the map similar to Section 18.47.140.

B. All final subdivision plans will provide the elevation of proposed structures, pads and adjacent grade. If the site is filled above the base floodplain, the final pad elevation shall be certified by a registered professional engineer or surveyor and provided to the director of public works and shown on the final map. Approval of a Conditional Letter of Map Revision (CLOMR) by FEMA is required prior to grading.

C. All subdivision proposals shall be consistent with the need to minimize flood damage.

D. All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage.

E. All subdivision proposals shall have adequate drainage, provided to reduce exposure to flood damage. Certification of compliance shall be required of the developer.

F. Subdivisions will be required to have the base floodplain elevation established with consideration of the tentative map.

(Ord. 2284 § 1 (part), 2001)

18.47.190 Variances.

1. A. The planning commission shall hear requests for variances from the requirements of this chapter.

B. Those aggrieved by the decision of the planning commission may appeal such decision to the city council.

C. In considering a variance application, the planning commission shall consider all technical evaluations, all relevant factors, standards, etc., specified in other sections of this chapter, and:

1. The danger that materials may be swept onto other lands to the injury of others.

2. The danger to life and property due to flooding or erosion damage.

3. The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner.

4. The importance of the services provided by the proposed facility to the community.

5. The necessity to the facility of a waterfront location, where applicable.

6. The availability of alternative locations for the proposed uses that are not subject to flooding or erosion damage.

7. The compatibility of the proposed use with existing and anticipated development.

8. The relationship of the proposed use to the comprehensive plan and floodplain-management program for that area.

9. The safety of access to the property in times of flood for ordinary and emergency vehicles.

10. The expected heights, velocity, duration, rate of rise and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site.

11. The costs of providing governmental services during and after flood conditions, including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, water system and streets and bridges.

D. Generally, variances may only be issued for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level providing subsections (A) through (F) of this section have been fully considered. As the lot size increases beyond the one-half acre, the technical justification required for issuing the variance increases.

E. Upon consideration of the factors of Section 18.47.190(C) and the purpose of this chapter, the planning commission may attach such conditions to the granting of variances as it deems necessary to further the purpose of this chapter.

F. The floodplain administrator shall maintain the records of all appeal actions and report any variances to the Federal Insurance Administration of the Federal Emergency Management Agency in the biennial report.

G. Conditions for Variances:

1. Variances may be issued for the repair, rehabilitation, or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places, provided that the proposed repair, rehabilitation, or restoration will not preclude the structure's continued designation as an historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.

2. Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

3. Variances shall only be issued upon a determination that the variance is the minimum

necessary, considering the flood hazard, to afford relief.

4. Variances shall only be issued upon:

a. A showing of good and sufficient cause such as renovation, rehabilitation or reconstruction. Variances issued for economic considerations, aesthetics or because variances have been used in the past, are not good and sufficient cause.

b. A determination that failure to grant the variance would result in exceptional hardship to the applicant.

c. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, or extraordinary public expense; create nuisances; cause fraud on or victimization to the public or conflict with existing local laws or ordinances.

5. Any applicant to whom a variance is granted shall be given written notice that the structure will be permitted to be built with a lowest floor elevation below the base flood elevation and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation. It is recommended that a copy of the notice be recorded by the floodplain administrator in the office of the Shasta County recorder and be recorded in a manner so that it appears in the chain of title of the affected parcel of land.

(Ord. 2284 § 1 (part), 2001)

APPENDIX G

City of Redding Storm Drain Utility Operations and Maintenance Plan

DRAFT
STORM DRAIN UTILITY
MAINTENANCE AND OPERATIONS PLAN

REDDING
MUNICIPAL UTILITIES

REDDING MUNICIPAL UTILITIES
MARCH 2003

Maintenance and Operations Plan Preface

To prevent flooding and to protect life and property, the City has accepted or incurred certain obligations related to control of storm waters. As a result of regulations, the role has been expanding to better protect water quality and to deal with plan and species issues.

This document, a Maintenance and Operations Plan (Plan) for the Storm Drain Utility, relates to three other documents of the City and various permits issued to the City for storm drain and stream channel maintenance. Incorporated herein by reference are the following:

- Redding Municipal Code
- Storm Drain Master Plan, as amended
- Storm Water Quality Improvement Plan

This Plan outlines activities which relate to the Storm Drain Utility enacted within the City of Redding in September 1993. The Utility was formed following the completion of a City-Wide Master Storm Drain Study which defined capital improvement needs and projected costs within the City and also provided an estimate of impacts as a result of development. One of the Study recommendations enacted by the City Council, was the creation of the Storm Drain Utility (Utility). The formation of the Utility was to provide an adequate funding source for:

- Storm drain maintenance;
- Street sweeping;
- Future water quality requirements under the pending Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) program; and
- Capital improvements needed to upgrade existing facilities identified in the Master Storm Drain Study.

Since the formation of the Utility, maintenance activities have been conducted utilizing an on-demand methodology, whereby the cleaning of ditches, catch basins and channels is done when a blockage problem is observed or called in by the public at large. Activities contained within the maintenance program in 1993 have been modified to reflect current funding levels.

As federal regulations related to NPDES become required on small urban areas, it is necessary to further define the activities, costs, and revenues related to maintenance and operations. To that end, this Plan has been developed to provide guidance with measurable goals for maintenance personnel, to define the various facilities within the City to be maintained, to provide information to the regulatory agencies who overview maintenance within storm water channels, to obtain necessary permits, and to provide cost estimates managers and planners can utilize in the management of the Utility.

This Plan is divided into the following eight sections:

1. Introduction
2. Facility Types

3. Existing Facilities Inventory and Maintenance
4. Regulatory Permits
5. Operational Goals and Objectives
6. Recommended Maintenance Practices
7. Financial Issues
8. Summary of Maintenance and Operations Recommendations

Contained within these sections is information related to pending NPDES Phase II requirements as they relate to maintenance; essential and regulatory issues and needs; suggested way to be more efficient through the use of existing programs operated by others and/or the transfer of tasks to reduce duplication; projected growth in facilities through the year 2023; financial forecasts; discussion of capital improvements and the need to develop and maintain capital improvement programs; and, operation and maintenance funding operations and recommendations.

Essentially, this is a combination management audit and work plan for the Storm Drain Utility to prepare the Utility for the next ten years. Without significant changes, the Utility is subject to failure and inability to meet maintenance obligations.

This is not intended to be a static document. It is intended to be a working document for the community on meeting needs and mandates related to storm water runoff and pollution prevention. To the extent there are issues, this is also a problem statement on dealing with a complex issue by the community.

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Section 1
Introduction

In July 1993, a City-Wide Master Storm Drain Study (Study) was completed and recommended that the City pursue the formation of a Storm Drain Utility. The goal of formation of this utility was to provide an adequate funding source for storm drain maintenance, street sweeping, future water quality requirements under the pending Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) program, and capital improvements needed to upgrade existing facilities identified in the Master Storm Drain Study. In October 1993, the Storm Drain Utility was established by adoption of Ordinance No. 2061 (See Appendix A) by the Redding City Council.

Today, as the Storm Drain Utility (Utility) begins to address non-point source pollution and water quality issues, while complying with more stringent permitting processes required by wildlife and wetland regulatory agencies and a constrained financial forecast, it is critical to the Utility's overall success that a comprehensive maintenance plan be in place.

A. PURPOSE

The goal of the storm water maintenance and operations plan is to outline a program for efficient, cost-effective and environmentally responsible maintenance of the City's storm water infrastructure.

Foremost in the development of these guidelines was compliance with Federal and State laws; protection of the lives and property of City residents from flooding; to effectively enhance water quality; and, to preserve the City's natural wetlands and riparian habitat.

The primary objectives of the plan are:

- To complete a comprehensive facilities inventory of the system.
- To develop operating procedures.
- To establish overall policies and levels of service.
- To develop a detailed activity reporting system.
- To establish a 10-year financial plan.

It is important to note that no maintenance plan is ever "complete." This plan will continue to evolve as regulations change, facilities increase, and standards/costs are further refined. The plan will let the public and decision makers know what the City can accomplish with the funds available, what the priorities are, and what cannot be done without further funds or support.

B. HISTORIC MAINTENANCE LEVELS

Prior to the Storm Drain Utility

At the time of the 1993 Study, the City's Streets Division had three, four-man crews dedicated to streets and storm drain maintenance. Each crew consisted of (1) working supervisor, (1) a heavy equipment operator and (2) maintenance workers. The City was divided into three quadrants with one crew assigned to each quadrant. Each crew was responsible for performing all maintenance work associated with roadways, pavement markings and striping, curbs, gutter, sidewalks and the existing drainage system within their specific quadrant.

The crews approached storm drain maintenance by surveying the system each year, prioritizing system cleaning and clearing, and addressing the highest priority sections of the system first. The overall volumes of both the street and storm drain maintenance, as well as, budget limitations prevented the Streets Division from doing much more than respond to customer needs and meet minimal maintenance levels. There were no funds for system repair and replacement.

The 1993 Study found that the Streets Division personnel were maintaining the facilities at the following levels:

- 15 miles of open drainage channels were inspected annually with about five miles being cleaned each year;
- 114 miles of storm drain pipes were inspected annually. Cleaning was performed only at areas where problems were noted; and
- Catch basins/inlets were cleaned on an "as needed/emergency" basis only. Maintenance was very labor intensive, as staff did not have access to a vacuum truck.

In 1993, street sweeping was not performed by the Streets Division staff. This activity was under the Sewer Division and accomplished by (2) full-time street sweeper operators utilizing two street sweepers. The result of their performance was as follows:

- Residential streets were being swept once every two weeks, arterial streets once per week, and commercial areas three times per week. There were 511 curb miles and an 80% completion rate was maintained.

Storm Drain Utility – First Year Review

The goal of establishing the Storm Drain Utility was to result in a funding mechanism for daily operations, capital improvements, and for the anticipated NPDES program mandate.

In 1994, many of the Study's recommendations for maintenance levels, equipment purchases and/or replacements, and staffing were implemented. Initial purchases included a new street sweeper and VacCon (vacuum) truck. Storm drain maintenance activities and the street sweeping operations were combined to form one operating utility. Staffing consisted of six full time positions – (1) working supervisor, (1) a heavy equipment operator, (2) maintenance men, and (2) street sweepers.

First year maintenance level results were as follows:

- Of the 15 miles of open drainage channels – 100% were inspected and 50% were cleaned;
- Of the 5,041 catch basins/inlets – 40% were cleaned and inspected;
- 531 curb miles were swept at a frequency of once per month for residential streets and once per week for commercial areas – 90% completion rate; and
- 129 miles of storm drain pipes were scheduled for inspection and cleaning – 5% were inspected and cleaned.

This first year review also revealed that the storm drain service charge, initiated with the establishment of the Utility, was inadequate to fund all aspects of storm water maintenance. (*See Section 7 for the service charge formula, rates, annual revenue, etc.*) Also, the Storm

Drain Utility personnel were unable to achieve and/or maintain the maintenance frequencies and performance levels desired. This was due in part to the increasing number of facilities, the need for additional equipment, preparation for transition to the new Corporation Yard increased travel times, and new procedures for material disposal.

As a result of public controversy and to keep customer rates as low as possible, the City Council decided not to increase fees. Because of the funding shortfall, the Utility found it necessary to reduce manpower, reduce service levels and forego identified capital improvements.

Storm Drain Utility – 2001/02

In response to demands by regulatory agencies and in anticipation of NPDES requirements being applied to the City in 2003, the City conducted a comprehensive review of Storm Drain Utility operations in 2002. Information was collected through interviews with the Utility staff and records maintained on the facilities, maintenance frequencies, field surveys, crew configurations, equipment and repair/replacement needs. This review revealed that due to budget constraints over the years, personnel decreased, maintenance frequencies had been pared down, activity and facility reporting records had not been updated, and there was no funding available for repair and replacement of existing facilities that are undersized or failing. Also noted, was the ongoing increase in the number of new facilities due to development and the added burden of the pending NPDES requirements beginning in March 2003.

The following provides a brief summary of the current program.

- Administration of the Utility is handled by a Public Works Manager and a Public Works Supervisor. They each spend approximately 25% to 30% of their time overseeing operations, budget, report preparation, special projects, etc., for the Utility.

- There are currently five full-time employees budgeted to the Utility – (1) working supervisor, (1) a heavy equipment operator, (2) maintenance men, and (1) a street sweeper.

- Most maintenance work is performed by a working supervisor and a two-person crew unless the type, location, or magnitude of the project requires additional assistance.

- The 18 miles of identified open drainage channels/ditches are inspected annually. City crews accomplish cleaning of the channels based on the type of maintenance permitted within that section, as previously determined by the Department of Fish and Game. City crews, with the assistance of the California Conservation Corps crews, clean approximately 50% of these channels/ditches annually.

- There are 5,220 catch basins/inlets and maintenance addresses 20% per year.

- The 129 miles of storm drain pipes are maintained on an "as needed" basis with about 20% being inspected annually.

- The 570 curb miles are swept by one street sweeper. Residential streets are swept six times per year while commercial arteries are swept weekly.

In summary, the Utility continues to face all of the challenges that existed at the time the

Utility was formed. These challenges are compounded by increasing infrastructure and implementation of NPDES requirements as a result of growth of and new regulations.

Section 2
Facility Types

This section defines in general terms the types of facilities that are constructed and maintained as part of the City's overall storm water system. Recommended maintenance activities for these facilities are outlined in *Section 6*.

A. CULVERTS/PIPES

A culvert is a relatively short section of pipe or concrete box usually designed to convey flow under or away from a roadway. Because of its semi-open nature, it is prone to blockages from vegetation, trash, and other debris in addition to sediment.

Pipes are longer than culverts and more likely to be deeper underground and located in areas such as backyards and longitudinally under roadways where access is difficult. Typically, pipes are constructed of concrete or plastic. However, past practice included corrugated metal pipe which has a shorter expected design life span.

B. CATCH BASINS/INLETS

Catch basins are inlets at the curb, several feet deep, which allow the transition of surface drainage to the storm drain pipe. Catch basins can also act as a junction structure allowing multiple inlet pipes and surface drainage to merge into a single, sometimes larger, outlet pipe.

C. NATURAL STREAM CHANNELS

In the Redding area, natural stream flows are a result of rainfall and some seasonal springs. The rainfall follows the slope of the earth down to a natural swale where the water collects to form a stream channel. These stream channels descend geographically, merging with other channels, and develop into larger streams. While these stream channels typically follow nature's path, most will pass through some sort of man-made culvert or pipe system before reaching the river.

D. OPEN CHANNELS

Open channels primarily convey storm water flows. These channels also descend geographically and are the main source of channelization for conveying storm water to the Sacramento River. Many of these channels are natural drainage courses, however, some are intentionally constructed or re-shaped by newer development for storm water flows and/or to maintain their soil lining.

E. EARTHEN DITCHES

Ditches are defined as long, narrow excavations dug in the earth for the purpose of channeling storm water. These maybe man-made, typically constructed by excavation to a grade, and maintain their earthen lining.

F. CONCRETE CHANNELS

These types of channels are basically defined as an open channel with improvements. Typically, the improvements include concrete bottoms, and possibly vertical or sloping concrete sides.

G. ROADSIDE DITCHES

Roadside ditches are a low-lying stretch of land constructed for the purpose of conveying storm water runoff adjacent to roadways. These roadside ditches are located along certain portions of arterial/collector streets

and throughout older and more rural residential development. In many cases, these roadside ditches are left in a natural grassy swale type condition and some have incorporated corrugated pipe to enter and exit private properties. In rural open canyon areas, cobble lining is utilized in steep areas to reduce erosion.

H. DETENTION/RETENTION BASINS

Basins provide temporary storage for storm water, which allows sediment and pollutants to settle out of the water to the bottom of the pond. Generally speaking ponds are designed and/or utilized to hold back flood waters and release it slowly to streams during peak storm events. They are also installed for water quality benefits. The effectiveness of a pond is based on its ability to hold a certain amount of water, or design volume, for a calculated period of time to minimize flooding downstream.

I. STREETS, CURBS, AND GUTTERS

Pollution prevention and good housekeeping for Municipal Operations are one of the six minimum measures that must be addressed in Phase II of the NPDES requirements. Ideally, it is best to keep debris and pollutants from entering the storm water system in the first place. However, since that is not always possible, street sweeping is considered a drainage management service and is performed to meet these goals:

- Remove street dirt, debris and other hazards for health, safety and appearance.
- Protect air quality through road dust removal.
- Remove street debris and sediments which tend to block flow and cause flooding.
- Protect public investment in transportation facilities from damage.
- Protect water quality by removing excess debris and pollutant-carrying sediments before they reach streams.

Section 3
Existing Facilities Inventory and Maintenance Levels

A. EXISTING FACILITIES

The following table summarizes the storm drainage system inventory. The table shows the facilities identified in January 2002 and the updated findings of the ongoing comprehensive inventory through December 2002. The January 2002 information was based on quantities provided by field crews and GIS data derived from the existing storm drain atlas books. The December 2002 inventory quantities are a result of an extensive city-wide field review conducted by the Utility staff. Implementation of the detailed inventory procedures identified in this Plan will enable Utility staff to maintain an up-to-date record of the storm drain infrastructure.

Table 3 - 1
Facility Inventory Summary

Maintenance Item	January 2002 Quantities	December 2002 Quantities	Unit Measurement
Culverts/Pipes (1)	681,120	727,673	Feet
Catch Basins/Inlet Structures	5,220	5,220	Each
Earthen Ditches (2)	79,200	360,320	Feet
Natural Stream Channels		171,027	Feet
Open Channels		242,799	Feet
Concrete Channels		61,626	Feet
Roadside Ditches (3)	N/A	N/A	Feet
Detention Basins	3	48	Each
Street Sweeping	537	570	Curb Miles

Notes:

1. Generally, drainage pipes do not require regular maintenance, however, a thorough inspection and rating of all pipes will be conducted as a part of this plan and repeated every five years.

2. The inventory quantities available in January 2002 did not clearly delineate between natural stream channels, open channels, earthen ditches, concrete channels, and/or roadside ditches. Additionally, the January 2002 quantity shown only identifies that portion which was being maintained by the City.

3. Inventory of the roadside ditches is scheduled to be completed in 2003/04.

B. CURRENT MAINTENANCE PRACTICES

Current maintenance practices for the above-referenced facilities consist of the following types of activities.

Culverts/Pipes

Drainage pipes do not require regular maintenance. Most cleaning and/or repair to culverts and pipes are done in response to flooding complaints. Clogging or blockages are usually caused by trash or sediment accumulation, entry of tree roots, and collapse or poor alignment of the pipe.

Catch Basins/Inlets

These facilities are maintained on an "as needed" or "time permitting" basis. The task usually involves the removal of sediment, trash and debris. Depending on the size and type of debris, the removal is either done by hand or operation of the vacuum truck. Under current maintenance procedures only 20% are inspected/cleaned annually.

Ditches/Channels

The Utility currently inspects identified ditches/channels annually. Maintenance of earthen ditches, natural stream channels and storm water channels is performed based on some previously defined "ditch type" criteria established in 1996 by the local Department of Fish and Game.

Ditch type "A" is cleaned only at the inlet/outlet of the culvert, 50 feet plus/minus upstream and downstream. A backhoe or other equipment is satisfactory as long as operated from the top of the ditch bank.

Ditch type "B" is cleaned only to maintain flow of water. This task is accomplished by placing a backhoe, dozer or similar equipment into the ditch.

Ditch type "C" is also cleaned to maintain flow of water. However, these ditches may only be cleaned by hand and the banks are to be left undisturbed. Work is usually accomplished by California Conservation Corps or juvenile offenders working under the Crystal Creek Conservation Camp work program. These channels are of concern to regulatory agencies for impacts on endangered plants or species.

Maintenance activities include, cleaning, reshaping, sediment removal, vegetation control and erosion prevention. In addition to handwork, certain activities require equipment such as a backhoe, mucker, track loader and various types of trucks. Fifty percent of the channels are cleaned on even years with the other half being cleaned on odd years.

Detention/Retention Basins

While an inventory of the basins has not yet been completed, of the basins that have been identified, maintenance practices currently include clean up of trash, debris and weed abatement. To date, only three basins are maintained. Work is done by hand, usually performed by the juveniles from the Crystal Creek work program, and the work is monitored by a City Utility supervisor.

Street Sweeping

The City's 537 curb miles are swept by one employee alternating between two sweepers. Only those City streets with curb and gutter are swept. Streets identified as commercial arteries are swept weekly while residential streets are swept six times per year. The driver makes multiple trips to the Transfer Station daily to dump debris. During a peak leaf season, the sweeper dumps loads at various locations throughout the City which are picked up by the Utility crews and transferred to the landfill by dump trucks.

Section 4
Regulatory Permits

This section of the Plan identifies current regulatory permits required to perform routine and annual storm water channel maintenance.

A. PERMIT HISTORY

Through the years, the City of Redding has complied with the permitting process required by the Department of Fish and Game for channel maintenance. The last permit was entered into in 1996 in the form of a Memorandum of Understanding (MOU) and addressed maintenance far certain watercourses, natural streams, drainages and flood control projects and facilities. The annual fee for this permit was $662 and had a term of five years. Upon expiration of the MOU in December 2001, the City learned of new Federal/State mandates that have resulted in a more stringent permitting process required by the wildlife and wetland regulatory agencies. The new process has prompted the City to more closely address its' storm drain maintenance and operation. The effect of this new requirement is that the City may have to utilize more expensive maintenance practices in core areas (hand work) or drop sensitive channels from maintenance.

B. DEPARTMENT OF FISH AND GAME

The Department of Fish and Game (DFG) is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the law requires any person, state or local government agency, or public utility proposing a project that may impact a river, stream, or lake to notify the Department before beginning the project. If the DFG determines that the project may adversely affect existing fish and wildlife resources, a Lake or Streambed Alteration Agreement is required.

Under Fish and Game Code Section 1601, before any local governmental agency begins a construction project that will:

- Divert, obstruct, or change the natural flow or the bed, channel or bank of any river, stream, or lake;
- Use material from a streambed; or
- Result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavements where it can pass into any river, stream, or lake;

The agency must first notify the DFG of the proposed project. The notification requirement applies to any work undertaken in or near a river, stream, or lake that flows at least intermittently through a bed or channel.

To achieve a new Agreement or, in the City's case, obtain a new Memorandum of Understanding (MOU), the City must complete the following items:

1. A completed Notification of Lake or Streambed Alteration form (FG2023). The form requires (1) a map of the project location, (2) a project description, (3) construction plans and drawings, (4) California Environmental Quality Act (CEQA) documentation when applicable, and (5) copies of any local, State, Federal or other required permits/authorizations.

2. Completion of a Project Questionnaire

form (FG2024)

3. The appropriate application fee as specified in the current fee schedule.

Upon receipt of the Notification documents, DFG has a minimum of 30 days to determine if our Notification is complete. Once a determination is made, the City will be notified and, if an Agreement is required, a list of steps will be provided for the City to follow in protecting the resources. CEQA determination will also be reviewed at this time. After the City has completed all related legal requirements and the Agreement has been executed by both DFG and the City, we may begin our project.

This Agreement, per Section 1601(f) of the Fish and Game Code, is automatically renewed by DFG when it expires unless DFG determines that "there has been a substantial change in conditions." If conditions have not significantly changed, the Agreement will be renewed upon payment of any applicable fees. If DFG determines that substantial changes have occurred, an amended Agreement accounting for the changed conditions will be required along with CEQA compliance before a renewal will be granted.

Fish and Game Code Section 1601(f) also clarifies that the City does not need to acquire a Lake or Streambed Alteration Agreement before commencing the following types of emergency work:

- Immediate emergency work necessary to protect life or property.
- Immediate emergency repairs to public service facilities under specified circumstances.
- Emergency projects undertaken, carried out, or approved by a public agency to maintain, repair, or restore an existing highway, as defined, within the existing right-of-way of the highway, damaged as a result of fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide, within one year of the damage.

While pre-notification is not required for the work described above, the City must notify DFG **in writing** of the emergency work within 14 days after the work begins.

C. U. S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers (Corps) has been regulating activities in the Nation's waters since 1899, to protect its navigable capacity. Since the 1960s, the regulatory program's aim was expanded by Congress to consider the full public interest in protecting and using water resources, environmental impacts, and commercial benefits. In 1972, Section 404 of the Clean Water Act was passed. It prohibits discharging dredged or fill material in U.S. water without a permit from the Corps. Court rules and litigation further defined "water of the U.S." to include virtually all wetlands. Because the definition of "discharge of dredged material" was modified in August 1993, activities that impact waters, including wetland, will usually require a Corps permit.

Waters of the U.S. specifically refer to:

1. All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

2. All other water such as intrastate lakes, rivers, streams (including intermittent streams) mudflats, sand flats, "wetlands,"

sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds where the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

a. Which are or could be used by interstate or foreign travelers for recreational or other purposes;
b. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
c. Which are used or could be used for industrial purposes by industries in interstate commerce;

3. All impoundments of waters otherwise defined as waters of the United States under this definition;

4. Tributaries of waters identified in paragraphs (1) through (4) of this definition;

5. The territorial sea; and

6. "Wetlands" adjacent to water (other than waters that are themselves wetlands) identified in paragraphs (1) through (6) of this definition.

The U.S. Army Corps of Engineers defines numerous Nationwide Permits for various activities associated with storm drainage systems. Four such permits apply to storm drain maintenance facilities:

NWP - 7 Outfall Structures Maintenance

Activities related to:

1. Construction of outfall structures and associated intake structures where the effluents from the outfall are authorized, conditionally authorized, or specifically exempted, or are otherwise in compliance with regulations issued under the national Pollutant Discharge Elimination System (NPDES) Program.

2. Maintenance excavation, including dredging, to remove accumulated sediments blocking or restricting outfall and intake structures, accumulated sediments from small impoundments associated with outfall land intake structures, and accumulated sediments from canals associated with outfall and intake structures, provided that the activity meets all of the following criteria.

   a. The permittee notifies the District Engineer.
   b. The amount of excavated or dredged material must be the minimum necessary to restore the out falls, intakes, small impaundments, and canals to original design capacities and design configurations (i.e., depth and width);
   c. The excavated or dredged material is deposited and retained at an upland site, unless otherwise approved by the district Engineer under separate authorization; and
   d. Proper soil erosion and sediment control measures are used to minimize reentry of sediments into waters of the U.S.

The notification portion of this permit also requires submission of information regarding the original design capacities and configurations of the facility and identification of the presence of special aquatic sites (e.g. vegetated shallows) in the vicinity of the proposed work.

NWP - 31 Maintenance of Existing Flood Control Facilities

This permit covers discharge of dredge or fill material resulting from activities associated with the maintenance of existing flood control facilities, including debris basins, retention/detention basins, and channels that were previously authorized by the Corps by Individual Permit, General Permit, by 33 CFR 330.3, or did not require a permit at the time it was constructed.

This permit requires physical characteristics of the facility be submitted and approved by a Corps District Engineer to establish a maintenance baseline for the facility. The required documentation includes as-built drawings and the supporting documentation of the design capacities of the flood control facility. Such documentation needs to include BMP's to ensure that the impacts of the aquatic environment are minimal.

This permit does not authorize maintenance of a flood control facility that has been abandoned. A flood control facility will be considered abandoned if it has operated at a significantly reduced capacity without needed maintenance being accomplished in a timely manner.

In emergency situations, this NWP may be used to authorize maintenance activities in flood control facility for which no maintenance baseline has been approved. Emergency situations are those which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforseen, and significant economic hardship if action is not taken before a maintenance baseline can be approved. This exception requires mitigation of the impacts of the emergency maintenance be completed following the emergency.

NWP - 41 Reshaping Existing Drainage Ditches

Discharges of dredged or fill material into non-tidal waters of the U.S., excluding non-tidal wetlands adjacent to tidal waters, to modify the cross-sectional configuration of currently serviceable drainage ditches constructed in waters of the U.S. The reshaping of the ditch cannot increase drainage capacity beyond the original design capacity. Nor can it expand the area drained by the ditch as originally designed.

Essentially, this permit allows changing of channel configurations only for the purpose of wetland enhancement projects. Any increase in a wetland habitat within a ditch designated as a storm water conveyance facility impedes the ability to perform required channel maintenance assuring health and safety of the public and protection of property from flood damages.

NWP - 43 Storm Water Management Facilities

This permit cover discharges of dredged or fill material into non-tidal waters of the U.S., excluding non-tidal wetlands adjacent to tidal waters, for the construction and maintenance of storm water management facilities, including activities for the excavation of storm water ponds/facilities, detention basins, and retention basins; the installation of maintenance of water control structures, outfall structures and emergency spillways; and the maintenance dredging of existing storm water management ponds/facilities and detention and retention basins, provided the activity meets all of the following criteria.

1. The discharge for the construction of new storm water management facilities does not cause the loss of greater than 1/2-

acre of non-tidal waters of the U.S., excluding non-tidal wetlands adjacent to tidal waters.

2. The discharge does not cause the loss of greater than 300 linear-feet of a stream bed, unless for intermittent stream beds this criterion is waived in writing pursuant to a determination by the District Engineer, as specified below, that the project complies with all terms and conditions of this NWP and that any adverse impacts of the project on the aquatic environment are minimal, both individually and cumulatively;

3. For discharges causing the loss of greater than 300 linear feet of intermittent steam beds, the permittee notifies the District Engineer. In such cases, to be authorized the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine the adverse environmental effects are minimal both individually and cumulatively, and then waive this limitation in writing before the permittee may proceed;

4. The discharges of dredged or fill material for the construction of new storm water management facilities in perennial steams is not authorized;

5. For discharges or excavation for the construction of new storm water management facilities or for the maintenance of existing storm water management facilities causing the loss of greater than 1/10-acre of non-tidal waters, excluding non-tidal wetlands adjacent to tidal waters, provided the permittee notifies the District Engineer. Notification must include:

   a. A maintenance plan. The maintenance plan should be in accordance with state and local requirements, if any such requirements exist.
   b. For discharges in special aquatic sites, including wetlands and submerged aquatic vegetation, the notification must include a delineation of the affected areas.
   c. A compensatory mitigation proposal that offsets the loss of waters of the U.S. Maintenance in constructed areas and not within compensatory mitigation areas.

6. The permittee must minimize discharges into waters of the U.S. at the project site to the maximum extent practicable, and notification must include a written statement to District Engineer detailing compliance with this condition;

7. The storm water management facility must be designed using BMP's and watershed protection techniques.

8. Maintenance excavation will be in accordance with an approved maintenance plan and will not exceed the original contours of the facility as approved and constructed; and

9. The discharge is part of a single and complete project.

To maintain channel capacity, and thereby consistent flood plain elevations, many of the City of Redding waterways require occasional maintenance activities to remove sediment and/or excessive vegetation from channels or culverts. Removal of accumulated sediment and/or vegetation from waters of the U.S. (As defined by the Corps of Engineers) requires permission from the Corps in the form of one of the described permits. Explanation of the

nature and extent of the maintenance required to maintain the existing flood plain level is one of the goals of this document. The Storm Drain utility is the entity performing this maintenance. The permit process will require substantial record keeping and likely include an increase in frequency of channel maintenance to prevent the accumulation of excessive vegetation creating jurisdictional wetlands with negative impacts on conveyance and flood plain elevations.

D. STATE WATER QUALITY CONTROL BOARD

Under Federal law (Clean Water Act) every applicant for a Federal permit or license for an activity which may result in a discharge into a water body must request State certification that the proposed activity will not violate State and Federal water quality standards. This certification process is managed by the State Water Quality Control Board Regional office. Each Regional Water Quality Control Board establishes water quality standards that specify:

1. The designated beneficial uses of the waters, e.g., drinking water, agriculture, recreation, fish and wildlife habitat.

2. Water Quality Objectives. Water quality objectives are numeric and narrative limits or bans on specific water characteristics that support eh designated beneficial uses.

3. A state-specific Anti-degradation Policy. An anti-degradation policy is a specification that no activities will degrade the existing water quality.

Any project that requires an Army Corps of Engineers Section 404 permit also requires a Water Quality Certification issued by the local Regional Water Quality Control Board.

Submission of a Water Quality Certification application requires:

1. A $500.00 procession fee;

2. A detailed description of the project site;

3. Evaluation of the potential impacts of the project;

4. Identification of the BMP's being implement in association with the project;

5. Identification of the type of CEQA document used;

6. Other permits associated with the project; and

7. History of projects carried out by the applicant within the previous five years.

E. U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. EPA Clean Water Act Requirements

On December 8, 1999 the federal government as part of the Clean Water Act issued final regulations for storm water management in smaller communities - known as the National Pollutant Discharge Elimination System (NPDES) Phase II Rule. The City of Redding was listed in the Federal Register as a city that must obtain an NPDES permit under the Phase II Rule. The rule is designed to comply with the requirements of the Clean Water Act (CWA) to further protect our Nation's streams, rivers, and beaches from polluted storm water runoff. Proposed Phase II regulations follow the 1990 NPDES Phase I Rule, which addressed priority sources of pollutant runoff, including storm water

pollution from medium and large municipal separate storm sewer systems (MS4s), industrial sources, and construction sites disturbing at least five acres.

Objectives

The United States Environmental Protection Agency's (EPA's) objectives in developing the Phase II regulations include:

1. Provide a comprehensive storm water program that designates and controls additional sources of storm water discharges to protect water quality, pursuant to CWS Section 402 (p)(6).

2. Address discharges of storm water activities not addressed by Phase I, including:

   - All construction site activity involving clearing, grading and excavating land equal to or greater than one acre (including projects that comprise several sites of less than one acre each).
   - "Light" industrial activities not exposed to storm water.
   - Municipal Separate Storm Water Sewer Systems (MS4s) located in urbanized areas not covered under Phase I.
   - Municipally owned industrial facilities that were addressed under Phase I but granted an extension under ISTEA (Intermodal Surface Transportation Act).

3. Facilitate and promote watershed planning as a framework for implementing water quality programs wherever possible.

EPA aims to achieve these objectives by balancing nationwide automatic designation and locally based designation. EPA will designate on a nationwide basis.

- Storm water discharges from small MS4s located in urbanized areas.
- Construction activities that result in land disturbance equal to or greater than one acre.

EPA believes that this designation criteria addresses the main sources of storm water pollution causing significant degradation of surface waters. Permitting authorities (see subsequent definition of permitting authority) may designate additional small MS4s, categories or individual sources of storm water discharges that are problematic in specific communities.

NPDES Phase II Rules

The NPDES Phase II Rules cover the following:

1. Small MS4s (serving a population of less than 100,000 and located in an urbanized area or designated by the permitting authority).
2. Construction activities disturbing one acre or greater.
3. Industrial sources designated by the permitting authority.
4. ISTEA sources (including municipally-owned/operated industrial facilities).

NPDES Phase II Permitting Authority for the State of California

The State of California is authorized to administer the federal NPDES program and the State Water Resources Control Board and its Regional Water Quality Control Board branch is the designated agency responsible for the following:

- Provide waivers
- Issue Permits
- Issue menu of appropriate Best Management Practices (BMPs) in cases of general permits
- Support local programs
- Oversee programs
- Ensure municipalities have adequate legal authority
- Provide Technical Assistance

Storm Water Management Requirements under NPDES Phase II

1. For MS4s The EPA requires, under the Phase II regulation, that all owners/operators of small MS4s reduce the discharge of pollutants from a regulated system to the "maximum extent practicable" to protect water quality (Federal Register Vol. 63, p. 1574). At a minimum, jurisdictions regulated under Phase II must:

- Specify BMPs for six minimum control measures and implement them to the "maximum extent practicable."
- Identify measurable goals for control measures.
- Show an implementation schedule of activities or frequency of activities.
- Define the entity responsible for implementation.

2. For Construction and Other Activities — Construction activities that disturb one to five acres must also be regulated under an NPDES Phase II permit. The NPDES permitting authority may also require that other facilities and industrial and construction activities, as well as small MS4s outside urbanized areas, be designated on a case-by-case or categorical basis.

These requirements are discussed in detail in the subsequent subsections that follow.

Six Minimum Control Measures

Municipal storm water management programs must specify BMPs for the following six minimum control measures.

1. Public Education and Outreach on Storm Water Impacts
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Storm Water Runoff Control
5. Post-Construction Storm Water Management in New Development and Redevelopment
6. Pollution Prevention / Good Housekeeping for Municipal Operations

Storm drain maintenance activities fall under the last minimum control measure. Owners or operators of small MS4s must develop and implement cost-effective operation and maintenance, as well as training programs, with the goal of preventing or reducing pollutant runoff from municipal operations. In the case of storm drain maintenance the primary pollutant of concern will be sediment. Since one of the primary goals of storm drain maintenance is to remove excessive sediment from the pipes, catch basins, channels and detention facilities appropriate BMPs will focus on timing of the maintenance activities, preventing creation of erosion prone banks and preventing accidental discharge of any petroleum products to the storm drain facilities by equipment being employed in the maintenance efforts.

Measurable Goals For Control Measures

The requirement allowing each permittee to identify its own measurable goals for each control measure is unique to Phase II. Communities regulated under Phase I were subject to more prescriptive compliance

requirements. Examples of measurable goals include:

- Inspecting or repairing a certain number of drain inlets each year.
- Cleaning a certain number of miles of open channel storm drain.
- Inspecting and cleaning a certain number of detention basins.
- Conducting a certain number of training classes for municipal operations each year.
- Reporting the number of volunteers participating in storm drain cleanup programs.

Implementation Schedule of Activities or Frequency of Activities

Regulated communities must show an implementation schedule of activities or frequency of activities that will be done as part of the storm water management program. An example might include the following entries:

Sweep City Streets
"X" times per year or "X" miles per year
Vacuum Storm Drain Inlets
"Y" times per year
Conduct classroom storm water education
"Z" times per year

Phase II Permitting Process

A general permit will most likely be issued by State Water Resources Control Board to cover all MS4s in the state. Permittees such as the City of Redding will most likely submit a Notice of Intent (NOI) to the permitting authority (SWRCB) to be covered under a general permit. The City would be required to identify and submit the following information:

- The BMPs that will be implemented.
- The measurable goals for the minimum control measures.
- The month and year in which each BMP will be started and completed or the frequency of action if it is ongoing.
- The person(s) responsible for implementing or coordinating the storm water management program.

In an effort to improve water quality and subsequently the environmental health of our streams and community resources the City of Redding is seeking participation in the State of California General Small Municipal Separate Storm Sewer System discharge permit. This permit requires that the City address the quality of storm water running off of or through City facilities. Such facilities include all streets, storm drain, flood control Facilities, yards, parks, etc. The permit requires that the City have a plan in place specifying what Best Management Practices (BMP) will be implemented to protect and/or improve storm water quality. The permit requires that the City depend on the experience of other cities participating in the permit over the past decade to identify BMPs that are appropriate and effective thus avoiding the necessity of analytical testing and monitoring. Although most of the City departments/divisions will be impacted in some way or another by the requirements of this permit, the division with the largest burden is expected to be the Storm Drain Utility.

F. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

The Strom Drain Utility Maintenance and Operation Plan is developed to guide in the maintenance of existing storm drain facilities. It is not the intent of the City of Redding to develop new or modified drainage courses as a part of the maintenance effort. Any new or

modified drainage course, by City project or private project approvals, will be reviewed by the appropriate agencies prior to any work being done to ensure that all State and Federal regulations related to environmental considerations are considered. This plan speaks to the maintenance of facilities that are already in place and have been there for a number of years.

With regard to the maintenance of existing facilities, Article 19, Categorical Exemptions as defined in the 2002 CEQA Guidelines governs. As indicated, "Section 21084 of the Public Resources Code requires these guidelines to include a list of classes of projects which have been determined not to have a significant effect on the environment, and which shall, therefore, be exempt from the provisions of CEQA."

Contained within Article 19 are several sections which define the various types of Categorical Exemptions. With regard to the Storm Drain Utility Maintenance and Operations Plan, the following sections apply:

15301. Existing Facilities – Class 1 consists of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. The types of "existing facilities" itemized within section 15301 are not intended to be all-inclusive of the types of projects which might fall within Class 1." The key consideration is whether the project involves negligible or no expansion of an existing use. Of the examples listed within the section, example (b) which states "Existing facilities of both investor and publicly-owned utilities used to provide electric power, natural gas, sewerage, or other public utility services" seems to best describe the maintenance functions of the Storm Drain Utility.

15302. Replacement or Reconstruction – "Class 2 consists of replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced, as further defined within the section."

Within the examples included in the section, example (c) which states "Replacement or reconstruction of existing utility systems and/or facilities involving negligible or no expansion of capacity" seems to best describe the maintenance functions of the Storm Drain Utility.

15269. Emergency Projects – There is further exemption language for Emergency Projects found in section 15269 which outlines various emergency projects which are exempt from the requirements of CEQA. These deal with the projects necessary to restore facilities damaged or destroyed as a result of a disaster and emergency repairs to publicly or privately owned serviced facilities necessary to maintain service essential to the public health, safety or welfare.

Based on the above, the daily and annual work efforts that the Storm Drain Utility will do as described within the Storm Drain Utility Maintenance and Operations Plan are exempt from the CEQA requirements. Also, emergency actions and repairs taken to protect people, property and structures would also be exempt during, between and after storm and flooding events.

Section 5
Operational Goals and Objectives

The success of the program is predicated upon the identification and implementation of specific goals and objectives to enable the City to meet even the most basic needs under current funding constraints as a result of growth and new regulations.

A. GOAL

To achieve efficient, cost-effective, and environmentally responsible maintenance of the City's storm water infrastructure while successfully meeting all Federal and State regulations, protecting the lives and property of City residents from flooding, enhancing water quality, and preserving our natural wetlands and riparian habitat.

B. OBJECTIVES

Inventory of Facilities

- complete and maintain a comprehensive record of all physical facilities the department maintains including quantity, location, physical attributes (measurements, type, makeup), and property ownership.

Needs Assessment

- establish a common rating system for identifying the condition of a facility at the time of maintenance, e.g., *maintenance needed immediately, maintenance needed sooner than scheduled, regularly scheduled maintenance, only maintain when funds and/or time are available.*

- identify each type of maintenance activity required for all facilities.

- establish desired levels of service in terms of maintenance frequency for each activity by facility type.

Crew Configurations

- define optimal crew sizes based on the concept that for every activity, there is a combination of people, skills, equipment and materials that result in the most efficient performance of the work. Identify by activity the number and skills of people, types of equipment, and the kinds and amounts of materials required to perform the task most efficiently for each activity.

Planning Elements

- prepare a list of all tasks and activities performed by the Storm Drain Division for which they need to plan and collect costs.

- develop measurement units for each activity to document the amount of production.

- utilize the output measures to identify unit costs (costs of labor, equipment and materials associated with one unit of production) for use in planning, budgeting, scheduling and reporting of actual accomplishments.

Develop Work Schedules

- prepare a short-term scheduling program and resource allocation system that facilitates the actual performance of maintenance activities.

- develop a long-term work plan and financial plan that make the most efficient use of available resources.

- calculate what cannot be done with existing support levels.

- quantify capital needs and prioritize projects based on the following–growth related; projected life of project; and project infrastructure.

Implement a Reporting System

- purchase software program that will enable the tracking of facility types and quantity, maintenance labor hours, equipment hours and production data.

- evaluate current work flow patterns and develop mechanism that provides for data input and monitoring on a daily basis.

- put measures in place to accurately reflect the work being done or not being done.

It is important to reevaluate maintenance practices on a regular basis. Table 5 - 1 is an example of a performance summary sheet and questions that may be used to conduct such an assessment.

Table 5 - 1
Storm Drain Activities
Monthly Performance Analysis

Month/Year _____

Category	Result	Activity	Comment	Summary
Street Sweeping				
		Total miles swept		
		Amount of debris collected		
		Number of public inquiries/complaints		
		Hours of equipment downtime		
		Number/type of illegally dumped materials encountered		
Channels				
		Number of outfalls inspected		
		Miles of channels inspected		
		Number of channel feet cleaned		
		Volume of debris removed		
		SF of erosion control		
		SF of vegetation control – chemical		
		SF of vegetation control – mechanical		
Catch Basins				
		Number of catch basins inspected		
		Number of catch basins needing cleaning		
		Number of catch basins needing repair		
		Number of catch basins cleaned		
		Number of catch basins repaired		
		Volume of debris removed		
Detention/Retention Basins				
		Number of basins inspected		
		Number scheduled for cleaning		
		Number cleaned		
		Amount of debris removed		
		SF of vegetation control completed – chemical		
		SF of vegetation control completed – mechanical		
Roadside Ditches				
		Number of feet maintained		
		Amount of debris removed		
		SF of vegetation control completed – chemical		
		SF of vegetation control completed – mechanical		

Category	Result	Activity	Comment	Summary
Culverts/Pipes				
		Feet of pipes/culverts inspected		
		Feet of pipes/culverts receiving condition assessment		
		Feet of pipes/culverts cleaned		
		Feet of pipes/culverts repaired		
		Number of illicit discharges detected		
Bridge Area Drains				
		Number of drains inspected		
		Number of drains needing cleaning		
		Number of drains cleaned		
		Number of drains needing repair		
		Number of drains repaired		
Miscellaneous				
		Miles of access road maintained		
		Feet of fence repaired		
		Number of public inquiries/complaints re storm drain related items		
		Number of public inquiries/complaints requiring field review		
		Number of special event requests		
		Hours of storm drain related training received		

Assessment questions:

Make comparisons and evaluate what is and isn't working.
Are maintenance staff aware of how their actions affect storm water quality?
What additional training is needed for staff?
Has staff been making improvements – evaluate time/activity.
Are the BMPs working successfully -- what practices need to be added/changed.
Were any major costs savings realized?
What additional resources and/or capital is needed to continue with a successful maintenance program?
Ideas for improving or modifying existing BMPs for efficiency and/or effectiveness.

Section 6
Recommended Maintenance Practices

Storm Water facilities must be maintained or they will not function properly. Determining what is adequate comes from experience, industry identified best management practices, general good housekeeping methods, and standards for levels of maintenance. These levels of maintenance may vary from year to year as the system expands, ages, and/or State and Federal regulations are changed.

Performance of adequate maintenance will ensure flood control management and provide protection for the health and safety of City residents and properties. Adequate flood management is established by flood plain analysis, storm drain master planning, and engineering design of public facilities to convey flood peaks. Such design accounts for significant accumulation of sediment, debris or vegetation. Therefore, adequate conveyance can only be assured by preventing such accumulation which defines the level of maintenance required.

As a part of the overall operations and maintenance plan, an outline for specific maintenance practices has been developed. These practices included defined maintenance activities, standards, scheduling and reporting procedures. It is important to recognize these practices as general guidelines and may need to be tailored to meet specific situations.

Additionally, these practices will remain dynamic, be actively reviewed, and updated annually.

A. RECOMMENDED MAINTENANCE WORK ACTIVITIES

Maintenance work activities identify all major maintenance work and include activities which are performed frequently and in amounts that make them a significant part of the total work program. Each activity must be clearly defined so maintenance personnel at all levels of management uniformly understand the operation to be performed and/or the type of deficiency, if any, to be corrected.

Personnel who plan, schedule, perform, report, or evaluate maintenance work must know what each work activity means. Work activities are used for the following purposes:

- Planned maintenance work is identified in the annual maintenance work plan by activity name and number.
- Activity names and numbers are used for authorizing, assigning, and reporting work.
- Activity names and numbers are used on work scheduling guides and work performance summaries.

Work measurement units are established for the major maintenance activities. For example, "Curb Miles" is the work measurement unit for street sweeping while "Linear Feet" is the work unit for cleaning channels, ditches, culverts, and pipes. These measurement units are used to describe how much work is planned and to report how much work is accomplished for each activity.

For some activities, specific work measurement units – other than labor hours – would not be meaningful. An example of this is in the miscellaneous maintenance activities which includes a number of different operations. Many of these activities cannot be measured by a common unit other than labor hours.

Below, Table 6-1 identifies the recommended Maintenance Work Activity List for the Utility which includes an assigned activity number and work measurement unit. Table 6-2 compares the current and recommended frequencies of each maintenance activity. Table 6-3 provides an analysis of the maintenance activities by translating the work into the current number of hours available annually to perform the task; showing the hours needed to meet the recommended practices as identified in the performance standards; the shortfall in personnel man hours to meet the recommended maintenance practices; and, the consequences resulting from the shortfall in personnel hours.

Table 6 - 1
Maintenance Work Activity List

Activity Number	Activity Name	Work Measure Unit
10-00	Inspect Channels and Earthen Ditches	Miles
15-00	Clean Channels and Earthen Ditches	Linear Feet
20-00	Inspect and Clean Detention Basins	Each
25-00	Inspect and Clean Roadside Ditches	Linear Feet
30-00	Inspect, Clean and Repair Catch Basins/Inlet Structures	Each
35-00	Clean and Flush Bridge Area Drains	Each
40-00	Inspect and Clean Culverts/Storm Drain Pipes	Linear Feet
45-00	Repair Culverts/Storm Drain Pipes	Linear Feet
50-00	Street Sweeping Operations	Curb Miles
55-00	**Miscellaneous Activities:**	
-01	Vehicle and Equipment Maintenance	Labor Hours
-02	Engineering Field Assistance	Labor Hours
-03	Response to Storm Drain Inquiries/Complaints	Labor Hours
-04	Response to Street Sweeping Inquiries/Complaints	Labor Hours
-05	Assisting other Redding Municipal Utilities Divisions	Labor Hours
-06	Assisting other City Departments	Labor Hours
-07	Employee Training	Labor Hours
-08	Material Disposal (trips and amount disposed)	No. of Trips/Tonnages
-09	Maintain Erosion Control	Square Feet
-10	Vegetation Control – Mechanical	Square Feet
-11	Vegetation Control – Chemical	Square Feet
-12	Maintain Access Roads	Miles
-13	Fence Repair (chain link/wood)	Linear Feet

Table 6 - 2
Maintenance Work Activities
Current and Recommended Frequencies

Activity	Current Frequency	Recommended Frequency	Annual Activity Frequency Increases
Street Sweeping			
Residential	6 times/year	12 times/year	6 times/year
Commercial	52 times/year	52 times/year	None
Channels			
Inspection	1 time/year*	1 time/year*	None
Cleaning	1 time every 2 years	1 time/year*	1 time/year
Catch Basins			
Inspection	1 time every 5 years	1 time/year*	1 time/year
Cleaning	As needed**	1 time/year***	1 time/year
Repair	As needed**	2% of structures annually	2% of structures annually
Detention/Retention Basins			
Inspection	1 time/year*	1 time/year*	None
Cleaning	1 time every 2 years	1 time every 2 years	None
Culverts/Pipes			
Inspection	As needed	1 time every 3-5 years	1 time every 3-5 years
Cleaning	1 time every 3-5 years	1 time every 3-5 years	None
Repair	Pending funding****	Pending funding****	None
Roadside Ditches			
Inspection	As needed**	1 time/year	1 time/year
Cleaning	As needed**	1 time/year***	1 time/year
Bridge Area Drains			
Inspection	2 times/year	2 times/year	None
Cleaning	2 times/year	2 times/year	None

* Additional inspections may be required after major storm events

** Cleaning and repairs are currently prompted by public request or flooding. General maintenance is performed as time permits.

*** This will be in the first year only to allow for a thorough inspection of structures in order to schedule repairs. Subsequent annual cleaning will be based on inspection findings.

**** The only capital available for major repairs is developer driven.

Table 6 - 3
Maintenance Activity Analysis
Anticipated Implementation FY 03/04

Activity	Hours to Accomplish Recommended Activities	Distribution of Existing Personnel Hours	Personnel Hour Deficit	Consequence
Street Sweeping	2,432	1,760	672	2,520 curb miles unswept annually
Channels				
Inspection (including all outfalls)	752	520	232	One third of the channels/outfalls will not be inspected annually
Cleaning	2,120	1,740	380	Of the channels scheduled for maintenance annually, one-half will not be cleaned
Catch Basins				
Inspection	928	192	736	4,050 catch basins not inspected
Cleaning/Repair	4,176	832	3,344	4,140 catch basins not cleaned/repaired
Detention/Retention Basins				
Inspection	24	8	16	40 basins not inspected each year
Cleaning	194	24	170	19 basins not cleaned annually
Culverts/Pipes*	300	180	120	Maintenance will be limited and the condition assessment will not be accomplished.
Roadside Ditches**				
Inspection	0	160		See footnote.
Cleaning/Repair	0	120		See footnote.
Bridge Area Drains	88	64	24	Only 1/3 of the area drains being inspected/maintained annually.
Holidays/Vacations/Sick Leave	2,176	1,600	576	Hours reflect holidays and sick leave only for 3 additional fulltime entry level maintenance worker positions
Miscellaneous Activities***	3,490	3,200	290	Shortfall may occur should public or interdepartment requests of storm drain personnel increase.
Totals	16,680	10,400	6,280	

* Condition assessment of the city-wide pipe system will be spread over 5 years.

** No records are available for estimation. Maintenance is prompted by public request or flooding. A thorough inventory and inspection of structures is scheduled for completion in FY 03/04. Inspections will continue to be done annually and subsequent cleaning will be based on inspection findings.

*** Miscellaneous activities include but are not limited to special events, employee training, engineering field assistance, etc.

B. RECOMMENDED PERFORMANCE STANDARDS

"Performance Standards" have been established for each of the major maintenance work activities. These performance standards specify:

- The most effective crew size.
- The kinds and number of equipment required.
- The major types of material that should be used.
- Recommended procedures for performing the work.
- An estimate of expected average daily accomplishment with standard crew size, equipment and procedures.
- Authorization and scheduling criteria.

Following is an item-by-item description of the format of the performance standards.

1. Activity Identification/Date The activity name is shown as well as the "effective date" of the performance standard to be used when updating or replacing performance standards.

2. Description and Purpose The Description and Purpose section of the performance standards explains the work activity and the kinds of defects to be corrected or reasons for doing the work.

3. Authorized By and Limits On Work Category The "Authorized By" category will specify the level of authority responsible for authorizing the work. This is to insure that certain activities requiring special equipment, coordination, or expertise will not be scheduled or performed without the proper approval. The type of control to be placed on the quantity or area in which work will be performed is identified.

4. Performance Criteria This section includes important information for the "scheduler" about when to schedule the work and for the crew leader to identify the work to be done.

5. Crew Size The crew size outlines the numbers of personnel needed to do the work. The crew size is based on average conditions. Sometimes, there will be a need to add or delete people to satisfy special traffic safety conditions or hauling requirements.

6. Equipment The basic requirements for major pieces of equipment are listed. Situations such as the breakdown, unavailability of equipment, or special materials hauling requirements may require the addition, deletion, or substitution of equipment.

7. Materials The materials section includes a list of the major materials to be used for the activity.

8. Work Method The work method outlines, step-by-step, the recommended procedures for performing the work. Each step should be performed in order to correctly maintain the feature as well as provide the quality of work desired.

9. Average Daily Production The average daily production is an estimate of the amount of work a crew can accomplish during a day using the recommended crew size, equipment, materials and work method. This estimate is shown as a range and should be attainable over a period of time. Some days the accomplishment may be more or less than the estimate, but eventually, the average should fall in line.

10. Notes Any other relevant, helpful information or instructions.

Use of Performance Standards

Maintenance supervisory personnel should become thoroughly familiar with these performance standards. It is important that the performance standards be used when making assignments and performing work. Some situations will require deviation from the performance standards--such as more or fewer flagmen or additional vehicles/equipment. These situations are recognized, and crew leaders are expected to consider such situations when organizing and managing their activities.

Personnel and equipment needs should be determined using factors such as haul distance and time estimates (spot, dump, load, and cycle times.)

The performance standards also provide guidance and a measure for supervisors to use when evaluating work in progress and completed.

Field personnel are in the best position to identify new or better work methods or difficulties with the current performance standards. These suggestions for improvements or questions should be directed to the crew leader or supervisor.

The performance standards should be reviewed and updated annually. If other changes occur that require more frequent review and update or development, the performance standards can be changed to suit these needs.

The following table provides a sample Performance Standard Form. Performance Standards have been established for all storm drain activities utilizing the recommended format and guidelines. These may be found under Appendix B.

Table 6 - 4
Performance Standard

ACTIVITY NUMBER	NAME	DATE
50-00	STREET SWEEPING OPERATIONS	12/01/02

DESCRIPTION & PURPOSE

Street sweep city owned and maintained roadways throughout the community to remove dirt, debris, and reduce pollutants in storm water runoff for health, safety and appearance.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	City Limits

PERFORMANCE CRITERIA

Plan to sweep residential, commercial and state contracted routes as indicated in the street sweeping route booklet.

CREW SIZE	WORK METHOD
■ 1 Sweeper Operator ■ 1 Maintenance Worker (as necessary) ■ ■ 1.5 TOTAL	1. A.M. Inspection of equipment, check fuel and oil levels, proceed to work site location. 2. Sweep designated route each day. 3. Transport all debris to designated dump site. 4. End of shift, return to Corp Yard, wosh out, fuel up, clean equipment and prepare for next day of work.
EQUIPMENT	
■ 1 Street Sweeper ■ Appropriate Hand Tools ■ ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ Water ■ Gutter Brooms ■ ■	30 Curb Miles Per Day
NOTES: Inform Street Supervisor of any roadways not swept and those that can only be partially cleaned.	

C. RECOMMENDED WORK SCHEDULING

The objectives of work scheduling are:

- Complete the planned amount of work.
- Perform the work when it should be done.
- Prioritize the work.
- Utilize the proper people, equipment, and supplies to do the work.
- Ensure to the extent possible that all flood control facilities are functioning at design capacity during a storm event.
- To have procedures in place to effectively handle emergencies.

Three tools are available to help the supervisor meet these objectives. The *Work Program* defines the estimated amount of work and the estimated labor-days required for each activity to provide the desired levels of service; a *Work Calendar* helps to establish when the various activities should be done; and, the *Performance Standards* provide information about quantity standards, personnel requirements and how much work can be done in a given time.

The annual work program establishes the kinds and amount of work to be done during the year and the resources that will be required to do that work. This annual plan needs to be broken into weekly and monthly plans for effective scheduling work and to permit timely evaluations of work program performance.

The process of "distributing" the annual work load throughout the year is done by allocating a part of the work (in labor-hours, by activity) to specific months. Some types of work – emergency or service activities – must be done throughout the year as the need arises. Other types of work must be accomplished on a regularly scheduled basis – such as preventive maintenance work. Finally, some types of work can only be done during certain seasonal periods, but can be shifted from one month to the other, and still other work can be done almost any time during year.

These factors must be considered when distributing the different types of work. Preventive maintenance and other types of work which must be performed on a regularly scheduled basis are distributed so as to level labor power needs as much as possible. Finally, work which can be performed any time is distributed to those months with the fewest labor-days. In this way, staffing needs are kept as uniform as possible resulting in more efficient use of available labor power.

A work calendar lists – activity by activity – the labor-hours for each month. These labor-hours are used in conjunction with the work program annual work quantities for work scheduling and the preparation of periodic Activity Status Reports.

Once the work program and staffing levels have been set, the work load distribution can be finalized and the calendar prepared to summarize/communicate the planned monthly distribution of the work program.

Work scheduling is the process of using the Work Calendar and specific scheduling procedures to plan ahead, establish work priorities and accomplish the work.

The performance standards apply to corrective and preventive maintenance activities. These procedures are not as rigid or foolproof as implied by the description. Equipment breakdowns, emergencies, or bad weather will disrupt a schedule – but part of the scheduling process is to be aware that

these situations will occur and to be prepared to respond with little or no difficulty.

Items to consider when completing the Work Calendar should include:

- Good estimates will improve the scheduling process significantly. Take time to estimate the amount of work needed and the number of hours required to do the work. The performance standards, inspections and sound judgment based on experience all help the estimating process.

- It is usually best to prepare a schedule and work assignments assuming everything will work as planned – no equipment breakdowns, no emergencies, etc. However, make sure a backlog of "alternate" work is available so that little time is wasted when adjustments to the schedule must be made.

- Weather and seasons must be considered when planning work.

- Vacations, injuries and illnesses must be anticipated.

- Some guidelines for identifying alternate work are

  - Low priority work that needs to be done, but not necessarily during the next week or so.

  - Work that does not require special equipment or a lot of preparation time.

  - Preventive maintenance on light equipment.

- Note that it is not necessary to "formally schedule" obvious day-to-day routine activities. It is necessary, however, to regularly check the work reports and accomplishments to verify the distribution of work assignments. A periodic review and adjustment of the work assignments may be necessary to maintain a "balanced work load."

A sample Work Calendar is shown in Table 6-5 on the following page.

Table 6 - 5
Work Calendar

STORM DRAIN UTILITY
WORK CALENDAR

Fiscal Year: _____
Date Prepared: _____

Activity Identification		Monthly Distributon of Time In Hours*												
Activity No.	**Activity Description**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Total Per Activity**
10-00	Inspect Channels and Earthen Ditches													
15-00	Clean Channels and Earthen Ditches													
20-00	Inspect and Clean Detention Basins													
25-00	Inspect and Clean Roadside Ditches													
30-00	Inspect, Clean, and Repair Catch Basins/Inlet Structures													
35-00	Clean and Flush Bridge Area Drains													
40-00	Inspect and Clean Culverts/Storm Drain Pipes													
45-00	Repair Culverts/Storm Drain Pipes													
50-00	Street Sweeping Operations													
55-00	Miscellaneous Activities													
	Employee Benefits**	134	134	133	133	134	134	133	133	133	133	133	133	1,600
	Total Hours Per Month	868	868	868	866	866	866	866	866	866	866	866	868	10,400

* Calendar work hours are based on 5 employees each working a total of 220 days annually.

** Time identified includes city employee averages of 8 sick days, 19 vacation days and 13 holidays per year.

Prepared By _____

D. ACTIVITY REPORTING

Comprehensive maintenance programs include procedures for reporting and summarizing work accomplished and labor-hours used for maintenance activities. This information enables the manager/supervisor to compare actual performance with the planned work program. These planned, actual comparisons, conducted on a regular basis, are essential for effective management and control of the work program.

The reporting procedures provide specific information:

- What facility required work.
- What work was done by activity.
- How much of each activity was done.
- The labor-hours used to accomplish the work.

This information will be used by managers in their effort to:

- Make sure the right kinds and amounts of maintenance work are done.
- Identify the problem areas and related corrective actions.
- Develop future work programs and budgets.
- Identify opportunities for improved productivity.

The work report process consists of daily completion of a simple form as outlined in the following section.

Daily Work Activity Report

The Daily Work Activity Report will be used to record and summarize (1) the kinds and amounts of work performed by maintenance personnel, (2) the number of labor-hours used to do that work, and (3) the cost of the work. The report can be used to summarize all work activities. It will also aid in capturing a complete inventory of all facilities that were cleaned and inspected for any given time frame. This will be especially helpful when preparing the annual work calendar and annual budget.

All Working Supervisors will prepare the Daily Work Activity Report. The following instructions are for the completion of the sample Daily Work Activity Report shown on Table 6-6.

1. Identification Data This includes the date the work is performed; number of pages required to accurately capture all activities for that date; the employees' names and ID numbers; and, the signatures of the employee completing the report and of the supervisor monitoring and/or overseeing the activities for that day. On the sample Daily Work Activity Report form you will see that the employee names and ID numbers have been pre-printed. Whenever additional pages are needed to document combinations of activities or extra employees, number the pages accordingly.

2. Item Number This is a preprinted consecutive number that is simply used as an identifier for an activity when recording the detailed information for that activity on the bottom half of the report form. This will minimize repetitive entry of related information.

3. Activity Name Write out the name of the activity being performed. Use the activity names as identified on the *Maintenance Activity List.*

4. Activity Number This number consists of four digits, e.g., 25-00. The first two

digits are the major code and the second two digits are considered the secondary code. The secondary code is primarily used in connection with the miscellaneous major code "55". However, the secondary code will be used as an identifier with some major codes, e.g., disposal of materials for certain activities, response to a citizen inquiry/complaint. In the space provided, enter the number of each activity performed on that specific day. Use the *Maintenance Activity List* or the *Performance Standards* to complete the blank.

5. Labor Hours Record the number of hours worked by each employee, by the appropriate activity. Record the time spent to the nearest quarter-hour. For example, record 1 hour and 45 minutes as 1.75 and 3 hours and 20 minutes as 3.25 hours.

6. Equipment Unit Numbers/Hours of Use Enter the assigned equipment number of any mechanical equipment which was used to perform the specific activity and the number of hours it was used for the specific activity. Reference the *Vehicle and Equipment Inventory* in the Appendix for correct identification numbers.

7. Facility ID When available, enter the specific identification for the facility and/or attach a list of the facilities to the activity report. Examples of Facility ID are: 16R-A (street sweeping route); S12-50 (specific catch basin identifier); 150 (specific channel identifier); etc.

8. Location Identify the location of the activity. Provide as detailed a location as is pertinent to the activity. For example, 1300 Yellowstone St (address location for a specific catch basin); Hartnell Ave between Churn Creek and Victor Ave (fence repaid); Linden Channel (inspection of an entire channel); etc.

9. Work Performance Provide a brief description of the work performed, materials used, the use of non-City personnel, etc.

10 Quantity/Unit of Measure Measure and record the amount of work done for each activity. Use the correct measurement unit for each activity (reference *Maintenance Activity List*). Record the amount of work done to the nearest whole unit. Record labor-hours to the nearest hour. For activities with labor-hour as the unit of measure, the "quantity" will be exactly the same as "total hours" for the activity.

11. Notes/Comments Provide any additional relevant information that may be of use in summarizing and analyzing the work activity data.

Optimally, this information will be keyed daily into a Storm Water Management software program. However, until a software program is purchased and installed, this information may be captured in a spreadsheet format.

Table 6 - 4
STORM DRAIN UTILITY
DAILY WORK ACTIVITY REPORT

DATE WORK PERFORMED: 12-01-02

PAGE: 1 of 1

Item Number	Activity Name	Activity ID Number	Labor Hours: Alves 0235	Campbell 1165	Isitt 3838	Jackson 4042	Slacher 7970	TOTAL HOURS	Equipment Unit Numbers/Hours of Use		
1	Channel inspection	10-00			8			8	217 / 3		
2	Catchbasin Cleaning	30-00		3		4	3	10	275 / 4	277 / 1	
3	Street Sweeping	50-00	6.5					6.5	233 / 6.5		
4	Citizen Request	30-03		1			1	2	277 / 1		
5	Fence Repair	55-13		4		4	4	12	275 / 4	277 / 2	
6	Disposal-Street Sweeping	50-08	1.5					1.5	233 / 1.5		
7											
8											
	Total Regular Hours		8	8	8	8	8	40			
	Total Overtime Hours										

Item Number	Facility ID	Location	Work Performance (Description of task, materials used, etc.)	Quantity	Unit of Measure
1	150	Entire channel	Inspection	7	Miles
2	Attached	Silver Creek Subdivision	Clean and repair catchbasins	30	EA
3	16R-A		Street sweeping	35	Miles
4	S12-50	Winwood Court	Citizen request to check plugged catchbasin	1	EA
5		Shasta View Dr @ Victor Ave	Repair chain link fence	300	LF
6		Corp Yard	Disposal of street sweeping debris	2/4	Trip/Tons

NOTES/COMMENTS: _____

Report Completed By

Supervisor's Signature

E. NEW FACILITY ADDITIONS

Storm drain infrastructure is added to the system by several means:

- In-house construction and maintenance projects;
- New development that is accepted for maintenance;
- Additions and/or maintenance projects performed by Encroachment Permits; and
- Taking over existing infrastructure through annexation or an agency maintenance agreement.

The procedures for obtaining "as-built" information and maintaining the inventory varies slightly depending upon how the infrastructure was added to the system, as noted above.

1. In-house construction and maintenance projects – These projects are typically designed by the Engineering Division, but may be designed by a consulting engineer on behalf of the Storm Drain Utility. The projects are bid out through the normal City bidding process and typically are inspected by Engineering Division Inspectors, although very large projects may use contract inspection. During the "final punch list" walkthrough of the project, the Engineering Division representative is accompanied by Storm Drain Utility field personnel and a Municipal Utilities technician. Each of these staff personnel makes individual annotations and markups. These markups are incorporated into "as-built" drawings by the Engineering Division. The "as-builts" are forwarded to the GIS Division for inclusion in the atlas system. Once an Inventory Management Software System is in place, this data will also be added to the system by a member of the Storm Drain Utility staff. Upon completion of the project, the inspectors forward construction drawing markups to Engineering Division personnel to be "As-built" and placed in the drawing archive. These drawings will be checked and verified against the atlases by Engineering staff and then sent for scanning.

2. New development that is accepted for maintenance – New development is typically designed by outside engineering firms. Approved plans are placed in the Engineering drawing system. During the "final punch list" walkthrough of the development, the Engineering Division representative is accompanied by Storm Drain personnel and a Municipal Utilities Technician. These staff members make annotations and markups of their findings which are incorporated into "as-built" drawings by the Engineering Division. These "as-builts" are forwarded to the GIS Division for inclusion in the atlas system. Again, once an Inventory management Software System is in place, this data will also be added to the system by a member of the Storm Drain Utility staff. Upon completion of the development Engineering inspectors forward construction drawing markups to Engineering Division personnel to be "As-built" and placed in the drawing archive. These drawings will be checked and verified against the atlases by Engineering staff and then sent for scanning.

3. Additions and/or maintenance projects performed by Encroachment Permit – These projects are usually small in scale and generally consist of short extensions

of storm drain pipes, the addition of a catch basin, or regarding and possibly adding a concrete invert to an existing earthen ditch. The work is inspected by Engineering inspectors and the Permit is signed off upon completion. Copies of completed encroachment permits are forwarded to both the Municipal Utilities Technician and GIS Division for inclusion in the atlas system.

4. Taking over existing infrastructure through annexation or an agency maintenance agreement – This is extremely infrequent and additions to the system are typically made by field review of the Storm Drain Utility staff of any existing records from the agency. Once reviewed, markups are forwarded to the GIS Division for inclusion in the atlas system. (Note: If an inventory management system is in place, this data will also be added to the system by a member of the Storm Drain Utility staff.)

Section 7
Financial Issues

Creation of the Storm Drain Utility in 1993 was to create a funding mechanism for the three major components of the Utility: (1) daily operations and maintenance; (2) capital improvements; and (3) costs associated with the anticipated NPDES program mandates. Responsibilities identified for the Utility at the time of formation were:

- Planning, design, and construction of the public storm drainage system including the inspection, operation, and maintenance of the complete system;
- Street sweeping of City streets to reduce chemicals, hazardous materials, debris, and other pollutants from entering the storm drainage system;
- Preparation of public information designed to educate and inform the general public on the need to reduce surface pollution; and
- Monitoring of all state and federal regulations relating to storm drainage management and surface pollution reduction

A. UTILITY SERVICE CHARGE

In order to meet these responsibilities, a Storm Drain Utility service charge was developed. The monthly charge was based on the classification of property user groups *(single-family residential, multi-family residential and commercial/institutional)* and a land use-based impervious acreage factor (IAF). The IAF is a factor for each land use which, when multiplied by a parcel's actual acreage, derives the estimated imperious surface of that parcel. The impervious area is that which prohibits the natural drainage of rainwater into the ground (i.e., buildings, parking lots, sidewalks, etc.) This service charge was imposed on each developed lot and parcel of land within the City. A flat fee is assessed against single-family residential and multi-family residential, while a calculated amount is developed for commercial and industrial based on size configurations.

The table below identifies the service charges established in September 1993 for each of the customer groups. These are the same rates being charged today.

Customer Group	Service Rate
Single-Family Residential	$ 1.32/unit
Multi-Family Residential	$ .83/unit
Commercial and Institutional	$19.07/IA*

*Impervious Acreage

Revenue for the first full year of operation (FY 1994/95) from the utility service charge was $797,090 *(See Table 7–1, Utility Revenue /Expenditure History on the following page)*. However, review of the first year operations of the Utility revealed that the storm drain service charge revenue was insufficient to fund all three of the components of the Utility. In fact, funding only covered maintenance costs. The shortfall in funding also resulted in the need to decrease the levels of service provided on certain storm drain tasks/facilities.

While an increase in revenue from new development has been recognized over the past 10 years, the quantity of storm water facilities and the cost of maintenance services have also increased accordingly.

Table 7 - 1
Utility Revenue/Expenditure History

	Actual Numbers								Budget Numbers
	FY 1994-95	FY 1995-96	FY 1996-97	FY 1997-98	FY1998-99	FY 1999-00	FY 2000-01	FY 2001-02	FY 2002-03
Revenue									
Monthly Charge	797,089.89	805,027.86	829,997.14	833,631.85	810,716.07	845,528.58	847,660.00	876,251.30	870,660.00
Street Cleaning	16,680.00	16,680.00	13,900.00	19,460.00	16,680.00	16,680.00	16,680.00	16,720.00	16,700.00
Interest	31,787.11	16,987.74	26,620.52	17,690.34	9,445.19	14,921.80	22,851.91	15,551.37	22,690.00
Misc	220.00	237.95	7,609.72	-	3,223.00	-	-	50.00	
Transfer from Development Fund									
Total Revenue	**845,777.00**	**838,933.55**	**878,127.38**	**870,782.19**	**840,064.26**	**877,130.38**	**887,191.91**	**908,572.67**	**910,050.00**
Expense									
Personnel	414,790.94	378,498.49	340,913.83	345,816.74	324,694.34	352,100.45	293,699.22	306,245.35	327,240.00
O&M	271,710.56	394,643.26	377,013.81	366,981.55	379,481.00	354,252.88	405,738.01	448,132.32	477,370.00
Capital proj & equip	99,058.39	202,980.66	297,494.71	397,883.60	273,952.71	419,326.41	154,622.18	323,348.64	679,090.00
Total Expense	**785,559.89**	**976,122.41**	**1,015,422.35**	**1,110,681.89**	**978,128.05**	**1,125,679.74**	**854,059.41**	**1,077,726.31**	**1,483,700.00**

Expenditure History by Division

Division 801 -- General and Administration

Personnel & x-charges	145802.98	88268.89	99,309.86	94,520.94	84,042.51	96,636.67	65,476.51	103,408.56	50,670.00
O&M	48868.4	147509.13	120,332.53	110,663.30	129,511.97	95,803.09	135,596.66	139,735.86	155,230.00
I/D charges	64112.03	75894.03	87,092.49	95,586.58	85,836.37	111,225.22	113,874.44	147,402.12	139,980.00
Capital & equipment							-		
Division total	258,783.41	311,672.05	306,734.88	300,770.82	299,390.85	303,664.98	314,947.61	390,546.54	345,880.00

Division 802 -- Maintenance

Personnel & x-charges	170212.05	189823.59	195,986.40	201,860.92	185,627.70	204,472.85	176,291.80	151,975.81	219,250.00
O&M	34743.31	29250.72	35,068.26	40,884.10	59,630.47	57,802.31	77,323.34	101,272.93	60,730.00
I/D charges	36194.02	38873.01	29,137.36	32,477.91	36,906.98	29,538.12	27,788.00	27,360.00	26,600.00
Capital & equipment									
Division total	241,149.38	257,947.32	260,192.02	275,222.93	282,165.15	291,813.28	281,403.14	280,608.74	306,580.00

Division 803 -- Street Sweeping

Personnel & x-charges	98775.91	100406.01	45,617.57	49,434.88	55,024.13	50,990.93	51,930.91	50,860.98	57,320.00
O&M	27014.03	36721.92	24,987.25	44,311.86	34,871.41	20,245.34	12,084.37	3,718.05	61,270.00
I/D charges	55455.84	86394.45	80,395.92	43,057.80	32,937.64	39,638.80	33,771.20	33,364.80	33,560.00
Capital & equipment									
Division total	181,245.78	203,522.38	151,000.74	136,804.54	122,833.18	110,875.07	97,786.48	87,943.83	152,150.00

Division 809 -- Capital Outlay

Personnel & x-charges									
O&M									
I/D charges					(213.64)		5,300.00	(4,721.44)	
Capital & equipment	99058.39	202980.66	297,494.71	397,883.60	273,952.71	419,326.41	154,622.18	323,348.64	679,090.00
Division total	104,381.32	202,980.66	297,494.71	397,883.60	273,738.87	419,326.41	159,922.18	316,627.20	679,090.00

Fund Total	**785,559.89**	**976,122.41**	**1,015,422.35**	**1,110,681.89**	**978,128.05**	**1,125,679.74**	**854,059.41**	**1,077,726.31**	**1,483,700.00**

B. CAPITAL IMPROVEMENTS AND DEVELOPMENT FEE FOR STORM DRAIN IMPROVEMENTS

The 1993 City-Wide Storm Drain Master Plan (referred to as the Montgomery Watson Study) was prepared to determine capital improvement infrastructure needs and provide a mechanism for funding such improvements. The mechanism established was a storm drain utility service charge basing fees on impervious area attributable to different land uses.

Following completion of the capital improvement plan, the fee structure was altered in such a manner to substantially reduce the total income expected from the Storm Drain Utility. In addition, changes in environmental requirements and resource agency attitudes in the last ten years have dramatically increased the complications and costs associated with construction of storm water drainage improvements. For example, the Master Plan estimated the Clover Creek detention basin at $1.7 million. The actual cost will be over $5 million.

Funding for storm water drainage improvements associated with new development can be charged to the storm drain impact fee account. Because of the amount of development that has occurred over the past decade (with and without adequate storm water drainage impact mitigation) a new development nexus can be drawn on virtually every channel. However, the storm drainage impact fees are not being used exclusively for capital improvement projects listed in the 1992 master plan. For example, they will also need to pay for a Master Plan update.

The Storm Drain Development Impact Fee as of January 2, 2003 is as follows:

Customer Group	Impact Fee
Single Family Home	$ 252.00
Multi-Family/Dwelling	$ 123.74
Commercial, per 1,000 SF	$ 157.90
Office, per 1,000 SF	$ 145.01
Industrial, per 1,000 SF	$ 105.70

The projected Impact Fee revenue can be reviewed in the Storm Drain Utility Revenue and Expenditure Plan. (See Table 7-4)

The combination of inadequate funding to meet the expected capital improvement costs, impact fee project requirements and increased costs associated with storm water drainage improvement projects, due to environmental and resource agency concerns, has resulted in a need for a new Storm Water Drainage Master Plan (Plan). To date, no significant progress has been made toward achieving any of the outlined 1993 Master Plan improvement projects.

The strategy for the new Plan is to revise the 1993 plan to provide flood protection through the creation of regional detention/retention basins including the following tasks:

- revise flood plain hydrology, hydraulic analysis and flood plain maps;
- account for infrastructure constructed in the last decade;
- define regional detention opportunities in all storm drainage basins;

- provide planning level feasibility studies for three to five regional detention facilities;
- provide a programmatic plan for a detailed inventory and assessment of facility condition;
- to provide the basis for future master planning efforts to include a more detailed repair and replacement program;
- provide a capital improvement plan for future storm water drainage infrastructure; and,
- provide a capital improvement financial plan.

The initial strategy for accomplishing this Plan within a limited budget was to extend a contract to a local hydrologist for the revised flood plain hydrology, hydraulic analysis and flood plain maps; review this information for concurrence; and, pass it on to a consultant for completion of the remaining components of the plan.

Progress on the Plan project is pending completion of the City of Redding Storm Water Quality Improvement Plan (NPDES Submittal), inventory and review of the local hydrologist submittals, and development of a specific scope of work for the contract. The request for proposal is already drafted pending this scope of work. The projected time line for work on the City-Wide Storm Water Drainage Master Plan is to issue the Request for Proposal in April 2003 with completion of a draft document in late 2004.

C. PROJECTED FACILITY GROWTH

Table 7– 2, Storm Drain Activities/Performance Measures, as shown on page 37, identifies the actual activities performed and the level of service accomplished in both 1993/94 and 2001/02.

Additionally, projections in storm drain facilities growth has been calculated based on the forecast population as shown in the General Plan and recent building permit history. Incorporated in the projections are new activities and required increases in existing services needed to meet the NPDES mandate.
The 2007 projections have been included to reflect the Utility's activities/performance anticipated at the completion of the NPDES implementation phase.

A sampling of the new activities and/or required increases in existing services include:

- Increased frequency in both residential and commercial street sweeping.
- Development of public education and outreach programs and materials.
- Annual inspection and cleaning of all catch basins.
- Inventorying and mapping of all facilities.
- Condition assessment of facilities.
- Comprehensive collection and recording of all related maintenance data.
- Progress reporting on performance and effectiveness of activities.

Table 7 - 2
STORM DRAIN ACTIVITIES AND PERFORMANCE MEASURES
1993 - 2023

	Actual		Projected		
Activity/Measure	**1993**	**2002**	**2007**	**2013**	**2023**
Size of City (sq miles)	58.41	59.76	64	69*	75**
Population (2.477 per household)	76,500	84,143	91,868	99,593	121,415
Number of Employees	6	5	8	10	12
Miles of Storm Drain Pipes/Culverts	114	138	150	162	193
Percentage Inspected/Cleaned/Repaired Annually	5%	20%	100%	100%	100%
Number of Catch Basins	4,844	5,220	5,843	6,467	7,714
Percentage Inspected/Cleaned/Repaired Annually	5%	20%	100%	100%	100%
Number of Retention/Detention Basins	N/A	48	49	50	52
Number of Basins Maintained Annually	0	3	49	50	52
Miles of City Streets	390	436	485	535	637
Number of Curb Miles Swept	511	570	669	768	972
Number of Times Residential Streets are Swept Annually	24	6	24	24	24
Number of Times Commercial Streets are Swept Annually	150	52	150	150	150
Miles of Earthen Ditches and Open, Stream and Concrete Channels	144	174	188	202	219
Miles Maintained	15	18	18	20	22
Percentage Inspected/Cleaned Annually	15% -- 7	18% -- 9	18% -- 18	20% -- 20	22% -- 22
Number of Bridge Area Drains	N/A	94	94		
Percentage Inspected/Cleaned Annually		32%	94%		

Notes:
- * Assume buildout of primary growth area as illustrated in General Plan
- ** Assume 50% buildout of secondary growth area as illustrated in General Plan

D. STORM WATER QUALITY IMPROVEMENT PLAN (NPDES - WATER QUALITY BMPs)

The National Pollutant Discharge Elimination System (NPDES) is a system of permits required under the Federal Water Pollution Control Act to reduce or eliminate pollutant discharge to waters of the United States. Phase I of the NPDES program was implemented by the United States Environmental Protection Agency (USEPA) in 1990, requiring urban areas with populations greater that 100,000 and construction activities of five acres or more to obtain an NPDES Storm Water Permit.

In 1999, new rules governing Phase II of the NPDES program were published to cover an extensive list of smaller urban areas and construction projects of one acre or more and those construction projects on or adjacent to sensitive areas. The City of Redding was specifically listed by USEPA as a participant in Phase II.

The NPDES municipal permit for the City of Redding requires submission of an annual permit fee of $10,000 and development of a Storm Water Quality Improvement Plan (SWQIP). Addressed in the SWQIP are the six minimum control measures as outlined by the USEPA. These measures are public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site storm water run off, post-construction storm water management and pollution prevention and good housekeeping for municipal operations. Chapter 5 of the SWQIP provides details on how the City will implement programs and/or practices to meet these six control measures, along with measurable goals, implementation time schedules and designation of resources and responsible staff.

Four out of the six minimum control measures apply to, and will have a significant financial impact on, the Storm Drain Utility. Implementation of the NPDES program will require the addition of equipment (street sweepers, backhoe, trucks), materials/supplies for the various tasks and personnel (equipment operators, data entry, maintenance workers).

Unfortunately, the exact work tasks have not yet been defined through the permit process. Therefore, an order of magnitude number is being used to estimate program costs based on discussions with other agencies, reports prepared by the American Public Works Association (APWA) and discussions with consulting firms who have prepared NPDES plans for other agencies. The number has been as low as $ 1.39 per capita to a high of $19.00 per capita. The average cost within this range is $10.20 per capita. These numbers are approximately one year old.

Implementation within Redding would occur approximately two years after the numbers were developed. Therefore, an inflation factor and a contingency are applied which results in a per capita estimate of $13.00 annually as the basis for projecting rates and financial planning. This projected figure includes all City-wide related activities necessary to implement the NPDES program.

Table 7 – 3, *Projected Storm Drain Utility and NPDES Implementation Expenditures*, shows a line item for NPDES implementation based on the estimated $3.00 per capita cost factor. IT is understood that the NPDES full implementation will occur over a five year period as the plan is developed and work tasks are brought on line. As such, the financial assessment anticipates implementation of the full per capita fee over that period. To that end, the first year shows

20% of the fee, the second year shows 40% of the fee and so on through the five year period. At full implementation fo the per capita fee, the Utility budget will have doubled. At this point in time, there is no defined revenue source included in the assessment for the NPDES work tasks and as such the 10-year financial plan indicates a substantial deficit position. For further information on the NPDES Permit and implementation schedule, refer to the Storm Water Quality Improvement Plan.

Basically, the City/Utility needs to increase revenue each year by about $200,000 a year over the next five years to have an additional $1,000,000 per year for operational costs. This increase does not address the capital costs associated with storm drains in the City.

Table 7 - 3
Projected Storm Drain Utility and NPDES Implementation Expenditures
2003 - 2007

	2003/04	2004/05	2005/06	2006/07	2007/08
Population	85,573	87,028	88,508	90,012	91,542
NPDES Implementation (City-wide)	$ 222,491	$ 452,547	$ 690,360	$ 936,128	$ 1,190,052
Projected Storm Drain Expenditure Estimates	$ 1,020,756	$ 1,026,190	$ 1,010,257	$ 1,026,548	$ 1,053,583
Total Projected	$ 1,243,247	$ 1,478,737	$ 1,700,617	$ 1,962,676	$ 2,243,635

Note: For detailed Storm Drain Revenue/Expenditure Plan reference Appendix J(1) and J(2)

E. FUNDING OPTIONS

This section deals with two topics:

- Funding for Operations and Maintenance
- Funding for Capital Improvements

Operations and Maintenance

Operations are funded entirely by the Storm Drain Utility Tax. That fee raises about 876,734 per year and covers the following in the current budget:

General and Administration	$	238,900
Fees	$	125,000
Maintenance	$	311,580
Street Sweeping	$	152,150
Debt Service	$	51,500
Rolling Stock Contribution	$	50,000
Total	$	929,130

Currently, the Utility is using reserves, interest and a contract with the State to balance its budget. With the NPDES requirements, the Utility will need to ramp up its budget by about $220,000 per year for next five years to an estimated $2,000,000 by 2008.

Options that could be considered include the following:

City General Fund – These are discretionary funds available to the City for non-utility-based services. Typically, these funds are used to support Police, Fire, Streets, Parks, Administrative Departments, and other projects not covered under utility-based fee structures. Availability of these funds is limited at best.

Transfer of Duties – Review functions currently within the Storm Drain Utility to determine if they would be more appropriately served by another utility. For instance, the underground piping system maintenance and inspection could be shifted to the Wastewater Utility. Wastewater currently maintains a piping collection system and analyzes the condition of wastewater throughout its industrial discharge work group. Shifting of such tasks into its operations plan may allow the use of Storm Drain Utility funds to continue channel maintenance, while using the Wastewater Utility funds to monitor the storm water pipe system. Another possible shift would be to transfer street sweeping and catch basin cleaning to the Sold Waste Division, using the destination and state of the materials collected as a nexus, i.e., litter abatement of streets and leaves.

Sales Tax – One funding option that is used for a variety af programs is a sales tax addition. Typically, the amount is one-quarter of a percent, which is then dedicated to a specified program or list of projects. This option would require a vote. To fund NPDES requirements, the City would need one-sixteenth of a cent to raise $1,100,000.

Increase Storm Drain Utility Assessment Rates
This option would increase the assessment on each developed parcel by an amount necessary to meet the current financial requirements and the additional water quality program required under the Clean Water Act. This option is subject to Proposition 218 requirements, which specify:

- Both property owner and voter approval whereby if a majority of property owners object the voting public must approve the measure by a /3 majority.

- Revenues from the fee may not exceed the funds required to provide the property-related services.
- Revenues may not be used for any purpose other than that for which the fee was imposed.
- The amount of the fee may not exceed the proportional cost of the service attributable to the parcel.

Inspection Fees – NPDES requirements include inspections to determine compliance, including prohibition of illegal discharges to the municipal storm sewer system. It is possible to impose fees relative to the actual cost of compliance inspections that is based on actual effort, instead of property-related and therefore not subject to Proposition 218. This can be applied to new development inspections as well as discharge compliance.

Developer Impact Fee – It may be possible to adopt an expanded development fee to pay for the cost of new developments' impact on the City's storm water management system based on NPDES requirements. A study would need to be conducted to determine whether the findings required under the Mitigation Fee Act can be made. In any event, in order to minimize rate increases, the City would need to raise development fees to cover all future capital costs not associated with maintenance.

CEQA Review Fee – All projects subject to CEQA review must perform an analysis of whether the project will have an impact on "any water quality standards or waste discharge requirements." Because of the new NPDES water quality requirements, project review workload will increase on the Planning and Builiding permit staff. Adequate fees relative to the cost of providing review of water quality issues and ongoing mitigation monitoring would be appropriate.

Assembly Constitutional Amendment – On February 11, 2003, Assembly Constitutional Amendment ACA 10 was introduced, proposing that storm-drain utilities be included in the list of utilities exempt from Proposition 218 requirements. If passed, this amendment would allow increasing the current storm-drain utility fee without requiring a 2/3 majority vote.

City General Fund - These are discretionary funds available to the City for non-utility based services. Typically, these funds are used to support Police, Fire, Streets, Parks and overall Administrative departments of the City. Competition for these funds is high, and it is unlikely that they would be available for Storm Water Utility needs.

Maintenance Districts – Facilities serving new development may be included in a facilities maintenance district. However, limitations exist on the use of such districts pursuant to Proposition 218.

Combination of the Above – In reality, it will take a combination of the above along with carefully managing new requirements to address funding for operations and maintenance.

Capital Costs

Capital costs include two areas:

- Replacement and Repair of Existing Facilities
- System Expansion and Increase Carrying Capacity or Detention to Relieve Flows

Replacement and Repair – These should be funded by the Storm Drain Utility to repair and replace failed, damaged, and undersized storm drains. Also, included in this category would be the conversion of an open channel to an enclosed drain. Currently, these are not funded by Storm Drain fees.

System Expansion and Increase Carrying Capacity – These occur as a result of new growth, more impervious surfaces, and to prevent flooding. Developers and new development fees would be expected to pay for these improvements, but the question is the timing of the projects, collecting from multiple owners, and the risk of flooding until improvements are made and absolute funding is available. The Storm Drain Master Plan details these improvements.

In June 1993, the City adopted a Storm Water Master Plan based on the prior General Plan. A revised General Plan was adopted in 2000 which made minor adjustments to the City's long-term land use plan. Consideration has been given to doing a new master storm drain plan with a change of focus from conveying and passing storm water to doing retention in core basins. This has been on hold due to lack of staff, competing projects and monitoring the work and issues associated with the detention project on Clover Creek.

The 1993 Storm Drain Master Plan identified a total of $22.7 million needed for storm drain improvements in the City. Projects were divided into five phases, with an average of $3 million each, totaling about $15.2 million in 1993 dollars. In 2003, the estimated cost of these same improvements is $24.76 million. A sixth phase was identified for the Downtown Area with a cost of about $7.5 million, but was not recommended to be funded during the plan.

The Storm Drain Master Plan did not include a time frame for funding capital improvements. At the current rate of funding, $350,000 per year, it will take 71 years to pay for the improvements. Currently, storm drain utility fees do not provide funding for capital improvements. Depending upon the rate of construction, existing storm drain fees will generate about $3.5 million over the next ten years in 2003 dollars.

F. LONG TERM FORECAST

Following are two separate ten-year financial plans. The first, Table 7-4, is the existing financial plan without NPDES folded in. It shows the Utility operating using up reserves and going into the red by 2007/08. Due to recent cost increases not yet reflected in the ten-year financial plan, this will likely occur sooner unless changes are made. Note this plan does not show any replacement of existing facilities by using utility rates. Any and all capital costs are funded by the development fees, including master planning.

The second ten-year financial plan, Table 7-5, folds in the NPDES Phase 2 requirements. The net effect of this is to make things about ten times worse at the end of ten years. This plan ramps up the Phase 2 requirements over the first five years. There are not any fees for capital improvements other than by the Storm Drain Construction Tax.

Section 8
Summary of Maintenance and Operations Recommendations

The recommended operotions and maintenance plan has been developed to quantify and qualify the size of the overall storm drainage system within the City of Redding and the various management practices that have been or will be implemented to maintain the system. The plan also verifies that the City of Redding does not provide a uniform maintenance level in all portions of the system. Attention is directed to those sections of the system which may impact developed properties as a result of flooding.

It is intended that this Plan is a working document and adjusted as needed to reflect changing conditions. It is the goal of the document to provide stable funding and a businesslike approach to the operation of the Utility. It is a document which will be modified as the system grows, maintenance practices change and documentation as to what is a City maintained facility is verified. In summary, the plan includes the following recommendations:

- Implementation of a comprehensive reporting and tracking system to facilitate the scheduling and tracking of storm drain maintenance, provide inventory controls, and financial implications for budget development.

- Purchase and use of an operations management software program to efficiently manage the City's storm drain assets and effectively capture work order and maintenance data.

- Establish a program to confirm drainage system information through field surveys in order to validate inventory and improve accuracy of mapping.

- Research easement data to verify ownership of property associated with storm drain facilities.

- Increase the frequency of street sweeping on residential streets from once every two months to once per month.

- Establishment of an annual inspection of storm drain facilities which include: streams, channels, catch basins, detention /retention basins, culverts/pipes, roadside ditches and bridge area drains.

- Establishment of a greater Administrative process to coordinate reports, monitor work efforts, and expand community education related to the storm drain system.

- Development of realistic revenue projections and sources to meet the needs of the Storm Drain Utility.

The above work tasks are in addition to the work currently being done by the Storm Drain Utility in a "fire fighting mode." As such, additional revenue will be required to meet the needs of a growing community, an aging system and new federal mandates under the NPDES program. It is this challenge which will shape the Storm Drain Utility in years to come and which mandate the need for the implementation of this Maintenance and Operation Plan.

APPENDIX A

Storm Drain Utility Ordinance

ORDINANCE 2061

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF REDDING AMENDING TITLE 14 OF THE REDDING MUNICIPAL CODE BY ADDING A NEW CHAPTER 14.18 ENTITLED STORM DRAINAGE UTILITY.

The City Council of the City of Redding does hereby ordain as follows:

Section 1. Title 14, Utilities, of the Redding Municipal Code is hereby amended by adding a new Chapter 14.18, Storm Drainage Utility, as follows:

Chapter 14.18
STORM DRAINAGE UTILITY

Sections:

14.18.010 Purpose

A. The purpose of the Storm Drainage Utility Division is to:
* provide for the effective management and financing of a Storm Drainage System within the City;
* provide a mechanism for mitigating the damaging effects of uncontrolled and unplanned stormwater runoff;
* improve the public health, safety, and welfare by providing for the safe and efficient capture and conveyance of stormwater runoff and the correction of stormwater problems;
* authorize the establishment and implementation of a master plan for storm drainage, including design, coordination, construction, management, operation, maintenance, inspection, and enforcement;
* establish reasonable storm drainage service charges based upon each property's contribution of stormwater runoff to the system and use and benefit of services and facilities; and
* encourage and facilitate urban water resources management techniques, including detention of stormwater runoff, minimization of the need to construct storm drains, and the enhancement of the environment.

B. In order to accomplish such purpose, a storm drainage service charge shall be made on each developed lot or parcel in the City. Each property's contribution to runoff shall be the primary consideration in setting the service charge.

C. The City's storm drainage service charges shall be fair and reasonable and bear a substantial relationship to the cost of providing service and facilities. Similar properties shall pay similar storm drainage service charges. Charges shall reflect the net impervious acreage of each property. Rate studies to assist in establishing charges shall be conducted.

14.18.020 Definitions

A. For the purpose of this chapter, the words and phrases shall be defined as follows, unless the context clearly indicates or requires a different meaning:

1. "Approved Plans" shall mean plans approved under the City of Redding Municipal Code.

2. "Building Department" shall mean the Building Department of the City of Redding.

3. "City" shall mean the City of Redding, California.

4. "City Manager" shall mean the City Manager of the City of Redding.

5. "Council" shall mean the Council of the City of Redding.

6. "County" shall mean the County of Shasta, California.

7. "Director" shall mean the Director of Public Works of the City of Redding.

8. "Developer" shall mean a person, firm, partnership, corporation, or other entity that excavates, fills, builds structures, or otherwise improves or changes a specific parcel or tract of land.

9. "Drainage Code" shall mean the "Storm Drainage Utility Code" of the City of Redding as contained in Chapter 14.18 of the Redding Municipal Code.

10. "Erosion Control Plan" shall mean a plan required by an ordinance, rule, or regulation for controlling the movement of soils due to storm runoff created by construction activities.

11. "Existing" shall mean present or in effect as of the time of the adoption of this chapter.

12. "Facilities" shall mean various drainage works that may include inlets, conduits, manholes, energy dissipation structures, channels, ditches, pipelines, outlets, retention/detention basins, and other structural components.

13. "Impervious Acreage Factor" (IAF) shall mean a factor for each land use which, when multiplied by a parcel's actual acreage, derives the estimated impervious surface of that parcel of real property.

14. "Impervious Surface" shall mean surfaces on or in a lot or parcel of real property which reduce the rate of infiltration of stormwater into the earth. Examples of impervious surfaces include asphalt paving, roofs, and concrete walkways.

15. "Mobile Home Park" means any or tract of land containing one or more mobile home lots.

16. "Multi-Family Residential" shall mean a common-wall dwelling, with kitchen and bathroom(s) intended for permanent private occupancy by one or more persons or a single family, for living and sleeping purposes.

17. "National Flood Insurance Program" shall mean the federal program to provide subsidized insurance for flood damage to properties in flood plains. The program includes a number of regulations restricting what can be done in a flood plain.

18. "Notice" shall mean a written or printed communication conveying information or warning.

19. "Open Space" land use shall be defined as land use classifications, Parks and Golf, Agriculture, Greenway, Recreation, and Undesignated.

20. "Order" shall mean the whole or any part of the final disposition (whether affirmative, negative, injunctive, or declaratory in form) or any matter issued by the Utility Engineer or City Manager or person designated by them pursuant to any provision of this chapter.

21. "Premises" shall mean the lot or parcel and the buildings situated thereon.

22. "Private" shall mean that property or facilities owned by individuals, corporations, and other organizations, and not by city, state, or federal governments.

23. "Public" shall mean that property or facilities owned by city, state, or federal governments.

24. "Residential Dwelling Unit" shall mean a living space in either a single-family (detached) or a multi-family (common-wall) dwelling, with kitchen and bathroom(s) intended for permanent private occupancy by one or more persons or a single family, for living and sleeping purposes.

25. "Risk Manager" shall mean the Risk Manager for the City of Redding.

26. "Single-Family Residential" shall mean a detached living space, with kitchen and bathroom(s) intended for permanent private occupancy by one or more persons or a single family, for living and sleeping purposes.

27. "Storm Drain" shall mean a drain which carries stormwater, surface runoff, street washwaters, and drainage, but which excludes sanitary sewage and industrial wastes.

28. "Storm Drainage System" shall mean all facilities, structures, and natural watercourses used for collecting and conducting stormwater to, through, and from drainage areas to the points of final outlet, including but not limited to any and all of the following: inlets, conduits and appurtenant features, canals, creeks, channels, catch basins, ditches, streams, gulches, gullies, flumes, culverts, siphons, retention or detention basins, dams, floodwalls, levees, and pumping stations.

29. "Storm Drainage Utility Code" shall mean Chapter 14.18 of the Redding Municipal Code.

30. "Storm Drainage Utility Division" shall mean the Storm Drainage Utility Division of the Department of Public Works of the City of Redding.

31. "Street Cleaning" shall mean the regular, periodic, removal of silts, leaves, pollutants, and other debris from the public streets of the City of Redding.

32. "Undeveloped Land" shall mean a parcel of land that is without any building, structure, or improvement.
33. "Utility Engineer" shall mean the City Engineer or his/her representative designated to administer the functions of the Storm Drainage Utility Division.

14.18.030 Organization of Storm Drainage Utility Division

The Storm Drainage Utility Division shall have the responsibility for operating existing and new stormwater facilities; implementing and enforcing the provisions of this chapter; and other related duties as directed by the City Manager.

14.18.040 Storm Drainage Utility Division Functions

A. The Storm Drainage Utility Division shall be responsible for the planning, design, and construction of the public storm drainage system in the City and shall inspect, operate, and maintain them. For the purpose of this chapter, storm drainage system is as defined in the definitions.

B. Street cleaning shall be performed by the Storm Drainage Utility Division to reduce chemicals, hazardous materials, debris, and other pollutants from entering the storm drainage system.

C. The Storm Drainage Utility Division shall be responsible for public information designed to educate and inform the general public on the need to reduce surface pollution.

D. The Storm Drainage Utility Division shall be responsible for monitoring all state and federal regulations relating to storm drainage management and surface pollution reduction.

14.18.050 Rules and Regulations

In order to accomplish the purpose of this chapter to protect the drainage facilities, improvements, and properties owned by the City; secure the best results from the construction, operation, and maintenance thereof; and prevent damage and misuse of any of the drainage facilities, improvements, or properties within the City, the Utility Engineer may make and enforce rules and regulations that are approved by the City Council, and are necessary and reasonable:

A. To prescribe the manner in which storm drains, ditches, channels, and other stormwater facilities are to be designed, installed, adjusted, used, altered, or otherwise changed.

B. To prescribe inspection and other fees permitted by this chapter.

C. To prescribe the manner in which such facilities are operated.

D. To facilitate the enforcement of this chapter.

E. To prescribe the collection procedures and timing of service charge bills.

F. To protect the drainage facilities, improvements, and properties controlled by the Storm Drainage Utility Division, and to prescribe the manner of their use by any public or private person, firm, or corporation.

G. To protect the public health, safety, and welfare.

14.18.060 Erosion, Siltation, and Sedimentation

A. The Storm Drainage Utility Division shall be responsible for controlling erosion, siltation, and sedimentation that will adversely affect storm drains, drainage ditches, watercourses, and other drainage facilities after the improvements have been constructed and are accepted for maintenance and operation.

B. The Storm Drainage Utility Division shall not be responsible for erosion, siltation, and sedimentation for projects of other governmental agencies having erosion control plans unless the agencies do not fulfill their surveillance and enforcement policies.

14.18.070 Prohibited Discharges

A. The willful or negligent disposal of petroleum products (oil and grease), pesticides, fertilizers, household or industrial chemicals, industrial process wastewater, domestic sewage, animal waste, or other pollutants onto private or public property or into the Storm Drainage System is prohibited.

14.18.080 Compliance by Industrial Users with Federal and State Standards

A. All industrial activities shall comply with the strictest of any applicable federal or state standards or regulations covering the discharge of stormwater or surface water, including but not limited to those adopted pursuant to the Clean Water Act, PL 95-217, as amended, and the National Pollutant Discharge Elimination System (NPDES).

B. Any industrial activity not complying with the standards or regulations as required by subsection thereof may be required by the Director to develop and implement a compliance schedule for any measures or facilities as may be necessary to meet said standards and regulations.

C. Industrial activities required to obtain NPDES permits regulating the discharge of stormwater and surface water to the City's Storm Drainage Systems shall notify the Director that they are subject to such permit. Notice shall be made in writing within thirty (30) days before such activity commences. The NPDES permit holders shall notify the Director immediately by telephone upon discovery of any discharge in violation of their permit.

D. The Director or a representative shall have access to the site of the industrial activity regulated by a NPDES industrial stormwater permit, for purposes of inspection and monitoring, upon notice to the designated representative of the NPDES permit holder.

14.18.090 Multiple Fund Projects

Where a public improvement is funded by the City and other agencies or organizations, and storm drainage is not a primary part of that project, the Storm Drainage Utility Division's responsibility for the storm drainage costs shall be in proportion to the City's share of the total cost of the project, unless otherwise agreed.

14.18.100 Flood Control Structures

The maintenance of pump stations which are built as a part of the City's storm drain system shall be a function of the Storm Drainage Utility Division.

14.18.110 Private Facilities

A. The owner shall be responsible for stormwater drainage facilities located on their private property where runoff will principally be collected within that property. The owner shall clean and maintain the facility or channel as required to ensure proper operation consistent with the Rules and Regulations of the Storm Drainage Utility Division.

B. Where public facilities are in easements, the owner of the property is responsible for aesthetic maintenance such as lawn mowing, litter pickup, etc. The owner shall place no structures or plantings that interfere with the drainage facility or its operation and maintenance. The owner shall not deposit any clippings, debris, or other material in the storm drain system, either public or private.

14.18.120 Public Facilities

The Storm Drainage Utility Division shall be responsible for the inspection, maintenance, and operation of drainage facilities on all streets, boulevards, alleys, viaducts, sidewalks, curbing, street crossings, grade separations, and other public ways and easements, and highway structures and appurtenances belonging to the City, and all drains, ditches, culverts, canals, streams, levees, tunnels, and appurtenances thereof.

14.18.130 Ancillary Improvements

The Utility Engineer may authorize the construction of curbs, pavements, channels, watercourses, conduits, culverts, or other structures necessary to properly operate and maintain stormwater facilities.

14.18.140 Routine and Remedial Maintenance

The Utility Engineer shall provide for inspection and routine maintenance of facilities under the control of the Storm Drainage Utility Division. In addition to street sweeping, maintenance may include catch basin cleaning, grating and casting repair, inlet and outlet structure repair, bridge surface drainage systems cleaning, channel clearing, erosion repair, and other incidentals. The Utility Engineer shall provide for remedial maintenance of facilities based on the severity of the problem and potential hazard to the public. Remedial maintenance of bridge surface drainage systems and state highway drainage facilities shall remain the responsibility of agencies other than the Storm Drainage Utility Division.

14.18.150 Emergency Situations

Nothing in this chapter shall be construed to prevent immediate action by the Director in emergency situations.

14.18.160 Land and Facilities Affected Outside the City

Where stormwater drains from lands outside the City, facilities within the City shall be designed in accordance with this chapter as if the entire drainage area was within the City.

14.18.170 National Flood Insurance Program

A. The Storm Drainage Utility Division shall assist the Planning Department in the administration of the National Flood Insurance Program.

B. The Storm Drainage Utility Division shall assist the Planning Department and the Land Development Division of Public Works in the review of detailed site plans submitted with applications for permits for development in areas of special flood hazard. The review shall be based on the Flood Insurance Study and the Floodway Boundary and Floodway Map furnished by the Federal Emergency Management Agency. The Storm Drainage Utility Division shall provide the Planning Department with such information as required. It will assist in appeals, public information, map reviews, flood profile determinations, and other calculations and consultations required in the administration of the program.

14.18.180 Flooding, Liability

Floods from stormwater runoff may occasionally occur which exceed the capacity of Storm Drainage Systems constructed, operated, or maintained by funds made available under this chapter. This chapter does not imply that property subject to the fees and charges established herein will always be free from stormwater flooding or flood damage, or that Storm Drainage Systems capable of handling all storm events can be cost-effectively constructed, operated, or maintained. Nor shall this chapter create a liability on the part of, or cause of action against, the City or any officer or employee thereof for any flood

damage that may result from such storms or the runoff thereof. Nor does this chapter purport to reduce the need or the necessity for obtaining flood insurance.

14.18.190 Master Plan

The Utility Engineer shall establish and maintain a master plan for a Storm Drainage System to handle the stormwater runoff.

14.18.200 Encroachment Permits and Plan Review

A. It shall be unlawful for any person or organization to construct, enlarge, alter, repair, relocate, or demolish a storm drain, natural watercourse, or other drainage facility, without first filing an application and obtaining an encroachment permit from the Department of Public Works. An application shall be made by the owner of the property involved, or an authorized agent employed in connection with the proposed work. Permits for minor repairs, as defined in Section 14.18.050 of the Rules and Regulations, shall not be required. Minor repairs are that work that merely restores a facility to its former function and has no potential to disrupt the functioning of that facility or to cause increased erosion or other negative impact on the public or the environment.

B. Encroachment permits are required and may be granted by the Department of Public Works for the following improvement categories:

1. Connection into the public Storm Drainage System, except unimproved creeks or streams.

2. Improvements which are or will become public facilities owned and maintained by the City.

3. Improvements within dedicated but unimproved street rights-of-way.

4. Improvements which are, or will be, public retention or detention facilities.

C. Connection into a Storm Drainage System shall be performed only by contractors who meet the following requirements:

1. They shall have the appropriate license issued by the City, County or State; and

2. They have posted a bond with the City in the amount determined by the Department of Public Works; and

3. They provide insurance as required by the City's Risk Manager.

14.18.210 Construction of Storm Drains

In appropriate circumstances as determined by the City, where private developers construct a main storm drain pipeline at the City's requirement greater in size than is needed for the private developer's own development, the City may contribute to the cost of such oversizing or increased depth.

Where the City's master storm drain plan requires a storm drain pipeline to be constructed greater in size than required for the applicant's development, the City shall assume the incremental cost of oversizing the storm drain to satisfy the master storm drain plan. The City will pay the invoice pipe price difference between the size needed for the development and the size recommended in the master storm drain plan, plus fifteen percent, provided an agreement is entered into with the City prior to commencement of work and when funds are available. All agreements and/or contracts shall be approved by the City Council before work commences.

14.18.220 Right of Entry for Survey and Examination

A. After presenting proper credentials and securing permission, the employees of the Storm Drainage Utility Division or its agents, including contractors and their employees, consultants and their employees, may enter upon lands within the City to make surveys and examinations to accomplish the necessary preliminary findings to establish a master plan and for detailed analysis to prepare final plans and specifications for the proposed improvements.

B. Where improvements are constructed and accepted that require periodic maintenance or inspection upon the lands by the Storm Drainage Utility Division, the owner of such lands shall grant the City a perpetual easement and right-of-entry around and access to any Storm Drainage System.

14.18.230 Inspection and Surveillance

The Utility Engineer shall inspect premises and enforce all laws relating to construction, alteration, repair, removal, demolition, equipment, use, location, and maintenance of the Storm Drainage System except as may be otherwise provided for.

14.18.240 Notice of Violations

When the Utility Engineer finds the Storm Drainage System or the construction thereof is contrary to the approved plans or presents an unsafe or dangerous condition in connection with the provisions of this chapter or of any law or ordinance relating to the same subject matter, the Utility Engineer shall give notice to the owner of the premises.

14.18.250 Establishment of Connection Charges and Service Rates

The City Council may from time-to-time, at its discretion and by resolution, fix, alter, change, amend, or revise all connection charges and service rates in connection with the storm drainage system.

14.18.260 Rates - Standards

In fixing and establishing storm drainage rates for service within the corporate limits of the City, the City Council shall be guided by and must conform to and abide by the provisions of this section. Storm drainage rates shall be sufficient to produce sufficient revenue to pay all the costs of operation and maintenance of the storm drainage utility division and the storm drainage system, and to discharge and pay all costs in connection with the additions and betterments to the storm drainage system, and to discharge and pay all cost of depreciation and obsolescence of the storm drainage system, and to discharge and pay the bonded indebtedness, including the principal and interest amounts thereof, incurred by the City to construct the storm drainage system, and to establish and maintain a reserve fund.

14.18.270 Funding

Funding for Storm Drainage Utility Division activities may include, but shall not be limited to:

A. Storm drainage service charge.

B. Permit and inspection fees.

C. Direct charges. This charge will be collected from the owner(s) and developer(s) for the cost of designing and constructing Storm Drainage Systems and administrative costs and related expenses where the Storm Drainage Utility Division designs and/or constructs or contracts for the construction of such systems.

D. Development fees. This charge will be based on the interior square footage of new development or renovations for the purpose of providing funds for the improvement of the Storm Drainage System.

E. Direct assessment. This charge will be collected from owners in localized areas that desire Storm Drainage Systems not considered a part of the regional development or where an improvement is desired ahead of the priority status.

F. Construction tax - storm drain element. All construction currently pays a storm drainage element charge of ten cents per square foot of ground floor construction. Mobile home parks or mobile homes on individual lots shall pay one hundred dollars per mobile home lot. This tax is expected to continue.

G. Other income obtained from federal, state, local, and private grants, or revolving funds.

14.18.280 Storm Drainage Fund

All revenues generated by or on behalf of the Storm Drainage Utility Division, including storm drainage service charges, permit and inspection fees, and direct charges and interest earnings on those revenues, shall be deposited in a storm drainage fund and used exclusively for Storm Drainage Utility Division purposes.

14.18.290 Storm Drainage Service Charge

A storm drainage service charge is imposed on each developed lot and parcel of land within the City, and the owner thereof, excepting therefrom streets, arterials, alleys, viaducts, sidewalks, curbing, street crossings, grade separations, other public ways and easements, and highway structures and appurtenances belonging to the City. Charges and fees set forth in this chapter shall be adopted by resolution of the City Council.

A. Undeveloped land and open space shall be exempted from storm drainage service charges.

B. Road and freeway rights-of-way shall be exempted from the storm drainage service charge because they function as part of the Storm Drainage System.

C. In all cases where a parcel has several tenants, the city contracts only with the owner of the property or his authorized agent(s). In cases where the parcel has multiple use classifications, as listed in Chapter 14.18.300, the use classification with the higher impervious acreage factor, listed in Chapter 14.18.310, will be used to calculate the service charge.

14.18.300 Classification of Property User Groups

There shall be the following classifications based on use of property for determination of the storm drainage service charge:

A. Commercial:
   1. Industrial, service commercial, retail, and highway commercial
   2. Office, office residential, airport service
   3. Mobile home parks

B. Public or institutional

C. Residential:
   1. Single-family residential
   2. Multi-family residential.

14.18.310 Land Use Impervious Acreage Factor (IAF)

Land uses are identified and recognized for purposes of this chapter, each of which has an assigned impervious acreage factor (IAF). The land use of each property shall be assigned based on the records of the County Recorder or

Auditor, the City, or through field examination or photogrammetric analysis.

IMPERVIOUS ACREAGE FACTOR
(based on parcel area)

A.	Commercial	
	1. Industrial, service commercial, hotel, retail, and highway commercial	0.950
	2. Office, office residential, motel, and airport service . .	0.800
B.	Public or Institutional.	0.700

14.18.320 Monthly Service Charge

A. The total impervious acreage for all developed parcels shall be calculated using the IAF for each, or actual measurements, or any other approved methods.

B. The annual revenue requirement of the Storm Drainage Utility Division will then be allocated to developed residential and nonresidential lands in proportion to their total impervious acreage to determine an annual revenue requirement per impervious acre.

C. The monthly revenue requirement per imperious acre will be the allocated annual revenue requirement per impervious acre divided by twelve.

D. The monthly service charge for Commercial and Public or Institutional land use classifications shall be calculated based on the total impervious acreage for the developed parcels using the IAF for each, or actual measurements, or any other approved methods, times the monthly revenue requirement per impervious acre.

E. The monthly service charge for Single-Family Residential shall be based on the estimated impervious area of .08 Acres per unit for that land use classification times the monthly revenue requirement per impervious acre.

F. The monthly service charge for Multi-Family Residential shall be based on the estimated impervious area of .05 Acres per unit for that land use classification times the monthly revenue requirement per impervious acre.

14.18.330 Billing and Collection

Billing, collection, and imposing of monthly service charges shall be as directed by the City Council.

14.18.340 Board of Appeals

A. A board consisting of the Director, the Utility Engineer, and the City Attorney, or representatives appointed by them, shall serve as the Board of Appeals to hear and determine any appeal filed with the Storm Drainage Utility Division.

B. The City Council shall have full authority to affirm, modify, reverse, or set aside the interpretation, ruling, or order appealed from, or to grant a variance, and its decision shall be final.

Section 2. If any subsection, sentence, clause, phrase, or portion of this chapter is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this chapter. The City Council of this City hereby declares that it would have adopted this ordinance/chapter, and each subsection, sentence, clause, phrase, or portion thereof, irrespective of the fact that any one or more subsections, sentences, clauses, phrases, or portions be declared invalid or unconstitutional.

Section 3. The City Council has found that this matter is statutorily exempt pursuant to Section 15273 of the California Environmental Quality Act Guidelines.

Section 4. This Ordinance shall go into effect and be in full force and operation from and after 30 days after its final passage and adoption.

Section 5. The City Clerk shall certify to the adoption of this Ordinance and cause its publication according to law.

I HEREBY CERTIFY that the foregoing Ordinance was introduced and read at a regular meeting of the City Council on the 21st day of September, 1993, and was duly read and adopted on the 5th day of October, 1993, at a regular meeting of the City Council by the following vote:

AYES: COUNCIL MEMBERS: Dahl, Moss and Arness
NOES: COUNCIL MEMBERS: Anderson and Kehoe
ABSENT: COUNCIL MEMBERS: None
ABSTAIN: COUNCIL MEMBERS: None

CARL ARNESS, Mayor
City of Redding

ATTEST:

CONNIE STROHMAYER, City Clerk

FORM APPROVED:

RANDALL A. HAYS, City Attorney

APPENDIX B

Performance Standards

REDDING MUNICIPAL UTILITIES

STORM WATER UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
10-00	INSPECT CHANNELS AND DITCHES	12/01/02

DESCRIPTION & PURPOSE

Inspect channels and ditches for proper cross-section, sedimentation, debris, vegetation, potential illicit discharges, and erosion damage in order to schedule cleaning or repairs as needed.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements/right-of-ways still to be determined

PERFORMANCE CRITERIA

Perform complete inspection of channels and ditches on an annual basis and as necessary after major storm events.

CREW SIZE	WORK METHOD
1 Working Supervisor 1 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Visually inspect channels for cross-section, sediment, debris, erosion, and unwanted vegetation that may prevent storm water from properly flowing. 4. Remove traffic control devices and move onto next location. 5. Document findings for preparation of a prioritization list. 6. Notify Water Quality officer/inspector of any potential illicit discharge for investigation. 7. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
1 Pickup Necessary Measuring devices Necessary Traffic Control Devices	
MATERIAL	**AVERAGE DAILY PRODUCTION**
Notebook, maps, previous inspection sheets, pens, pencils, measuring devices	8 miles per day
NOTES:	

REDDING
MUNICIPAL UTILITIES

STORM WATER UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
15-00	CLEAN CHANNELS AND DITCHES	12/01/02

DESCRIPTION & PURPOSE

Removal of silt, debris, trash, and overgrown vegetation to maintoin flood control capacity and/or for the improvement of water quality.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Sensitivity, easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

Preform necessary work on an onnual basis and as deemed necessary. Additionol cleaning may be required after major storm events. Adhere to established maintenance criteria specific to each channel/ditch type as designated by the "A-E" rating system attached.

CREW SIZE	WORK METHOD
■ .5 Working Supervisor ■ 1 Heavy Equipment Operator ■ 2 Maintenance Workers ■ 3.5 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Clean channels/ditches in accordance with maintenance criteria specific to each channel/ditch type as designated by the "A-E" rating system attached. 4. Remove traffic control devices and move onto next location. 5. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Pickup ■ 1 Dump Truck and Backhoe ■ Necessary Traffic Control Devices ■ Bull-Dozer only as permitted by Supervisor	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ ■ ■	750-1250 linear feet per day
NOTE:: All work in channels needs to be performed at a time of year and in such a manner as to avoid contributing to sediment loading of storm water runoff.	All materials removed will be disposed of properly at a designated site.

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
20-00	INSPECT AND CLEAN DETENTION/RETENTION BASINS	12/01/02

DESCRIPTION & PURPOSE

Inspection and removal, mechanically (including hauling and disposal), of sediment and debris deposited in basin to restore full capacity and original shape.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and Right-of-ways are still an issue

PERFORMANCE CRITERIA

Inspection is performed annually to check for flooding, trash, excessive silt build-up, unpleasant odors and signs of pollution. Maintenance will include removal of trash and debris, mowing, and removal of blockages from outlet structures. Remove sediment bi-annually or when basin capacity is significantly reduced. Clean out is normally justified when the sedimentation reaches 1-2 feet in depth or as established by design.

CREW SIZE

- .5 Working Supervisor
- 2 Heavy Equipment Operator
- 1 Maintenance Workers

3.5 TOTAL

EQUIPMENT

- 1 Pickup
- 1 Dump Truck and Backhoe
- Necessary Traffic Control Devices
- Bull-Dozer only as permitted by Supervisor

WORK METHOD

1. A.M. Inspect of equipment, check fuel and oil levels, proceed to work site location.
2. Notify Water Quality officer/inspector of nay potential illicit discharge for investigation. Reschedule maintenance following investigation.
3. Setup proper traffic control devices.
4. Prepare removal and disposal sites for access. Stock pile materials for removal, load material and haul to designated disposal site. Shape basin to desired line and grade.
5. Grade disposal site as necessary.
6. Remove traffic control devices and move onto next location.
7. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.

MATERIAL	AVERAGE DAILY PRODUCTION
Disposal Fees	2-5 basin per day

NOTES:

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
25-00	INSPECT AND CLEAN ROADSIDE DITCHES	12/01/02

DESCRIPTION & PURPOSE

Inspect for potential illicit or non-storm water discharge, structural integrity and property functioning. Clean the roadside ditches to remove silt and debris.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

Plan for structures to be inspected ond cleaned a minimum of once per year. Annual cleaning shall be the major effort to allow thorough inspection of structure in order to schedule repairs.

CREW SIZE

- .5 Working Supervisor (½ time)
- 1 Equipment Operator
- 2 Maintenance Worker

- 3.5 TOTAL

EQUIPMENT

- 1 Backhoe and trailer
- Appropriate Hand Tools

WORK METHOD

1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location.
2. Notify Water Quality officer/inspector of any potential illicit or non-storm water discharges and reschedule maintenance.
3. Setup proper traffic control devices.
4. Inspect structure visually to determine if further cleaning or repair is necessary.
5. Remove and dispose of debris at a designated dump site.
6. Remove traffic control devices and move onto next location.
7. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.

MATERIAL

- Pipe and clamps
- Base rock
-
-

AVERAGE DAILY PRODUCTION

2,000 linear feet per day

NOTES: Dispose of debris at a designated dump site only. Structures that cannot be cleaned shall be reported to the street supervisor for initiation of corrective action.

REDDING MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
30-00	INSPECT, CLEAN AND REPAIR CATCH BASINS/INLET STRUCTURES	12/01/02

DESCRIPTION & PURPOSE

Inspect, clean and repair catch basins, inlets, sumps, grates, outflow and other structures to remove silt and debris. Inspect for structural integrity, proper functioning, and to restore elements to their original operational condition.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	

PERFORMANCE CRITERIA

Plan for structures to be inspected once per year for deterioration, need for cleaning and potential illicit or non-storm water discharges. Schedule cleaning and repair as warranted. Plan minor repair of two percent (2%) of system structures per year if possible.

CREW SIZE

- 1 Working Supervisor (Inspection/assessment)
- 1 Equipment Operator
- 1 Maintenance Worker

- 3 TOTAL

EQUIPMENT

- 1 Vac-Con
- Appropriate Hand Tools
- Backhoe and trailer

WORK METHOD

1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location.
2. Notify Water Quality officer/inspector of any potential illicit or non-storm water discharge and reschedule maintenance.
3. Setup proper traffic control devices.
4. Locate truck in the best working position and as far off the roadway as practical.
5. Remove grate. Then remove debris, trash & sediment from catch basin.
6. Loosen solids with spade if necessary. Flush and vacuum catch basin.
7. Inspect structure visually to determine if further cleaning or repair is necessary. Repair to original condition and test operation as appropriate.
8. Dispose of debris at a designated dump site.
9. Remove traffic control devices and move onto next location.
10. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.

MATERIAL

- Water
- Concrete
- Aggregates
- Miscellaneous parts, as required.

AVERAGE DAILY PRODUCTION

20 - 45 per day

NOTES: Structures that cannot be cleaned shall be reported to the street supervisor for initiation of corrective action.

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
35-00	CLEAN BRIDGE AREA DRAINS	12/01/02

DESCRIPTION & PURPOSE

Clean area drains to remove silt and debris, and to eliminate restriction to flow.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

Plan for all drains to be cleaned twice per year.

CREW SIZE	WORK METHOD
■ 1 Equipment Operator ■ 1 Maintenance Worker ■ ■ 2 TOTAL	1. A.M. Inspect of equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Locate truck in best working position and as far off roadway as possible. 4. Clean out ends of culvert/area drains. 5. Load excess material/debris into truck for disposal at designated dump area. 6. Remove traffic control devices and move onto next location. 7. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Dump truck with backhoe ■ Appropriate Hand Tools ■ 1 Vac-Con machine	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ Water ■	16 per day
NOTES: Inform Supervisor of any non-cleanable culverts of those that can only be partially cleaned. Work should be scheduled, whenever possible, in conjunction with annual cleaning of adjacent structures.	

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
40-00	INSPECT AND CLEAN CULVERTS/STORM DRAIN PIPES	12/01/02

DESCRIPTION & PURPOSE

The removal of debris of any type from within the facility by the use of the Voc-Con machine; or, by physically entering the facility and manually removing debris to restore full capacity.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

Plan inspection and cleaning of storm drain pipes and culverts every 3-5 years. Specific areas prone to flooding may require annual cleaning. Employees must have been trained and follow confined entry space procedures.

CREW SIZE	WORK METHOD
■ 1 Working Supervisor ■ 1 Equipment Operator ■ 2 Maintenance Worker ■ 4 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Obtain necessary safety equipment, tools, and materials for that days work.. 4. Remove debris from storm drain system. 5. Load debris and dispose of debris at a designated dump site. 6. Remove traffic control devices and move onto next location. 7. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Vac-Con machine ■ Appropriate Hand Tools ■ ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ Water ■ ■ ■	linear feet per day
NOTES: Work should be scheduled whenever possible, in conjunction with annual cleaning of adjacent structures.	

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
45-00	REPAIR CULVERTS/STORM DRAIN PIPES	12/01/02

DESCRIPTION & PURPOSE

Replacement of deteriorated or failing infrastructure is a capital project. In emergency situations, excavation and repair of storm drain lines is performed to eliminate blockages and repair failed pipes.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and Right-of-ways are still an issue

PERFORMANCE CRITERIA

Consult Engineering and Master Plan for possible required upsizing and design criteria for replacement of permanent storm drain infrastructure. During emergency situations the priority of repairs is:

1. Eliminate blockages and hazards to public safety;
2. Remove flow restrictions and repair damaged/failed pipe sections.

CREW SIZE

- 1 Working Supervisor
- 1 Equipment Operator
- 2 Maintenance Worker

4 TOTAL

EQUIPMENT

- 1 Dump truck with backhoe
- Appropriate Hand Tools
- 1 Pickup

WORK METHOD

1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location.
2. Setup proper traffic control devices.
3. Take necessary measures to control flow – providing uninterrupted service whenever possible.
4. Cut pavement and /or excavate to the extent required to determine necessary scope of repairs.
5. Remove flow restrictions, as necessary.
6. Back fill and compact in lifts to within 10 inches of surface.
7. Place select material (rock or shell) and compact to within 2 inches of surface (see note below).
8. Request repaving as required.
9. Remove traffic control devices and move onto next location.
10. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.

MATERIAL

- Pipe & fittings
- Sand
- Cement
- Base rock & asphalt as required

AVERAGE DAILY PRODUCTION

50 linear feet per day

NOTES: Verify location of other utilities prior to excavation. Back fill specifications apply to paved areas. In easements and other unpaved areas, back fill and compact in 2-foot lifts to grade; re-sod as necessary. Install safety fence and secure jat site at end of workday as required.

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
50-00	STREET SWEEPING OPERATIONS	12/01/02

DESCRIPTION & PURPOSE

Street sweep city owned and maintained roadways throughout the community.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	City Limits

PERFORMANCE CRITERIA

Plan to sweep curbed residential, commercial and state contracted routes as indicated in the street sweeping route booklet.

CREW SIZE	WORK METHOD
■ 1 Sweeper Operator ■ 1 Maintenance Worker (½ time as necessary) ■ ■ 1.5 TOTAL	1. A.M. Inspect of equipment, check fuel and oil levels, proceed to work site location. 2. Sweep designated route each day. 3. Transport all debris to designated dump site. 4. End of Shift, return to Corp Yard, wash out, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Street Sweeper ■ Appropriate Hand Tools ■ ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ Water ■ Gutter Brooms ■ ■	30 curb miles per day
NOTES: Inform Supervisor of any roadways not swept and those that can only be partially cleaned.	

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-00 thru 55-07	MISCELLANEOUS WORK ACTIVITIES	12/01/02

DESCRIPTION & PURPOSE

All work performed that is not described in any other task identified on the Maintenance Activity List. This includes, but is not limited to, activities such as responding to storm drain and street sweeping inquiries/complaints, providing assistance to other departments /divisions, attending employee training, vehicle/equipment washing; engineering field assistance, etc.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	

PERFORMANCE CRITERIA

When using any of the above noted activity numbers, the work will be measured in labor hours only.

CREW SIZE	WORK METHOD
■ 1 Working Supervisor ■ 1 Equipment Operator ■ 1 Sweeper Operator ■ 2 Maintenance Workers ■ 5 Total (As needed, will vary depending on task and upon direction of supervisor)	1.
EQUIPMENT	
■ 1 Pickup(s) ■ Appropriate Hand Tools and/or equipment as needed	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ ■	Labor Hours
NOTES: Use "55-00" when performing any miscellaneous activity for which there is no specific secondary code. Also, secondary codes should be used with the major code associated with the task when appropriate, e.g., "55-08" to identify material	and number of trips made to dispose of debris collected during the street sweeping process; "30-03" should be used when responding to a citizen complaint regarding a clogged catch basin. Always use the Miscellaneous Activity's work measure unit when documenting work with a secondary code.

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-08	MATERIAL DISPOSAL	7/01/02

DESCRIPTION & PURPOSE

Identification of all trips necessary to dispose of trash, debris, sediment, etc., and the total weight of the disposed material in relationship to all storm drain activities.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	

PERFORMANCE CRITERIA

Total trips and amount of disposed material will be quantified daily for each activity.

CREW SIZE	WORK METHOD
■ N/A ■ ■ ■	1. As deemed most cost effective.
EQUIPMENT	
■ N/A ■ ■ ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ ■ ■ ■	Number of Trips/Tonnage to complete daily activity.
NOTES:	

REDDING MUNICIPAL UTILITIES

STORM WATER UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-09	MAINTAIN EROSION CONTROL	12/01/02

DESCRIPTION & PURPOSE

Placement of rip rap, sand bags, or other erosion control materials and repair of damaged areas of erosion protection to restore material to original condition. This work is preformed to prevent further deterioration and eliminate potential erosion problems.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Sensitivity, easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

Work is to be established when damage or deterioration is severe enough to present potential erosion problems. Erosion under-cutting roadways, sidewalks, or prepared embankments/improvements shall be repaired immediately. Repair of undermined stabilizers shall be scheduled immediately.

CREW SIZE

- 1 Working Supervisor
- 1 Heavy Equipment Operator
- 2 Maintenance Workers

- 4 TOTAL

EQUIPMENT

- 1 Pickup
- 1 Dump Truck and Backhoe
- Necessary Traffic Control Devices
- Bull-Dozer only as permitted by Supervisor

WORK METHOD

1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location.
2. Setup proper traffic control devices.
3. Shape work area to receive rip-rap, or other erosion control materials. Place material and grout where applicable.
4. Back fill as necessary.
5. Remove traffic control devices and move onto next location.
6. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.

MATERIAL

- 1-50 Tons of Rock for rip-rap (Delivered)
- 1-12 Yards of ready mix concrete (If needed)
- Water

AVERAGE DAILY PRODUCTION

Measurement by square feet--production will vary by site.

NOTES:

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-10	VEGETATION CONTROL - MECHANICAL	12/01/02

DESCRIPTION & PURPOSE

The mechanical removal of brush and weeds to maintain detention, debris basins, and channels free of vegetation.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and Right-of-ways are still an issue

PERFORMANCE CRITERIA

Work to be scheduled when weeds and willows grow up at un-sprayable locations or when growth is too high for effective spraying.

CREW SIZE	WORK METHOD
■ 1 Equipment Operator ■ 1 Maintenance Worker ■ ■ 2 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Maw or grade channel area as required. 4. Remove traffic control devices and move onto next location. 5. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Mower or Grader ■ 1 Tilt Trailer (if needed) ■ 1 Dump or Pickup Truck ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ ■ ■	Measurement by square feet–production will vary by site.
NOTES:	

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-11	VEGETATION CONTROL - CHEMICAL	12/01/02

DESCRIPTION & PURPOSE

The application of herbicides, to designated areas to prevent new growth and/or control existing vegetation, for the purpose of insuring the capacity and integrity of Storm Drain Facilities.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

Application of pre-emergence herbicide and past-emergence herbicide annually to designated areas combining applications where possible. Chemicals may only be applied by trained and certified employees. Do not apply chemicals near sensitive waterways or streams.

CREW SIZE	WORK METHOD
■ 2 Maintenance Workers ■ ■ ■ 2 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Treat channel area as required. 4. Remove traffic control devices and move onto next location. 5. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Truck Mounted Spray Rig ■ ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ Chemicals ■ Water ■	Measurement by square feet– production will vary by site.
NOTES: Read entire label and following all directions prior to the commence of spraying. An employee must be properly trained before handling / applying herbicides / pesticides.	

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-12	MAINTAIN ACCESS ROADS	12/01/02

DESCRIPTION & PURPOSE

Mechanical grading of access roads to remove minor ruts and erosion, and restore to original shape and cross slope, for access to facility site.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and right-of-ways are still an issue

PERFORMANCE CRITERIA

As needed prior to rainy season, or when the weather affects the access road condition. Plan to re-profile access roads on a two year frequency.

CREW SIZE	WORK METHOD
■ 1 Equipment Operator ■ 2 Maintenance Worker ■ ■ 3 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Restore access road to an acceptable manner, restoring cross sections, filling potholes, grading out ruts. 4. Remove traffic control devices and move onto next location. 5. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Grader ■ 1 Roller (if needed) ■ 1 Trailer (if needed) ■	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ Base Rock ■ ■ ■	1/2 mile per day
NOTES:	

REDDING
MUNICIPAL UTILITIES

STORM DRAIN UTILITY
OPERATIONS AND MAINTENANCE MANUAL
PERFORMANCE STANDARD

ACTIVITY NUMBER	NAME	DATE
55-13	FENCE REPAIRS	12/01/02

DESCRIPTION & PURPOSE

The repair and/or re-establishment of downed or damaged fences to restore fence to proper condition and to provide right-of-way control.

AUTHORIZED BY	LIMITS ON WORK
Supervisor or Working Supervisor	Easements and Right-of-ways are still an issue

PERFORMANCE CRITERIA

Repair of downed or open fence areas to be performed upon detection. Repairs to damaged locations that remain partially functional are to be scheduled in priority with other work.

CREW SIZE	WORK METHOD
■ 2 Maintenance Workers ■ ■ ■ 2 TOTAL	1. A.M. Inspect equipment, check fuel and oil levels, proceed to work site location. 2. Setup proper traffic control devices. 3. Perform necessary repairs to fence posts, fabric, top rails, chain link . 4. Remove traffic control devices and move onto next location. 5. End of Shift, return to Corp Yard, fuel up, clean equipment and prepare for next day work.
EQUIPMENT	
■ 1 Pickup ■ 1 Dump Truck and Backhoe ■ Necessary Traffic Control Devices ■ Bull-Dozer only as permitted by Supervisor	
MATERIAL	**AVERAGE DAILY PRODUCTION**
■ 10 to 50 Linear Feet Fence Fabric ■ Miscellaneous Hardware ■ Bags of Ready Mix Concrete ■	100 linear feet per day
NOTES:	

APPENDIX C

Channel/Ditch Inventory Maps

The following map depicts a sample of the information that is being developed for inclusion in the Storm Drain Plan. A complete set of maps will be on file at the Storm Drain Utility Office.

Location Map
Calaboose Creek

Projection
NAD-1927 StatePlane
California Zone I

REDDING MUNICIPAL UTILITIES

City of Redding GIS Division
March 2003
Source: Public Works Data
Created in ArcGIS 8 using ArcMap

Legend
CHANNEL CATEGORY
- Main
- Secondary
- Tertiary
- Detention Basin
- Storm Drain System
- Outfall
- ACID Canal
- Sacramento River
- City Boundary
- Railroad

0 0.05 0.1 Miles

N S E W

APPENDIX D

Channel/Ditch Maintenance Parameters

STORM DRAIN UTILITY
CHANNEL/DITCH MAINTENANCE PROCEDURES

TYPE "A"

Required maintenance in these ditches is considered sensitive areas. All intended work shall be in accordance and agreement with the Department of Fish and Game and Army Corps of Engineers prior to the commence of any work. Generally, these ditches are considered handwork sites only and any type of machinery is not permissible. Due to the excessive amount of overgrown foliage, staff may require additional assistance from outside agencies, such as California Conservation Corp, which has been trained and are sensitive to watershed related projects. The existing ditch banks are not to be disturbed and all handwork is considered lightly pruning and trimming of dense folioge allowing the conveyance of storm water to flow without interruption. It is in these types of ditches that leaving vegetation in place helps prevent erosion, trap sediment, and filters storm water. Again, care should be taken not to disturb wildlife or aquatic life, including any riparian vegetation which is needed for the wildlife to survive. Removal of debris and unwanted materials will be disposed of properly at a designated site.

TYPE "B"

Required maintenance in these ditches shall only occur at the inlets and outlets portion of the ditch, 15 feet plus/minus upstream and/or downstream. Any piece of equipment utilized for the purpose of excavation and/or clearing debris is only permissible when operations take place from the top portion of the bank. Care should be taken not to disturb wildlife or aquatic life, including any riparian vegetation which is needed for the wildlife to survive. Removal of sediments, debris, and unwanted materials will be disposed of properly at an appropriate designated site.

TYPE "C"

Required maintenance in these ditches shall only occur from the top portion fo the bank or from the shoulder portion of the roadway, on either side of the ditch. These particular ditches are commonly referred to as roadside/shoulder ditches. Both convey storm water adjacent to roadways and privately owned properties/businesses. Excavation equipment such as a backhoe or grader from removing unwanted sediment is permissible. Leaving vegetation in selected locations prevents erosion, traps sediment, and filters storm water. Removal of sediments, debris, and unwanted materials will be disposed of properly at an appropriate designoted site.

TYPE "D"

Required maintenance in these ditches is to strictly maintain the flow of storm water inside the ditch itself and not allow any amount of storm water to escape. Storm water conveyance in these ditches are to protect the citizens of Redding from flooding. To the best of out knowledge, these ditches do not have any issues pertain to wildlife or aquatic life including any riparian vegetation which is needed to the wildlife to survive. In order to maintain these ditches, silt must be removed occasionally utilizing heavy equipment such as backhoes and bulldozers. Best management practices shall be implemented meaning that all silt removal is to be kept at a minimum. Leaving vegetation in place helps with erosion, filters storm water, and leaves vegetation along the banks of open ditches which helps stabilize the soil and prevent erosion. It is imperative that over-cleaning does not occur in these ditches by staff. Removal sediments, debris, and unwanted materials will be disposed of properly at a designated site.

TYPE "E"

This designation indicates that equipment has not been used in this area due to inability to access the channel/ditch or there has been no need to perform maintenance.

Calaboose Creek

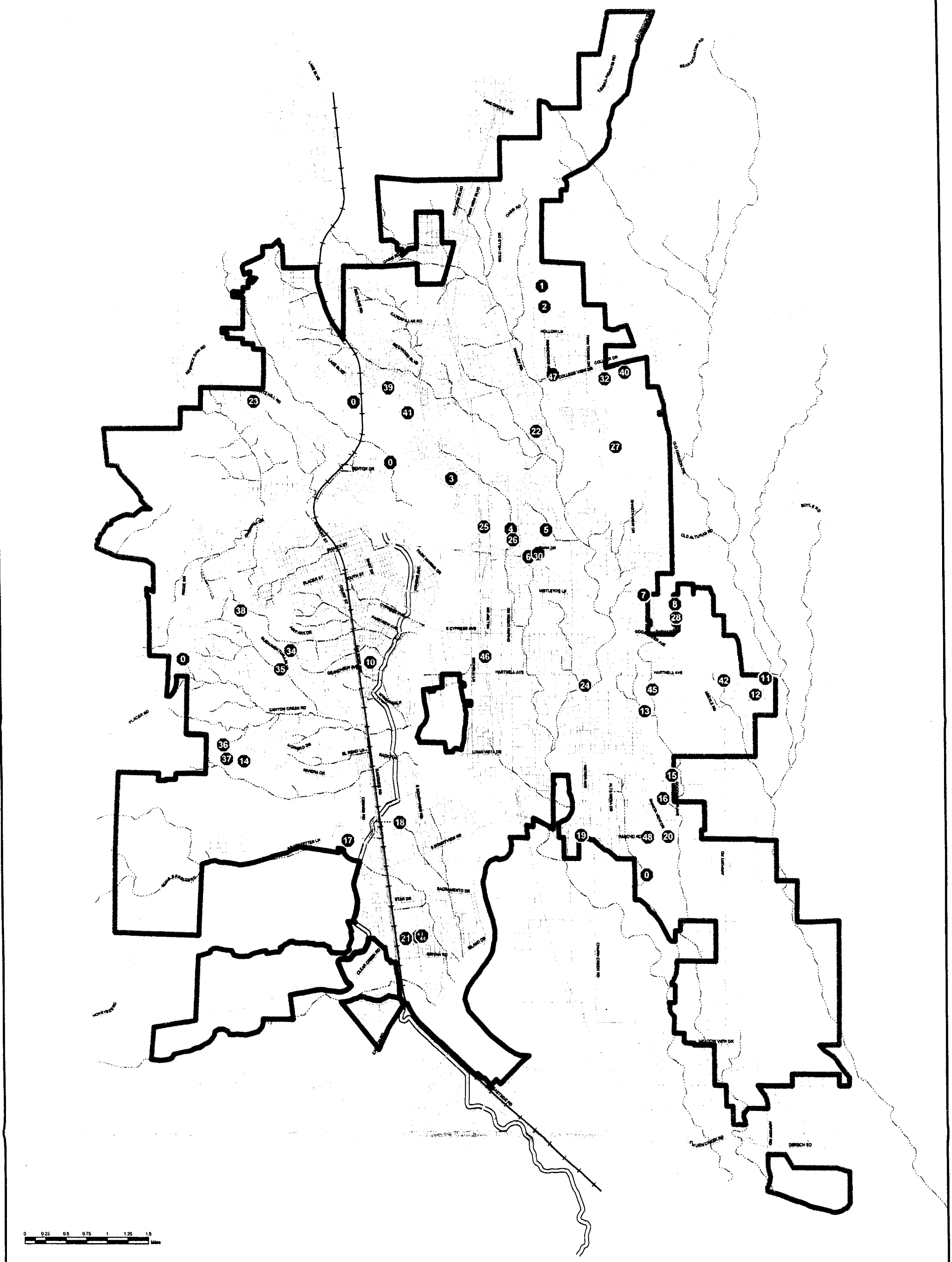
Category	*Segment Number*	*Location From*	*Location To*	*Permit Required*	*Section Type*	*Width*	*Length*	*Depth*	*Total Square Feet*	*Ditch Type*	*Sensitivity*	*Sensitivity Types*	*Inspection Frequency*	*Maintenance Frequency*	*HAND*	*TRUCK*	*BH*	*CAT*	*LOADER*	*SPRAY*	*MUCKER*	*CK*	*CCC*	*NOTES*
M	150	Sacramento River	E/O Park Marina Drive at Box Culvert	Yes	SC	14	42	6	588	A	H	V, E												
M	151	W/O Park Marina Dr	Double Box Culvert at 2471 Athens Ave	Yes	ED	10	537	6	5370	A	M	V, E	A	3-5 Yrs	X									Remove carts and trash; previously
M	152	W/O ACID	Civic Center Dr	Yes	ED	10.4	600	5	6240	A	M	V, E	A	3-5 Yrs	X								X	Trash removal required 2 - 3 times per year
M	153	West side of Cypress Street School	Grape St	No	CC	10.4	117	6	1216.8	D	N		A	3-5 Yrs			X							
M	154	West of Grape St Bridge	N/E property line of 990 Cypress Ave	No	CC	11.9	592	5	7044.8	D	N		A	3-5 Yrs		X		X						Bobcat
M	155	Hill St E/O Market St	Hill St W/O California St	Yes	ED	8	225	6	1800	A	M	V, E	A	3-5 Yrs						X			X	Spray twice a year; major clearing using
M	156	2222 California St	Gold St	Yes	ED	9.8	993	8	9731.4	A	M	V, E	A	3-5 Yrs									X	
M	157	North side of Gold St	1920 California St	No	CC	10	107	5	1070	D	N		A	3-5 Yrs	X									This may be on private property, not accessible by
M	158	N/O Gold St	South St	Yes	ED	12	171	5	2052	A	M	V, E	A	3-5 Yrs	X									West side of RtOH, may be private.
M	159	West side (back) of 1527 Sacramento St	E/O Railroad Tracks	Not in Jurisdiction	ED	7	20	5	140	A	L	V, E	A	3-5 Yrs	X									Back of Gerlinger's Steel
M	160	West side Railroad Tracks Front of 1742 Railroad Ave	Placer Street	Yes	ED	6.3	159	9	1001.7	C	L	V, E	A	B		X	X							Remove vegetation to keep erosion
M	161	N/E corner of Yuba St at Oregon St	161 feet north on Oregon St	Yes	ED	8	161	5	1288	C	L	V, E	A	A		X	X							Required to keep clean for Market Fest
M	162	N/E corner of Tehama St at Oregon St	189 feet north on Oregon St	Yes	ED	5	189	8	945	C	L	V, E	A	B		X	X							Remove vegetation

Category	Segment Number	Location From	Location To	Permit Required	Section Type	Width	Length	Depth	Total Square Feet	Ditch Type	Sensitivity	Sensitivity Types	Inspection Frenquency	Maintenance Frenquency	HAND	TRUCK	BH	CAT	LOADER	SPRAY	MUCKER	CK	CCC	NOTES
M	163	N/S of Oregon St 189 feet N/O Tehama	Shasta St	No	CC	5	108	8	540	D	N		A	3-5 Yrs	X	X	X							Remove rock, carts and trim trees
M	164	N/E corner of 1333 Chestnut St	87 feet west to Concrete Channel	No	ED	6	87	4	522	C	L	V, E	A	3-5 Yrs	X									Keep pipe face open; down retaining wall is
M	165	West from N/W corner of 1333 Chestnut St	End of CC on S/S of 1321 Chestnut St	No	CC	6	171	4	1026	D	N		A	B				X				X		Trim and remove trash
M	166	S/W corner of 1321 Chestnut St	Willis St	Yes	ED	6	378	4	2268	D	L	V, E	A	3-5 Yrs	X								X	No access for backhoe or cat now, must be
M	167	1400 Willis St	1365 Magnolia Ave	Yes	ED	9	417	4	3753	D	L	V, E	A	B		X	X	X						
M	168	1410 Orange Ave	Backside of 1431 Olive Ave	Yes	ED	5	291	5	1455	A	L	V, E	A	3-5 Yrs	X									Very limited work required
M	169	E/S Arch Pipe at back of 1431 Olive Ave	W/S of Concrete Channel	Yes	ED	6	69	5	414	D	L	V, E	A	B	X									
M	170	E/S Open Ditch at back of 1431 Olive Ave	Olive Ave	No	CC	8	87	4	696	D	N		A	3-5 Yrs				X						Lift bobcat over wall; rock removal
M	171	1420 Olive Ave	1445 Almond Ave	Yes	ED	5	753	4	3765	A,E	L	V, E	A	B	X									Lots of trimming needed, would like to use
M	172	W/S of Almond Ave across from 1376	N/E corner of 1441 Pleasant St	Yes	ED	5	1399	4	6995	A,E	L	V, E	A	B	X									Pipe inlet/outlet cleaning only; hard to get to;
M	173	Pleasant St	Backside of 1450 Pleasant St	No	CC	5	135	2	675	D	N		A	B	X							X		
M	174	Between 1450 & 1510 Pleasant St	Backside of 1520 Pleasant St	No	ED	2	93	1	186	C	L	V	A	AN		X	X							Ditch needs cleaning now
M	175	N/W corner 3002 Placer St	N/E corner of Placer St and Oak St	No	ED				0	A,E	N	V, E	A	3-5 Yrs	X									Keep pipe ends open; private yards

Category	Segment Number	Location From	Location To	Permit Required	Section Type	Width	Length	Depth	Total Square Feet	Ditch Type	Sensitivity	Sensitivity Types	Inspection Frenquency	Maintenance Frenquency	HAND	TRUCK	BH	CAT	LOADER	SPRAY	MUCKER	CK	CCC	NOTES
S	176	1376 Almond Ave	S/W corner of 2700 Placer St	Yes	ED	3	1008	4	3024	A	M	V, E	A	3-5 Yrs	X									Clean pipe at Placer St only concern
S	177	N/W portion of 2700 Placer St	S/S of 1640 Highland Ave	Yes	ED	3	909	2	2727	A,E	L	V, E	A	B	X									Clean pipe at Placer St
S	178	Backside of 1778 Highland Dr	N/S of South St	No	ED	3	306	3	918	A	L	V, E	A	3-5 Yrs	X									Clean pipe at Highland Ave opening
S	179	Alley behind 1747 Pleasant St	S/W corner of 1807 Pleasant St	No	ED	2	399	1	798	A	N	V	A	A	X	X	X							Remove trash

APPENDIX E

Retention/Detention Inventory and Maps



Legend

● Detention Basins

Location Map
Storm Water
Detention Facilities

N
W E
S

Projection
NAD-1927
StatePlane California
Zone I

City of Redding GIS Division
October 2002

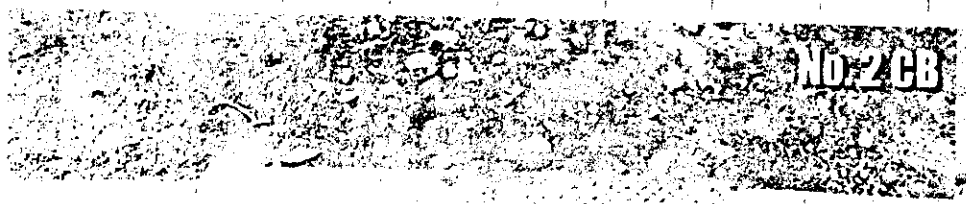
Source: Public Works Data
Created in ArcGIS 8 using ArcMap

CITY OF REDDING GIS GIS DIVISION

ID	GRID	SUBNAME
1	A10	GOLD HILLS 5
2	B10	EASTRIDGE ESTATES
3	G8	WILLOW PARK APARTMENTS
4	J10	HOME DEPOT
5	J10	LANCER HILLS ESTATES 4
6	K10	CIRCUIT CITY
7	L12	RAVENWOOD ESTATES 17 1
8	L13	CITY OF REDDING CORPORATION YARD
10	N6	AUTOZONE
11	O15	STILLWATER HEIGHTS 1
12	O15	STILLWATER HEIGHTS 1
13	P12	FOREST HOMES 3
14	S4	COUNTRY HEIGHTS 15 2
15	S13	CARRIAGE GLEN ESTATES 5B
16	T13	PACIFIC HEIGHTS 3
17	V6	HELLER LANE
18	V7	BONNYVIEW ESTATES 2
19	V11	CHURN CREEK MEADOWS 1
20	V13	COPPER CREEK 1
21	Y7	EASTSIDE INDUSTRIAL PARK
22		SHASTA HILLS ESTATES 2 1
23		RIVER RIDGE PARK 5
24		SHADOWBROOK APARTMENTS
25		TJ MAX
26		TARGET
27		HACIENDA HEIGHTS 7
28		CITY OF REDDING TRANSFER STATION
29		BEL AIR ESTATES
30		WALMART
32		SIMPSON COLLEGE
34		HOLIDAY MARKET
35		COUNTRY HEIGHTS 16
36		COUNTRY HEIGHTS 15 3
37		COUNTRY HEIGHTS 15 2
38		WEST REDDING PRESCHOOL
39		TREE HOUSE SENIOR APARTMENTS
40		GOLDEN UMBRELLA
41		SHOPCO
42		LUMBERJACK
43		WAVERLY MANOR
44		WAVERLY MANOR
45		FOREST HILLS ESTATES 2
46		KMART
47		OAKDALE HEIGHTS SENIOR LIVING
48		WESTERN ACRES 1

APPENDIX F

Catch Basin/Inlets Inventory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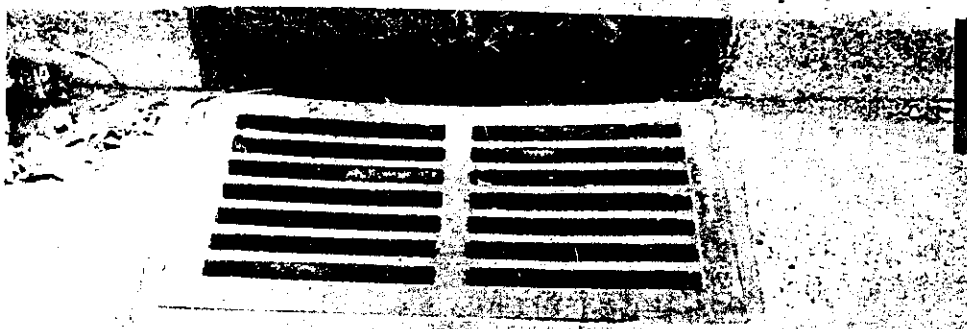


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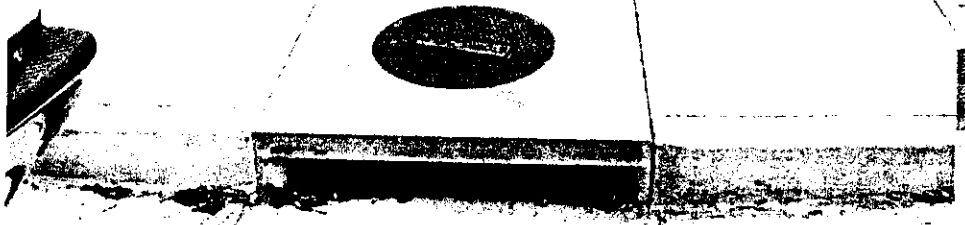

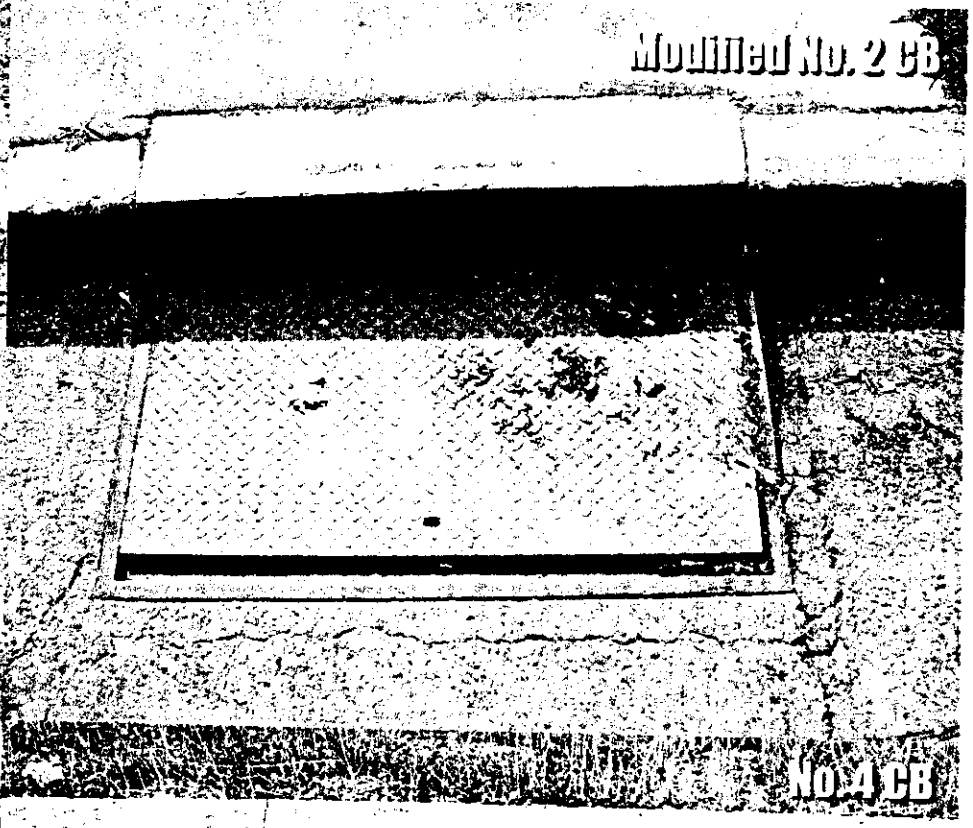
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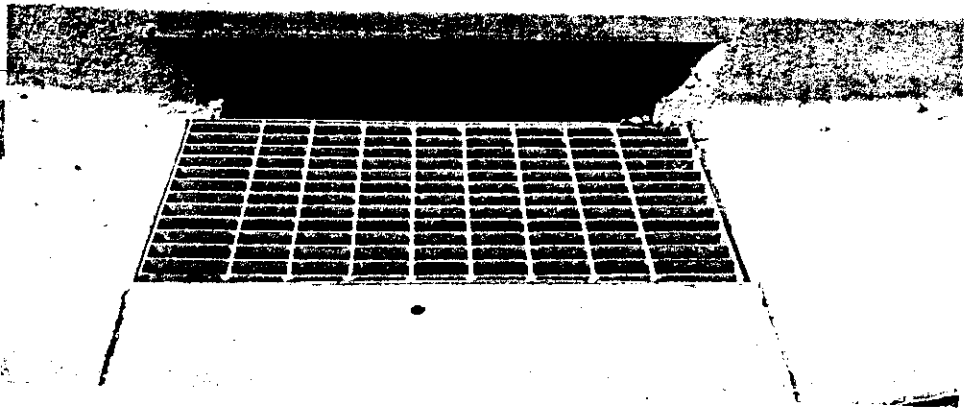
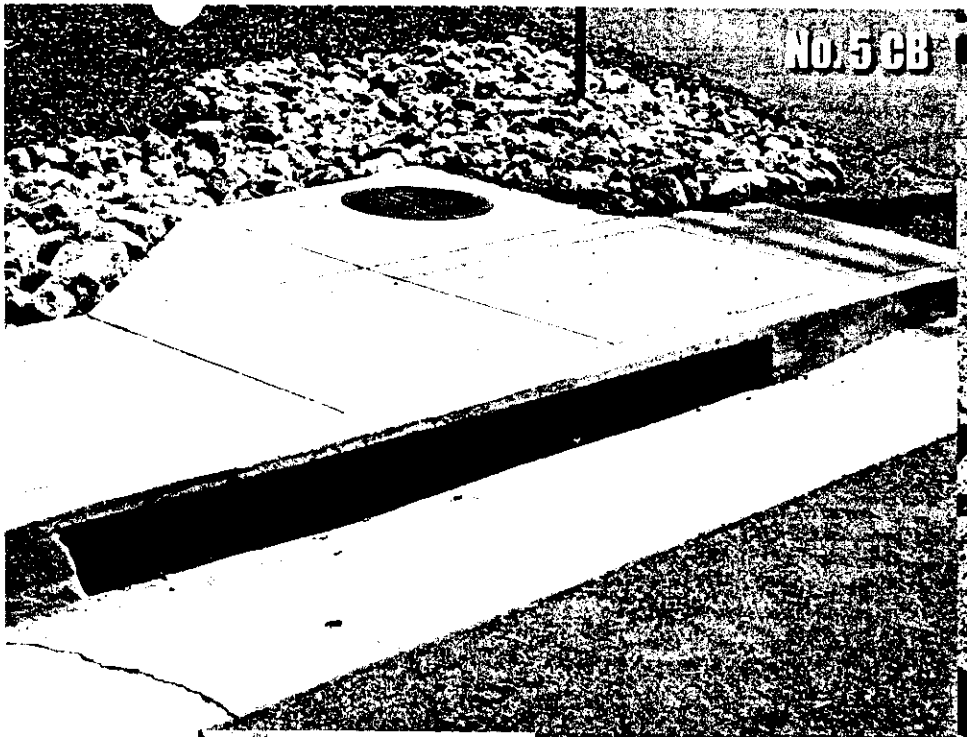
No. 4 CB





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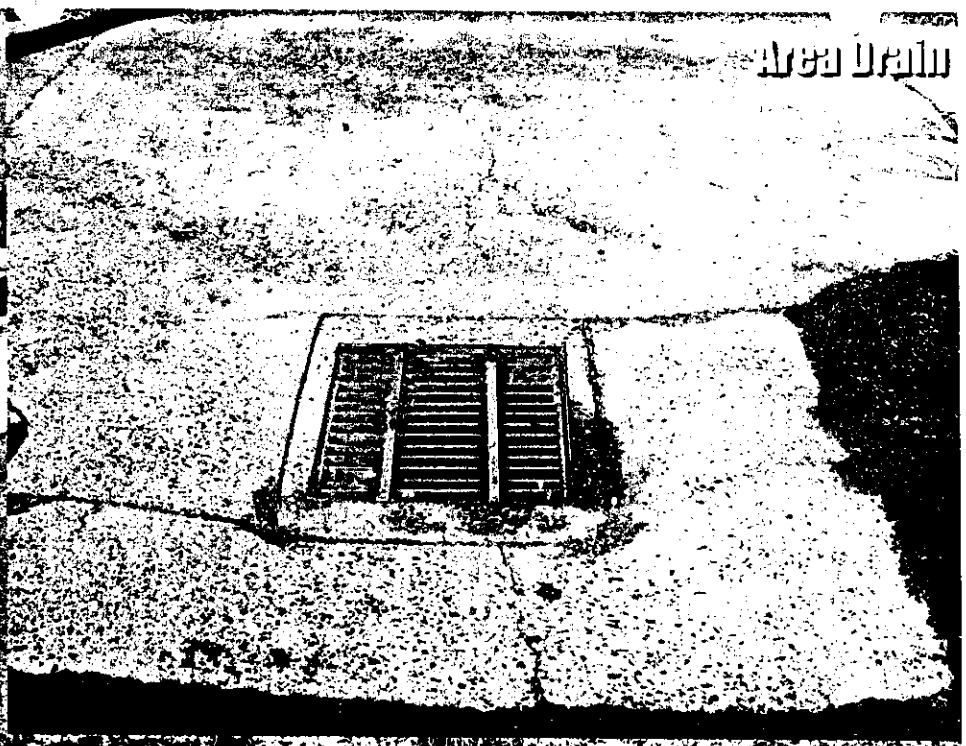


Area Drain

Miscellaneous Inlet

Miscellaneous Inlet W/ TeePee

TYPE	Expr1001
#	1
#1	1
#2	309
#3	2709
#3 BUBBLE OUT	2
#3 MODIFIED	2
#3&#5	1
#4	183
#5	61
10" OPEN INLET	1
24	1
33	6
CB	7
CURB INLET	2
DI	105
DI (CLEANOUT)	1
DI/JUNCTION	1
INLET	2
JUNCTION BOX	82
JUNCTION BOX -	1
JUNCTION BOX /	1
JUNCTION BOX BU	1
JUNCTION BOX RO	1
MD/AD	1
MH	2
MISC DRAIN	66
MISC DRAIN CURB	1
MISC INLET	1
MOD #3	1
MOD#3	1
MODIFIED #3	1
TEMP DI	1
UNDERSIDEWALK	1

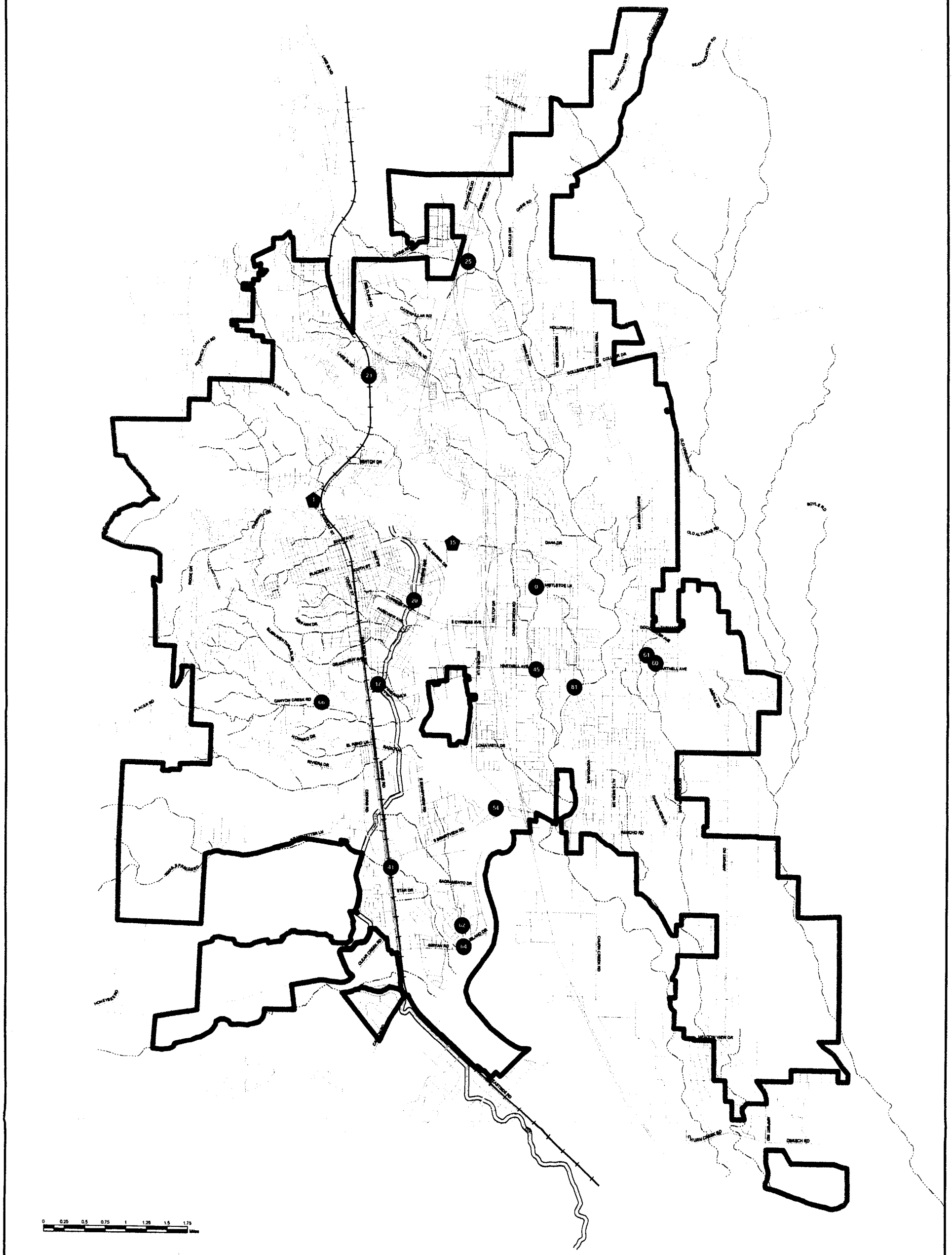
APPENDIX G

Bridge Area Drain Inventory and Map

BRIDGE AREA DRAIN INVENTORY

City Bridge Number	State Bridge Number	Street Name	Crossing	Number of Area Drains
1	6C-001	Benton Drive (Diestelhorst)	Sacramento River	8
15	6C-108	Cypress Avenue	Sacramento River	32
17	6C-162	Wyndham Lane	ACID Canal	6
20	6C-047	Locust Street	ACID Canal	1
23	6C-033	Lake Blvd	SPRR	4
25	6C-058	Twin View Blvd	Churn Creek	16
41	C-335	Eastside Road	Olney Creek	1
45	6C-140	Lawrence Road	Hartnell Avenue	1
54	6C-136	South Bonnyview Road	Sacramento River	7
60	N/A	Hawn Avenue	Between Bonset Street & Oakview Drive	2
61	N/A	Wilson Avenue	Between Shasta View Drive and Oakview Drive	2
62	N/A	Lakewood Drive	West of Reflection Avenue	2
64	N/A	Island Drive	West of Riverside Drive	1
66	N/A	Canyon Creek Road	1570 Canyon Creek Road	1
81	N/A	Victor Avenue	South of Hartnell Avenue	6
N/A	N/A	Mistletoe Lane	East side of Mistletoe School	4

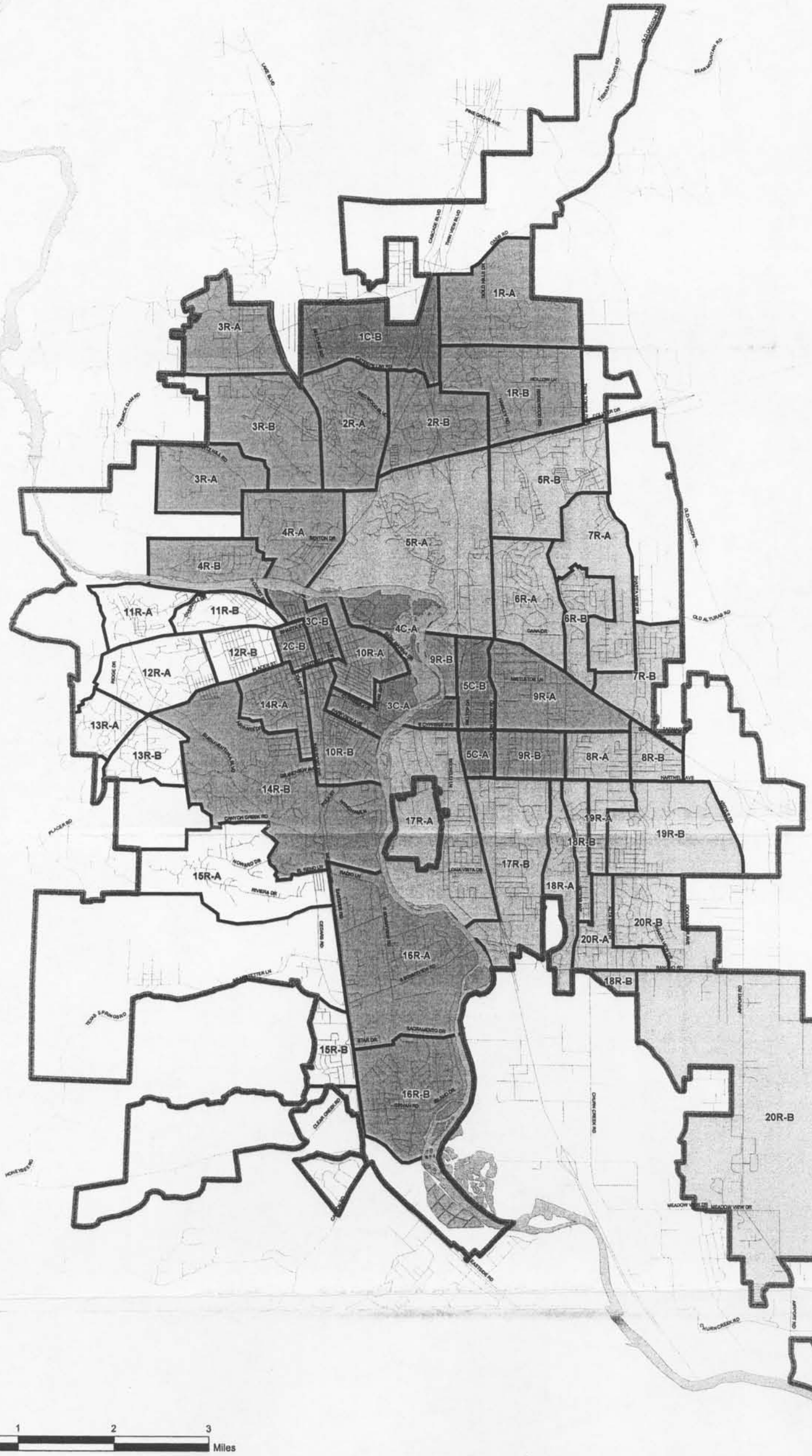
Sep-02



Location Map
Bridge Drain Inventory

APPENDIX H

Street Sweeping Route Index and Map



Legend

DAY

- Commercial
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday

Location Map
Street Sweeping Zones

N
W E
S

Projection
NAD-1927
StatePlane California
Zone I

City of Redding GIS Division
October 2002

Source: Public Works Data
Created in ArcGIS 8 using ArcMap

CITY OF REDDING GIS DIVISION

STREET SWEEPING DATES BY ROUTE

5C-A con't
6/3/2003
6/17/2003
7/1/2003
7/15/2003
7/29/2003
8/12/2003
8/26/2003
9/9/2003
9/23/2003
10/7/2003
10/21/2003
11/4/2003
11/18/2003
12/2/2003
12/16/2003
12/30/2003

5C-B
1/7/2003
1/21/2003
2/4/2003
2/18/2003
3/4/2003
3/18/2003
4/1/2003
4/15/2003
4/29/2003
5/13/2003
5/27/2003
6/10/2003
6/24/2003
7/8/2003
7/22/2003
8/5/2003
8/19/2003
9/2/2003
9/16/2003
9/30/2003
10/14/2003
10/28/2003
11/11/2003
11/25/2003
12/9/2003
12/23/2003

5R-A
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5/5/2003
7/7/2003
9/8/2003
11/3/2003
12/29/2003

5R-B
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5/12/2003
7/14/2003
9/15/2003

5R-B con't
11/10/2003

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7/21/2003
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11/17/2003

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11R-B
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12R-A
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8/29/2003
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12/26/2003

18R-A
1/17/2003
3/14/2003
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7/11/2003
9/5/2003
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18R-B
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3/21/2003
5/16/2003
7/18/2003
9/12/2003
11/7/2003

19R-A
1/31/2003
3/28/2003
5/23/2003
7/25/2003
9/19/2003
11/14/2003

19R-B
2/7/2003
5/30/2003
8/1/2003
9/26/2003
11/21/2003

20R-A
2/14/2003
4/11/2003
6/6/2003
8/8/2003
10/3/2003
12/5/2003

20R-B
2/21/2003
4/18/2003
6/13/2003
8/15/2003
10/10/2003
12/12/2003

APPENDIX I

Vehicle and Equipment Inventory

STORM DRAIN UTILITY
VEHICLE AND EQUPMENT INVENTORY

DIVISION 801

Vehicle Number	Type of Vehicle	License Number
217	2002 Ford F-150 4x4	1084827

DIVISION 802

Vehicle Number	Type of Vehicle	License Number
268	2000 JCB Backhoe	1018888
271	1973 Loard Mucker	N/A
273	2002 International Truck 10 yard	1128022
274	1994 International Trailer	917089
275	1999 Ford F-450 Truck	1020646
277	1994 Ford Vac-Con	4855
278	1998 Vermeer Chipper	1005267
279	200 Gallon Weed Sprayer	301347
280	Confined Space Trailer	322607
286	1994 Welding Trailer	101883
N 780	1989 Lincoln Welder	N/A
N 977	1980 Universal Heater	N/A
N1 449	2001 Wacker Tamper	N/A
N1 852	2002 HusQvarn	N/A
N1 854	2000 Stihl	N/A
N1 855	2000 Stihl Chain Pole Saw	N/A
N1 865	1999 Stihl Chain Saw	N/A
N1 866	1990 Stihl Chain Saw	N/A
N1 868	1997 Husqvarna	N/A
N1 869	1998 Husqvarna	N/A
N1 870	1998 Husqvarna	N/A
N1 952	1996 Wacker Tamper	N/A
1449	2" Trash Pump by Wacker	N/A
1856	Husqvarna Back Pack Blower	N/A
1854	Stihl Chain Saw	N/A
1860	Wacker 5.6 Generator	N/A

DIVISION 803

Vehicle Number	Type of Vehicle	License Number
233	Ford Swartz Sweeper	1020142
234	Ford Swartz Sweeper	1020143

7/15/2002

APPENDIX H

City of Redding General Plan Natural Resources Element Excerpt

Natural Resources Element

INTRODUCTION

PURPOSE AND CONTENT

The City of Redding is fortunate to have a wide range of resources within its Planning Area. These include the Sacramento River, creeks, ponds, wetlands, vernal pools, and groundwater resources; a variety of vegetation types and communities; wildlife; archaeological, historic, and cultural resources; mineral resources; and agricultural lands.

These resources contribute to the City's economy and are important elements of Redding's quality of life. Both responsible management and protection of these resources are needed. This Plan seeks to balance the need to accommodate growth with the need for the conservation, protection, and enhancement of the area's natural resources.

Most of the background data and information related to this element are contained within Chapter 9 of the City of Redding *General Plan Background Report*. Information regarding archaeological, historic, and cultural resources is contained in Chapter 8 of the same document.

Specific topics addressed within the Policy Document include:

- Surface Water.
- Groundwater.
- Biological Resources.
- Open Space.
- Archaeological, Historic, and Cultural Resources.
- Mineral Resources.
- Energy Resources and Conservation.
- Agricultural Lands.

Air quality, which is also considered a resource, is addressed in a separate Air Quality Element. Park and recreation facilities and programs are addressed within the City's Recreation Element.

AUTHORITY

In accordance with Government Code Sections 65302(d) and 65302(e), a general plan is required to include both a Conservation and an Open Space Element.

The Conservation Element is required to address the conservation, development, and utilization of natural resources, including water and its hydraulic force, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources. The Conservation Element may also cover:

- The reclamation of land and waters.
- Prevention and control of the pollution of streams and other waters.
- Regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan.
- Prevention, control, and correction of the erosion of soils, beaches, and shores.
- Protection of watersheds.
- The location, quantity, and quality of rock, sand, and gravel resources.
- Flood control.

It is the intent of the Legislature that cities preparing general plans recognize open space as a limited and valuable resource to be conserved whenever possible. The Open Space Element is specifically required to consider open space for the preservation of natural resources (fish and wildlife habitat); open space used for the managed production of resources (food and fiber); open space for outdoor recreation, including areas of scenic, historic, and cultural value; and open space necessary to maintain the public health and safety.

The Conservation and Open Space Elements are commonly combined because of the overlapping topics each is required to address. The City of Redding has chosen to prepare a Natural Resources Element which effectively meets the statutory requirements of both documents.

GOALS AND POLICIES

SURFACE AND GROUNDWATER RESOURCES

The availability, quantity, and quality of water resources are vital to natural processes and human activities within any urban area. Water is essential to the development of housing, commerce and industry, agricultural operations, recreation, and the maintenance of high-quality fish and wildlife habitats.

Surface water within the Planning Area consists of the Sacramento River and numerous tributary creeks. There are also a number of ponds, most of which are in private ownership. In 1995, 58 percent of the City's water supply was drawn from the Sacramento River. Another 18 percent was drawn from the Spring Creek Conduit, which receives its water from Whiskeytown Lake. The remaining 24 percent of the City's water supply was drawn from wells located in the Redding Groundwater Basin.

In addition to the City of Redding, a number of water districts provide domestic and agricultural water within the Planning Area. These districts also obtain their supplies from a variety of sources, including the Sacramento River, Spring Creek Conduit, Muletown Conduit (which is also connected to Whiskeytown Lake), and wells.

The quality and quantity of water resources can be affected by a variety of activities including, but not limited to:

- Sedimentation and siltation resulting from erosion caused primarily by grading, construction, and the removal of vegetation.
- Increased stormwater runoff and reductions in groundwater recharge created by covering the soil with buildings, pavement, and other impervious surfaces.
- Excessive pumping of groundwater.
- Excessive water consumption.
- Contamination resulting from the improper or excessive use of pesticides, herbicides, and fertilizers in conjunction with large agricultural operations, golf courses, and other urban uses.
- Contamination resulting from improperly managed urban stormwater runoff, which often contains pesticides, herbicides, oil, grease, and heavy metals.
- Discharge of various chemicals and compounds into surface water, groundwater, or storm-drain systems through improper handling and disposal by businesses, industries, or individuals.
- Contamination resulting from high concentrations of on-site, sewage-disposal systems or systems installed in areas with unsuitable soils.
- Leaching of soils that have been contaminated by hazardous materials or substances.

Erosion and sedimentation control are the primary issues in the Redding area from a water-quality perspective. While the City recognizes the economic importance of allowing grading and other site-development activities to occur during what is considered the "rainy season" (typically October 15 through April 15), of equal or greater importance is the protection of our surface-water resources. Siltation of our waterways has dramatic negative effects on aquatic wildlife, including Federally protected species of anadromous fish. The following policies strike a balance between these objectives.

GOAL NR1

MINIMIZE SOIL-EROSION AND SEDIMENTATION PROBLEMS RESULTING FROM DEVELOPMENT ACTIVITIES; IMPROVE THE QUALITY OF STORMWATER RUNOFF.

Policies to achieve this goal are to:

NR1A. Establish a process for the development, review, and approval of erosion- and sedimentation-control plans of single-family residential construction and similar small projects.

NR1B. Require development applicants to submit and receive Public Works Department approval for erosion- and sediment-control plans prior to undertaking grading activities.

NR1C. Minimize soil erosion and sedimentation created during and after construction activities to the fullest extent practicable, using Best Management Practices (BMPs).

NR1D. Make project monitoring and enforcement activities a priority to ensure that erosion-control measures are in place prior to the start of the rainy season and function properly and effectively:

- Installed properly.
- In place prior to the start of the rainy season.
- Functional and effective.

NR1E. Aggressively pursue immediate remediation when erosion damage is discovered and/or initial control measures fail.

NR1F. Establish and levy fines for failure to comply with the requirements of the Grading Ordinance and/or an approved erosion- and sediment-control plan.

NR1G. Support and/or jointly sponsor erosion- and sedimentation-control training and education activities in conjunction with the development community.

NR1H. Ensure that employees responsible for monitoring and enforcing the City's Grading Ordinance receive adequate training regarding erosion- and sediment-control practices.

NR1I. Work with Shasta County and other regional, State, and Federal agencies to reduce the amount of toxic chemicals and other agents or pollutants entering the surface water system from agriculture, golf course, and urban runoff.

NR1J. Encourage neighboring jurisdictions to adopt and enforce consistent erosion- and sediment-control measures.

GOAL NR2

DEVELOP AND MAINTAIN ADEQUATE WATER SUPPLIES FOR DOMESTIC AND FIRE-SUPPRESSION PURPOSES.

Policies to achieve this goal are to:

NR2A. Continue to evaluate options for increasing the City's and other water providers' water supplies, including, but not limited to, acquiring additional allocations from the Sacramento River, development of additional wells, and enhancement of water-storage and treatment facilities.

NR2B. Encourage water-conservation practices including, but not limited to, use of:

- A tiered pricing system for water which is tied to the amount consumed by a household or business.
- Native plants or other plants with low water requirements in public and private development projects.
- Drip irrigation systems.
- "Gray water" for landscape irrigation if approved by Shasta County.

NR2C. Utilize water reclamation projects in landscape and agricultural uses if approved by the California Regional Water Quality Control Board and State Department of Health Services.

NR2D. Support efforts to limit exportation of surface water to other areas of the State and to protect local water rights.

GOAL NR3

PRESERVE AND PROTECT THE QUANTITY AND QUALITY OF GROUNDWATER RESOURCES WITHIN THE PLANNING AREA.

Policies to achieve this goal are to:

NR3A. Provide maximum groundwater-recharge opportunities by maintaining the natural condition of waterways and floodplains to the extent feasible given flood-control requirements.

NR3B. Comply with the Regional Water Quality Control Board's regulations and standards to maintain and improve groundwater quality in the Planning Area.

NR3C. Support the preparation of a groundwater management plan for the Redding Groundwater Basin that will address long-term sustainability of the resource.

NR3D. Support efforts to prevent exportation of groundwater to other areas of the State and to retain local control over the resource.

NR3E. Work with appropriate State, Federal, and local agencies to protect, improve, and enhance groundwater quality in the region.

GOAL NR4

PREVENT AND REMEDY SURFACE-WATER, GROUNDWATER, AND SOIL CONTAMINATION.

Policies to achieve this goal are to:

NR4A. Discourage the establishment of any new septic systems, except in areas where residential densities are low (1–5 units per acre and larger) and soils are suitable for septic system use.

NR4B. Continue to accept, recycle, and/or properly dispose of household hazardous wastes through ongoing operation of the City's Household Hazardous Waste Collection Program.

NR4C. Work with appropriate local, State, and Federal agencies to ensure that those responsible for soil, surface-water, and/or groundwater contamination are required to initiate, monitor, and complete full remediation activities.

NR4D. Work with Shasta County and other appropriate agencies to educate the public and business owners regarding proper handling and disposal of hazardous materials and household hazardous wastes.

NR4E. Establish and enforce penalties for illegal dumping of both hazardous and nonhazardous materials.

BIOLOGICAL RESOURCES

Unlike many urban areas, the Redding Planning Area contains a variety of biological and wildlife resources. Generalized habitat mapping of the Planning Area has been completed through the use of three different processes: Satellite Imagery Mapping, Riparian Mapping, and Vernal Pool Complex Mapping. Methodology for both the Riparian and Vernal Pool Complex mapping efforts involved the use of infrared aerial photos and field surveys. Although this data should not be considered site-specific, it does provide a reasonably accurate composite of basic habitat types and their general distribution throughout the Planning Area.

Major habitat types or communities within the Planning Area include:

- Woodland (Blue Oak-Grey/Digger Pine).
- Annual Grasslands.
- Mixed Chaparral.
- Riparian.
- Aquatic.
- Vernal Pools.
- Wetlands.
- Irrigated Agriculture and Urban Vegetation.

For purposes of this General Plan, the following habitat types are considered sensitive and require special consideration when developing within or in proximity of them: riparian, vernal pools, aquatic, and wetlands.

These habitats support a variety of both plant and animal species, some of which are classified as special status species. Special status species include:

- Species that are listed or proposed for listing as Threatened or Endangered under the State or Federal Endangered Species Acts.
- Species that meet the definition of rare, unique, or endangered under the California Environmental Quality Act (CEQA).
- Species listed as "Species of Special Concern" by the California Department of Fish and Game (DFG).

Potential impacts to sensitive habitats and/or special status species must be mitigated in accordance with the requirements of the California Environmental Quality Act.

Because the potential for finding special status species is particularly high in vernal pools and vernal pool complexes, Figure 3-1 shows the approximate locations of known vernal pool resources. These resources are located within the Stillwater Creek and Clover Creek basins. Note that this figure is not intended to represent the locations of all vernal pools within the Planning Area. Proper field documentation by a qualified biologist or botanist must be provided with all development proposals located in areas considered to have a high probability of containing vernal pools.

GOAL NR5 — PRESERVE AND PROTECT THE SIGNIFICANT HABITATS, PLANTS, AND WILDLIFE THAT EXIST IN THE PLANNING AREA.

Policies to achieve this goal are to:

NR5A. Minimize the disruption of sensitive habitat caused by new development by encouraging innovative design and site planning and establishing performance standards for habitat protection.

NR5B. Work to preserve and enhance fisheries in the Sacramento River and those streams or stream segments identified on Figure 3-2.

NR5C. Maintain and update data and information regarding areas of significant biological value within the Planning Area to:

- Provide critical information to the community.
- Facilitate resource conservation.
- Facilitate appropriate management of development activities.

GOAL NR6 — PROTECT "SPECIAL STATUS" PLANT AND ANIMAL SPECIES; PRESERVE AND PROTECT CREEK CORRIDORS, RIPARIAN AREAS, VERNAL POOLS, AND WETLANDS.

Policies to achieve this goal are to:

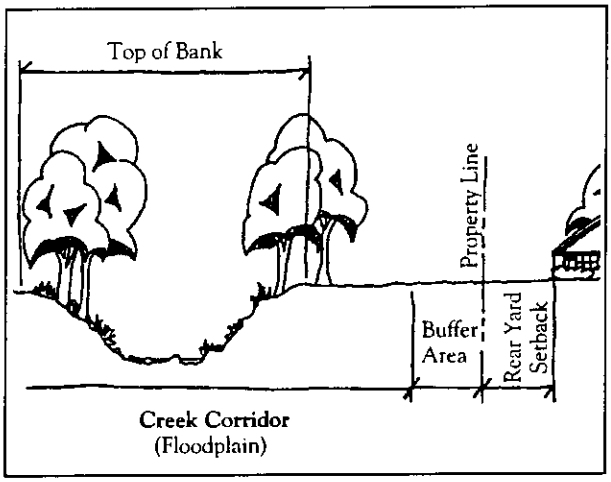
NR6A. Preserve watercourses, vernal pools, riparian habitat, and wetlands in their natural state to the extent feasible. Fully mitigate unavoidable adverse impacts such as wetland filling or disturbance.

NR6B. Provide adequate buffering of sensitive habitats whenever necessary. Buffer size should be based upon the type of habitat as well as its size and habitat value.

NR6C. Ensure that uses allowed within riparian corridors:

- Minimize the creation of erosion, sedimentation, and increased runoff.
- Emphasize retention and enhancement of natural riparian vegetation.
- Provide for unimpaired passage of fish and wildlife.
- Avoid activities or development of new features that result in disturbance or dispersal of wildlife.
- Avoid channelization.
- Avoid substantial interference with surface and subsurface flows.
- Incorporate natural vegetation buffers.

NR6D. Amend the Municipal Code to implement minimum river and creek corridor development setbacks (buffer areas) in accordance with Figure 3-3. These setbacks may be modified based on project/resource-



specific circumstances and appropriate mitigation. These buffer areas should be dedicated or a permanent conservation easement granted to the City as a condition of development approval.

NR6E. Strive to conserve all "special status species" within the Planning Area. Ensure implementation of statutory protection for these species.

NR6F. Support public and private efforts to establish habitat mitigation banks, habitat conservation plans, conservation easements, and other mechanisms that serve to protect sensitive habitats and species.

NR6G. Ensure implementation of policies and regulations for protection of those wildlife species having statutory protection under local, State, and/or Federal laws.

GOAL NR7

RECOGNIZE THE AESTHETIC AND BIOLOGICAL VALUES OF OAK WOODLANDS AND OTHER NATURAL VEGETATION.

Policies to achieve this goal are to:

NR7A. Promote existing native oaks, especially valley oaks, by establishing standards for the design of development projects. The preservation of stands of trees within developments is preferred over preservation of individual trees, with the exception of special-status species and heritage trees.

NR7B. Identify and establish appropriate "tree mitigation areas" to be used for the planting of native trees in concert with development project mitigation.

GOAL NR8

RECOGNIZE AND PROTECT HABITAT LINKAGES AND MIGRATORY CORRIDORS.

Policies to achieve this goal are to:

NR8A. Maintain, where possible, the habitat linkages/wildlife corridors and sensitive habitats that are created by the open-space ("Greenway") network established by this General Plan. Require development in areas depicted as "Greenway" on the General Plan Diagram to consider corridor impacts and, where necessary, provide alternate usable links between habitat types or areas and/or provide alternate development plans that avoid the open-space network and sensitive habitats.

NR8B. Maintain and preserve other natural habitat linkages and wildlife corridors in the City where feasible. Discourage development impacts to these linkages and corridors and fully mitigate associated unavoidable adverse impacts.

GOAL NR9

PROMOTE AND FACILITATE HABITAT PRESERVATION, RESTORATION, AND ENHANCEMENT.

Policies to achieve this goal are to:

NR9A. Encourage the acquisition, preservation, restoration, and enhancement of native

vegetation with a focus on wetlands and riparian habitat that will improve the biological value and integrity of the City's natural resources. Encourage native landscape in unvegetated, manmade areas such as along streets and in abandoned lots.

NR9B. Encourage education and community involvement in the protection and enhancement of local biological resources.

OPEN SPACE

In addition to protecting life and property, open-space areas are essential to the health and livability of a community. Open space may consist of developed and undeveloped parklands (see Recreation Element). Open-space lands also include natural areas, either public or private, that have been set aside in perpetuity for their ecological, visual, or safety-related aspects.

Redding is fortunate to have an extensive open-space network. The heart of this network is the Sacramento River. Into the river flows numerous tributary streams that, for the most part, originate in steep terrain to the west and north of the city. Policies of this and past General Plans have set aside these slope and stream-side areas from development. Together, they represent many square miles of open space. These lands are depicted on the General Plan Diagram as "Greenway" and are subject to the development constraints proposed by this Plan. Figure 3-4 depicts the open-space lands that were under direct public control at the time this Plan was adopted.

While open space is valuable in and of itself, connectivity and public accessibility enhance this value appreciably. Policies contained in the Community Development and Design Element address the need to provide public access to these open-space corridors. The Recreation Element calls for the development of a comprehensive Trail Master Plan that will eventually afford all citizens access to and through many natural areas that seem remote from the hustle and bustle of city life.

As discussed in detail within the Health and Safety Element, the Redding Planning Area contains several natural features which are considered hazardous for development. These include areas containing excessive slopes (greater than 20 percent) and areas within the 100-year floodplain of the Sacramento River or its tributaries. In the interest of public safety and to reduce the potential for loss of life or property damage from wildland fires or floods, it is essential that development restrictions be applied within these hazard areas.

GOAL NR10

PRESERVE AREAS CONTAINING EXCESSIVE SLOPES OR 100-YEAR FLOODPLAINS AS OPEN SPACE TO PREVENT LOSS OF LIFE AND PROPERTY DAMAGE AND TO PROVIDE VALUABLE HABITAT AND RECREATIONAL OPPORTUNITIES.

Policies to achieve this goal are to:

NR10A. Require as a condition of development approval public dedication (in fee) of flood-prone lands adjacent to the Sacramento River and those tributary streams identified on Figure 3-3. Exceptions to this policy may be made based on: (1) the provisions of any adopted specific plan or (2) approval by the City in consideration of special circumstances unique to a flood-prone area where the extent of flooding is largely dictated by inadequate drainage improvements, where an entire parcel is constrained by floodplain, and/or where the flooding occurs within a developed area.

NR10B. Preserve land publicly dedicated under Policy NR10A as open space. Development in these areas will be restricted to passive, low-impact uses that minimize removal of existing vegetation and maintain or increase the existing habitat value, while providing adequate protection from wildland fires.

NR10C. Require, as a condition of development approval, that private open-space easements be established for significant areas of nondeveloped lands that exceed a slope of 20 percent. Use public dedications and/or trail easements when necessary to connect these areas to existing or proposed public open space.

GOAL NR11

PROMOTE THE PRESERVATION AND APPROPRIATE PUBLIC USE OF KEY OPEN-SPACE LANDS WITHIN THE COMMUNITY.

Policies to achieve this goal are to:

NR11A. Develop a Comprehensive Open Space Plan that addresses the following items:

- Framework for open-space lands.
- Role of public and private open-space lands.
- Agricultural land preservation.
- Important ecological areas.
- Acquisitions and management of public open-space land.

ARCHAEOLOGICAL, HISTORIC, AND CULTURAL RESOURCES

Due to the presence of the Sacramento River and its numerous tributary creeks, the Redding Planning Area has a relatively high potential for cultural resources. The river, creeks, and old river terraces are prime locations for cultural resource sites, both prehistoric and historic. Through records kept at the Northeast Information Center at California State University, Chico, 213 prehistoric sites have been located and documented. Two archaeological sites have been listed on the National Register of Historic Places. Many more sites are likely to exist and could be susceptible to inadvertent destruction during construction and development activities if precautions are not implemented.

Redding also has numerous historic structures dating from the late Victorian period and good examples of architecture dating from the 1920s to the 1940s, including Art Deco and Works Progress Administration (WPA) period buildings. Only three of the City's historic structures (Old City Hall—1313 Market Street; Pine Street School—1135 Pine Street; and the Frisbie House—1246 East Street) have been listed on the National Register of Historic Places. However, many more of the City's historic structures would likely qualify for nomination to the National Register or other State and local registers, either as individual structures or as historic districts.

GOAL NR12

PROTECT AND ENHANCE HISTORICAL AND CULTURALLY SIGNIFICANT RESOURCES WITHIN THE PLANNING AREA.

Policies to achieve this goal are to:

NR12A. Ensure protection of prehistoric, cultural, and archaeological resources during the development process.

NR12B. Refer development proposals that may adversely affect archaeological sites to the California Archaeological Inventory, Northeast Information Center, at Chico State University.

NR12C. Encourage public and private efforts to identify, preserve, protect and/or restore historic buildings, structures, landmarks, and important cultural resources.

NR12D. The City shall not knowingly approve any public or private project that may adversely affect an archaeological site without first consulting the Archaeological Inventory, Northeast Information Center, conducting a site evaluation as may be indicated, and attempting to mitigate any adverse impacts according to the recommendations of a qualified archaeologist. City implementation of this policy shall be guided by Appendix "K" of the *CEQA Guidelines*.

MINERAL RESOURCES

Mineral deposits within the Planning Area consist of copper, gold, tungsten, and gravel. In addition, the area around the Redding Municipal Airport contains gas-bearing strata. The westerly portion of the Planning Area has been mined in the past for placer and lode gold, tungsten, and copper. Most previous mining efforts did not prove to be economically viable. However, this is likely to change in the future as the value of precious metals continues to increase. Gravel-bearing deposits exist along the Sacramento River,

Clear Creek, Olney Creek, Churn Creek, and Stillwater Creek.

In 1997, the California Department of Conservation, Division of Mines and Geology (DMG) published a DMG Open File Report 97-03 entitled, *Mineral Land Classification of Alluvial Sand and Gravel, Crushed Stone, Volcanic Cinders, Limestone, and Diatomite Within Shasta County, California.* The primary purpose of the report is to identify the known or inferred mineral potential of lands within the County to ensure that the mineral potential of land is recognized by local government decision-makers and considered before land use decisions are made that could preclude future mining. The report also contains 50-year projections for population and per capita consumption of aggregate and a comparison between the estimated 50-year aggregate demand and current reserves.

The findings of the report indicate that current known concrete-grade alluvial aggregate reserves within Shasta County are calculated to be approximately 30.3 million tons. Based on a historic aggregate consumption rate of 8.0 tons per person per year, the report estimates that current known reserves are likely to be depleted within 17 years. This information highlights the importance of protecting both known and inferred deposits from encroachment by potentially incompatible land uses.

Land classifications utilized in the referenced DMG report are presented in the form of Mineral Resource Zones (MRZs). Each zone type relates to the degree of knowledge about a mineral resource occurrence and the economic characteristics of the deposits. Areas of identified mineral resource significance, either demonstrated/measured or inferred, are classified as MRZ-2a or MRZ-2b.

Although most areas along the Sacramento River are classified as MRZ-2a or 2b in the 1997 DMG Report, the presence of existing incompatible development will preclude mineral-extraction activities in those locations. Conversely, areas classified as MRZ-2a and 2b, where mineral-extraction activities are considered feasible, have been designated with a "Critical Mineral Resources Overlay" on the General Plan Diagram.

GOAL NR13

ENSURE AN ADEQUATE SUPPLY OF MINERAL RESOURCES TO MEET LONG-TERM REGIONAL NEEDS.

PROTECT CRITICAL MINERAL RESOURCE AREAS FROM ENCROACHMENT BY INCOMPATIBLE LAND USES.

Policies to achieve this goal are to:

NR13A. Focus mineral resource-protection efforts in areas identified with a "Critical Mineral Resource Overlay" on the General Plan Diagram. Remove the "Critical Mineral Resource Overlay" when the mineral resource is exhausted and reclamation completed.

NR13B. Maintain current information regarding the status and location of mineral deposits within the Planning Area.

NR13C. Prohibit incompatible development in or near areas designated "Critical Mineral Resource Overlay." Residential uses within overlay areas should be limited to 1.0 dwelling unit per 40 acres.

NR13D. Require a use permit to establish new mining operations. The use permit shall contain conditions necessary to protect the public health, safety, and welfare; to minimize impacts on adjacent land uses; and to mitigate other potential adverse environmental impacts.

NR13E. Outside Critical Mineral Resource Overlay areas (but within areas classified as Mineral Resource Zones MRZ2a and/or MRZ2b by the State Division of Mines and Geology), mining may be permitted in the in-stream, floodplain, or gravel bar areas of a river or creek provided removal of sand and gravel is:

- Conducted during a declared civil or hazardous material emergency or natural disaster to relieve or correct potential hazards to the public health, safety, or welfare caused by such emergency or disaster.

- For removal of dredger tailings for reclamation purposes only.
- To protect a public structure, such as a bridge, when it is determined to be necessary by the public entity responsible for said structure.
- To remove a buildup of sand and gravel to maintain the channel capacity and prevent flooding.

For Items 2, 3, and 4 above, the use permit and reclamation plan for mining of said areas shall be based on a stream management program, prepared by qualified professionals in appropriate disciplines, which includes data and analysis to show that:

- There will be no significant adverse impact on in-stream habitat; riparian habirat; wetlands; or rare, threatened, or endangered species of fish, wildlife, or plants.
- There will be no significant adverse impact on existing structures, including bridges or levees.
- There will be no significant increase in bank erosion, deposition, or flooding.
- There will be no significant adverse impacts to surrounding properties, including, but not limited to, noise, visual impacts, dust, and similar impacts.

ENERGY RESOURCES AND CONSERVATION

Electricity within the City limits is provided by the City of Redding through its transmission and distribution system. Natural gas—and electric service within the remainder of the Planning Area—is provided by Pacific Gas and Electric Company (PG&E). The City's goal is to provide electric service to both residents and businesses at the lowest possible rates, while maintaining system reliability in an environmentally responsible manner. System planning and needed facilities are addressed in the Public Facilities and Services Element. However, there is also a need to encourage conservation and the use of alternative forms of energy, such as solar, to ensure that energy resources are utilized responsibly and long-term demands can be met. A similar emphasis on conservation should be promoted for all nonrenewable energy sources.

Another important energy-conservation strategy is to actively pursue the benefits obtained from resource-recovery and recycling programs. It is well-documented that in most instances, the reuse of materials utilizes less energy (and resources) than producing products from raw materials.

GOAL NR14 REDUCE CONSUMPTION OF NONRENEWABLE ENERGY SOURCES AND SUPPORT THE DEVELOPMENT AND UTILIZATION OF NEW ENERGY SOURCES.

Policies to achieve this goal are to:

NR14A. Provide an electric usage analysis and efficiency recommendations for those customers who request the service.

NR14B. Encourage electric utility customers to alter their consumption of electric power to reduce the City's overall and peak electric load.

NR14C. Explore the commercial viability of extracting natural gas resources within the vicinity of the Redding Municipal Airport.

NR14D. Continue current source-reduction, recycling, and composting programs that are contained in the joint County of Shasta, City of Redding, and City of Anderson Source Reduction and Recycling Element. (This element is not a part of this General Plan.)

NR14E. Encourage design that takes advantage of solar orientation and access.

AGRICULTURAL LANDS

The source of information on soils within the Planning Area used for this General Plan is limited to the soil maps prepared by the Natural Resource Conservation Service (NRCS) and the California Department of Conservation (CDC) Important Farmland Series Mapping and Monitoring Program.

The NRCS classification system organizes soils into eight major capability classes designated by Roman numerals I through VIII. Class I and II soils are considered "prime" and have the fewest limitations in terms of range of use. The other soil classifications have progressively greater natural limitations.

The CDC Important Farmland Series Mapping and Monitoring Program designates important farmlands in California based on NRCS soil surveys and available land use data. This system is also classified into eight categories including Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance, Grazing Land, Urban Land, Other Land, and Land Committed to Incompatible Uses. Acreages associated with each CDC system category and its percentage of the total acreage of the Planning Area are summarized in Table 9-1 in the *General Plan Background Report*.

According to the referenced information, there are approximately 5,019 acres of Prime Farmland within the Planning Area. These soils are depicted on Figure 3-5.

GOAL NR15

PROMOTE THE ECONOMIC VIABILITY OF AGRICULTURE IN AREAS SUITED FOR AGRICULTURAL USE.

Policies to achieve this goal are to:

NR15A. Protect existing prime agricultural soils outside the primary and secondary growth areas and freeway interchange areas with lot sizes (five acres and larger) capable of supporting agricultural operations.

NR15B. Discourage the cancellation of Williamson Act contracts until it is demonstrated that the lands with such contracts will be needed for urban development in the immediate future.

NR15C. Establish performance criteria to minimize impacts of urban development near existing income-producing agricultural lands on agricultural practices and reduce conflicts between urban and agricultural uses.

APPENDIX I

City of Redding Storm Drain Master Plan

(As Developed)

APPENDIX J

Attachment 4 from WQO 2003-0005-DWQ

Areas subject to high growth or serving a population of at least 50,000 must comply with the following provisions (for counties this threshold population applies to the population within the permit area).

A. RECEIVING WATER LIMITATIONS

1. Discharges shall not cause or contribute to an exceedance of water quality standards contained in a Statewide Water Quality Control Plan, the California Toxics Rule (CTR), or in the applicable RWQCB Basin Plan.

2. The permittees shall comply with Receiving Water Limitations A.1 through timely implementation of control measures and other actions to reduce pollutants in the discharges in accordance with the SWMP and other requirements of this permit including any modifications. The SWMP shall be designed to achieve compliance with Receiving Water Limitations A.1. If exceedance(s) of water quality objectives or water quality standards (collectively, WQS) persist notwithstanding implementation of the SWMP and other requirements of this permit, the permittees shall assure compliance with Receiving Water Limitations A.1 by complying with the following procedure:

   a. Upon a determination by either the permittees or the RWQCB that discharges are causing or contributing to an exceedance of an applicable WQS, the permittees shall promptly notify and thereafter submit a report to the RWQCB that describes BMPs that are currently being implemented and additional BMPs that will be implemented to prevent or reduce any pollutants that are causing or contributing to the exceedance of WQSs. The report may be incorporated in the annual update to the SWMP unless the RWQCB directs an earlier submittal. The report shall include an implementation schedule. The RWQCB may require modifications to the report.

   b. Submit any modifications to the report required by the RWQCB within 30 days of notification.

   c. Within 30 days following approval of the report described above by the RWQCB, the permittees shall revise the SWMP and monitoring program to incorporate the approved modified BMPs that have been and will be implemented, implementation schedule, and any additional monitoring required.

   d. Implement the revised SWMP and monitoring program in accordance with the approved schedule.

   So long as the permittees have complied with the procedures set forth above and are implementing the revised SWMP, the permittees do not have to repeat the same procedure for continuing or recurring exceedances of the same receiving water limitations unless directed by the RWQCB to develop additional BMPs.

B. DESIGN STANDARDS

Regulated Small MS4s subject to this requirement must adopt an ordinance or other document to ensure implementation of the Design Standards included herein or a functionally equivalent program that is acceptable to the appropriate RWQCB. The ordinance or other document must be adopted and effective prior to the expiration of this General Permit or, for Small MS4s designated subsequent to the Permit adoption, within five years of designation as a regulated Small MS4.

All discretionary development and redevelopment projects that fall into one of the following categories are subject to these Design Standards. These categories are:

- Single-Family Hillside Residences
- 100,000 Square Foot Commercial Developments
- Automotive Repair Shops
- Retail Gasoline Outlets
- Restaurants
- Home Subdivisions with 10 or more housing units
- Parking lots 5,000 square feet or more or with 25 or more parking spaces and potentially exposed to storm water runoff

1. Conflicts With Local Practices
   Where provisions of the Design Standards conflict with established local codes or other regulatory mechanism, (e.g., specific language of signage used on storm drain stenciling), the Permittee may continue the local practice and modify the Design Standards to be consistent with the code or other regulatory mechanism, except that to the extent that the standards in the Design Standards are more stringent than those under local codes or other regulatory mechanism, such more stringent standards shall apply.

2. Design Standards Applicable to All Categories

   a. Peak Storm Water Runoff Discharge Rates
      Post-development peak storm water runoff discharge rates shall not exceed the estimated pre-development rate for developments where the increased peak storm water discharge rate will result in increased potential for downstream erosion.

   b. Conserve Natural Areas
      If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

      1) Concentrate or cluster Development on portions of a site while leaving the remaining land in a natural undisturbed condition.
      2) Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
      3) Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

4) Promote natural vegetation by using parking lot islands and other landscaped areas.
5) Preserve riparian areas and wetlands.

c. Minimize Storm Water Pollutants of Concern
Storm water runoff from a site has the potential to contribute oil and grease, suspended solids, metals, gasoline, pesticides, and pathogens to the storm water conveyance system. The development must be designed so as to minimize, to the maximum extent practicable, the introduction of pollutants of concern that may result in significant impacts, generated from site runoff of directly connected impervious areas (DCIA), to the storm water conveyance system as approved by the building official. Pollutants of concern consist of any pollutants that exhibit one or more of the following characteristics: current loadings or historic deposits of the pollutant are impacting the beneficial uses of a receiving water, elevated levels of the pollutant are found in sediments of a receiving water and/or have the potential to bioaccumulate in organisms therein, or the detectable inputs of the pollutant are at concentrations or loads considered potentially toxic to humans and/or flora and fauna.

In meeting this specific requirement, "minimization of the pollutants of concern" will require the incorporation of a BMP or combination of BMPs best suited to maximize the reduction of pollutant loadings in that runoff to the Maximum Extent Practicable. Those BMPs best suited for that purpose are those listed in the *California Storm Water Best Management Practices Handbooks*; *Caltrans Storm Water Quality Handbook: Planning and Design Staff Guide*; *Manual for Storm Water Management in Washington State*; *The Maryland Stormwater Design Manual*; *Florida Development Manual: A Guide to Sound Land and Water Management*; Denver *Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices* and *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* , USEPA Report No. EPA-840-B-92-002, as "likely to have significant impact" beneficial to water quality for targeted pollutants that are of concern at the site in question. However, it is possible that a combination of BMPs not so designated, may in a particular circumstance, be better suited to maximize the reduction of the pollutants.

d. Protect Slopes and Channels
Project plans must include BMPs consistent with local codes, ordinances, or other regulatory mechanism and the Design Standards to decrease the potential of slopes and/or channels from eroding and impacting storm water runoff:

1) Convey runoff safely from the tops of slopes and stabilize disturbed slopes.
2) Utilize natural drainage systems to the maximum extent practicable.
3) Stabilize permanent channel crossings.
4) Vegetate slopes with native or drought tolerant vegetation, as appropriate.
5) Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion, with the approval of all agencies

with jurisdiction, e.g., the U.S. Army Corps of Engineers and the California Department of Fish and Game.

e. Provide Storm Drain System Stenciling and Signage
Storm drain stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets. The stencil contains a brief statement that prohibits the dumping of improper materials into the storm water conveyance system. Graphical icons, either illustrating anti-dumping symbols or images of receiving water fauna, are effective supplements to the anti-dumping message. All storm drain inlets and catch basins within the project area must be stenciled with prohibitive language (such as: "NO DUMPING – DRAINS TO OCEAN") and/or graphical icons to discourage illegal dumping.· Signs and prohibitive language and/or graphical icons, which prohibit illegal dumping, must be posted at public access points along channels and creeks within the project area.· Legibility of stencils and signs must be maintained.

f. Properly Design Outdoor Material Storage Areas
Outdoor material storage areas refer to storage areas or storage facilities solely for the storage of materials. Improper storage of materials outdoors may provide an opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the storm water conveyance system. Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the storm water conveyance system, the following Structural or Treatment BMPs are required:

1) Materials with the potential to contaminate storm water must be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the storm water conveyance system; or (2) protected by secondary containment structures such as berms, dikes, or curbs.
2) The storage area must be paved and sufficiently impervious to contain leaks and spills.
3) The storage area must have a roof or awning to minimize collection of storm water within the secondary containment area.

g. Properly Design Trash Storage Areas
A trash storage area refers to an area where a trash receptacle or receptacles (dumpsters) are located for use as a repository for solid wastes. Loose trash and debris can be easily transported by the forces of water or wind into nearby storm drain inlets, channels, and/or creeks. All trash container areas must meet the following Structural or Treatment Control BMP requirements (individual single family residences are exempt from these requirements):

1) Trash container areas must have drainage from adjoining roofs and pavement diverted around the area(s).
2) Trash container areas must be screened or walled to prevent off-site transport of trash.

h. Provide Proof of Ongoing BMP Maintenance

Improper maintenance is one of the most common reasons why water quality controls will not function as designed or which may cause the system to fail entirely. It is important to consider who will be responsible for maintenance of a permanent BMP, and what equipment is required to perform the maintenance properly. As part of project review, if a project applicant has included or is required to include, Structural or Treatment Control BMPs in project plans, the Permittee shall require that the applicant provide verification of maintenance provisions through such means as may be appropriate, including, but not limited to legal agreements, covenants, CEQA mitigation requirements and/or Conditional Use Permits.

For all properties, the verification will include the developer's signed statement, as part of the project application, accepting responsibility for all structural and treatment control BMP maintenance until the time the property is transferred and, where applicable, a signed agreement from the public entity assuming responsibility for Structural or Treatment Control BMP maintenance. The transfer of property to a private or public owner must have conditions requiring the recipient to assume responsibility for maintenance of any Structural or Treatment Control BMP to be included in the sales or lease agreement for that property, and will be the owner's responsibility. The condition of transfer shall include a provision that the property owners conduct maintenance inspection of all Structural or Treatment Control BMPs at least once a year and retain proof of inspection. For residential properties where the Structural or Treatment Control BMPs are located within a common area which will be maintained by a homeowner's association, language regarding the responsibility for maintenance must be included in the project's conditions, covenants and restrictions (CC&Rs). Printed educational materials will be required to accompany the first deed transfer to highlight the existence of the requirement and to provide information on what storm water management facilities are present, signs that maintenance is needed, how the necessary maintenance can be performed, and assistance that the Permittee can provide. The transfer of this information shall also be required with any subsequent sale of the property.

If Structural or Treatment Control BMPs are located within a public area proposed for transfer, they will be the responsibility of the developer until they are accepted for transfer by the County or other appropriate public agency. Structural or Treatment Control BMPs proposed for transfer must meet design standards adopted by the public entity for the BMP installed and should be approved by the County or other appropriate public agency prior to its installation.

i. Design Standards for Structural or Treatment Control BMPs
The Permittees shall require that post-construction treatment control BMPs incorporate, at a minimum, either a volumetric or flow based treatment control design standard, or both, as identified below to mitigate (infiltrate, filter or treat) storm water runoff:

1) Volumetric Treatment Control BMP

a) The 85th percentile 24-hour runoff event determined as the maximized capture storm water volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998); or
b) The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial/ Commercial, (2003); or
c) The volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for "treatment" that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event.

2) Flow Based Treatment Control BMP
   a) The flow of runoff produced from a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the area; or
   b) The flow of runoff produced from a rain event that will result in treatment of the same portion of runoff as treated using volumetric standards above.

Limited Exclusion
Restaurants and Retail Gasoline Outlets, where the land area for development or redevelopment is less than 5,000 square feet, are excluded from the numerical Structural or Treatment Control BMP design standard requirement only.

3. Provisions Applicable to Individual Priority Project Categories

   a. 100,000 Square Foot Commercial Developments

      1) Properly Design Loading/Unloading Dock Areas
      Loading/unloading dock areas have the potential for material spills to be quickly transported to the storm water conveyance system. To minimize this potential, the following design criteria are required:

         a) Cover loading dock areas or design drainage to minimize run-on and runoff of storm water.
         b) Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.

      2) Properly Design Repair/Maintenance Bays
      Oil and grease, solvents, car battery acid, coolant and gasoline from the repair/maintenance bays can negatively impact storm water if allowed to come into contact with storm water runoff. Therefore, design plans for repair bays must include the following:

a) Repair/maintenance bays must be indoors or designed in such a way that doesn't allow storm water runon or contact with storm water runoff.
b) Design a repair/maintenance bay drainage system to capture all washwater, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

3) Properly Design Vehicle/Equipment Wash Areas
The activity of vehicle/equipment washing/steam cleaning has the potential to contribute metals, oil and grease, solvents, phosphates, and suspended solids to the storm water conveyance system. Include in the project plans an area for washing/steam cleaning of vehicles and equipment. The area in the site design must be:

a) Self-contained and/ or covered, equipped with a clarifier, or other pretreatment facility, and
b) Properly connected to a sanitary sewer or other appropriately permitted disposal facility.

b. Restaurants

1) Properly Design Equipment/Accessory Wash Areas
The activity of outdoor equipment/accessory washing/steam cleaning has the potential to contribute metals, oil and grease, solvents, phosphates, and suspended solids to the storm water conveyance system. Include in the project plans an area for the washing/steam cleaning of equipment and accessories. This area must be:

a) Self-contained, equipped with a grease trap, and properly connected to a sanitary sewer.
b) If the wash area is to be located outdoors, it must be covered, paved, have secondary containment, and be connected to the sanitary sewer or other appropriately permitted disposal facility.

c. Retail Gasoline Outlets

1) Properly Design Fueling Area
Fueling areas have the potential to contribute oil and grease, solvents, car battery acid, coolant and gasoline to the storm water conveyance system. The project plans must include the following BMPs:

a) The fuel dispensing area must be covered with an overhanging roof structure or canopy. The canopy's minimum dimensions must be equal to or greater than the area within the grade break. The canopy must not drain onto the fuel dispensing area, and the canopy downspouts must be routed to prevent drainage across the fueling area.

b) The fuel dispensing area must be paved with Portland cement concrete (or equivalent smooth impervious surface), and the use of asphalt concrete shall be prohibited.
c) The fuel dispensing area must have a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of storm water to the extent practicable.
d) At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.

d. Automotive Repair Shops

1) Properly Design Fueling Area
Fueling areas have the potential to contribute oil and grease, solvents, car battery acid, coolant and gasoline to the storm water conveyance system. Therefore, design plans, which include fueling areas, must contain the following BMPs:

a. The fuel dispensing area must be covered with an overhanging roof structure or canopy. The canopy's minimum dimensions must be equal to or greater than the area within the grade break. The canopy must not drain onto the fuel dispensing area, and the canopy downspouts must be routed to prevent drainage across the fueling area.
b. The fuel dispensing area must be paved with Portland cement concrete (or equivalent smooth impervious surface), and the use of asphalt concrete shall be prohibited.
c. The fuel dispensing area must have a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of storm water to the extent practicable.
d. At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.

2) Properly Design Repair/Maintenance Bays
Oil and grease, solvents, car battery acid, coolant and gasoline from the repair/maintenance bays can negatively impact storm water if allowed to come into contact with storm water runoff. Therefore, design plans for repair bays must include the following:

a) Repair/maintenance bays must be indoors or designed in such a way that doesn't allow storm water run-on or contact with storm water runoff.
b) Design a repair/maintenance bay drainage system to capture all wash-water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is

prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

3) Properly Design Vehicle/Equipment Wash Areas
The activity of vehicle/equipment washing/steam cleaning has the potential to contribute metals, oil and grease, solvents, phosphates, and suspended solids to the storm water conveyance system. Include in the project plans an area for washing/steam cleaning of vehicles and equipment. This area must be:

   a) Self-contained and/or covered, equipped with a clarifier, or other pretreatment facility, and properly connected to a sanitary sewer or other appropriately permitted disposal facility.

4) Properly Design Loading/Unloading Dock Areas
Loading/unloading dock areas have the potential for material spills to be quickly transported to the storm water conveyance system. To minimize this potential, the following design criteria are required:

   a) Cover loading dock areas or design drainage to minimize run-on and runoff of storm water.
   b) Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.

e. Parking Lots

1) Properly Design Parking Area
Parking lots contain pollutants such as heavy metals, oil and grease, and polycyclic aromatic hydrocarbons that are deposited on parking lot surfaces by motor-vehicles. These pollutants are directly transported to surface waters. To minimize the offsite transport of pollutants, the following design criteria are required:

   a) Reduce impervious land coverage of parking areas.
   b) Infiltrate or treat runoff.

2) Properly Design To Limit Oil Contamination and Perform Maintenance
Parking lots may accumulate oil, grease, and water insoluble hydrocarbons from vehicle drippings and engine system leaks:

   a) Treat to remove oil and petroleum hydrocarbons at parking lots that are heavily used (e.g. fast food outlets, lots with 25 or more parking spaces , sports event parking lots, shopping malls, grocery stores, discount warehouse stores).
   b) Ensure adequate operation and maintenance of treatment systems particularly sludge and oil removal, and system fouling and plugging prevention control.

4. Waiver

   A Permittee may, through adoption of an ordinance, code, or other regulatory mechanism incorporating the treatment requirements of the Design Standards, provide for a waiver from the requirement if impracticability for a specific property can be established. A waiver of impracticability shall be granted only when all other Structural or Treatment Control BMPs have been considered and rejected as infeasible. Recognized situations of impracticability include, (i) extreme limitations of space for treatment on a redevelopment project, (ii) unfavorable or unstable soil conditions at a site to attempt infiltration, and (iii) risk of ground water contamination because a known unconfined aquifer lies beneath the land surface or an existing or potential underground source of drinking water is less than 10 feet from the soil surface. Any other justification for impracticability must be separately petitioned by the Permittee and submitted to the appropriate RWQCB for consideration. The RWQCB may consider approval of the waiver justification or may delegate the authority to approve a class of waiver justifications to the RWQCB EO. The supplementary waiver justification becomes recognized and effective only after approval by the RWQCB or the RWQCB EO. A waiver granted by a Permittee to any development or redevelopment project may be revoked by the RWQCB EO for cause and with proper notice upon petition.

5. Limitation on Use of Infiltration BMPs

   Three factors significantly influence the potential for storm water to contaminate ground water. They are (i) pollutant mobility, (ii) pollutant abundance in storm water, (iii) and soluble fraction of pollutant. The risk of contamination of groundwater may be reduced by pretreatment of storm water. A discussion of limitations and guidance for infiltration practices is contained in, *Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration, Report No. EPA/600/R-94/051, USEPA (1994).*

   In addition, the distance of the groundwater table from the infiltration BMP may also be a factor determining the risk of contamination. A water table distance separation of ten feet depth in California presumptively poses negligible risk for storm water not associated with industrial activity or high vehicular traffic.

   Site specific conditions must be evaluated when determining the most appropriate BMP. Additionally, monitoring and maintenance must be provided to ensure groundwater is protected and the infiltration BMP is not rendered ineffective by overload. This is especially important for infiltration BMPs for areas of industrial activity or areas subject to high vehicular traffic [25,000 or greater average daily traffic (ADT) on main roadway or 15,000 or more ADT on any intersecting roadway]. In some cases pretreatment may be necessary.

6. Alternative Certification for Storm Water Treatment Mitigation

   In lieu of conducting detailed BMP review to verify Structural or Treatment Control BMP adequacy, a Permittee may elect to accept a signed certification from a Civil Engineer or a Licensed Architect registered in the State of California, that the plan meets

the criteria established herein. The Permittee is encouraged to verify that certifying person(s) have been trained on BMP design for water quality, not more than two years prior to the signature date. Training conducted by an organization with storm water BMP design expertise (e.g., a University, American Society of Civil Engineers, American Society of Landscape Architects, American Public Works Association, or the California Water Environment Association) may be considered qualifying.

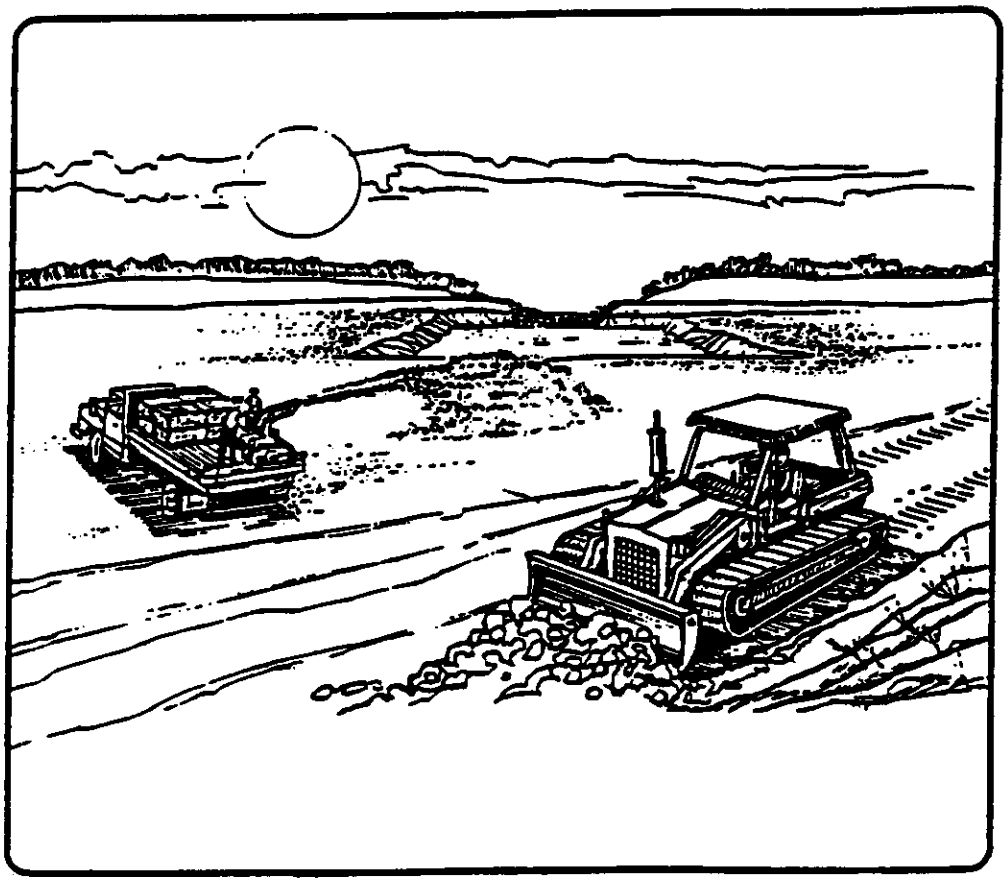
APPENDIX K

City of Redding Erosion and Sediment Control Standards Design Manual

CITY OF REDDING

EROSION AND SEDIMENT CONTROL STANDARDS

DESIGN MANUAL



Prepared by

John McCullah CPESC #311

Western Shasta Resource Conservation District

for the

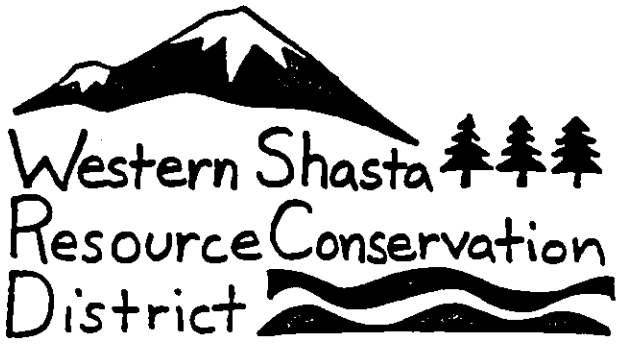
City of Redding Department of Public Works

Additional copies of the Erosion and Sediment Control Standards Design Manual are available from Western Shasta Resource Conservation District, 3179 Bechelli Ln., Suite 107, Redding, CA 96002 (916) 246-5252. Copies cost $28+$4 for shipping and handling. This manual is intended for periodic update. Sections may be changed as practices for erosion and sediment control evolve. The Western Shasta Resource Conservation District will attempt to keep the purchasers of this manual notified of any revisions.

Disclaimer

This manual provides minimum standards for erosion and sediment control from land disturbing activities associated with urban development within Shasta County. Additional information from professionals, agencies, organizations and institutions with expertise in a particular area may be useful in selecting, designing, and installing certain practices. This manual was reviewed and accepted by the City of Redding Public Works Department and the County of Shasta Department of Public Works.

The Western Shasta Resource Conservation District and the author make no warranty about the contents of this manual - they are not responsible or liable for any damage that results from the direct or indirect use of this manual.



EROSION AND SEDIMENT CONTROL STANDARDS DESIGN MANUAL

INTRODUCTION

PURPOSE OF THE STANDARDS

The purpose of the City of Redding Erosion and Sediment Control standards is to provide the minimum requirements to control water quality impacts from accelerated erosion due to construction activities. These practices, standards, and specifications were compiled to address the erosion, sedimentation, and water quality problems associated with site development within Shasta County and the City of Redding.

The standards and specifications were developed from accepted industry standards and largely adapted from the USDA Soil Conservation Service standards and specifications, the ABAG Manual of Standards for Erosion and Sediment Control Measures, the North Carolina Erosion and Sediment Control Planning and Design Manual, the Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky, the Handbook of Best Management Practices by Tahoe Regional Planning Agency.

The intent of this manual is to show what practices are effective in reducing erosion and sedimentation in Shasta County, how to install those practices, where they should be placed, and when they should be installed and maintained. It was not the intent to provide all the design criteria needed for example: to determine soil loss, to calculate runoff, to design a stable channel, or to determine the maximum permissible velocity for a given soil type. There are many engineering design manuals available that show these calculations and provide the necessary design tables.There is a list of references provided that give a more in-depth understanding of the erosion and sediment control practices discussed in this manual and they are a source of the required engineering design criteria. It is assumed that the professional engineer, erosion control specialist, or soil scientist preparing the erosion control plans will have the access to and the expertise to use the engineering design material when necessary. The Shasta County Development Standards provide a method for hydrology analysis of small watersheds and some precipitation isopluvial maps.

PRINCIPLES OF EROSION AND SEDIMENT CONTROL

The following are principles for controlling erosion and off-site sedimentation from construction sites:

- fit the development to the existing topography, soils, and vegetation as much as is possible;

- schedule construction operations in order to minimize soil exposure during the rainy season;
- minimize disturbance and soil exposure by retaining natural vegetation adopting phased construction techniques, and using temporary cover;
- vegetate and mulch all denuded areas to protect the soil from winter rains. The primary effort for controlling sediment pollution from construction sites should be minimizing raindrop impact on bare soil;
- utilize proper grading, barriers, or ditches to minimize concentrated flows and divert runoff away from denuded slopes or other critical areas;
- minimize the steepness of slopes and control the length of slopes by utilizing benches, terraces, contour furrows, or diversion ditches;
- utilize riprap, channel linings, or temporary structures in the channel to slow runoff velocities and allow the drainageways to handle the increased runoff from disturbed areas;
- keep the sediment on-site by utilizing sediment basins, traps, or sediment barriers;
- monitor and inspect sites frequently to assure the measures are functioning properly and correct problems promptly.

Vegetation as a Solution

Dense, healthy vegetation and the associated leaf litter protects the soil from raindrop impact. Raindrop impact is a major force in dislodging soil particles which then allows them to move downslope. The dislodged soil particles often form a crust on the soil surface. When this crust forms the soil infiltration rate decreases and runoff increases. As runoff increases so does surface erosion.

Vegetation also protects the soil from sheet and rill erosion. It shields the soil surface from the transport of soil particles and scour from overland flow (sheet flow) and it decreases the erosive energy of the flowing water by reducing velocity.

The shielding effect of the plant canopy and leaves is augmented by roots and rhyzomes that hold the soil in place, improve the soils physical condition, and increase the rate of infiltration, further decreasing runoff. Plants also remove water from the soil through transpiration, thus increasing its capacity to absorb water.

Suitable vegetative cover provides excellent erosion protection, and reduces the need for high cost, low efficiency, high maintenance sediment control measures. Vegetative cover is relatively inexpensive to achieve and tends to be self-healing; it is often the only practical, long-term solution of stabilization and erosion control on most disturbed sites.

Initial investigation of site characteristics and planning for vegetation stabilization reduces its cost, minimizes maintenance and repair, and makes other erosion and sediment control measures more effective and less costly to maintain. Permanent erosion control (post-construction landscaping) is also less costly where soils have not been eroded.

Exposed subsoils are generally, difficult to amend, are infertile, and require more irrigation. Natural, undisturbed areas can provide low-maintenance landscaping, shade, and privacy. Large trees increase property values when they are properly protected during construction.

Besides preventing erosion, healthy vegetative cover provides a stable land surface, reduces heat reflectance and dust, restricts weed growth, and complements architecture. The result is a pleasant environment for employees, tenants and customers, and an attractive site for homes.

Property values can be increased dramatically by small investments in erosion control. The final landscaping represents a small fraction of total construction costs, but can contribute greatly to an increased market value of the development. Healthy vegetation and planned development will reduce concentrated flows and peak discharge, thus reducing channel erosion and flooding. Good, healthy vegetative cover greatly reduces the environmental impacts that poor water quality and habitat reduction is having on rivers and streams.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA

EROSION AND SEDIMENT CONTROL PLANS

The erosion control plan shall be submitted with the grading plan as per stipulations in the grading ordinance. The ordinance requires the applicant to provide a **final** erosion plan, which shall be approved prior to the commencement of any work, and shall be implemented upon completion of the project.

If work will not be completed by October 15, and the permit does not allow work to continue during the wet weather season (Oct 15 through April 15), then a **closure** plan shall be required as a condition of the permit.

If the permit allows work to be done during the wet weather season, the permit shall require a **wet weather (Interim)** operating and erosion control plan. This plan must be approved prior to the commencement of any work and include all necessary temporary and permanent erosion control measures, including those to be followed should the work stop at any time during the wet weather season.

If the site or portion of the site is planned to be idle for more than 45 days, then vegetative stabilization must be accomplished within seven days. The wet weather plan shall include a plan for the immediate (within 24 hours of the first forecast of a storm front) installation of emergency erosion control measures.

GUIDELINES FOR EROSION CONTROL PLANS

PLAN PREPARER

For any project which disturbs more than 5 acres or where the Public Works Director determines that the project may adversely impact a watercourse, the plan shall be prepared by:

- a Registered Civil Engineer experienced in erosion control ;
- a Certified Professional Soil Erosion and Sediment Control specialist (CPESC) ;
- or a Soil Scientist certified by the American Registry of Certified Professionals in Agronomy, Crops, and Soils.

CONTENT

The plan shall consist of three parts:

a. A **narrative**, containing:

- a brief description of the proposed land-disturbing activities, existing site conditions, and adjacent areas (such as creeks and

buildings) that might be affected by the proposed clearing and grading;
- a description of critical areas on the site—areas that have a potential for serious erosion problems, including the name, location and aerial extent of moderate and highly erodible soils and slopes on the project site.
- the date grading will begin and the expected date of stabilization;
- a brief description of the measures that will be used to control erosion and sedimentation on the site and when these measures will be implemented;
- a description of an inspection and maintenance program, with provisions for frequency of inspection, reseeding, repair and reconstruction of damaged structures, cleanout and disposal of trapped sediment, duration of maintenance program, and final disposition of the measures when site work is complete.

b. A **map** showing:

- existing site contours at an interval and scale sufficient for distinguishing runoff patterns before and after disturbance;
- final contours;
- a legend, if necessary;
- limits of clearing and grading;
- existing vegetation, such as grassy areas or vegetative buffers, that may reduce erosion or off-site sedimentation;
- critical areas within or near the project site, such as streams, lakes, wetlands, or the aerial extent of erodible soils;
- the location and types of erosion and sediment control measures, including the aerial extent of vegetative treatments.

c. **Plan details**, including:

- detailed drawing of erosion and sediment control structures and measures, showing dimensions, materials, and other important details;
- design criteria and calculations such as design particle size for sediment basins and peak discharge for channel design and outlets;
- seeding or vegetative specifications;
- inspection and maintenance notes.

Narrative and details shall be placed on Erosion Control Plan map if possible.

PLAN CHECK

General Approach

Responsibility: It is not the responsibility of the plan reviewer to ensure that the plan is appropriate for the level of work suggested by the proposed project. The reviewer can only ensure that the plan meets the minimum standards set by the reviewing agency and its authorizing ordinance.

Communications: Encourage informal communications between the plan reviewer and the plan preparer. This will enable the reviewer to make informal suggestions that may save the developer money and the preparer time, and it may result in a better, more effective plan. It will also enable the preparer to explain and justify the plan.

Incomplete Plans: Do not review seriously incomplete plans. Send them back with a request for the missing information.

Required Information: Make sure all the required information has been submitted. A checklist can be used by both plan reviewers and plan preparers, however, checklists can encourage laziness. Having everything checked off does not necessarily mean that everything is in order. (see pp. 11&12)

Plan Concept: The concept should be examined first, starting with the general and moving to the specific. Does the plan make sense?

Schedule: Examine the construction schedule. Will grading be completed before the wet weather season or before the summer thunderstorm months? When will storm drainage facilities, paving, and utilities be installed in reference to the wet weather season? If grading will take place during months when there is a high probability of heavy rains, what extra precautions will be taken to protect against erosion, sedimentation, and changing drainage patterns (Is a Wet Weather Plan necessary)?

Minimize Disturbance: Does the plan show areas that are <u>not</u> to be disturbed? If possible, native vegetation to be retained and stream buffer areas should be designated on the plan and flagged in the field. A well-conceived erosion control plan will minimize erosion by attempting to minimize disturbance and retain natural vegetation. A phased approach to development can assure that the extent and timing of grading does not exceed the contractors ability to perform erosion and sediment control.

Site Drainage: Make sure you understand where all drainage comes from on and above the site, where it goes, and how it traverses the site. For large sites, require or prepare a drainage area map. If drainage patterns are unclear, ask for clarification.

Sediment Basins and Traps: Locate all sediment basins and traps and define their tributary areas. Erosion control within areas that drain to sediment barriers need not be as intensive as within areas not so protected.

Erosion Control: Check the method used to prevent erosion. Hydraulic seeding and mulching may adequately stabilize some areas, but other areas, because of their proximity to sensitive features such as watercourses, or their steepness and erosive soil, may need far more intensive revegetation efforts. On steep and critical slopes, a reliable backup system for hydraulic seeding, such as punched straw, is strongly recommended.

Channels and Outlets: Examine all drainageways where concentrated flows will occur. Be sure adequate erosion protection is provided both along channels and at channel and pipe outlets. Check the sources of runoff to be sure that all the runoff comes from undisturbed or stabilized areas or has been desilted by sediment basins or other sediment retention devices.

Miscellaneous: Look for haul roads, stockpile areas, and borrow areas. They are often overlooked and can have a substantial effect on drainage patterns. Have construction or access roads been surfaced with rock, as a minimum treatment, before the rainy season? Look at all points of vehicle access to the site and be sure mud and dirt will not be tracked onto paved streets and that sediment-laden runoff will not escape from the site at these points. Pay particular attention to watercourses and their protection.

Plan Details: Once the plan concept has been shown to be adequate, check the details to be sure the concept is adequately described in the plans.

Structural Details: Be sure that sufficiently detailed drawings of each structure (sediment basin, dike, ditch, silt fence, etc.) are included so there is no doubt about location, dimensions, or method of construction.

Calculations: Determine if calculations have been submitted to support the capacity and structural integrity of all structures. Were the calculations made correctly? Non-engineered structures, such as straw bale barriers, do not generally need hydrologic calculations, however, supporting information such as drainage area and peak flow should be available if requested.

Vegetation: Review seed, fertilizer, and mulch specifications. Check quantities and methods of application to be sure they are appropriate and consistent with local guidelines. Are there stipulations so that ineffective revegetation and/or damage can be remedied immediately?

Maintenance: Be sure that general maintenance requirements and, where necessary, specific maintenance criteria, such as the frequency of sediment basin cleaning, are included. Are there stockpiles of spare materials (filter fabric, straw bales, stakes, gravel, etc.) to repair damaged control measures? Routine maintenance inspections should be part of the plans.

Contingencies: The plan must provide for unforseen field conditions, scheduling delays, and other situations that may affect the assumed conditions. For example, straw mulch may need to be installed as an emergency measure during severe summer thunderstorms, or sediment basins may need to be cleaned more frequently.

Technical Review: Where applicable, the erosion and sediment control plan should be reviewed by the soils or geotechnical consultant for the project.

Signature: Where applicablehe erosion and sediment control plan should be signed by the preparer who shall be a qualified professional as listed in these standards.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

CHECKLIST FOR EROSION CONTROL PLANS

Narrative

- ☐ **Project description** A brief description of the nature and purpose of the land-disturbing activity and the amount of grading involved.
- ☐ **Existing site conditions** A description of the existing topography, vegetation, and drainage.
- ☐ **Adjacent areas** A description of neighboring areas, such as streams, lakes, residential areas, and roads that might be affected by the land disturbance.
- ☐ **Soils** A brief description of the soils on the site including erodibility and particle size distribution (texture).
- ☐ **Critical areas** A description of areas within the developed site that have potential for serious erosion or sediment problems.
- ☐ **Erosion and sediment control measures** A description of the methods that will be used to control erosion and sediment on the site. Temporary erosion control, and temporary sediment control measures. Who will be responsible for implementation? Financial guarantees may be required to assure proper implementation.
- ☐ **Permanent stabilization** A brief description of how the site will be stabilized after construction is completed. Permanent erosion control.
- ☐ **Maintenance** A schedule of regular inspections and repairs of erosion and sediment control structures, who is responsible for maintenance.

Map

The following information should appear on one or more maps:

- ☐ **Existing contours** Existing elevation contours of the site at an interval sufficient to determine drainage patterns.
- ☐ **Preliminary and final contours** Proposed changes in the existing elevation contours for each stage of grading.
- ☐ **Existing vegetation** Locations of trees, shrubs, grass, and unique vegetation.
- ☐ **Soils** Boundaries of the different soil types within the proposed development.
- ☐ **North arrow**
- ☐ **Vicinity Map**
- ☐ **Critical areas** Areas within or near the proposed development with potential for serious erosion or sediment problems.

☐ **Existing and final drainage patterns** A map showing the dividing lines and the direction of flow for the different drainage areas before and after development, and how well off-site water passes through the site without contamination.

☐ **Limits of clearing and grading** A line showing the areas to be disturbed, and proposed buffer strips.

☐ **Erosion and sediment control measures** Locations, names, and dimensions of the proposed temporary and permanent erosion and sediment control measures.

☐ **Storm drainage system** Location of permanent storm drain inlets, pipes, outlets, and other permanent drainage facilities (swales, waterways, etc.), and sizes of pipes and channels.

Details

☐ **Detailed drawings** Enlarged, dimensioned drawings of such key features as sediment basin risers, energy dissipators, waterway cross sections, and sediment barriers.

☐ **Seeding and mulching specifications** Seeding dates, seeding, fertilizing, and mulching rates in pounds per acre, and application procedures.

☐ **Maintenance program** Inspection schedule, spare materials needed, stockpile locations, and instructions for sediment removal and disposal and for repair of damaged structures.

Calculations

☐ **Calculations and assumptions** Data for design storm used to size pipes and channels and sediment basins and traps [e.g., 10-year, 6-hour storm = 3.1 in.; i_{peak} = 2.6 in./hr.], design particle size for sediment trap efficiencies, basin discharge rates, size and strength characteristics for filter fabric, wire mesh, fence posts, etc., and other calculations necessary to support drainage, erosion, and sediment control systems.

☐ **Attachments** The erosion control plan shall be accompanied with a grading plan.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA. Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

STANDARDS and SPECIFICATIONS for EROSION and SEDIMENT CONTROL MEASURES

Section A: Site Preparation Standards

Site preparation standards are probably the most effective erosion control practices. These are the planning standards. By planning for erosion control we can often avoid costly measures and mitigations. Construction activities scheduled between April 15 and Oct 15 require no erosion control practices other than stating on the plan what the proposed schedule is and what will be done if the construction schedule is extended into the winter months. If areas of a construction site are not disturbed and designated as such on the plan, then those areas need not be treated with erosion control. If construction is phased so that sensitive areas are not to be disturbed during the winter, then those areas need not be treated. Reducing the disturbed area can mean the difference between having to construct and maintain a large sediment basin or install a series of sediment barriers. Maintaining vegetation on the site will reduce erosion and may reduce future vegetative and landscape costs.

The other practices in this section, such as Surface Roughening and Topsoiling, are planned construction activities that will ensure the temporary and permanent vegetation will have a better chance of success and be easier to install.

STANDARD

CONSTRUCTION SCHEDULES AND SEQUENCING

Definition: Construction schedules and sequencing is a planning tool that coordinates the timing and phases of land-disturbing activities with expected weather patterns and appropriate erosion and sediment control measures.

Purpose: A construction schedule shows a conscious effort to phase construction in order to reduce on-site erosion and off-site sedimentation by assuring that land-disturbance activities and erosion and sediment control measures are completed in accordance with a planned schedule. A **construction schedule** is required on all erosion and sediment control plans in order to determine the extent of erosion control planning that is necessary. **Construction sequencing** is necessary to assure that erosion and sediment control practices are effectively coordinated with land disturbance and wet weather. **A very effective erosion control measure is to not schedule construction or land disturbance from October 15 to April 15.**

Planning Considerations:

- Designate areas of no disturbance. The removal of existing vegetation and ground cover leaves the site vulnerable to erosion by winter storms and mid-summer thunderstorms.

- Construction access should not damage valuable trees or disturb designated buffer zones. (see Minimize Disturbance and Buffer Strips)

- Install principal sediment control measures before major site grading takes place.

- Locate key runoff-control measures in conjunction with sediment traps to divert water from undisturbed areas out of the traps and sediment-laden water into the traps. Install diversions above areas to be disturbed prior to grading. Place necessary perimeter dikes with stable outlets before opening major areas for development. Install additional needed runoff control measures as grading takes place.

- Install the main runoff conveyance system with inlet and outlet protection devices early, and use it to convey storm runoff through the development site without creating gullies and washes. Install inlet protection for storm drains as soon as the drain is functional to trap sediment on-site in shallow pools and to allow flood flows to

safely enter the storm drainage system. (see Drop and Curb Inlet Sediment Barriers) Install outlet protection at the same time as the conveyance system to prevent damage to the receiving stream. (see Energy Dissipators)

Normally, install stream stabilization, including necessary stream crossings, independently and ahead of other construction activities. (Any stream disturbance requires a 1603 permit from California Department of Fish and Game.) It is usually best to schedule this work as soon as weather conditions permit. Site clearing and project construction increases storm runoff, often making streambank stabilization work more difficult and costly.

- Begin land clearing and grading as soon as key erosion and sediment control measures are in place. Once a scheduled development area is cleared, grading should follow immediately so that protective ground cover can be reestablished quickly. Do not leave any area bare and exposed for extended periods. Leave adjoining areas planned for development, or to be used for borrow and disposal, undisturbed as long as possible to serve as natural buffer zones.

- Runoff control is essential during the grading operation. Temporary diversions, slope drains, and inlet and outlet protection installed in a timely manner can be very effective in controlling erosion during this critical period of development.

- Immediately after land clearing and grading, apply surface stabilization on graded areas, channels, dikes and other disturbed areas. Apply vegetative stabilization (i.e. mulch and/or temporary seeding) within seven days to any portion of the site that is planned to be idle for more than 45 days. Install permanent stabilization measures immediately after final grading, in accordance with the vegetative plan. Temporary seeding and/or mulching may be necessary during extreme weather conditions and permanent measures may be delayed for a more suitable time.

- Coordinate building construction with other development activities so that all work can take place in an orderly manner and on schedule. Experience shows that careful project scheduling improves efficiency, reduces cost, and lowers the potential for erosion and sedimentation problems.

- Permanent erosion control and landscaping are the last major construction phases, but the topsoil stockpiling, tree preservation, undisturbed buffer area, and well-planned road locations established earlier in the project may determine the ease or difficulty of this activity. All disturbed areas should have permanent stabilization practices applied. Unstable sediment should be removed from sediment basins and traps. All temporary structures

should be removed after the area above has been properly stabilized. Borrow and disposal areas should be permanently vegetated or otherwise stabilized.

In planning construction work, it may be helpful to outline all land-disturbing activities necessary to complete the proposed project. Then list all practices needed to control erosion and sedimentation on the site. These two lists can then be combined in logical order to provide a practical and effective construction sequence schedule.

Design Criteria: The construction sequence schedule shall show the following:

- principal development activities,
- The date of initial land disturbance and the duration of the project.
- If a wet weather plan is required, the date when the site will be stabilized (winterized) with temporary erosion control.
- Timely construction techniques that can reduce the erosion potential of the site. When areas will be exposed and when they will be protected with temporary cover.
- the erosion and sedimentation control practices to be installed,
- compatibility with the general construction schedule of the contract.
- When and where erosion materials will be stockpiled on-site and when they will be deployed.
- Stages of grading so that only small areas are exposed at any one time; only the areas that are actively being developed should be exposed. As soon as grading is complete in one area, seed and/or mulch or otherwise protect the exposed soils.
- The date when permanent erosion control will be in place.
- The inspection and maintenance periods for the project.

There are many timely construction techniques that can reduce the erosion potential of a site, such as: (1) shaping earthen fills daily to prevent overflows and (2) constructing temporary diversions ahead of anticipated storms. These types of activities cannot be put on the construction sequence schedule but should be used whenever possible.

Using planned construction sequence scheduling to control erosion will help keep field personnel aware of the possibilities of erosion prevention through construction management.

Maintenance: Follow the construction sequence throughout project development. When changes in construction activities are needed, amend the sequence schedule in advance to maintain management control.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA

STANDARD

WET WEATHER INTERIM PLAN

Definition: A wet weather plan is a detailed erosion and sediment control plan and construction sequence schedule that clearly shows how construction will progress after October 15, delineating each phase of construction.

Purpose: To assure that construction activities during the rainy season does not produce accelerated erosion on and sedimentation from the construction site.

Construction Schedule: Construction procedures that limit land clearing, provide the timely installation of erosion and sediment controls, and quickly restore protective covers can significantly reduce the erosion potential of a site.

Design Considerations:

- proximity of the site to streams, waterways, storm sewers or other sediment delivery systems.
- erosive nature of the soils.
- extent and nature of ground disturbance.
- how the site will be stabilized at the end of each day and/or before an ensuing storm.
- ability of construction personnel to effectively implement erosion practices.
- the time of land disturbance and the duration of that disturbance.
- how temporary erosion measures can be cost-effectively (blended into) the overall project.

Specifications: The plans shall clearly show:

- labeling as a Wet Weather Interim Plan—a temporary erosion control plan for winter operations.
- a narrative how erosion will be minimized, how sediment will be kept on-site, and how the site will be protected if and when a storm approaches.
- what is the anticipated construction schedule and what is the sequencing and schedule for erosion and sediment control installations.
- the frequency of inspections, by whom, and when the necessary repairs and maintenance of the erosion and sediment control practices will be conducted. Plan may include a financial guarantee.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA

STANDARD

MINIMIZE DISTURBANCE AND BUFFER STRIPS

Definition: Minimizing disturbance and maintaining buffer strips is a planning process which retains natural vegetative cover and also maintains watercourse vegetative buffer strips.

Purpose: Erosion can be reduced 98% by protecting the soil from raindrop impact. Existing native vegetation usually provides the best soil protection. One of the most effective erosion control measures is to only disturb areas immediately needed for construction.

Water quality and wildlife habitat degradation can be greatly reduced by maintaining streamside buffer strips and riparian corridors. These buffer strips act to filter sediment from the surface runoff before it reaches the watercourse.The small drainages and intermittent streams are the sediment delivery systems to the rivers and lakes. If sediment can be kept out of the delivery systems, by maintaining buffer strips, then the sediment will not impact the fisheries.

Planning Considerations:

- Existing native vegetation shall be incorporated into the final landscape plan. It is adapted to the site, drought tolerant, and will provide shade and erosion protection. Shrubs or trees can be thinned and pruned for beauty and fire hazard reduction.
- Existing trees may be protected as per tree preservation ordinances or other development requirements.
- If the area is not disturbed then it does not require erosion control and concentrated flows down slope will be greatly reduced.
- Maintain and preserve riparian and naturally vegetated buffer strips along watercourses.
- Buffer strips around the perimeter of a site can reduce or eliminate off-site sedimentation.
- Alteration of a lake or streambed requires a permit from the California Department of Fish and Game.

Design Criteria:

- Designate areas of no disturbance. Clearly show on the plans, and flag in the field areas of no disturbance and construction vehicle exclusion.

- Designate trees and shrubs that are to be preserved.

- Designate watercourse buffer-filter strips. The following criteria is a temporary guide for the width of buffer strips. The California department of Fish and Game is presently completing a riparian zone mapping program. The mapping project may supersede or nullify these guidelines.

  For slopes up to 15% and adjacent to:

  Sacramento River—150 feet from the top of bank or
  75 feet from the edge of riparian vegetation,
  whichever is greater

  Main tributaries (Churn Creek, Middle Creek, Cow Creek, etc.)
  100 feet minimum
  50 feet from edge of riparian vegetation

  Side tributaries
  50 feet minimum
  25 feet from the edge of riparian vegetation

  Intermittent streams
  25 foot buffer from the edge of the channel

  The Guide to Small Roads, USDA-SCS, also provides information for sizing buffer strips. The width of a buffer strip between a road and the stream is recommended to be 50 feet plus four times the slope of the land in percent, measured between the road and the top of stream bank.

  Buffer width in feet = 50 + 4(%slope).

  Example: For a 10% slope, buffer length is 50ft. + (4)(10) = 90ft.

  Contact California Fish and Game for specific recommendations and 1603 permits if required.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA;
California Department of Fish and Game, Redding CA and the Guide to Small Roads;USDA, Soil Conservation Service

STANDARD

LAND GRADING FOR MINIMIZING EROSION

Definition: Land grading for minimizing erosion is grading that is intended to minimize the impacts of surface erosion and runoff.

Purpose: Where land grading is necessary for road or building construction, these land grading practices minimize the erosion potential and facilitate plant establishment.

Design Considerations: Design considerations should include the following:

- existing contours;
- land use;
- vegetation;
- soil;
- drainage;
- slope stability;
- slope length;
- slope angle;
- space limitations;
- erosion potential of land disturbance;
- erosion and sediment control measures implementability.

Development should fit existing topography as much as possible so that land disturbance is minimized.

Slope steepness and excessive slope lengths should be kept to a minimum. Benches, steps, or contour furrows can be installed on long slopes to break up the slope length. A bench should be graded back towards the slope and drain with a gentle gradient to a stable outlet.

Drainage from upland areas should be diverted away from exposed slopes.

The surfaces of cut and fill slopes should be left rough or should be serrated so that they hold seeds well and allow for good plant establishment.

Construction Specifications:

1. All graded or disturbed areas including slopes shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized.

2. All sediment control measures shall be constructed and maintained in accordance with the approved erosion and sediment control plan and the standards and specifications for the appropriate erosion control practices.

3. If topsoil is required for the establishment of vegetation, it shall be stockpiled in the amount necessary to complete finished grading of all exposed areas.

4. Areas to be filled shall be cleared, grubbed to remove trees, vegetation, roots and other objectionable material, and stripped of topsoil.

5. Areas to receive topsoil shall be scarified to a minimum depth of 3 inches prior to placement of topsoil.

6. All fills shall be compacted as required by building standards to reduce erosion, slippage, settlement, subsidence and other related problems. Fill intended to support buildings, structures, conduits, etc., shall be compacted in accordance with local requirements or codes.

   The outer face of the fill slope should be allowed to stay loose, not rolled, compacted, or bladed smooth. A bulldozer may run up and down the fill slope so the dozer treads (cleat tracks) create grooves perpendicular to the slope. If the soil is not too moist, excessive compaction will not occur.(see Surface Roughening)

7. All fill shall be placed and compacted in layers not to exceed 8 inches per lift.

8. Except for approved landfills, fill material shall be free of brush, rubbish, rocks, logs, stumps, building debris and other objectionable materials that would interfere with or prevent construction of satisfactory fills.

9. Use slope breaks, such as diversions, benches, or contour furrows as appropriate, to reduce the length of cut-and-fill slope to limit sheet and rill erosion and prevent gullying. All benches shall be kept free of sediment during all phases of development.

10. Slopes to be maintained by tractor or other equipment should not be steeper than 3:1. Slopes in excess of 2:1 may require hydroseeding, hydromulching, tackifying, and/or "punch-in" straw, special vegetation, or retaining walls. Roughen the surface of all slopes during the construction operation to retain water, increase infiltration, and facilitate vegetation establishment.

11. Seeps or springs encountered during construction shall be handled in accordance with approved methods.

12. Stabilize all graded areas with vegetation, crushed stone, riprap, or other ground cover as soon as grading is completed or if work is interrupted for 30 working days or more. Use mulch to stabilize areas temporarily where final grading must be delayed. The finished cut-and-fill slopes, which are to be vegetated with grass and legumes, should not be steeper than 2:1.

13. Stockpiles, borrow areas and spoil areas shall be shown on the plans and shall be subject to the provisions of this standard and sample specifications. (see Topsoiling)

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

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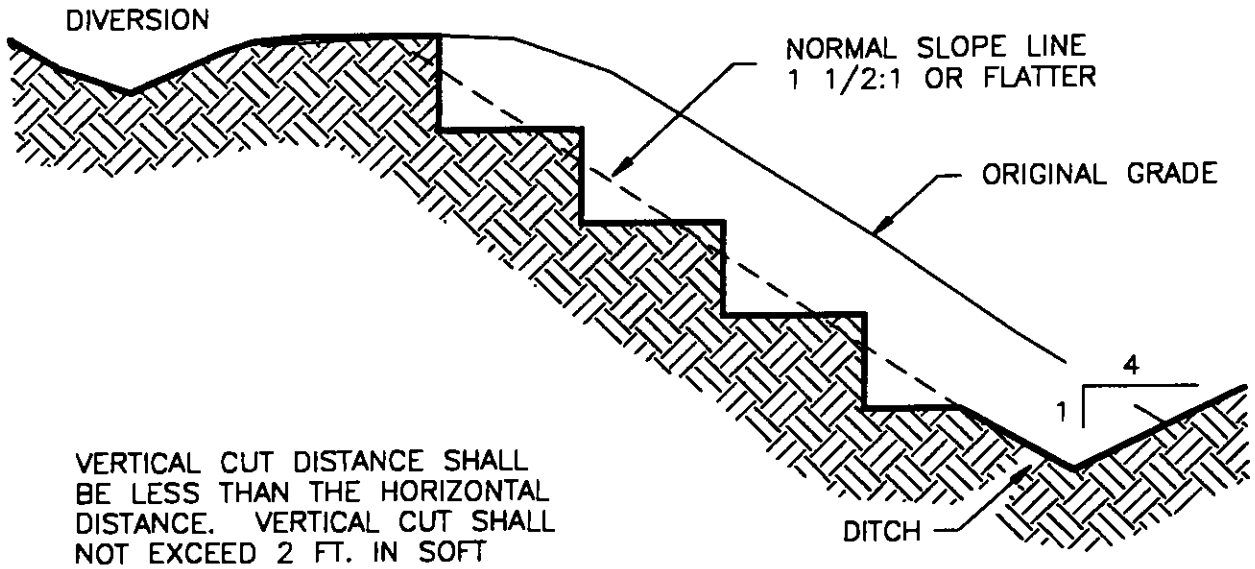
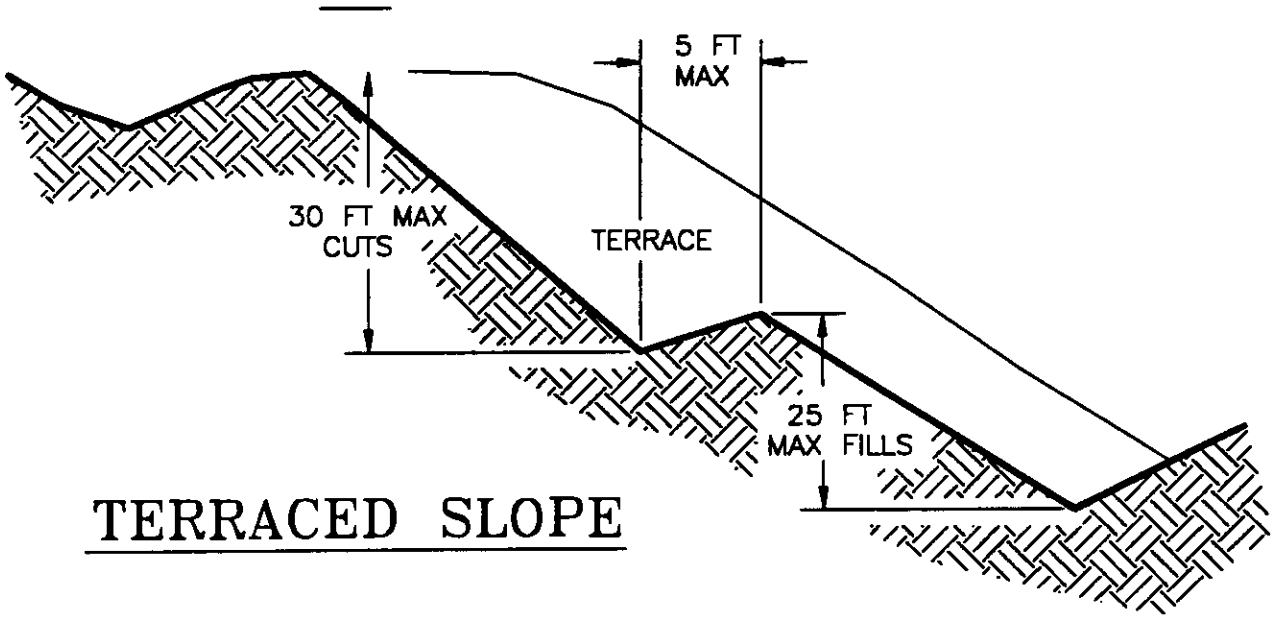


VERTICAL CUT DISTANCE SHALL BE LESS THAN THE HORIZONTAL DISTANCE. VERTICAL CUT SHALL NOT EXCEED 2 FT. IN SOFT MATERIAL AND 3 FT. IN ROCKY MATERIAL.

STEPPED SLOPE



TERRACED SLOPE

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STEPPED OR TERRACED SLOPE

STANDARD

SURFACE ROUGHENING

Definition: Roughening a bare soil surface with furrows running across the slope, stair stepping, or tracking with construction equipment.

Purpose: To aid the establishment of vegetative cover from seed, to reduce runoff velocity and increase infiltration, and to reduce erosion and provide for sediment trapping.

Conditions Where Practice Applies: All construction slopes require surface roughening to facilitate stabilization with vegetation, particularly slopes steeper than 3:1.

Planning Considerations: Rough slope surfaces are preferred because they aid the establishment of vegetation, improve water infiltration, and decrease runoff velocity. Graded areas with smooth, hard surfaces may be initially attractive, but such surfaces increase the potential for erosion. A rough, loose soil surface gives a mulching effect that provides more favorable moisture conditions than hard, smooth surfaces; this aids seed germination.

There are different methods for achieving a roughened soil surface on a slope, and the selection of an appropriate method depends upon the type of slope. Roughening methods include stair-step grading, furrowing, and tracking. Factors to be considered in choosing a method are slope steepness, mowing requirements, and whether the slope is formed by cutting or filling.

Construction Standards:

Cut slope roughening for areas not to be mowed: Stair-step grade or groove cut slopes with a gradient steeper than 3:1.

Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.

Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.

Do not make individual vertical cuts more than 2 feet high in soft materials or more than 3 feet high in rocky materials.

Grooving uses machinery to create a series of ridges and and depressions that run across the slope (on the contour).

Fill slope roughening for areas not to be mowed: Place fill slopes with a gradient steeper than 3:1 in lifts not to exceed 9 inches, and make sure each lift is properly compacted. Ensure that the face of the slope consists of loose, uncompacted fill 4 to 6 inches deep. Use grooving or tracking to roughen the face of the slopes, if necessary. Apply seed, fertilizer and straw mulch then track or punch in the mulch with the bulldozer. (see Mulching)

Do not blade or scrape the final slope face.

Cuts, fills, and graded areas that will be mowed: Make mowed slopes no steeper than 3:1.

Roughen these areas to shallow grooves by normal tilling, disking, harrowing, or use of cultipacker-seeder. Make the final pass of any such tillage implement on the contour.

Make grooves formed by such implements close together (less than 10 inches) and not less than 1 inch deep.

Excessive roughness is undesirable where mowing is planned.

Roughening with tracked machinery: Limit roughening with tracked machinery to sandy soils to avoid undue compaction of the soil surface. Tracking is very effective to "punch-in" straw mulch into soil with a sand component.

Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.

Seeding: Immediately seed and mulch roughened areas to obtain optimum seed germination and growth.

Maintenance: Periodically check the seeded slopes for rills and washes. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA, adapted from North Carolina Erosion and Sediment Control Planning and Design Manual.and Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

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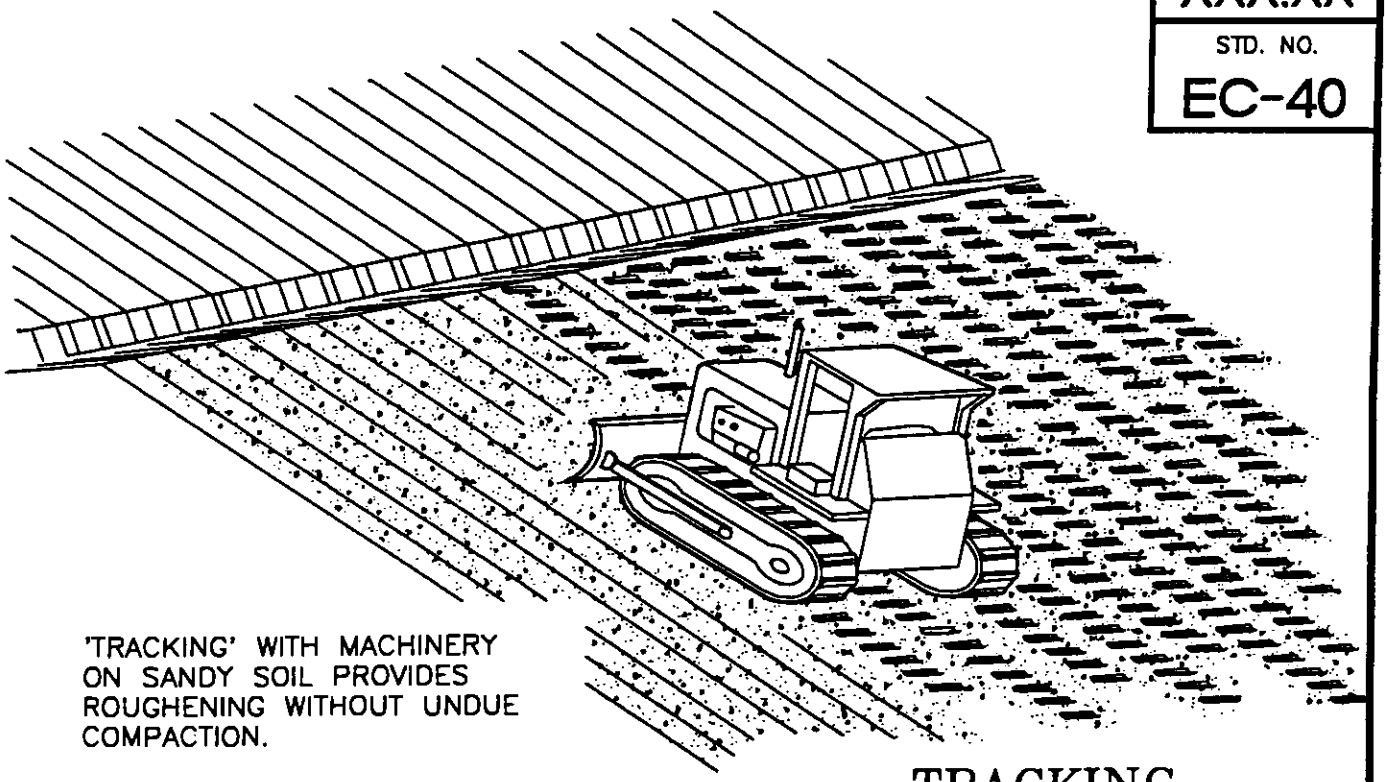
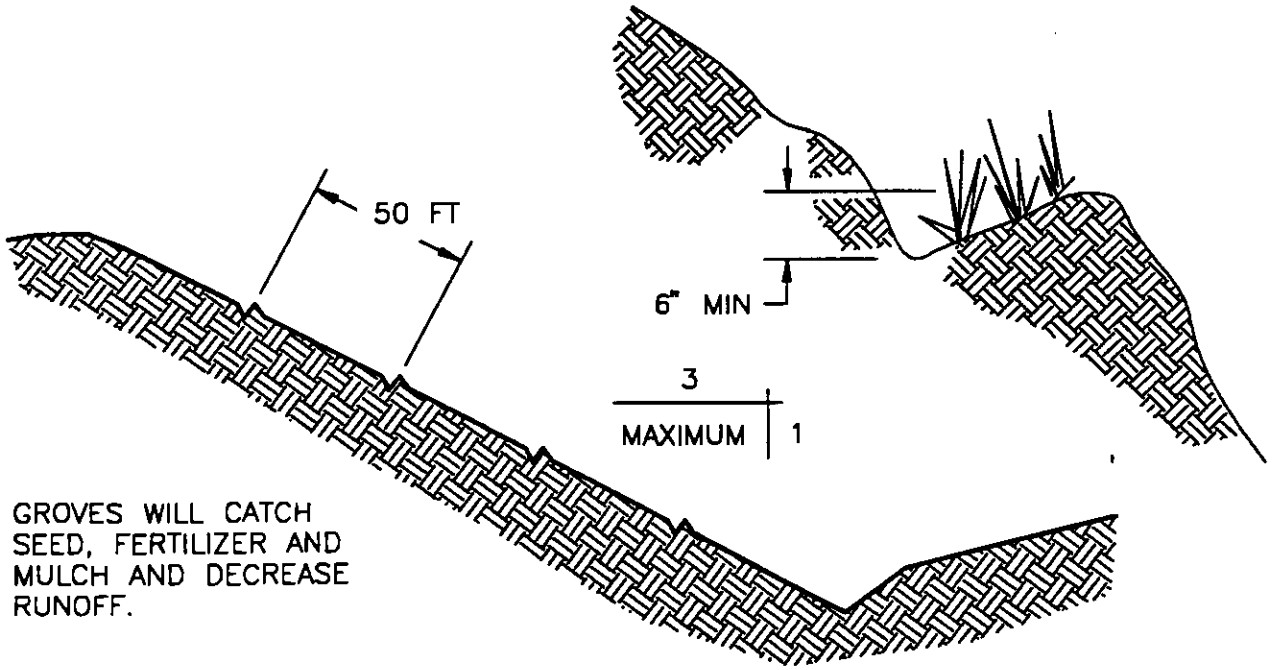


'TRACKING' WITH MACHINERY ON SANDY SOIL PROVIDES ROUGHENING WITHOUT UNDUE COMPACTION.

TRACKING



GROVES WILL CATCH SEED, FERTILIZER AND MULCH AND DECREASE RUNOFF.

CONTOUR FURROWS

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SURFACE ROUGHENING

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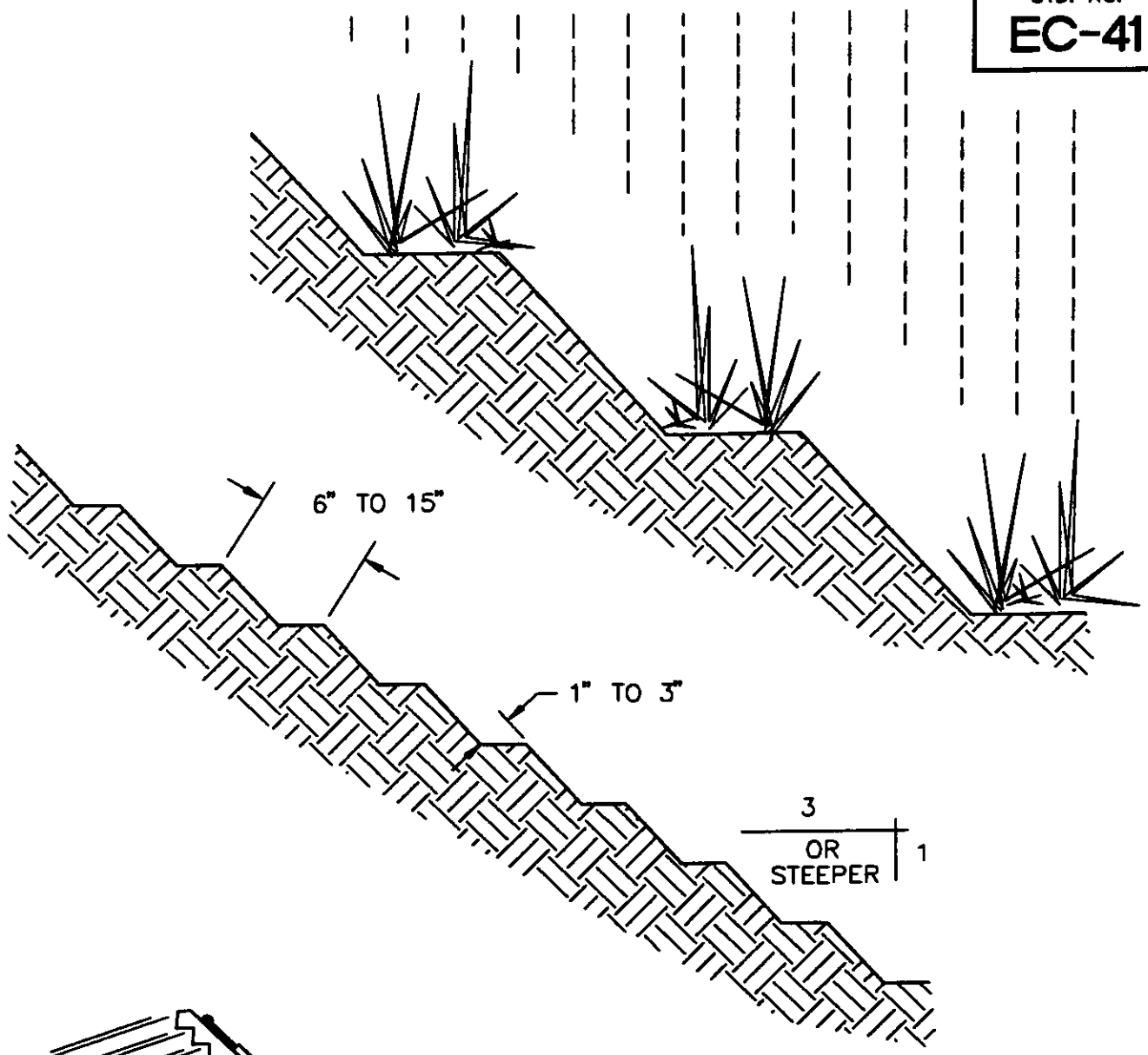

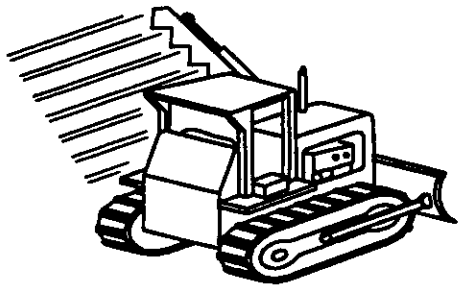

NOTES

GROVE BY CUTTING SERRATIONS ALONG THE CONTOUR. IRREGULARITIES IN THE SOIL SURFACE CATCH RAINWATER AND MULCH, FERTILIZER, AND SEED.

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GROVED OR SERRATED SLOPE

STANDARD

TOPSOILING

Definition: Topsoiling is the preservation and use of topsoil to enhance final site stabilization with vegetation.

Purpose: To provide a suitable growth medium for vegetation.

Conditions Where Practice Applies: Where a sufficient supply of quality topsoil is available.

- Where the subsoil or areas of existing surface soil present the following problems,

  The structure, pH, or nutrient balance of the available soil cannot be amended by reasonable means to provide an adequate growth medium for the desired vegetation;

- The soil is too shallow to provide adequate rooting depth or will not supply necessary moisture and nutrients for growth of desired vegetation;

- The soil contains substances toxic to the desired vegetation.

- Where high-quality turf or ornamental plants are desired.

- Where it may be desirable to try to establish native, indigenous grasses, and shrubs from the seeds "banked" in the topsoil.

- Where slopes are 2:1 or flatter.

Planning Considerations: Topsoil is the surface layer of the soil profile, generally characterized as darker than the subsoil due to enrichment with organic matter. It is the major zone of root development and biological activity. Microorganisms that enhance plant growth thrive in this layer. Topsoil can usually be differentiated from subsoil by texture as well as color. Clay content usually increases in the subsoil. The depth of topsoil may be quite variable. On severely eroded sites it may be gone entirely.

Advantages of topsoil include its high organic-matter content and friable consistence (soil-aggregates can be crushed with only moderate pressure), and its available water-holding capacity and nutrient content. Most often it is superior to subsoil in these characteristics. The texture and friability of topsoil are usually much more conducive to seedling emergence and root growth.

In addition to being a better growth medium, topsoil is often less erodible than subsoils, and the coarser texture of topsoil increases infiltration capacity and reduces runoff.

Although topsoil may provide an improved growth medium, there may be disadvantages, too. Stripping, stockpiling, hauling, and spreading topsoil, or importing topsoil, may not be cost-effective. Handling may be difficult if large amounts of branches or rocks are present, or if the terrain is too rough. Most topsoil contains weed seeds, which can compete with desirable species. However, these seeds may be advantageous because they are indigenous and may provide long term, native vegetative cover.

In site planning, compare the options of topsoiling with preparing a seedbed in the available subsoil. The clay content of many subsoils retains moisture. When properly amended, mulched, and fertilized, subsoils may provide a satisfactory growth medium, which is generally free of weed seeds.

Topsoiling is normally recommended where ornamental plants or high-maintenance turf will be grown. It may also be required to establish vegetation on shallow soils, soils containing potentially toxic materials, stony soils, and soils of critically low pH (high acidity).

If topsoiling is to be used, consider the following:

- quality and amount of topsoil,
- location for a stabilized stockpile that will not erode, block drainage, or interfere with work on the site.

Bonding—Scarify subsoil to a minimum depth of 3 inches before placing topsoil. If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly, and it will be difficult to establish vegetation.

Do not apply topsoil to slopes steeper than 2:1 to avoid slippage, nor to a subsoil of highly contrasting texture. Sandy topsoil over clay subsoil is a particularly poor combination, especially on steep slopes. Water may creep along the junction between the soil layers and cause the topsoil to slough.

Construction Specifications:

Topsoil: Determine whether the quality and quantity of available topsoil justifies selective handling.

Texture—loam, sandy loam, and silt loam are best; sandy clay loam, silty clay loam, clay loam, and loamy sand are fair. Do not use heavy clay and organic soils such as peat or muck as topsoil.

Stripping: Strip topsoil only from those areas that will be disturbed by excavation, filling, roadbuilding, or compaction by equipment. A 4 to 6-inch stripping depth is common, but depth varies depending on the site. Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Topsoil depth generally varies along a gradient from hilltop to toe of the slope. Put sediment basins, diversions, and other controls into place before stripping.

Stockpiling: Select stockpile location to avoid slopes, natural drainageways, and traffic routes. On large sites, respreading is easier and more economical when topsoil is stockpiled in small piles located near areas where they will be used.

Sediment barriers—Use sediment fences or other barriers where necessary to retain sediment.

Temporary seeding—Protect topsoil stockpiles by temporarily seeding and/or mulching as soon as possible to assure the stored material is not exposed and allowed to erode. (see Temporary Seeding and Mulching)

Permanent vegetation—If stockpiles will not be used within 12 months they must be stabilized with permanent vegetation to control erosion and weed growth. (see Permanent Seeding)

Site Preparation: Before spreading topsoil, establish erosion and sedimentation control practices such as diversions, berms, dikes, waterways, and sediment basins.

Grading—Maintain grades on the areas to be topsoiled according to the approved plan and do not alter them by adding topsoil.

Liming of subsoil—Where the pH of the existing subsoil is 6.0 or less, or the soil is composed of heavy clays, incorporate agricultural limestone in amounts recommended by soil tests or specified for the seeding mixture to be used. Incorporate lime to a depth of at least 2 inches by disking.

Roughening—Immediately prior to spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least 3 inches, to ensure bonding of the topsoil and subsoil. If no amendments have been incorporated, loosen the soil to a depth of at least 6 inches before spreading topsoil.

Spreading topsoil: Uniformly distribute topsoil to a minimum compacted depth of 2 inches on 3:1 slopes and 4 inches on flatter slopes. Do not spread topsoil while it is frozen or muddy or when the subgrade is wet or frozen. Correct any irregularities in the surface that result from topsoiling or other operations to prevent the formation of depressions or water pockets.

Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compaction, as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where high-maintenance turf is to be established.

On slopes and areas that will not be mowed, the surface may be left rough after spreading topsoil. A disk may be used to promote bonding at the interface between the topsoil and subsoil.

After topsoil application, follow procedures for seedbed preparation, taking care to avoid excessive mixing of topsoil into the subsoil.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA adapted from the North Carolina Erosion and Sediment Control Planning and Design Manual.

SECTION B: VEGETATIVE STABILIZATION STANDARDS

CRITICAL AREA TREATMENT METHODS

Ideally, treatment of disturbed sites should consider investigation of site characteristics prior to any disturbance. This allows planning which can determine the future success of the critical area treatment. If the site has a very shallow soil, then the top soil should be stored and redistributed over the disturbed site after completion of the project.

Also, consideration can be given to the potential success of the treatment after disturbance. In some cases, treatment with vegetation has high risk and pre-disturbance planning could reduce the disturbed area or develop treatment alternatives other than vegetation. The site needs soils investigation prior to disturbance. These actions prevent excessive sediment from being generated after disturbance has occurred and in future years. Also, this allows alternatives to be considered which could prove to be more economically feasible.

Along with plant species, there are specific conditions that must be considered before a treatment plan can be developed. There are factors that can affect the success of the treatment. These factors deal with the plant environment which impacts plant survival and performance. These factors are described below:

- Soil and Climate where the seeding is to be done. A good guide is the SCS Vegetative Soil Group rating guide. The rating guide describes site conditions and limitations. In Redding's Mediterranean climate, aspect, soil characteristics and available water holding capacity become very important factors.

  With perennial seedlings, whenever the water holding capacity of a site is less than 5 inches, the risk of failure is high. These sites normally will do better with annual plants or perennials if they are used with supplemental irrigation, especially during the establishment phase.

- Care should be exercised to create a favorable seedbed. A poor seedbed does not allow good seed-to-soil contact, nor is there a favorable environment for root development and growth.

- Attention should be given to the seeding methods and mulching of the treated site. It is important for proper seed placement and to protect the soil surface from erosion, crusting, and creating a favorable microclimate for the seedling emergence and growth. Ideally, a drill should be used to place the seed at correct depth and having the soil firm around the seed. If the seed is broadcast on the surface, care should be exercised for uniform coverage. Harrowing or raking the surface covers the seed.

  The surface should be mulched with straw or other suitable material so approximately 80 percent of the surface is covered. Care needs to be exercised in selecting the mulch so it is weed free and does not contain allelopathic substances that can leach and interfere with seedling germination and growth.

- The quality and quantity of the seed affect the effectiveness of the stand characteristic and protection it provides. Seed should be selected that has a high pure live seed rating (PLS) and seeding rates adjusted for the required seeding rate. Depending upon the site characteristics, seedbed condition, and time of seeding, rates should be adjusted to accommodate existing site conditions.

- The seeding time should be scheduled near the favorable period of germination and growth. Seeding should not be done when there is a long lead time before environmental conditions are favorable for germination and plant growth. Seed can be lost to animals and destroyed by unfavorable weather.

Seeding Recommendations: High potential for wildfires during the drought periods limits the selection of plant materials. Fire hazards are minimized by using plants which do not have large vegetative growth and consequently generate large amounts of fuel. Plant materials recommended in the following paragraphs were selected for their characteristics of large root development with lesser amounts of vegetative growth.

The selection of plant materials or a treatment plan depends upon the type of protection desired and the characteristics of the site being treated. Any number of classification can be developed and used. For the purpose of this report, the following "protection" categories and "site characteristics" were used to assign treatment and seeding recommendations.

Protection Categories:

- Temporary Period Protection: This protection would be for a site where protection would be needed less than a growing year. Uses

would be for sites where protection is desired for a short period until further development begins or other site activities are completed.

- Short to Moderate Period of Protection: This protection would be for a site where protection would be required for at least one growing season and not more than 3 to 4 years.

- Long Term, Permanent Protection: This protection would be for a site where protection would be needed for an infinite period of time. Uses would be for sites where development is completed and no further disturbance is anticipated for greater than 3 years.

Site Characteristics:

- Droughty Site: This site would be one with a south or south west aspect and the soil has less than 2 to 3 inches of available water holding capacity.

- Moderate Site: This site would have no aspect limitations with available water holding capacity of greater than 3 inches and less than 5 inches.

- Good Site: This site would have no aspect limitation with available water holding capacity (AWC) greater than 5 inches.

Treatment and Seeding: (Seeding rates are PLS and must be adjusted to the purchased seed rating.)

- Temporary Period Protection, any Site: Use only mulches to protect the surface from rain drop impact, surface sheet and rill erosion, and concentrated flow erosion. (See Mulching)

- Moderate Protection, Droughty, Moderate and Good Sites: Use temporary seeding recommendations for dryland seedings. (Since the protection is for a short period, no perennials are recommended.) Establishment irrigation may be needed in the droughty sites, but not required in the moderate and good sites during a normal rainfall year with plantings in early fall. More vegetative growth can be expected from the good sites with accompanying increased fuel loads especially with Blando Brome and Panoche Red Brome. (See Temporary Seeding)

- Long Term Protection, Droughty and Moderate Sites: For droughty sites only annual plants are recommended because of a minimal risk of failure. (See Temporary Seeding and Mulching)

Moderate sites on northern aspect slopes which are at the high end of the available water holding capacity (near 5 inches of AWC) could be seeded with perennials as recommended in the good site recommendations. These sites would require establishment irrigation and there is risk on long term stand sustainability.

1. Select seeding recommendation from the short term, droughty, moderate protection recommended list. (See Temporary Seeding)

2. If higher risk of failure is acceptable, the moderate sites on northern aspect with AWC approaching 5 inches, perennial seeding recommendations listed in the good sites can be used. Establishment irrigation would be required.

- Long Term Protection, Good Sites: The best protection can be provided by the establishment of perennial plants on good sites. This protection is often achieved by installing a permanent, appropriate landscape. Establishment irrigation is recommended but not required. It reduces establishment failure risks, especially during drought years. Zorro, an annual, is included in all perennial seedings to provide first year initial protection. Perennial plants will not provide acceptable protection in the first 2 to 3 years after establishment. There are some plants listed as recommended that have not been tested and seed may not be readily available. These plants should be used with caution as their performance may vary.

Source: Nick Pappas, USDA Soil Conservation Service, Red Bluff, CA

STANDARD

TEMPORARY SEEDING AND MULCHING

Definition: Temporary seeding and mulching is an erosion control measure intended to establish a vegetative cover on soils that will be exposed for periods up to 12 months.

Purpose: To temporarily stabilize the soil, reduce damage from sediment and runoff to downstream and off-site areas, and to provide protection to disturbed areas until permanent vegetation or other erosion control measures can be established. Seeding and mulching greatly reduces soil erosion, thus enhancing the effects of and reducing the reliance on sediment control.

Temporary seeding with legumes will increase nutrient cycling within the soil, reducing the need for amendments when permanent landscaping is installed.

Conditions Where Practice Applies: Graded or cleared areas which are exposed and subject to erosion during the wet weather season (October 15 to April 15) or those areas scheduled to remain bare more than 45 days. Some additional considerations are:

- For temporary protection (less than 6 months) of areas that are scheduled for further disturbance, mulches may be used without seed and fertilizer. (See Mulching)
- Cut slopes greater than 1:1 and comprised of more than 60% rock need not be treated.
- On slopes steeper than 2:1 that cannot receive adequate seedbed preparation and mulch is difficult to anchor, the slopes shall be hydroseeded. (See Hydroseeding)

Specifications:

1. Prior to seeding, install necessary erosion and sediment control measures such as diversions, berms, grade stabilization structures, (check dams), dikes, and sediment basins.

2. **Prepare the seedbed**—The seedbed should be granular, loose, uniform, 2- to 4-inches deep, and free of large clods,rocks and other objectionable material. Where hydroseeding methods are used, the surface may be left with a more irregular surface of large clods and stones.

3. **Surface roughening**—if the soil surface is loose, additional surface roughening may not be required except to break up large clods. If rainfall causes the soil surface to become sealed or crusted, loosen it just prior to seeding by discing, harrowing, raking, or other suitable methods. Groove or furrow slopes steeper than 3:1 on contour before seeding. (See Surface Roughening)

4. Construction activities usually expose the infertile subsoil material. Fertilizer is necessary for rapid growth of grasses or legumes.

5. **Mulching**: The use of appropriate mulching is necessary under normal conditions and is essential to seeding success under harsh site conditions. Harsh site conditions include:
   - seeding in the late fall for winter cover,
   - slopes steeper than 3:1,
   - excessively hot or dry weather,
   - adverse soils (shallow, rocky, or high in clay or sand)
   - decomposed granite soils, and
   - areas receiving concentrated flows.

   See Mulching Standard for specifications.

6. **Seeding**: Select seed blend from Table S-1.

Table S-1

Blends/Species	Rate	Optimum Seeding Date
Fescue 'Zorro' annual Rose clover (trifolium hirtum)*	5#/ac 7#/ac	Sept 15 - Nov 15
Brome 'Blando' Rose clover*	10#/ac 7#/ac	Sept 15 - Nov 15
Brome' Panoche' Rose clover*	10#/ac 7#/ac	Sept 15 - Nov 15
Fescue 'Zorro' Brome, Panoche red Rose clover*	5#/ac 5#/ac 7#/ac	Sept 15 - Nov 15
Crimson clover* Rose clover* Poppies, California Fescue 'Zorro' annual	25#/ac 45#/ac 3#/ac 5#/ac	Sept 1 - Nov 15 (beautiful flowers in the spring)

* All legume seeds shall be inoculated with the proper fresh, age-dated rhyzobium inoculant prior to broadcasting the seed. Inoculated legume seeds shall be dry applied (not hydroseeded) by hand or with an air operated seed gun.

Seed shall be broadcast evenly over the site, followed by mulching (See Mulching) or site shall be hydroseeded (See Hydroseeding). Pure live seed rates (PLS) less than 80% shall lead to adjustment of pounds/acre to meet the above seeding rates specified.

Late season, emergency erosion control (December-March) can be attempted by using:

Barley	240 #/ac
Fescue 'Zorro' annual	15#/ac

X 7. **Fertilizer:** Apply ammonium phosphate with sulfur:

16-20-0 + S 500#/acre.

Inspection and Maintenance: Inspect seeding areas six weeks after seasonal rains begin. Check for damage after significant storms (1" in 24 hours). If vegetation has not established or stands are not adequate, fertilize, reseed, and mulch damaged and sparse areas immediately.

Fall plantings can be top dressed with 50#/ac of nitrogen fertilizer in February or March.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; and USDA Soil Conservation Service, Redding, California.

STANDARD

PERMANENT SEEDING

Definition: Permanent seeding is a measure to establish perennial vegetative cover on disturbed areas.

Purpose: This practice will provide long term, permanent protection for a site where development is complete and no further disturbance is anticipated for 3 or more years. The purpose is to permanently reduce erosion and sediment yield from a disturbed area.

Conditions Where Practice Applies: This practice is for finish-graded areas which permanent, perennial vegetative cover is the most practical or most effective method of stabilizing the soil. Permanent seeding may also be used on rough-graded areas that will not be brought to final grade for a year or more.

Areas to be stabilized with permanent vegetation must be seeded by October 15, or immediately after final grade is reached in the fall or winter, unless temporary stabilization is applied. (See Temporary Seeding and Mulching)

- Cut slopes greater than 2:1 and comprised of more than 60% rock need not be treated.
- On slopes steeper than 2:1 that cannot receive adequate seedbed preparation and mulch is difficult to anchor, the slopes shall be hydroseeded. (See Hydroseeding)
- Irrigation during establishment is recommended but not required.
- 'Zorro' Fescue, an annual, is included in all perennial seedings to provide first year, initial protection.

Specifications:

1. Prior to seeding install necessary erosion and sediment control measures such as diversions, berms, grade stabilization structures, (check dams), dikes, and sediment basins.
2. **Prepare the seedbed**—The seedbed **should** be granular, loose, uniform, 2- to 4-inches deep, and free of large clods,rocks and other objectionable material. Where hydroseeding methods are used, the surface may be left with a more irregular surface of large clods and stones.
3. **Surface roughening**—if the soil surface is loose, additional surface roughening may not be required except to break up large

clods. If rainfall causes the soil surface to become sealed or crusted, loosen it just prior to seeding by discing, harrowing, raking, or other suitable methods. Groove or furrow slopes steeper than 3:1 on contour before seeding. (See Surface Roughening)

4. Construction activities usually expose the infertile subsoil material. Fertilizer is necessary for rapid growth of grasses or legumes.

5. **Mulching**: The use of appropriate mulching is necessary under normal conditions and is essential to seeding success under harsh site conditions. Harsh site conditions include:

- seeding in the late fall for winter cover,
- slopes steeper than 3:1,
- excessively hot or dry weather,
- adverse soils (shallow, rocky, or high in clay or sand)'
- decomposed granite soils, and
- areas receiving concentrated flows.

6. **Seeding:** Select seed blend from Table S-2.

Table S-2

Blends/Species	Rate	Optimum Seeding Date
Fescue 'Zorro' annual Fescue 'Scaldis','Durar' or 'Covar' Delar 'Small Burnet' Rose clover (trifolium hirtum)*	5#/ac 8#/ac 2#/ac 7#/ac	Sept 15 - Nov 15
Fescue 'Zorro' annual Fescue 'California' or 'Idaho' Delar "Small Burnet' Rose clover (trifolium hirtum)	5#/ac 8#/ac 2#/ac 7#/ac	Sept 15 - Nov 15

Seed shall be broadcast evenly over the site, followed by mulching. (See Mulching) Pure live seed rates (PLS) less than 80% shall lead to adjustment of pounds/acre to meet the above seeding rates specified.

Late season, emergency erosion control (December-March) can be attempted by using:

Barley	240 #/ac
Fescue 'Zorro' annual	15#/ac

7. **Fertilizer:** Apply ammonium phosphate with sulfur:

16-20-0 + S 500#/acre.

On typical disturbed sites, full establishment requires refertilization in the second growing season.

8. **Irrigation:** Moisture is essential for seed germination and seedling establishment. Supplemental irrigation can be very helpful in assuring adequate stands in the droughty, moderate sites or to speed development of full cover. Irrigation should be used where feasible, however, irrigation is not critical for these blends if planted at the appropriate time of the year and mulched properly.

Inspection and Maintenance: Inspect and maintain until fully established. Permanent vegetation cannot be determined to be fully established until soil cover has been maintained for one full year from the time of planting. Inspect seeded areas for failure and make necessary repairs promptly and do the reseeding within the same season, if possible.

Reseeding: If a stand has inadequate cover, re-evaluate the choice of plant materials, quantities of fertilizer and amendments, and use of irrigation. Re-establish the stand after seedbed preparation or over-seed the existing stand. consider temporary seeding and mulching of the time of year is not appropriate for permanent seeding.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; USDA , SCS Field Design Manual; and North Carolina Erosion and Sediment Control Planning and Design Manual.

STANDARD

HYDROSEEDING

Definition: Hydroseeding is a method of applying seed to critical sites hydraulically. The seed is usually applied as a slurry that also contains wood fiber (hydromulch), fertilizer, and a dye. The slurry is applied with equipment called a Hydromulcher.

Purpose: The purpose of this seeding method is to uniformly broadcast seed, fertilizer, and fiber mulch. This treatment is specially effective for slope that are steeper than 2:1 and cannot receive adequate seed bed preparation. The dye, usually green, provides a visual indicator to assure uniform coverage.

Conditions Where Practice Applies: Graded or cleared areas which are exposed and subject to erosion during the wet weather season (October 15 to April 15) or those areas scheduled to remain bare more than 45 days. Some additional considerations are:

- On highly erosive soils such as DG, where it may be necessary to apply seed, fertilizer, machine blown straw, and a mulch binder (tackifier) in successive applications.
- On slopes steeper than 2:1 that cannot receive adequate seedbed preparation and mulch would be difficult to anchor.
- Where the slope surface is irregular with large clods, stones, or a high percentage of rock.
- Where hydromulching equipment will have access.
- Where the dye is needed to monitor uniform coverage.

Design Considerations: It is mandatory for successful planting that there is good seed-to-soil contact. It is also recommended that critical erosion sites, such as steep DG cut slopes or where water quality impacts must be addressed, receive the equivalent of 2.5 Ton /acre of mulch, applied in two or three applications. Applying the seed with the mulch in one application would prevent good seed-to-soil contact. It is therefore recommended that the seed, dye, and 1/2 the wood fiber be applied. That first application shall be followed by an application of blown straw, followed by an application of tackifier, fertilizer, and the remainder of the wood fiber.

Construction Specifications

1. Prior to seeding install necessary erosion and sediment control measures such as diversions, berms, grade stabilization structures, (check dams), dikes, and sediment basins.

2. **Prepare the seedbed**—The seedbed **should** be granular, loose, uniform, 2- to 4-inches deep, and free of large clods,rocks and other objectionable material. Where hydroseeding methods are used, the surface may be left with a more irregular surface of large clods and stones.

3. **Surface roughening**—if the soil surface is loose, additional surface roughening may not be required except to break up large clods. If rainfall causes the soil surface to become sealed or crusted, loosen it just prior to seeding by discing, harrowing, raking, or other suitable methods. Groove or furrow slopes steeper than 3:1 on contour before seeding, if possible. (See Surface Roughening)

4. Hydromulching: Use 1500#/acre (minimum) to 3000#/acre wood fiber equivalent (fiber). This can be in the form of newsprint, virgin wood fibers, corrugated (Kraft) paper, or blends of newsprint/corrugated and newsprint/wood fiber. 1/

5. For critical slopes apply: (3 or 4 step application)
    1. Dry apply inoculate legume seed
    2. Fiber @ 500#/acre with grass seed
    3. 1-2 Ton/acre blown straw
        4. Fiber @ 400-500#/acre with tackifier @ 80-120 lbs/acre with recommended fertilizer

6. **Seeding:** Select seed blend from Table S-1 or Table S-2, Temporary Seeding and Mulching or Permanent Seeding.

Inspection and Maintenance: Inspect seeding areas six weeks after seasonal rains begin. Check for damage after significant storms (1" in 24 hours) and make repairs immediately. If stands are not adequate, reseed, fertilize, and mulch damaged or sparse areas.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA.; Vickie Bacon, Caltrans Landscaping Unit, District 2, Redding CA;

1/ U.C. Davis Agronomy Progress Report #98-Hydromulching Fibers-What's New, Burgess L. Kay

STANDARD

MULCHING

Definition: Mulching is the application of a protective layer of straw or other suitable material to the soil surface. Straw mulch is used as a temporary measure to protect bare or disturbed soil areas that have not been seeded. Straw mulch is also used in conjunction with seeding, and hydroseeding of critical areas for the establishment of temporary or permanent vegetation.

Purpose: To temporarily stabilize bare and disturbed soils, to protect the soil surface from raindrop impact, to increase infiltration, to conserve moisture, to prevent soil compaction or crusting, and to decrease runoff. Mulching also fosters growth of vegetation by protecting the seeds from predators, reducing evaporation, and insulating the soil.

Design Considerations: Mulch can be applied to any site where soil has been disturbed and vegetation removed. These practices provide temporary protection until the permanent vegetation can be established. As a temporary practice, mulching is applicable only for relatively short periods of time (6 months) or until the next seeding season has been reached.

Rice straw is a very good mulch. Air Quality Standards for the Sacramento Valley require a reduction in burning of the rice fields. As a consequence, rice straw could become more available for erosion control. Rice straw seems more durable and the bales are almost twice as heavy, therefore it is more cost effective. It does, however, tend to clump and is more difficult to spread uniformly.

Site Preparation: Prior to mulching, install any needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, grassed waterways and sediment basins.

Design Criteria: Straw is an excellent mulch material. Because of its length and bulk, it is highly effective in reducing the impact of raindrops and in moderating the microclimate of the soil surface. Straw mulch can be applied by hand on small sites and blown on by machine on large sites. Straw blowers have a range of about 50 feet. Some commercial models advertise a range up to 85 feet and a capacity of 15 tons per hour.

Straw mulch should cover the exposed area to a uniform depth. If the mulch is being used without seeding, then the depth can range from 2 to 4 inches. However, the mulch should not be applied more than 2 inches deep on seeded sites, unless it is incorporated into the soil by tracking, discing, or other 'punching in' technique. If the straw is

applied at rates higher than 3 tons per acre, the mulch may be too dense for the sunlight and seedlings to penetrate. Approximately one bale of straw covers 1000 square feet adequately. The soil surface should be barely visible through the straw mulch. Straw must be anchored to keep it from blowing away.

Straw mulch is commonly anchored by:

1. Crimping, tracking, disking, or punching into the soil;
2. Covering with a netting; or
3. Spraying with a chemical or organic tackifier.

On small sites, where straw has been distributed by hand, it can be anchored by hand punching it into the soil every 1 to 2 feet with a dull, round-nosed shovel. A sharp shovel will merely cut the straw and not anchor it.

Studies have been done comparing the effectiveness of wood fiber and straw mulch on 2:1 and 5:1 slopes of seven soil types. The wood fiber was applied hydraulically at rates of 1500# and 3000#/acre. Straw mulch was applied at 3000#/acre and tackified. Straw mulch provided much greater protection on all soils, but particularly on the uncemented fine sands, the decomposed granites, and the clay loams. (Erosion and Sediment Control Handbook, S. Goldman et al) **The most effective mulching technique for decomposed granite soils is to blow clean, dry straw onto the slope (2 Ton/acre) then hydraulically apply wood fiber (500#/acre) with organic tackifier (80#/acre).**

Mulching Specifications:

Mulch Matting—Erosion control blankets made of excelsior, coconut, or straw must be stapled to the surface especially in waterways and on steep slopes. Follow manufacturer's recommendations.

Straw—Obtain clean wheat, barley, oat, or rice straw in order to prevent the spread of noxious weeds. Avoid moldy, compacted straw because it tends to clump and is not distributed evenly.

The straw shall be evenly distributed by hand or machine to the desired depth (2 to 4 inches).

Seeded sites: 1 1/2 -2 ton /acre, 1-2" deep, covering 80% of the soil surface.

Unseeded sites: 2-3 ton/acre, 2-4 " deep, covering 90% (min.) of the soil surface.

Wood chips—Apply at the rate of approximately **6 tons per acre** or 275 pounds per 1,000 square feet when available and when feasible. These are particularly well suited for utility and road rights-of-way. If wood chips are used, increase the application rate of nitrogen fertilizer by 20 pounds of N per acre (200 pounds of 10-10-10, or 66 pounds of 30-0-0 per acre.

Wood cellulose fiber—Apply at the rate of 1500-3000 lbs/acre or 35-70 lbs/1,000 square feet by hydroseeding. When hydroseeding highly erosive soils such as **decomposed granite** (DG) use two applications—one application of 500 lbs/acre with seed, followed by the application of wood fiber at 1000 lbs/acre or followed by the application of straw at 1.5 Ton/acre then sprayed with 500 lbs/acre wood fiber and 80 lbs/acre tackifier.

Anchoring Mulch:

Mulch must be anchored immediately to minimize loss by wind or water. This may be done by one of the following methods, (listed by preference) depending upon size of area, erosion hazard, and cost. On sloping land practice No. 1 below should be done on the contour whenever possible, except "tracking" which should be done up and down the slope with cleat marks running across the slope.

1. **Mulch Anchoring Tool and Tracking** (Punching in) —A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the top two inches of soil. This practice affords maximum erosion control but is limited to flatter slopes where equipment can operate safely. "Tracking" is the process of cutting mulch (usually straw) into the soil using a bulldozer or other equipment that runs on cleated tracks. Tracking is used primarily on slopes 3:1 or steeper,.where the equipment can operate. This is an effective practice for fill slopes.

2. **Mulch Nettings**—Staple lightweight biodegradable paper, plastic or cotton netting over the mulch according to manufacturer's recommendations. Netting is usually available in rolls four feet wide and up to 300 feet long.

3. **Tackifiers**—Organic tackifiers are generally applied at rates of 80-120 lbs/acre, however manufacturers recommendations vary. Applications of liquid mulch binders should be heavier at edges, in valleys, and at crests of banks and other areas where the mulch will be moved by wind or water. All other areas should have a uniform application of the tackifier.

4. **Wood cellulose fiber**—The fiber binder shall be applied at a net dry weight of 750 pounds/acre. The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 pounds. of wood cellulose fiber per 100 gallons.

5. **Peg and Twine**—Drive 8-to 10-inch wide pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a criss-cross within a square pattern. Secure twine around each peg with two or more turns.

Maintenance: If properly applied and anchored, little additional maintenance is required during the first few months. After high winds. mulched areas should be checked for adequate cover and remulched if necessary. Straw mulch can last from 6 months to 3 years. Erosion control blankets are effective for up to three years.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; adapted from North Carolina Erosion and Sediment Control Planning and Design Manual; "Water Quality Management Plan for the Lake Tahoe Region" Volume II Handbook of BMPs (TRPA); and Delaware Erosion and Sediment Control Handbook

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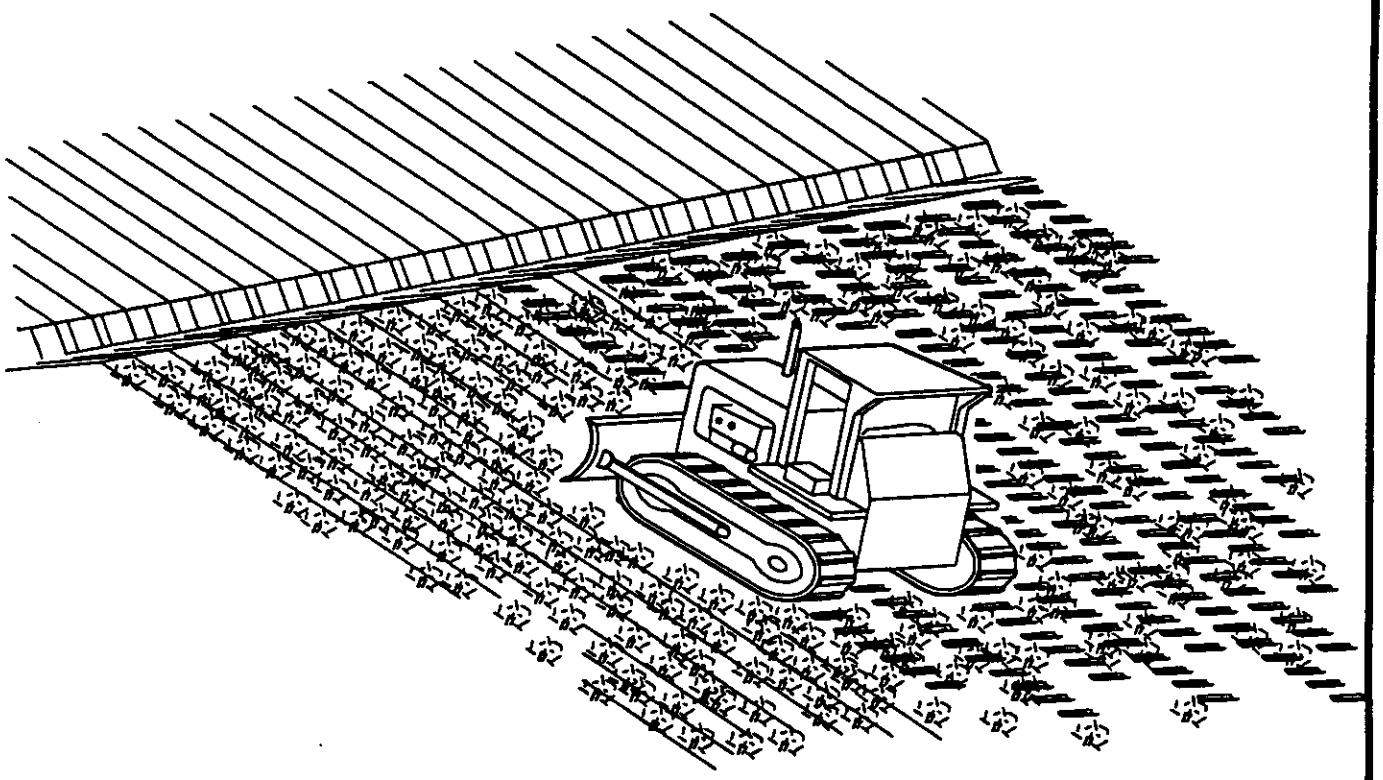
STD. NO.
EC-42

'TRACKING' WITH MACHINERY ON SANDY SOIL PROVIDES ROUGHENING WITHOUT UNDUE COMPACTION.



NOTES:

1. ROUGHEN SLOPE WITH BULLDOZER
2. BRODCAST SEED AND FERTILIZER.
3. SPREAD STRAW MULCH 3" THICK. (2 1/2 TONS PER ACRE)
4. TRACK STRAW MULCH INTO SLOPE BY RUNNING BULLDOZER UP AND AND DOWN SLOPE.

DWG DATE 6-92	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
MARK / DATE / REVISION		APPROVED BY DIRECTOR OF PUBLIC WORKS

STRAW ANCHORING

SECTION C: RUNOFF CONTROL STANDARDS

STANDARD

TEMPORARY DIKE

Definition: A temporary dike is a temporary ridge of compacted soil installed immediately above a new cut or fill slope or around the perimeter of a disturbed area.

Purpose: A dike performs either of two functions. When located above an exposed slope, it intercepts storm runoff from small upland areas and diverts it to an acceptable outlet. When located around the perimeter of a disturbed area, it prevents runoff from entering this area and also prevents sediment-laden runoff from leaving the disturbed area. A dike remains in place until permanent drainage features are installed and/or slopes are stabilized.

This standard applies to all earth-fill structures constructed according to *Earth Dams and Reservoirs* (USDA, Soil Conservation Service, Technical Release No. 60, June 1976).

Design Considerations:

Design considerations should include the following:

- drainage area;
- top width and height;
- side slopes and grade;
- quantity of water diverted;
- velocity of water diverted;
- stabilization against erosion;
- outlet.

SAMPLE SPECIFICATIONS FOR TEMPORARY DIKE

Construction Specifications:

1. The drainage area shall be less than 5 acres (for larger drainage areas see Standard and Sample Specifications for Permanent Waterway).

2. The top width shall be a minimum of 2 feet.

3. The height (compacted fill) shall be a minimum of 18 inches measured from the existing ground at the upslope toe to the top of the dike. The maximum height shall be 30 inches.

4. The side slopes shall be 2:1 or flatter.

5. The grade along the face of the dike (flow area) shall be dependent on topography, but shall be a minimum of 1% (sufficient grade to drain) to an adequate outlet. Drainage must be positive. The "flow area" of the dike is defined as the upslope portion of the dike face and adjacent ground surface over which diverted runoff water flows.

6. The flow area shall be stabilized:

   a. where the slope of the flow area exceeds 5%; or

   b. where the slope of the flow area is 1% to 5% and the maximum flow velocity from the 10-year frequency storm is exceeded as specified below:

Flow Area Surface	Maximum Velocity (feet per second)
Sand and sandy loam	2.5
Silt loam	3.0
Sandy clay loam	3.5
Clay loam	4.0
Clay, fine gravel and graded loam to gravel	5.0
Graded silt to cobbles	5.5
Shale, hardpan and coarse gravels	6.0

7. Stabilization, when required by No. 6 above, shall be:

   a. in accordance with the *Standard and Sample Specification for Grass Protection of Waterways, Swales and Dikes*, when the dike intercepts runoff from a protected or stabilized area (see ABAG Manual); or

   b. by lining the flow area with stone that meets MSHA size No. 2 or AASHTO M43 size No. 2 or 24 in a layer at least 3 inches thick and pressed into the soil. The lining shall extend up the upslope side of the dike to a height of at least 8 inches measured vertically from the upslope toe and shall extend upslope from the upslope toe a distance sufficient to include the flow area.

8. Diverted runoff from:

   a. a protected or stabilized area shall outlet directly to a grade stabilization structure and/or receiving water channel;

   b. a disturbed or exposed upland area shall outlet to a sediment trap or a sediment basin or to an area protected by these practices.

9. All dikes shall be machine-compacted with the tires or tracks going over at least 90% of the surface. There shall be a maximum of 6 inches of lift between each compaction

10. The dike shall be inspected periodically and maintained as required.

Source: Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

STANDARD

TEMPORARY SWALE

Definition: A temporary swale is a temporary ditch or drainageway constructed across or around disturbed areas of less than 5 acres, such as building pads or rights-of-way for pipelines and streets.

Purpose: A swale performs either of two functions. When located on a slope bench, it reduces the potential for erosion by intercepting storm runoff and diverting it to a stabilized outlet or sediment-trapping device. When located around the perimeter of a disturbed area, it prevents storm runoff from entering this disturbed area or directs sediment-laden runoff leaving this disturbed area. Runoff carried by a swale should be adequately handled to prevent flooding or erosion damage to adjacent property. A swale remains in place until permanent drainage features are installed and/or slopes are stabilized.

Design Considerations: Design considerations should include the following:

- location;
- drainage area;
- quantity and velocity of water being conveyed;
- bottom width;
- depth;
- side slope;
- grade;
- stabilization;
- outlet;
- traffic crossings;
- spacing between swales.

Construction Specifications:

1. The drainage area shall be less than 5 acres (for larger drainage areas, see *Standard and Sample Specifications for Permanent Waterway* (see ABAG Manual).

2. The bottom width shall be a minimum of 7 feet and the bottom shall be level.

3. The depth shall be a minimum of 1 foot.

4. The side slope shall be 2:1 or flatter (flat enough to allow construction traffic to cross if desired).

5. The grade shall be dependent on topography, but shall be a minimum of 1% (sufficient grade to drain) to an adequate outlet. Drainage must be positive.

6. The swale shall be stabilized:

   a. where the slope of the swale bottom exceeds 5%; or

   b. where the slope of the swale bottom is 1% to 5% and the maximum flow velocity from the 10-year frequency storm is exceeded as specified below:

Flow Area Surface	Maximum Velocity (feet per second)
Sand and sandy loam	2.5
Silt loam	3.0
Sandy clay loam	3.5
Clay loam	4.0
Clay, fine gravel and graded loam to gravel	5.0
Graded silt to cobbles	5.5
Shale, hardpan and coarse gravels	6.0

7. Stabilization, when required by No. 6 above, shall be:

   a. in accordance with the *Standard and Sample Specifications or Grass Protection of Waterways, Swales and Dikes* when the swale receives runoff from a stabilized area; or

   b. by lining the flow area with stone that meets MSHA No. 2 or AASHTO M43 size No. 2 or 24 in a layer at least 3 inches thick and pressed into the soil. The lining shall extend across the bottom and up both sides of the channel to a height at least 8 inches vertically above the bottom. See also Rock Lined Channels.

8. At all points where the swale will be crossed by vehicles several times a day, the swale shall be stabilized according to 7b above, except that the stone lining shall be at least 6 inches thick for the whole width of the traffic crossing.

9. Diverted runoff from:

   a. a protected or stabilized upland area shall outlet directly to a overside drain, temporary slope drain, or other grade stabilization structure and/or a receiving water channel;

   b. a disturbed or exposed upland area shall be conveyed to a sediment trap or basin or to an area protected by these practices.

10. The swale shall be located to take advantage of the most suitable outlet The swale shall discharge without causing erosion at its outlet.

11. All trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of so as not to interfere with the proper functioning of the swale.

12. The swale shall be excavated and/or shaped to line, grade and cross-section as required to meet the criteria specified herein, and be free of bank projections or other irregularities that will impede normal flow.

13. Fills shall be compacted as needed to prevent unequal settlement that would cause damage in the completed swale.

14. All earth removed and not needed in construction shall be spread or stockpiled so it will not interfere with the functioning of the swale.

15. The swale shall be inspected periodically and maintained as required.

Source: Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

STANDARD

GRASSED WATERWAYS, SWALES AND DIKES

Definition: Vegetation lining a natural or constructed waterway, swale or dike to protect it from erosion.

Purpose: Grass protection of drainageways reduces erosion by lowering water velocity over the soil surface and by binding soil particles with roots. A drainageway, as used in this standard, is any ground surface over which concentrated runoff travels. It is typically a manmade waterway, swale or ditch. It may also be the upslope side of a dike or berm, which intercepts overland flow of water and directs the concentrated flow along the surface of the barrier.

Grassed drainageways or vegetative linings should be used where:

- a vegetative lining can provide sufficient stability for the channel cross section and grade;
- slopes are generally less than 5 %;
- space is available for a relatively large cross section.

Design Considerations:

1. The placement of a grassed drainageway must be carefully considered. Its design should be based on a comprehensive evaluation of the surface contours and, for permanent waterways, on estimated peak surface runoff from the design storm. Natural subsurface drainage conditions should be evaluated to determine whether drainage from a grassed drainageway will adversely affect the subsurface drainage system. Where the drainage area exceeds 10 acres, it is recommended that grass-lined channels be designed by an engineer experienced in channel design. Establishment of a dense, resistant vegetation is essential. Construct and vegetate grass-lined channels early in the construction schedule before grading and paving increase the rate of runoff.

2. **Grass-lined channels must not be subject to sedimentation from disturbed areas.** They shall not be placed below high sediment producing areas unless measures (such as sediment basins) are installed to prevent sediment from reaching the channel.

3. Water velocity in grassed drainageways will be slower than in concrete or earth-lined drainageways. Therefore, grassed drainageways may need to be larger. If space does not permit the design of a wide or gently sloping channel, then other linings must be used.

4. An established grass-lined channel resembles natural drainage systems and, therefore, is usually preferred if design velocities are below 5 ft/sec. Velocities up to 6 ft/sec can be safely used under certain conditions. (See references for the design of stable channels.)

5. Outlets should function with a minimum of erosion. (see Riprap and Energy Dissipator)

6. Factors to consider in the selection of plants include:

- plants tolerant of temporary or seasonally high moisture and waterlogged soil conditions;
- plants that establish extensive fibrous roots or rhizomes to bind the soil mass and prevent erosion;
- plants that have low biomass and that do not mat excessively or cause flow to channelize;
- plants that develop and establish rapidly following the normally occurring light, early-season rains;
- plants that reseed and develop well from seed or provide continuous vegetative growth.

7. Seeding rates for plants should be sufficiently high to provide a dense grass stand. The seeds should be uniformly distributed to reduce patchy growth and soil exposure, especially when seeding bunching or non spreading grasses.

8. Seeding, mulching, fertilizing and irrigating considerations are the same as those discussed in Permanent Seeding. However, Hydroseeding should be used only if grass is established before the rainy season by irrigating.

9. Stabilization of a grassed drainageway should be accomplished before the first erosive rains of the season. Seeding should be completed by September 15 to maximize the chances of intercepting the light, early-season rains and the chances of grass establishment by October 15. A good indicator of stabilization is the absence of exposed soil in the drainageway.

Germinating rains do not always come before erosive rains. In addition, early season rains are often insufficient to establish adequate grass cover before the period of heavy winter rains (December to February). Therefore, a contingency plan is advised to ensure either grass establishment or another form of drainageway protection. Temporary irrigation measures can be used to establish grass. Measures such as straw mulching at the time of seeding can provide temporary protection until grass is established.

10. Specialized erosion control liners or erosion control blankets can be installed at the time of seeding Geotextile fabrics, erosion blankets, or special mulch protection such as fiberglass roving or straw and netting provide stability until the vegetation is fully established or as part of a contingency plan to be implemented if grass is not established by October 15. These protective liners must be used whenever design velocities exceed 2 ft/sec for bare soil conditions. It may also be necessary to divert water from the channel until vegetation is established or to line the channel with sod. Sediment traps may be needed at channel inlets and outlets.

11. If the area downstream from the drainageway is a critical area or warrants increased protection, the grass should be established in the drainageway by artificial means before the rainy season begins (before October 15).

Additional Design Criteria:

Capacity—As a minimum, grass-lined channels should carry peak runoff from the 1-year storm without eroding. Where flood hazard exists, increase the capacity according to the potential damage. Channel dimensions may be determined by using design tables with appropriate retardance factors or by Manning's formula using an appropriate "n" value. When retardance factors are used, the capacity is usually based on retardance "C" and stability on retardance "D". (See references for determining peak discharge)

Velocity—The allowable design velocity for grass-lined channels is based on soil conditions, type of vegetation, and method of establishment. (See references for the design of stable channels)

If design velocity of a channel to be vegetated by seeding exceeds 2 ft/sec, a temporary channel liner, such as an erosion control blanket, is required. The design of the liner may be based on peak flow from a 2-year storm. If vegetation is established by sodding, the permissible velocity for established vegetation may be used and no temporary

liner is needed. Whether a temporary lining is required or not permanent channel linings must be stable for the 10-year storm.

Cross section—The channel shape may be parabolic, trapezoidal, or V-shaped, depending on need and site conditions.

- **V-shaped grass channels** generally apply where the quantity of water is small, such as in short reaches along roadsides. The V-shaped cross section is least desirable because it is difficult to stabilize the bottom where velocities may be high.

- **Parabolic grass channels** are often used where larger flows are expected and space is available. The shape is pleasing and may best fit site conditions.

- **Trapezoidal grass channels** are used where runoff volumes are large and slope is low so that velocities are non-erosive to vegetated linings.

Side slopes—Grassed channel side slopes generally are constructed 3:1 or flatter to aid in the establishment of vegetation and for maintenance. Side slopes of V-shaped channels are usually constructed 6:1 or flatter along roadways for safety.

Grade—Either a uniform or gradually increasing grade is preferred to avoid sedimentation. Where the grade is excessive, grade stabilization structures may be required or channel linings of riprap or paving should be considered.

Inspection and Maintenance: During the establishment period, check grass-lined channels after every significant rainfall (1" in 24 hours). After grass is established, periodically check the channel for debris, scour, or erosion and immediately make repairs. It is particularly important to check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes. Remove all significant sediment accumulations to maintain the designed carrying capacity. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel. (See Permanent Seeding) Permanent grassed waterways should be seasonally maintained by mowing or irrigating, depending on the type of vegetation selected.

Source: Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG) and the North Carolina Erosion and Sediment Control Planning and Design Manual.

STANDARD

ROCK LINED CHANNEL

Definition: Rock-lined channels are channels or roadside ditches lined with rock or riprap.

Purpose: To convey concentrated surface runoff without erosion.

Conditions Where Practice Applies: This practice applies where design flow exceeds 2 ft/sec such that channel lining is required, but conditions are not suitable for vegetative protection. Specific conditions include:

- Decomposed Granite (D.G.) areas. All roadside ditches or drainage channels greater than 2% (max. permissible velocity is 2.5 fps.) located in D.G.soils.
- Design velocity exceeds that allowable for a grass-lined channel
- Channel will continue to down-cut without protection because it is adjusting to increased flow or a new base line (outlet elevation).

Design Criteria:

- Capacity: peak runoff from 10 year storm
- Side slopes: 2:1 or flatter
- Stone size: d= 2" minimum. Use engineering design procedures for sizing riprap for large or critical drainage channels. See reference material for the design of stable channels.
- Riprap thickness: T= 1.5 times the stone diameter or as shown on the plans; 6-inch-thick minimum.
- Foundation: Extra-strength filter fabric or an aggregate filter layer, if required. Use a foundation for D.G. soils.
- Channel cross section: as shown on plans for design high flow.
- Outlet: must be stable.

Construction Specifications:

- Excavate cross section to the grades shown on plans. Overcut for thickness of rock and filter.

- Place filter fabric or gravel filter layer, and rock as soon as the foundation is prepared.

- Place rock so it forms a dense, uniform, well-graded mass with few voids. Hand placement may be necessary to obtain good size distribution.

- No overfall of channel construction should exist. Grass-lined channels with riprap bottoms must have a smooth contact between riprap and vegetation.

Maintenance: Inspect channels at regular intervals and after major storms. Remove debris and make needed repairs where stones have been displaced. Take care not to restrict flow area when stones are replaced.

Give special attention to outlets and points where concentrated flow enters channel. Repair eroded areas promptly.

Check for sediment accumulation, piping, bank instability, and scour holes. repair promptly.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA

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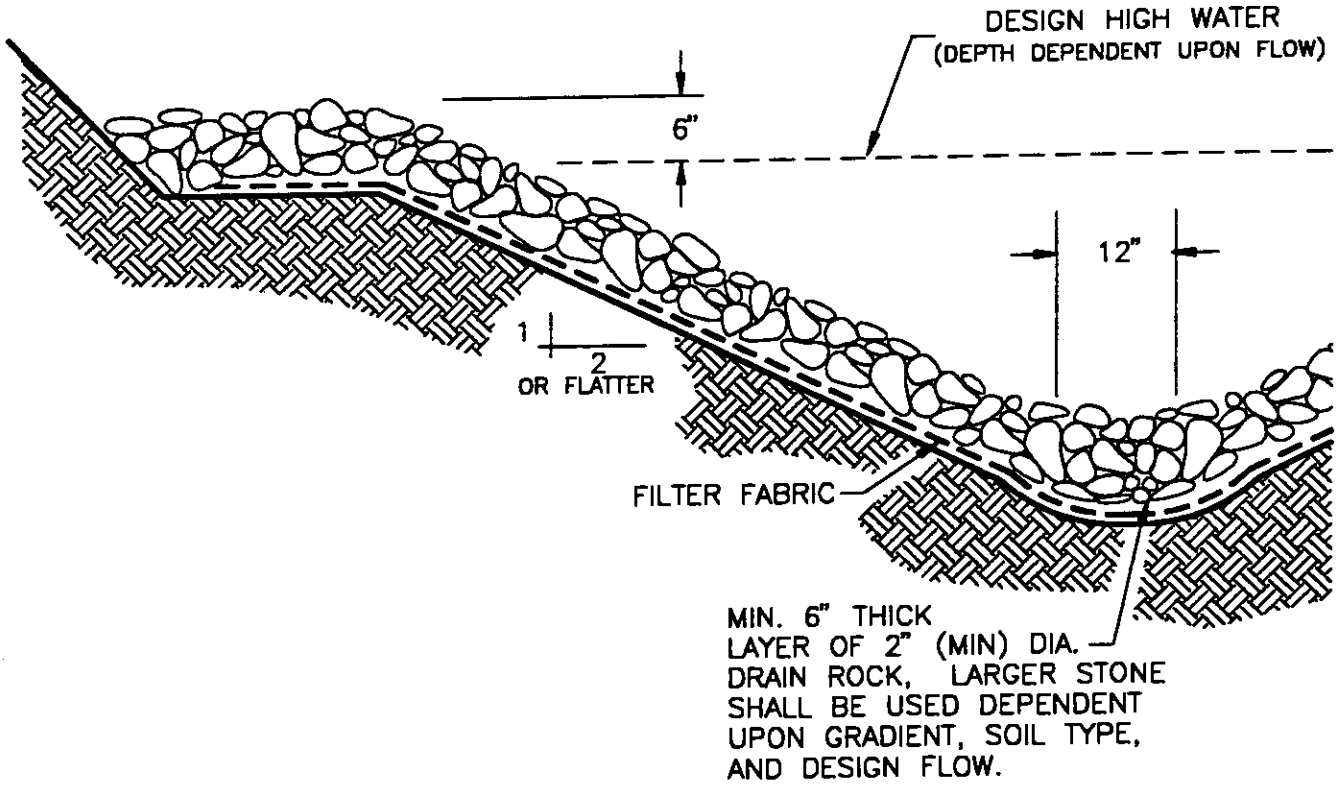

TYPICAL HALF SECTION

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ROCK LINED CHANNEL

STANDARD

RIPRAP

Definition: Riprap is a layer of stone designed to protect and stabilize areas subject to erosion.

Purpose: To protect the soil surface from erosive forces and/or improve stability of soil slopes that are subject to seepage or have poor soil structure.

Conditions Where Practice Applies: Riprap is used for the following applications:

- cut-and-fill slopes subject to seepage or weathering, particularly where conditions prohibit establishment of vegetation,
- channel side slopes and bottoms,
- inlets and outlets for culverts, bridges, slope drains, grade stabilization structures, and storm drains,
- streambank and stream grades,
- shorelines subject to wave action.

Planning Considerations: Riprap is a versatile, highly erosion-resistant material that can be used effectively in many locations and in a variety of ways to control erosion on construction sites.

Graded Versus Uniform Riprap

Riprap is classed as either graded or uniform. Graded riprap includes a wide mixture of stone sizes. Uniform riprap consists of stones nearly all the same size.

Graded riprap is preferred to uniform riprap in most applications because it forms a dense, flexible cover. Uniform riprap is more open and cannot adjust as effectively to movement of the stones. Graded riprap is also cheaper to install requiring less hand work for installation than uniform riprap, which must be placed in a uniform pattern. Uniform riprap may give a more pleasing appearance.

Riprap sizes are designated by either the mean diameter or the weight of the stones. The diameter specification is often misleading since the stones are usually angular. However, common practice is often misleading since the stones are usually angular. Common practice is to specify stone size by the diameter of an equivalent size of spherical stone. Table—Size of Riprap Stones lists some typical stones by weight, spherical diameter, and the corresponding

rectangular dimensions. These stone sizes are based upon an assumed specific weight of 165 lb/ft^3.

A method commonly used for specifying the range of stone sizes in graded riprap is to designate a diameter for which some percentage, by weight, will be smaller. For example "d_{85}" specifies a mixture of stones in which 85% of the stone by weight would be smaller than the diameter specified. Most designs are based on "d_{50}", or median size stones.

Riprap and gravel are often designated by classes. (See Table-Riprap Classes).

Table—Size of Riprap Stones

Weight (lb)	Mean Spherical Diameter (ft)	Length (ft)	Rectangular Shape Width/Height (ft)
50	0.8	1.4	0.5
100	1.1	1.8	0.6
150	1.3	2.0	0.7
300	1.6	2.6	0.9
500	1.9	3.0	1.0
1000	2.2	3.7	1.3
1500	2.6	4.7	1.5
2000	2.8	5.4	1.8
4000	3.6	6.0	2.0
6000	4.0	6.9	2.3
8000	4.5	7.6	2.5
20000	6.1	10.0	3.3

When considering riprap for surface stabilization, it is important to anticipate visual impacts, including weed control, hazards from snakes and other animals, danger of slides and hazards to areas below steep riprap slopes, damage and possible slides from children moving stones, and general safety.

Proper slope selection and surface preparation are essential for successful long term functioning of riprap. Adequate compaction of fill areas and proper use of filter blankets are necessary.

Sequence of construction—Schedule disturbance of areas that require riprap protection so the placement of riprap can follow immediately after grading. When riprap is used for outlet protection, place the riprap before or in conjunction with the installation of the structure so that it is in place before the first runoff event.

Design Criteria:

Gradation— Riprap should be a well-graded mixture with 50% by weight larger than the specified design size. The diameter of the largest stone size in such a mixture should be 1.5 times the d_{50} size with smaller sizes grading down to 1 inch.

Size—The designer should determine the riprap size that will be stable for design conditions. Having determined the design stone size, the designer should select the size or sizes that equal or exceed that minimum size based of riprap gradations commercially available in the area. Design criteria for sizing stone for stability of channels are contained in: USDA , SCS Field Design Manual; Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG); and other engineering design manuals.

Thickness—Construction techniques, dimensions of the area to be protected, size and gradation of the riprap, the frequency and duration of flow, difficulty and cost of maintenance, and consequence of failure should be considered when determining the thickness of riprap linings. The minimum thickness should be 1.5 times the maximum stone diameter, but in no case less that 6 inches.

Quality of stone—Stone for riprap may consist of field stone or quarry stone. The stone should be hard, angular, of such quality that it will not break down on exposure to water or weathering, and suitable in all other respects for the purpose intended. The specific gravity of the individual stones should be at least 2.5.

Table—Riprap Classes

Riprap		Erosion Control	
Class 1	**Class 2**	**Class A**	**Class B**
5 to 200 lb	25 to 250 lb	2" to 6"	5" to 15"
30% shall weigh a minimum of 60 lbs each	60% shall weigh a minimum of 100 lb each		
No more than 10% shall weigh less than 15 lb each	No more than 5% shall weigh less than 50 lb each	10% tolerance top and bottom sizes	
		Equally distributed, no gradation specified	Equally distributed, no gradation specified

Size of Stone—The sizes of stone used for riprap protection are determined by purpose and specific site conditions.

- **Slope Stabilization** —Riprap stone for slope stabilization not subject to flowing water or wave action should be sized for stability for the proposed grade. The gradient of the slope to be stabilized should be less than the natural angle of repose of the stone selected.

  Riprap used for surface stabilization of slopes does not add significant resistance to sliding or slope failure and should not be considered a retaining wall. The inherent stability of the soil must be satisfactory before riprap is used for surface stabilization. Slopes approaching 1.5:1 may require special stability analysis.

- **Outlet protection**—Design criteria for sizing stone and determining the dimensions of riprap pads at channel or conduit outlets are presented in: USDA , SCS Field Design Manual; Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG); and other engineering design manuals.

- **Channel stabilization and streambank protection**—Design criteria for sizing stone for stability of channels are contained in: USDA , SCS Field Design Manual; Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG); and other engineering design manuals.

Filter blanket—A filter blanket is a layer of material placed between the riprap and the underlying soil to prevent soil movement into or through the riprap.

A suitable filter may consist of a well-graded gravel or sand-gravel layer or a synthetic filter fabric manufactured for this express purpose. The design of a gravel filter blanket is based on the ratio of particle size in the overlying filter material to that of the base material in accordance with the criteria below. The designed gravel filter blanket may consist of several layers of increasingly large particles from sand to erosion control stone.

A **gravel filter blanket** should have the following relationship for a stable design:

$$\frac{d_{15}\ \text{filter}\ d_{85}}{\text{base}} \leq 5$$

$$5 \leq \frac{d_{15}\ \text{filter}\ d_{15}}{\text{base}} \leq 40$$

$$\frac{d_{50}\ \text{filter}\ d_{50}}{\text{base}} \leq 40$$

In these relationships, filter refers to the overlying material and base refers to the underlying material. These relationships must hold between the filter material and the base material (soil foundation) and between the riprap and the filter. More than one layer of filter material may be needed. Each layer of filter material should be at least 6 inches thick.

A synthetic filter fabric may be used with or in place of gravel filters. The following particle size relationships should exist:

- Filter fabric covering a base with granular particles containing 50% or less (by weight) of fine particles (less than U.S. Standard Sieve no. 200 (0.074mm):

  a.

$$\frac{d_{85}\ \text{base (mm)}}{\text{EOS* filter fabric (mm)}} > 1$$

  b. total open area of filter should not exceed 36%

- Filter fabric covering other soils:

  a. EOS is no larger than U.S. Standard Sieve no. 70 (0.21mm)

  b. total open area of filter should not exceed 10%.

  * EOS - Equivalent Opening Size compared to a U.S. standard sieve size.

No filter fabric should have less than 4% open area or an EOS less than U.S. Standard Sieve No. 100 (0.15mm). The permeability of the fabric must be greater than that of the soil. The fabric may be made of woven or nonwoven monofilament yarns and should meet the following minimum requirements:

- thickness 20-60 mils,
- grab strength 90-120 lb,
- conform to ASTM D-1682 or ASTM D-177.

Filter blankets should always be provided where seepage is significant or where flow velocity and duration of flow or turbulence may cause the underlying soil particles to move through the riprap.

Construction Specifications:

Subgrade preparation—Prepare the subgrade for riprap and filter to the required lines and grades shown on the plans. Compact any fill required in the subgrade to a density approximating that of the surrounding undisturbed material or overfill depressions with riprap. Remove brush, trees, stumps, and other objectionable material. Cut the subgrade sufficiently deep that the finished grade of the riprap will be at the elevation of the surrounding area. Channels should be excavated sufficiently to allow placement of the riprap in a manner such that the finished inside dimensions and grade of the riprap meet design specifications.

Sand and gravel filter blanket—Place the filter blanket immediately after the ground foundation is prepared. For gravel, spread filter stone in a uniform layer to the specified depth. Where more than one layer of filter material is used, spread the layers with minimal mixing.

Synthetic filter fabric—Place the cloth filter directly on the prepared foundation. Overlap the edges by at least 12 inches, and space anchor pins every 3 feet along the overlap. Bury the upper and lower ends of the cloth a minimum of 12 inches below ground. Take care not to damage the cloth when placing riprap. If damage occurs remove the riprap and repair the sheet by adding another layer of filter material with a minimum overlap of 12 inches around the damaged area. If extensive damage is suspected, remove and replace the entire sheet.

Where large stones are used or machine placement is difficult, a 4-inch layer of fine gravel or sand may be needed to protect the filter cloth.

Stone placement—Placement of riprap should follow immediately after placement of the filter. Place riprap so that it forms a dense, well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement. Place riprap to its full thickness in one operation. Do not place riprap by dumping through chutes or other methods that cause segregation of stone sizes. Take care not to dislodge the underlying base or filter when placing the stones.

The toe of the riprap slope should be keyed to a stable foundation at its base as shown in Figure EC-21. The toe should be excavated to t depth about 1.5 times the design thickness of the riprap and should extend horizontally from the slope.

The finished slope should be free of pockets of small stone or clusters of large stones. Hand placing may be necessary to achieve the proper distribution of stone sizes to produce a relatively smooth, uniform surface. The finished grade of riprap should be apparent.

Maintenance: In general, once a riprap installation has been properly designed and installed it requires very little maintenance. Riprap should be inspected periodically for scour or dislodged stones. Control of weed and brush growth may be needed in some locations.

Source: North Carolina Erosion and Sediment Control Planning and Design Manual.

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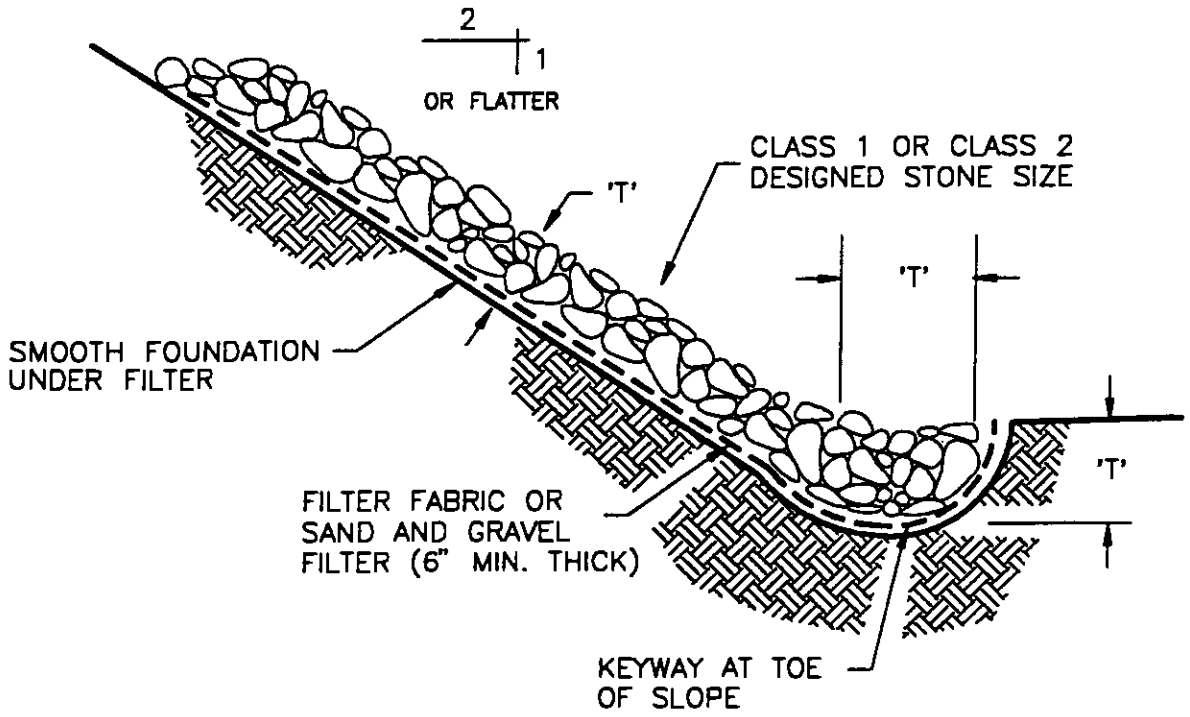

TYPICAL SECTION

NOTE:

'T' = THICKNESS : THICKNESS SHALL BE DETERMINED BY THE ENGINEER.

MINIMUM THICKNESS SHALL BE 1.5x THE MAXIMUM STONE DIAMETER, NEVER LESS THAN 6 INCHES.

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RIPRAP PROTECTION

STANDARD

TEMPORARY SLOPE DRAIN

Definition: A temporary slope drain is a flexible tubing, pipe, overside drain, or other conduit extending temporarily from the top to the bottom of a cut or fill slope.

Purpose: To convey concentrated runoff down the face of a cut or fill slope without causing erosion.

Conditions Where Practice Applies: This practice applies to construction areas where stormwater runoff above a cut or fill slope will cause erosion if allowed to flow over the slope. Temporary slope drains are generally used in conjunction with diversions to convey runoff down a slope until permanent water disposal measures can be installed.

Planning Considerations: There is often a significant lag between the time a cut or fill slope is graded and the time it is permanently stabilized. During this period, the slope is very vulnerable to erosion, and temporary slope drains together with temporary diversions can provide valuable protection.

It is very important that these temporary structures be sized, installed, and maintained properly, because their failure will usually result in severe erosion of the slope. The entrance section to the drain should be well-entrenched and stable so that surface water can enter freely. The drain should extend downslope beyond the toe of the slope to a stable area or appropriately stabilized outlet.

Other points of concern are failure from overtopping from inadequate pipe inlet capacity and lack of maintenance of diversion channel capacity and ridge height.

Design Criteria:

Capacity—Peak runoff from the 10-year storm. See reference material for determining the peak runoff.

Pipe size—Unless they are individually designed, size drains according to Table below:

Maximum Drainage Area per Pipe (acres)	Pipe Diameter (Inches)
0.50	12
0.75	15
1.00	18
>1.00*	as designed

* Inlet design becomes more complex beyond this size.

Conduit—Construct the slope drain from heavy-duty, flexible materials such as nonperforated, corrugated plastic pipe, open top overside drains with tapered inlets, or CMP. Install reinforced, hold-down grommets or stakes to anchor the conduit at intervals not to exceed 10 feet with the outlet end securely fastened in place. CMP or corrugated plastic pipe must have one (1) anchor assembly for ever 20 feet of slope drain.The conduit must extend beyond the toe of the slope.

Entrance—Construct the entrance to the slope drain of a standard flared-inlet section of pipe with a minimum 6-inch metal toe plate. Make all fittings watertight. A standard T-section fitting may also be used at the inlet. An open top flared inlet for overside drain may also be used.

Temporary diversion—Generally, use an earthen diversion with a dike ridge or berm to direct surface runoff into the temporary slope drain. Make the height of the ridge over the drain conduit a minimum on 1.5 foot and at least 6 inches higher than the adjoining ridge on either side. The lowest point of the diversion ridge should be a minimum of 1 foot above the top of the drain so that design flow can freely enter the pipe.

Outlet protection—Protect the outlet of the slope drain from erosion with an energy dissipator.

Construction

Specifications: A common failure of slope drains is caused by water saturating the soil and seeping along the pipe. This creates voids from consolidation and piping and causes washouts. Proper backfilling around and under the pipe "haunches" with stable soil material and hand compacting in 6-inch lifts to achieve firm contact between the pipe and the soil at all points will eliminate this type of failure.

1. Place slope drains on undisturbed soil or well-compacted fill at locations and elevations shown on the plans.

2. Slightly slope the section of pipe under the dike toward its outlet.

3. Hand tamp the soil under and around the entrance section in lifts not to exceed 6 inches.

4. Ensure that fill over the drain at the top of the slope has minimum dimensions of 1.5 foot depth, 4 foot top width, and 3:1 side slopes.

5. Ensure that all slope drain connections are watertight.

6. Ensure that all fill material is well-compacted. Securely fasten the exposed section of the drain with grommets or stakes spaced no more than 10 feet apart.

7. Extend the drain beyond the toe of the slope and adequately protect the outlet from erosion.

8. Make the settled, compacted dike ridge no less than 1 foot above the top of the pipe at every point.

9. Immediately stabilize all disturbed areas following construction.

Maintenance: Inspect the slope drain and supporting diversions after every rainfall and promptly make necessary repairs. When the protected area has been permanently stabilized, temporary measures may be removed, materials disposed of properly, and all disturbed areas stabilized appropriately.

Source: John McCullah-CPESC #311, Redding, CA; Adapted from North Carolina Erosion and Sediment Control Planning and Design Manual.

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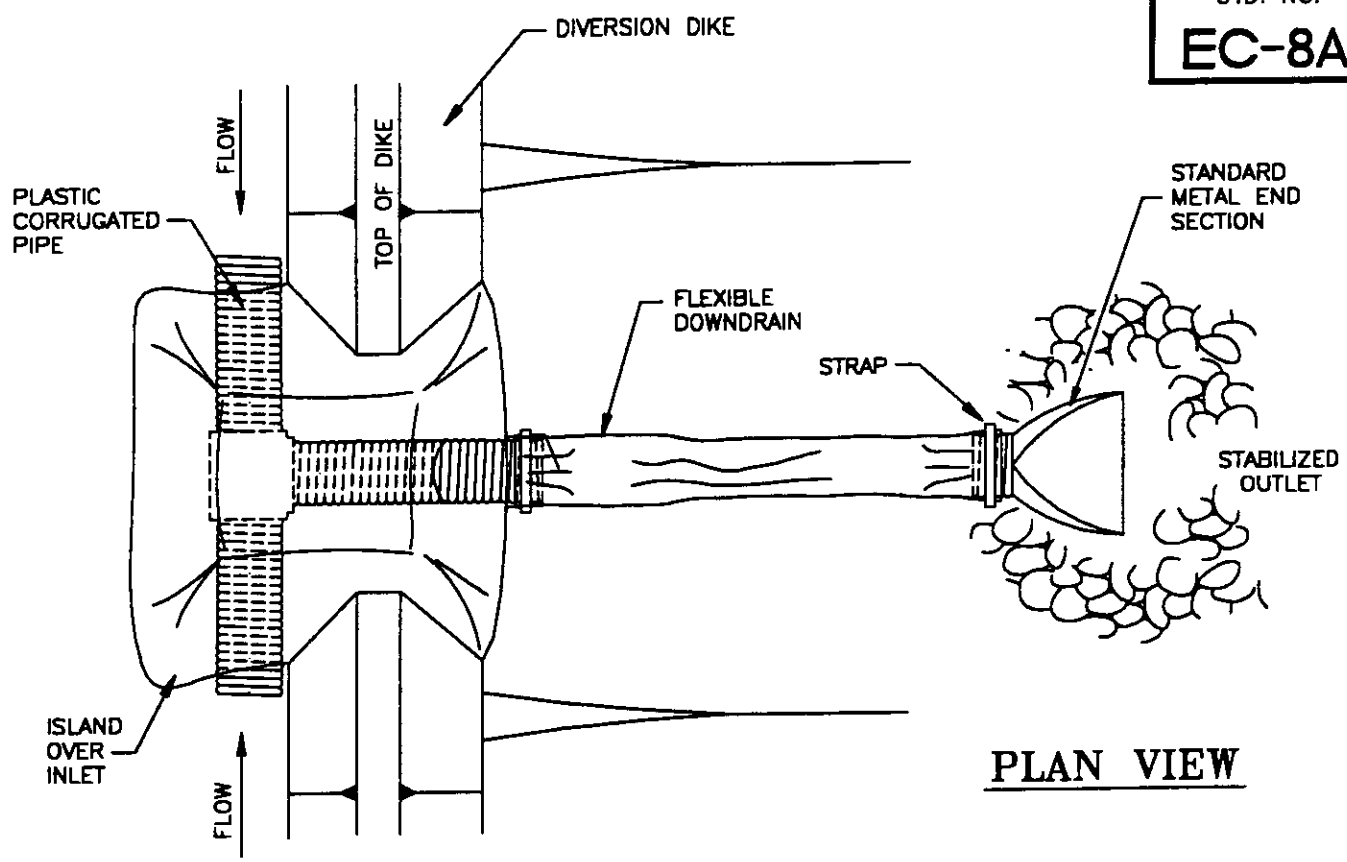
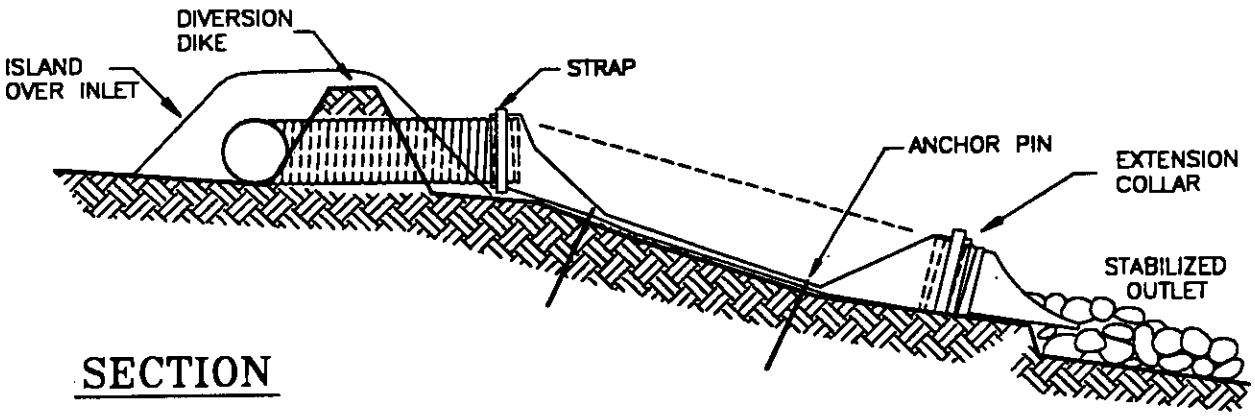


PLAN VIEW



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TEMPORARY SLOPE DRAIN

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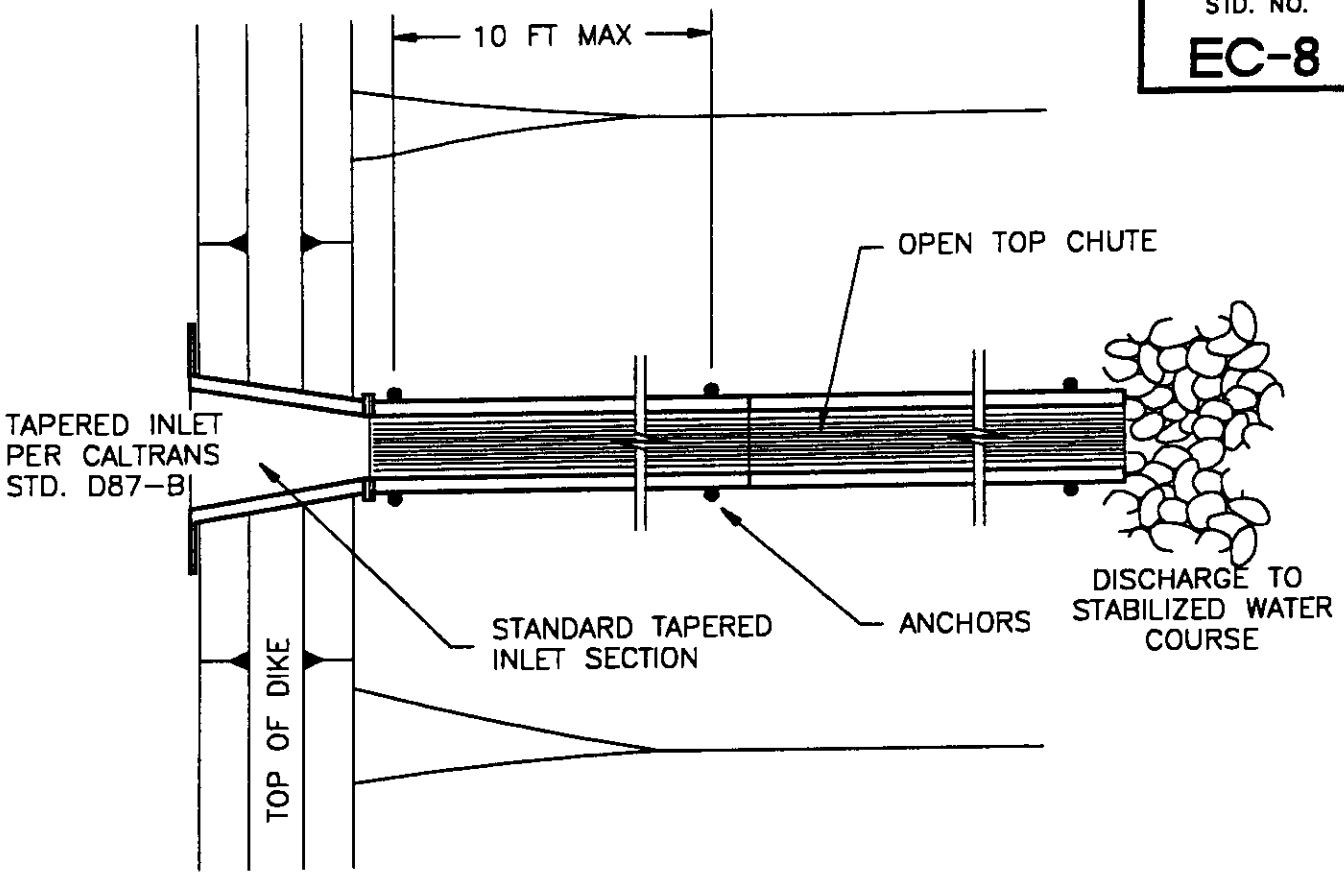
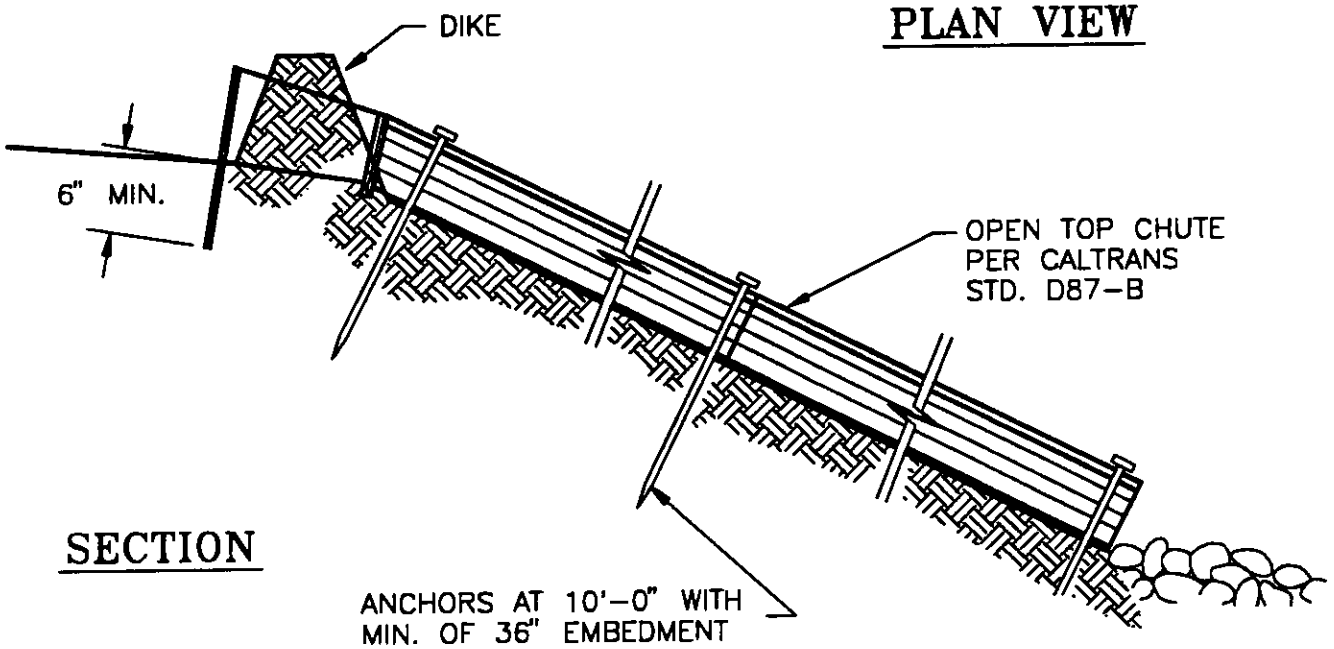


PLAN VIEW



SECTION

DWG DATE 6-92	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
6-92	NEW STD	
DATE	REVISION	DIRECTOR OF PUBLIC WORKS

OVERSIDE DRAIN

STANDARD

CONSTRUCTION ROAD STABILIZATION

Definition: Construction road stabilization is the stabilization of temporary construction access routes, on-site vehicle routes, emergency fire ingress/egress roads, and parking lots by dispersing runoff and surfacing.

Purpose: To control erosion on temporary construction routes and parking areas. This practice also reduces erosion from driveways, permanent access roads, and emergency fire roads that have been constructed on highly erodible soils such as decomposed granite (DG).

Planning Considerations: Construction road stabilization shall apply to roads on sites requiring a **Wet Weather Plan**, roads and driveways in DG soils, and other unstabilized dirt roads that are generating sediment and/or excessive runoff. Improperly planned and maintained construction roads can become a continual erosion problem. Excess runoff from roads causes erosion on adjacent areas, and an unstabilized road may become a dust problem.

Construction vehicle traffic routes are especially susceptible to erosion because they become compacted and collect and convey runoff water along their surfaces. Rills, gullies, and troublesome muddy areas form unless the road is stabilized. During wet weather, unstabilized dirt roads may become so muddy they are virtually unusable, generating sediment and causing work interruption. Proper grading and stabilization of construction routes often saves money for the contractor by improving the overall efficiency of the construction operation while reducing the erosion problem.

1. Situate construction roads to reduce erosion potential, following the natural contour of the terrain. Avoid steep slopes, wet or rocky areas, and highly erosive soils. If the temporary construction roads are anticipated to be the permanent roads, then there will be no additional cost to temporary rock surfacing, since base will need be applied before final paving.

2. Outsloped and unbermed roads do not concentrate runoff. Outsloped sections of road will disperse the runoff over the entire section of road. A road that is outsloped and bermed will concentrate flows and an overside drain or temporary slope drain will be required to safely drain the road.

3. Insloped roads will require a non-erosive roadside ditch. Steep gradients, concentrated flows and erosive soils may require a stabilized roadside ditch, using riprap, geotextiles and vegetation.

4. Minimize stream crossings and install them properly. Obtain 1603 permits from California Department of Fish and Game for working in or altering a stream channel.

5. When practical, install permanent paved roads and parking areas and use them for construction traffic early during the construction operation to minimize site disruption.

6. Outsloped roads with a berm or diversion dike will require temporary slope drain or other device to protect the fill slopes from concentrated runoff.

Design Criteria:

Fill slope of road embankment—2:1 or flatter for vegetative stabilization.

Ditch capacity—Roadside ditch and temporary slope drains—10 year peak runoff. (See Rock Lined Channels)

Rock surface—Use a 6-inch minimum thick base rock or other approved rock.

Permanent road standards—See road design standards.

Construction Standards:

1. Ensure that road construction follows the natural contours of the terrain if it is possible. Outslope road if possible.

2. Locate parking areas on naturally flat areas if they are available. Keep grades sufficient for drainage but generally not more than 2 to 3%.

3. Provide surface drainage, and divert excess runoff to stable areas by using waterbars, rolling dips, temporary slope drains or other runoff control measures. (See Waterbars and Rolling Dips; Temporary Slope Drain)

4. Apply a minimum 6 inches of road base, gravel, or other approved rock to the road surface before October 15.

5. If possible, keep cuts and fills at 2:1 or flatter for safety and stability and to facilitate establishment of vegetation and maintenance. See also Land Grading for Minimizing Erosion.

6. Vegetate cuts, fills, and other disturbed areas as soon as grading is complete. Vegetate, rock line or otherwise stabilize roadside ditches if they are actively eroding. See Rock Lined Channels.

7. Where seepage areas or seasonally wet areas must be crossed, install subsurface drains or geotextile fabric cloth before placing the crushed stone.

8. Provide appropriate sediment control measures to prevent off-site sedimentation.

Maintenance: Inspect construction roads and parking areas periodically for condition of surface. Topdress with new gravel as needed. Check road ditches and other seeded areas for erosion and sedimentation after runoff-producing rains. Maintain all vegetation in a healthy, vigorous condition. Sediment-producing areas should be treated immediately.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; Adapted from North Carolina Erosion and Sediment Control Planning and Design Manual.

STANDARD

WATERBARS AND ROLLING DIPS

Definition: Waterbars and rolling dips are ridges or ridge-and-channels constructed diagonally across a sloping road or utility right-of-way that is subject to erosion.

Purpose: To limit the accumulation of erosive volumes of water on roads by diverting surface runoff at predesigned intervals.

Conditions Where Practice Applies: Where runoff protection is needed to prevent erosion on sloping access right-of-ways or other long, narrow sloping areas generally less than 100 feet in width.

Planning Considerations: Construction of access roads, power lines, pipelines, and other similar installations often requires clearing long narrow right-of-ways over sloping terrain. Roads concentrate runoff. Gully formation may be especially severe in tire tracks and ruts. To prevent gullying, runoff can often be diverted across the width of the right-of-way to undisturbed areas by using small waterbars or rolling dips.

A waterbar is a berm and excavation built diagonally across the road. Waterbars generally become less effective if driven over during wet weather, and are difficult to cross with low clearance vehicles. Rolling dips are gently sloping excavations running diagonally across the road surface, and are more appropriate for winter use. Rolling dips are more difficult to construct, but are much easier to traverse.

Special attention should be given to the placement of each individual outlet area and the cumulative effects of each additional diversion. If possible, outlet the diversion onto a stable area such as on a ridge line, onto a stable vegetated (brush) area, or onto a rock dissipator. Never outlet waterbars or rolling dips onto unprotected fill slopes. Use gravel to stabilize the waterbars or rolling dips where significant vehicular traffic is anticipated.

Give special consideration to each individual outlet area, as well as to the cumulative effect of added diversions. Use gravel to stabilize the diversion where significant vehicular traffic is anticipated.

Design Criteria: Height—18 inch minimum measured from the channel bottom to the ridge top.

Side slope—2:1 or flatter; 3:1 or flatter where vehicles cross

Base width of ridge—6 foot minimum

Spacing of waterbars/rolling dips is shown below:

Slope (%)	Spacing (feet)	Spacing (feet) D.G. Soils
<5	125	100
5 to 10	100	75
10 to 20	75	50
20 to 35	50	25
>35	25	25

The distance it takes for the unrocked running surface of a nearby road to develop a 1-inch rill is a rough measure of the appropriate spacing distance.

Grade and angle—Positive grade not to exceed 2%. A crossing angle of approximately 60 degrees is preferred.

Outlet—Diversions should have stable outlets, either natural or constructed. Site spacing may need to be adjusted for field conditions to use the most suitable areas for water disposal—into brush, onto a ridge line, or onto an energy dissipator.

Construction Specifications:

1. Install the diversion as soon as the right-of-way has been cleared and graded.

2. Construct a rolling dip if the road is intended for winter use and normal vehicular use—low clearance.

3. The waterbars and rolling dips should be built at an angle of 45 to 60 degrees from the centerline

4. The diversion should have a positive grade of 2%.

5. The height from channel bottom to the top of the settled ridge shall be 18 inches and the side slopes of the ridge shall be 2:1 or flatter.

Maintenance: Periodically inspect right-of-way diversions for wear and after every heavy rainfall for erosion damage. Immediately remove sediment from the flow area. Check outlet areas and make timely repairs as needed. When permanent road drainage is established and the area above the temporary right-of-way diversions is permanently stabilized, remove the diversion to blend with the natural ground, and appropriately stabilize the disturbed area.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; North Carolina Erosion and Sediment Control Planning and Design Manual; USDA-Soil Conservation Service: Guide to Building Small Roads

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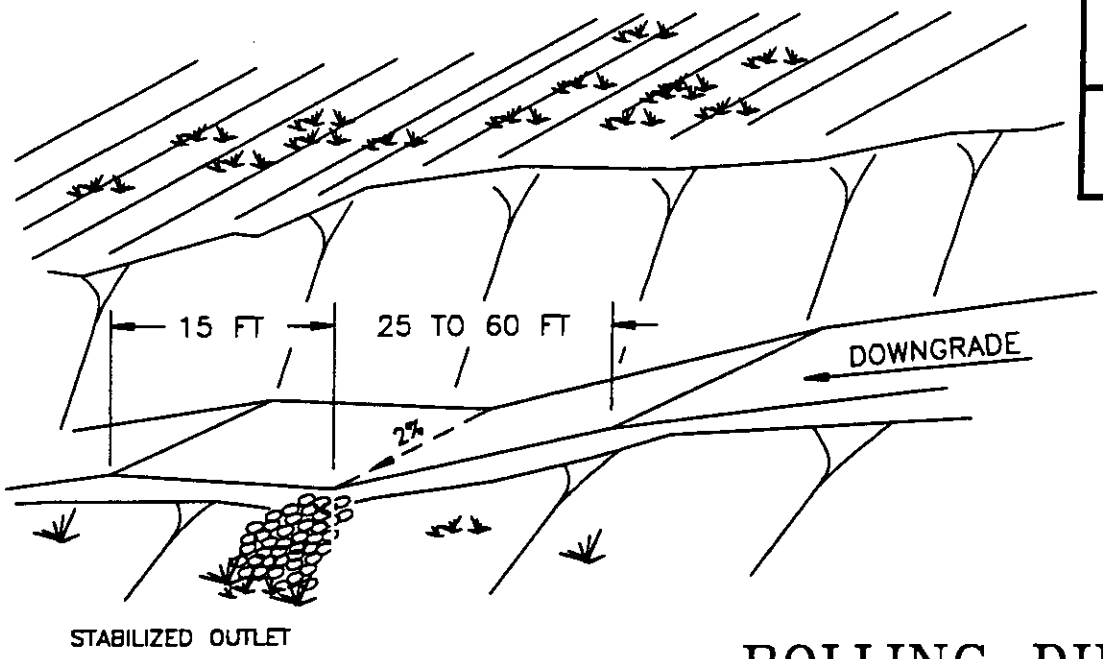
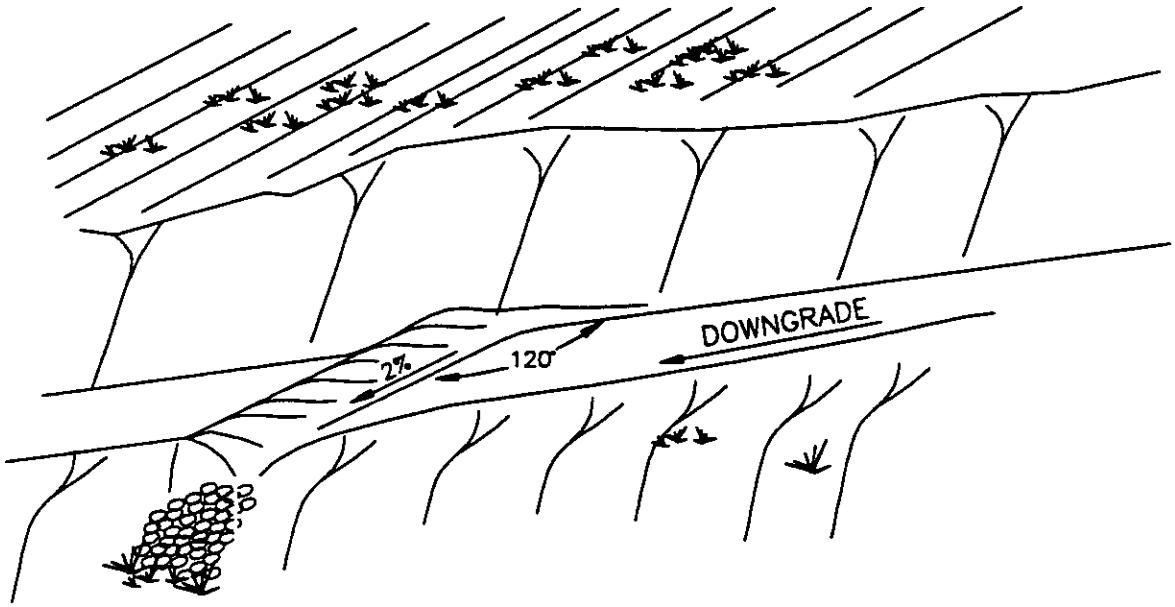
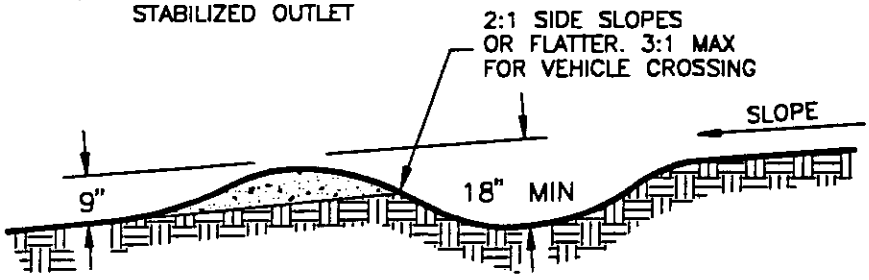


ROLLING DIP





WATERBAR

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ROLLING DIP AND WATERBAR

STANDARD

ENERGY DISSIPATOR

Definition: An energy dissipator is a structure designed to control erosion at the outlet of a channel or conduit.

Purpose: To prevent erosion at the outlet of a channel or conduit by reducing the velocity of flow and dissipating the energy.

Conditions Where Practice Applies: This practice applies where the discharge velocity of a pipe, box culvert, diversion, open channel, or other water conveyance structure exceeds the permissible velocity of the receiving channel or disposal area.

Planning Considerations: The outlets of channels, conduits, and other structures are points of high erosion potential, because they frequently carry flows at velocities that exceed the allowable limit for the area downstream. To prevent scour and undermining, an outlet stabilization structure is needed to absorb the impact of the flow and reduce the velocity to non-erosive levels.

A riprap-lined apron is the most commonly used practice for this purpose because of its relatively low cost and ease of installation. The riprap apron should be extended downstream until stable conditions are reached, even though this may exceed the length calculated for design velocity control.

Riprap-stilling basins or plunge pools reduce flow velocity rapidly. They should be considered in lieu of aprons where overfalls exit at the ends of pipes or where high flows would require excessive apron length. Consider other energy dissipators such as concrete impact basins or paved outlet structures where site conditions warrant. The City of Redding Construction Standards show permanent type, concrete energy dissipators.

Design Criteria: The criteria for design of riprap outlets are:

Capacity—10-year peak runoff or the design discharge of the water conveyance structure, whichever is greater.

Tailwater depth—Determine the depth of tailwater immediately below the pipe outlet based on the design discharge plus other contributing flows. If the tailwater depth is less than half the diameter of the outlet pipe and the receiving stream is sufficiently wide to accept the divergence of flow, it is classed as a minimum tailwater condition.

If the tailwater depth is greater than half the pipe diameter, it is classed as a maximum tailwater condition. Pipes that outlet onto broad flat areas with no defined channel may be assumed to have a minimum tailwater condition unless site conditions indicate otherwise.

Apron size—The apron length and width can be determined according to the tailwater condition. If the water conveyance structure discharges directly into a well-defined channel, extend the apron across the channel bottom and up the channel banks to an elevation of 0.5 feet above the maximum tailwater depth or to the top of the bank, whichever is less.

Determine the maximum allowable velocity for the receiving stream, and design the riprap apron to reduce flow to this velocity before flow leaves the apron. Calculate the apron length for velocity control or use the length required to meet stable conditions downstream, whichever is greater.

Grade—Ensure that the apron has zero grade. There should be no overfall at the end of the apron; that is, the elevation of the top of the riprap at the downstream end should be the same as the elevation of the bottom of the receiving channel or the adjacent ground if there is no channel.

Alignment—The apron should be straight throughout its entire length, but if a curve is necessary to align the apron with the receiving stream, locate the curve in the upstream section of riprap.

Materials—Ensure that riprap consists of a well-graded mixture of stone. Larger stone should predominate, with sufficient smaller sizes to fill the voids between the stones. The diameter of the largest stone size should be no greater than 1.5 times the d_{50} size.

Thickness—The minimum thickness of riprap shall be 1.5 times the maximum stone diameter.

Stone quality—Select stone for riprap from field stone or quarry stone. The stone should be hard, angular, and highly weather-resistant. The specific gravity of the individual stones should be at least 2.5.

Filter—Install a filter to prevent soil movement through the openings in the riprap. The filter should consist of a graded gravel layer or a synthetic filter cloth. Design filter blankets by the method described in Riprap Standard.

Construction Specifications:

1. Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.

2. The riprap and gravel filter must conform to the specified grading limits shown on the plans.

3. Filter cloth, when used, must meet design requirements and be properly protected from punching or tearing during installation. Repair any damage by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap a minimum of 1 foot. If the damage is extensive, replace the entire filter cloth.

4. Riprap may be placed by equipment, but take care to avoid damaging the filter.

5. The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.

6. Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather-resistant and well graded.

7. Construct the apron on zero grade with no overfall at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.

8. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.

9. Immediately after construction, stabilize all disturbed areas with vegetation.

Maintenance: Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

Source: Adapted from North Carolina Erosion and Sediment Control Planning and Design Manual.and Tahoe Regional Planning Agency, Vol II Handbook of BMPs.

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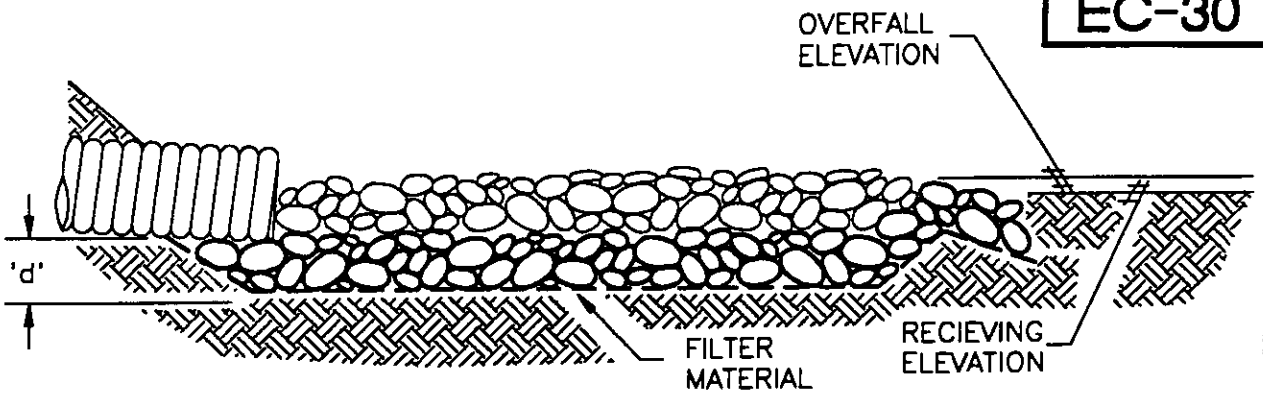
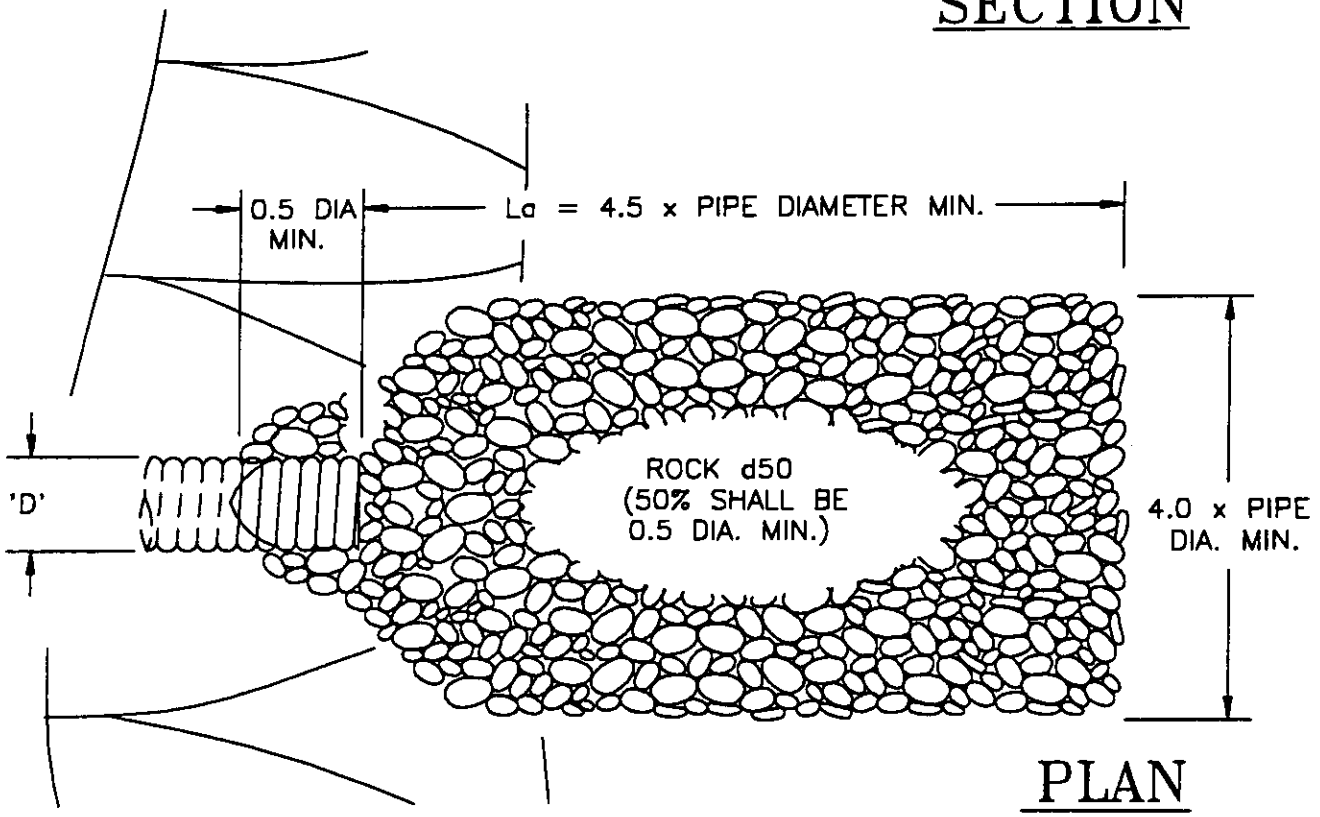


THICKNESS (d) = 1.5 x MAX ROCK DIAMETER (6" MIN.)

SECTION



PLAN

NOTES:

1. 'La' = LENGTH OF APRON. DISTANCE 'La' SHALL BE OF SUFFICIENT LENGTH TO DISSIPATE ENERGY. APRON SHALL BE SET AT A ZERO GRADE AND ALIGNED STRAIGHT.
2. FILTER MATERIAL SHALL BE FILTER FABRIC OR 6" THICK (MIN.) GRADED GRAVEL LAYER.

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ENERGY DISSIPATOR

STANDARD

PERMANENT STORM DRAIN OUTLET

Definition: De-energizing devices and erosion-resistant channel sections between storm drain outlets and stable downstream channels.

Purpose: These protection measures convert pipe flow to channel flow and reduce water velocity. They are used where storm drain outlets, road culverts, paved channel outlets, etc., discharge into existing streams or drainage systems. The entire length of the channel from the end of the structure to the stream or drainage system is protected by rock-lining, vegetation, concrete paving or other erosion-resistant material.

Design Considerations:

- depth of flow, roughness, gradient, side slopes, bottom width,discharge rate and velocity of each channel reach between the storm drain outlet and the existing publicly-maintained system or natural stream channel. (A channel reach is defined as a length of channel throughout which the hydraulic characteristics do not change);
- maximum allowable water velocity through each channel reach;
- type of storm drain outlet protection (aprons, lined waterways, riprap or grass protection);
- compliance with local and state regulations and requirements;
- maintenance requirements.

Refer to the City of Redding Construction Standards for two types of permanent Energy Dissipators.

For alternative methods of design and more information, consult a qualified engineer.

Source: Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

SECTION D: SEDIMENT CONTROL STANDARDS

Some erosion during construction is unavoidable. The purpose of sediment retention structures is to prevent sediment from leaving the site after it has been eroded from its place of origin. Sediment laden runoff should be detained on-site so that the soil particles can settle out before the runoff enters receiving waters.

The most common sediment retention structures are sediment basins, sediment traps, straw bale barriers, straw bale dikes, and silt fences. Sediment basins and traps are placed at low points below disturbed areas. Grading or drainage swales are used to route drainage from the disturbed areas into the basins. Straw bale dikes and silt fences can be placed below small disturbed areas on gentle to moderate slopes. Storm runoff temporarily ponds up behind these barriers, which allows the sediment to settle out. Straw bale barriers can be placed in gentle swales or drainageways to trap sediment and slow runoff velocities, thus reducing erosion.

All sediment retention structures are temporary and require careful installation. Many erosion problems are worsened by the inappropriate use or substandard installation of sediment retention structures. These measures require regular inspection, repair, regular cleanout intervals, and the sediment trapped must be disposed of.

STANDARD

TEMPORARY SEDIMENT BASIN

Definition: A temporary sediment basin is a basin with a watershed of 5 acres or larger constructed to collect and store sediment or debris, with a life span of 3 years or less.

Purpose: Sediment basin collects and holds runoff to allow suspended sediment to settle out. A number of small basins are preferable to one large basin. They are particularly useful below construction operations that expose soil to erosion. Sediment basins remain in place until the disturbed area is permanently stabilized.

This standard establishes the minimum acceptable standards for the design and construction of sediment basins:

The effective height of the basin dam is less than 10 feet. (The effective height is the difference in elevation measured from the emergency spillway crest to the lowest point in the cross-section taken along the centerline of the dam. If there is no emergency spillway, the top of the dam is the upper limit). For basin dams exceeding 10 feet in height, consult a registered civil engineer.

The earth fill structure is constructed according to Earth Dams and Reservoirs (USDA Soil Conservation Service, Technical Release No. 60, June 1976) and all local codes and regulations.

The basin is to be removed within 12 months after the completion of construction on the site.

Plans and specifications should comply with the rules and regulations of the California Division of Dam Safety, the California Department of Fish and Game and other state or local agencies.

Design Considerations: Design considerations should include the following:

- state and local laws, rules and regulations;
- drainage area less than 100 acres;
- design capacity;
- cleanout frequency;
- embankment and/or excavation specifications;
- principal and emergency spillway;
- compatibility with existing topography;
- risk of basin failure;
- soil erodibility, settleability, accumulation rate and particle size;
- controlled access for safety.

It is permissible to have a number of small sediment basins rather than one large basin. Small basins may be easier to locate, cheaper to build and easier to maintain. In addition, property damage risk is generally much lower with small basins. However, no basin should discharge to a lower basin unless the lower basin is designed to handle the runoff from the entire drainage area.

This standard and sample specifications describes a method to size sediment basins according to a surface area criterion. The surface area is determined by the expected flow and the settling velocity of the particle size to be captured.

The basin volume consists of a settling zone and a storage zone. The settling zone should be a minimum of 2 feet deep. The storage volume is estimated using the Universal Soil Loss Equation. Storage requirements will vary considerably depending primarily on local rainfall. Sediment storage volumes in the Bay Area can range from 30 to 120 cubic yards per acre, based on annual cleanout, 10% slopes, no other erosion control practices, and typical rainfall values.

Ideally a basin designed to this specification will attain a maximum practical sediment capture of approximately 60 to 70%. However, the fine particles common in Bay Area soils are very difficult to contain in a settling basin. Thus, sediment basins alone are not sufficient protection against soil loss. Erosion and sediment control plans that include vegetative cover of exposed slopes and nonerosive channeling of runoff greatly reduce the expected sediment yield. With such measures included in the plan, the storage volume of sediment basins can be significantly smaller than the figures quoted above and performance will be maximized.

Due to the nature of soils, it is strongly recommended that sediment basins be supplemented with other erosion control measures.

The Universal Soil Loss Equation can also be used to estimate the effect of vegetation and other erosion control measures on sediment loss. For example, established vegetation reduces soil loss by an approximate factor of 10. If this reduced figure is used to calculate the required storage volume of a basin, an inspection schedule should be implemented to ensure that vegetation does become established. In addition, unexpected high-intensity storms can generate more sediment than predicted. Therefore, sediment basins should be inspected for clean out after every storm, regardless of vegetative cover.

Design Specifications: Plans and specifications shall comply with rules land regulations as set forth by the California Division of Dam Safety, California Department of Fish and Game, and other federal, state or local agencies.

1. For the purpose of these specifications, sediment basins are classified as follows:

Classification of Temporary Sediment Basins:

Size	Max. Drainage area, acres	Max.Height* of dam, ft.	Min. Embank top width	Embank s/s	Seep collar
1	100	10'	10'	2:1 or flatter	Yes
2**	100	15'	10'	2.5:1 or flatter	Yes

* height is measured from the low point of original ground along the centerline of dam to top of the dam.

** for dam heights exceeding 10 feet, a registered civil engineer should be consulted for basin design.

2. The sediment basin shall be located to obtain the maximum storage benefit from the terrain and for ease of cleanout of the trapped sediment. It shall be located to minimize interference with construction activities and construction of utilities.

3. The volume of the sediment basin shall consist of two portions: a sediment storage zone and a settling zone.

4. The sediment storage zone shall consist of sufficient volume to retain sediment expected to be captured by the basin between maintenance cleanouts. For a one-per-year cleaning, storage for an entire season's soil capture shall be provided. This volume is in addition to the settling zone volume of the basin and may be estimated using the Universal Soil Loss Equation for incoming sediment and assuming basin efficiency for retaining sediment.

5. The sediment settling zone shall always be kept free of sediment. Within it, particles of sediment settle to the storage zone. The sediment settling volume shall be based upon a minimum 2-foot depth to the storage zone.

6. The surface area of the sediment basin shall be calculated at the height of the rim of the riser as follows:

$$A = \frac{K \times Q}{Vs}$$

where: **A** is the surface area of the sediment basin, in square feet;

Q is the design overflow rate at the riser or spillway, in cubic feet per second

Vs is the settling velocity of the selected particle size, expressed in feet per second. (All soil particles greater than or equal to the selected particle size are to be retained in the basin.)

K is an adjustment factor for nonideal settling basins, equal to **1.2**.

7. The design overflow rate at the riser, Q, shall be calculated by the TR-55 or Rational Method, or other approved method, and shall be based upon a minimum rainfall intensity of the 10 year frequency, 24 hour duration rainfall total, averaged over 24 hours, for the site in question. The emergency spillway when required shall be designed for the 50 year frequency, 24 hour duration rainfall total, averaged over 24 hours for the site in question. Runoff computation shall be based upon the soil cover conditions expected to prevail in the contributing drainage area during the anticipated effective life of this sediment basin. The sediment basin spillway shall be designed for a minimum storm event of 50 year, 24 hours. The riser can be sized to handle this event or sized to handle the 10 year, 24 hour event in which case an emergency spillway will be required to handle the 50 year, 24 hour event storm.

8. The settling velocity, Vs, which shall be for the 0.02 millimeter particle, is 0.00096 feet per second.

9. The basin configuration shall be such that the length is greater than or equal to the width. Basins constructed with length-to-width ratios ranging from 1:1 to 9:1 shall have a baffle constructed anywhere from near the inlet to the basin to mid-way to the riser. This baffle shall divert the inflow evenly across the width of the basin. The basin dimensions necessary to obtain the required volume and configuration shall be clearly shown on the plans.

10. The combined capacities of the riser or principle spillway and the emergency spillway shall be sufficient to pass the peak rate of runoff from a storm size commensurate with the degree of protection required.

11. Sediment basins shall be cleaned out when the storage volume is full. Unexpected high-intensity storms can generate higher quantities of sediment than predicted by the Universal Soil Loss Equation. Therefore, sediment basins shall be inspected for cleanout after every major storm.

    This cleanout shall restore the sediment basin to its original design volume. The elevation corresponding to the maximum allowable sediment level shall be determined, shall be stated in the design data as a distance below the top of riser, and shall be clearly marked on the riser. In no case shall this sediment level be less than 2 feet below the top of the riser. It shall be clearly marked on the plan where the sediment that is removed from the basin will be placed.

12. The principle spillway shall consist of a vertical pipe or box-type riser joined with a watertight connection to a pipe extending through the embankment and outlet beyond the downstream toe of the fill. The principle spillway shall meet the following specifications:

    a. The minimum capacity of the principle spillway shall be equal to the peak flow expected from the design storm. For those basins with no emergency spillway, the principle spillway shall have the capacity to handle the peak flow from a rainfall event commensurate with the degree of hazard involved. The minimum diameter of the pipe through the embankment shall be 18 inches. The minimum riser size shall be 1.5 times the diameter of the pipe through the embankment.

    b. When used in combination with an emergency spillway, the crest elevation of the riser shall be 1 foot below the elevation of the control section of the emergency spillway.

    c. The riser shall be completely watertight, and shall not have any holes, leaks, rips or perforations, except for the inlet opening at the top and a dewatering opening.

    d. Means for dewatering the settling zone shall be included in the sediment basin plans submitted for approval, and shall be installed during construction of the basin.

       Dewatering shall be done in such a manner as to remove the relatively clean water without removing any of the sediment that has settled out and without removing any appreciable quantities of floating debris.

       The sediment itself will have a high water content, to the point of being soupy. Dewatering the sediment is not required but does

facilitate cleanout of the basin and provides a public safety factor. The only practical means of dewatering the sediment is by the use of an under drain.

e. A concentric anti-vortex device and trash rack shall be securely installed on top of the riser.

f. A base with sufficient weight to prevent flotation of the riser shall be attached to the riser with a watertight connection. Tow approved bases for risers 10 feet or less in height are:

- concrete base 18 inches thick with the riser embedded 6 inches in the base;
- 1/4 inch minimum thickness steel plate attached to the riser by a continuous weld around the circumference of the riser to form a watertight connection. The plate shall have 2.5 feet of stone, gravel or tamped earth placed on it to prevent flotation.

In either case, each side of the square base shall be twice the riser diameter. For risers higher than 10 feet, computations shall be made to check flotation. The minimum safety factor shall be 1.25 (downward forces=1.25 x upward forces).

g. Anti-seep collars shall be installed around the pipe conduit within the normal saturation zone to increase the seepage length at least 10 percent when any of the following conditions exist:

- the settled height of dam exceeds 10 feet;
- the embankment material has a low silt-clay content (Unified Soil Classes SM or GM) and the pipe diameter is 18 inches or greater.

The phreatic line may be approximated with a line drawn downward on a 4:1 slope from the intersection of the normal pool (corresponding to the top of the riser and the upstream face of the embankment). The seepage length is the length of the flow path of a particle of water along the conduit from the riser to the point of intersection between the approximate phreatic line and the invert of the pipe conduit. When anti-seep collars are used, the equation for revised seepage length becomes:

$$Ls + 2nV > 1.1Ls \text{ or } n>.05Ls/V$$

where:

Ls is the saturated length of pipe between the riser and the intersection of the phreatic line and the pipe invert, in feet;

n is the number of anti-seep collars;

V is the vertical projection of the collar from the pipe, in feet.

The anti-seep collar and its connection to the pipe shall be watertight. The anti-seep collar(s) shall be located below the phreatic line in the embankment and should be equally spaced. The maximum spacing, in feet, between collars shall be 14 times the minimum projection of the collar measured perpendicular to the pipe. Collars shall not be located closer than 2 feet to a pipe joint. There shall be sufficient distance between collars to allow passage of hauling and compacting equipment.

h. An outlet shall be provided, including a means of conveying the discharge in an erosion-free manner to an existing stable stream. Drainage easements shall be obtained if this discharge crosses the property line before reaching the stream. These easements shall be in writing, shall be referenced on the erosion and sediment control plan, and shall be submitted for review along with the erosion and sediment control plan. Protection against scour at the discharge end of the pipe spillway shall be provided. Measure may include impact basin, riprap, revetment, excavated plunge pools, or other approved methods.

13. Emergency spillways shall not be constructed on fill. The emergency spillway cross-section shall be trapezoidal with a minimum bottom width of 8 feet. Emergency spillways shall meet the following specifications:

a. The minimum capacity of the emergency spillway shall be that required to pass the peak rate of runoff from a 50 year frequency storm, 24 hour event.

b. Erosion protection shall be provided by vegetation or other suitable means such as riprap, asphalt or concrete.

c. The velocity of flow in the exit channel shall not exceed 5 feet per second for vegetated channel. For channel with erosion protection other than vegetation, velocities shall be within the nonerosive range for the type of protection used.

d. The freeboard shall be at least 1 foot. Freeboard is the difference between the design high water elevation in the emergency spillway and the top of the settled embankment. If there is no emergency spillway, it is the difference between the water surface elevation required to pass the design flow through the pipe and the top of settled embankment.

14. Embankment cross sections shall be as follows:

    a. Size 1 basins: The minimum top width shall be 10 feet. The side slopes shall not be steeper than 2:1.

    b. Size 2 basins: The minimum top width shall be 10 feet. The side slopes shall not be steeper than 2 1/2:1.

15. Points of entrance of surface runoff into excavated sediment basins shall be protected to prevent erosion. dikes, swales, grade stabilization structures or other water control devices shall be installed as necessary to ensure direction of runoff and to protect points of entry into the basin. Points of entry should be located so as to ensure maximum travel distance of entering runoff to point of exit from the basin.

16. The sediment basin plans shall indicate the method(s) of disposing of the sediment removed from the basin. The sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the basin or in or adjacent to a stream or flood plain.

    The sediment basin plans shall also show the method of disposing of the sediment basin after the drainage area is stabilized, and shall include the stabilizing of the sediment basin site. Water lying over the trapped sediment shall be removed from the basin by pumping, cutting the top of the riser or other appropriate method prior to removing or breaching the embankment. Sediment shall not be allowed to flush into a stream or drainageway.

17. Sediment basins are attractive to children and can be very dangerous. Therefore, they shall be fenced or otherwise made inaccessible to persons or animals unless this is deemed unnecessary due to the remoteness of the site or other circumstances. In any case, regulations regarding health and safety shall be adhered to.

Construction Specifications:

1. Areas under the embankment and any structural works shall be cleared, grubbed and stripped of any vegetation and rootmat as shown on the erosion and sediment control plan. In order to facilitate cleanout and restoration, the basin area shall be cleared also.

2. A cut-off trench shall be excavated along the centerline of the earth fill embankments. The minimum depth shall be 2 feet. The cut off trench shall extend up both abutments to the riser crest elevation.

The bottom width shall be wide enough to permit operation of excavation and compacting equipment and a minimum of 4 feet. The side slopes shall be no steeper than 1:1. Compacting requirements shall be the same as those for the embankment. The trench shall be dewatered during the backfilling compacting operations.

3. Fill material for the embankment shall be taken from approved borrow areas. It shall be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material. Relatively pervious materials such as sand and gravel (Unified Soil Classes GW, GP, SW and SP) shall not be placed in the embankment. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compacting.

   Fill material shall be placed in 6-inch lifts, continuous layers over the entire length of the fill. Compacting shall be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or tread track of the equipment, or by the use of a compactor. The embankment shall be constructed to an elevation of 10 percent higher than the design height to allow for settlement if compacting is obtained with hauling equipment. If compactors are used for compacting, the overbuild may be reduced to not less than 5 percent.

4. The principle spillway riser shall be securely attached to the discharge pipe by welding all around and all connections shall be watertight. The pipe and riser shall be placed on a firm, smooth soul foundation. The connection between the riser and the riser base shall be watertight. Pervious materials such as sand, gravel or crushed stone shall not be used as backfill around the pipe or anti-seep collars.

   The fill material around the pipe spillway shall be placed in 4-inch layers and compacted under the shoulders and around the pipe to at least the same density as the adjacent embankment. a minimum of 2 feet of hand compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment. Steel base plates shall have at least 2 1/2 feet of compacted earth, stone or gravel over them to prevent flotation.

5. The emergency spillway shall not be installed in fill. Elevations, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway.

6. Baffles shall be constructed of 4" by 4" posts and 4' by 8' 1/2" exterior plywood. The posts shall be set at least 3 feet into the ground, no further apart than 8 feet center to center, and shall reach a height 6 inches below the riser crest elevation. The plywood shall be securely fastened to the upstream side of the posts.

7. The embankment and emergency spillway shall be stabilized with vegetation immediately following construction (See Standard and Sample Specifications for Planting of Exposed Soils).

8. Construction operations shall be carried out in such a manner that erosion and water pollution will be minimized.

9. State requirements shall be met concerning fencing and signs warning the public of hazards of soft sediment and floodwater.

10. Maintenance and repairs shall be carried out as follows:

    a. All damages caused by soil erosion or construction equipment shall be repaired before the end of each working day.
    b. Sediment shall be removed from the basin when it reaches the specified distance below the top of the riser. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.

11. When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposit shall be leveled or otherwise disposed of in accordance with the approved erosion and sediment control plan.

INFORMATION TO BE SUBMITTED FOR APPROVAL

Sediment basin designs and construction plans submitted to the reviewing agency shall include the following:

- Specific location of the dam;
- Plan view of dam, storage basin and emergency spillway;
- Cross section of dam, principle spillway and emergency spillway;
- Details of pipe connections, riser to pipe connection, riser base, anti-seep collars, trash rack and anti-vortex device;
- Runoff calculation for 10 year 24 hour storm and 50 year 24 hour storm events;

- Storage calculations including total volume required, total volume available, and level of sediment at which cleanout shall be required (stated as a distance from the riser crest to the sediment surface);

- Calculations showing design of pipe and emergency spillway.

(Note: Runoff, storage and design calculations may be submitted using the design data sheets in the appendix.

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

INSTRUCTIONS:

1. Calculate runoff for the average hourly rainfall from the 10 year, 24 hour storm and the 50 year 24 hour storm, by using TR-55 or the Rational Method. Particle size analysis can be performed by the engineering firm providing the geotechnical report. The basin will be designed to capture the 0.02 mm particle.

2. The minimum surface area, to capture particles of selected diameter and larger, is the inverse of the particle settling velocity multiplied by 1.2 and by the average runoff in ft^3/sec. (For 0.02 mm diameter particles the surface area is 1250 square feet per ft^3/sec of runoff).

3. The minimum settling depth is 2 feet.

4. For the required storage depth, estimate the soil loss in cubic yards using USLE, (average dry unit weight of sediment eroded and deposited in reservoirs is approximately 75 lbs/cubic feet and 1 ton/cubic yard; convert to cubic feet; multiply by E from step 1; E approximates the capture efficiency of a properly designed basin, and finally, divide by the surface area to obtain the required depth of storage in feet).

5. The required volume of the basin is the surface area times the sum of the storage and settling depths.

   The volume of a naturally shaped (no excavation in basin) basin may be approximated by the formula V=0.4Ad, where V is in cubic feet; A is the surface area of the basin, in square feet, and d is the maximum depth of the basin, in feet. Volume may be computed from contour information or other suitable methods.

   If the volume of basin is not adequate, excavate to obtain the required volume.

Unobstructed basin settling depth must be maintained. Therefore cleanout is required when sediment accumulates within 2 feet of the top of the riser.

6. Calculate peak runoff by applying 50% in one hour of the 10 year, 24 hour and 50 year, 24 hour total rainfall to the TR-55 or rational Method.

7. Design the pipe spillway to carry the 10 year, 24 hour storm or both the 10 year, 24 hour storm and the 50 year, 24 hour storm. If the pipe is designed for the 10 year 24 hour storm, only an emergency spillway is required. (see USDA, SCS Field Design Manual, ABAG Manual, or listed design reference material)

8. Determine value "H" from field conditions; "H" is interval between the centerline of the outlet pipe and the emergency spillway, to the design high water.

9. See Trash Rack and Anti-Vortex Device Design. (see ABAG or listed design reference material)

10. Design the emergency spillway to carry at least the peak runoff from the 50 year, 24 hour storm. A design storm event should be used commensurate with the degree of risk associated with failure of the structure.

11. See Anti-seep Collar Design. (see ABAG or listed design reference material)

12. The emergency spillway crest must be set no closer to riser crest than value of h, which causes pipe spillway to carry the minimum required Q. Therefore, the elevation difference between spillways shall be equal to the value of h, or one foot, whichever is greater. Design high water is the elevation of the emergency spillway crest plus the value of Hp, or if there is no emergency spillway, it is the elevation of the riser crest plus h required to handle the 50 year storm. Minimum top of dam elevation requires 1.0 feet of freeboard above design high water. See detail Typical Sediment Basin)

PROCEDURE FOR DETERMINING OR ALTERING SEDIMENT BASIN SHAPE

As specified in the standard and Specification, the pool area at the elevation of crest of the principle spillway shall have a length to width ration (L:W) of at least 1 to 1. For L:W ranging from 1:1 to 9:1 a baffle must be inserted. For L:W of 10:1 or greater, no baffle is necessary. The purpose of this requirement is to minimize the "short-circuiting" effect of the sediment laden inflow to the riser and thereby allow the effectiveness of the sediment basin to approach ideal performance. The purpose of this

procedure is to prescribe the parameters, procedures and methods of determining and modifying the shape of the basin.

The length of the flow path (L) is the distance from the point of inflow to the riser (outflow point). The point of inflow is the point that the stream enters the normal pool (pool level at the riser crest elevation). The pool area (A) is the area of the normal pool. The effective width (W_e) is found by the equation:

$$W=A/L$$

$$\text{and L:W ratio} = L/W_e$$

In the event there is more than one inflow point, any inflow point at L:W less than 10:1 which conveys more than 30 percent of the total peak inflow rate shall be baffled.

The required basin shape may be obtained by proper site selection, by excavation or by constructing a baffle in the basin. The purpose of the baffle is to increase the effective flow length from the inflow point to the riser. Baffles shall be placed from near the inflow to mid-way between the inflow point and the riser. The baffle length shall be as required to effectively distribute inflow across the entire width of the basin. The effective length (le) shall be the shortest distance the water must flow from the the inflow point around the end of the baffle to the outflow point.

Source: USDA , SCS Field Design Manual, Redding, California; Adapted from Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG).

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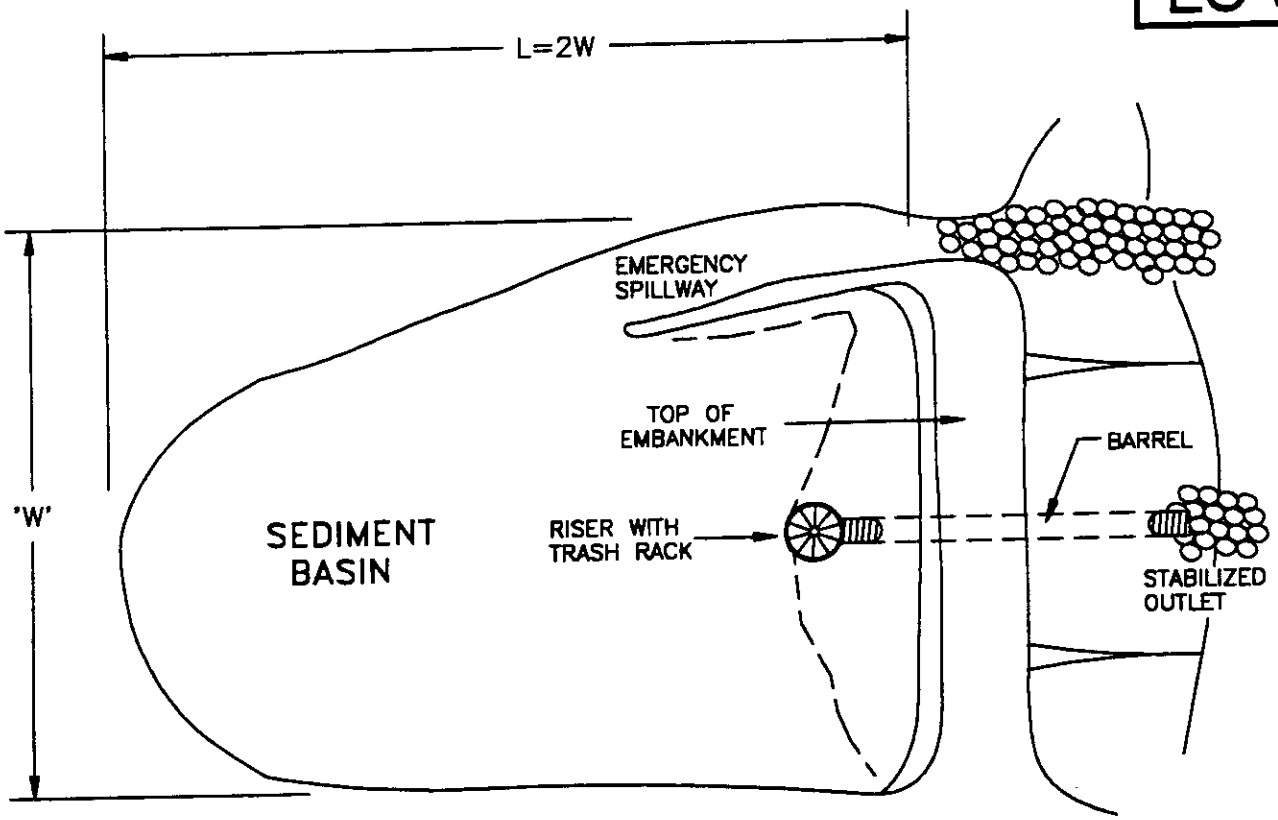
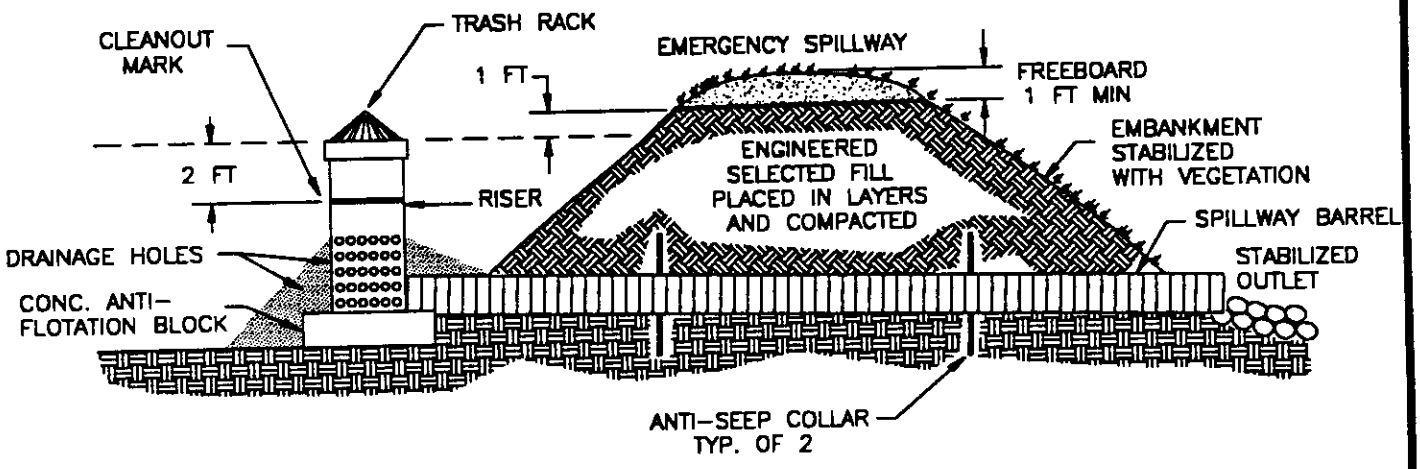




DWG DATE 6-92	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
MARK	DATE	REVISION
		DIRECTOR OF PUBLIC WORKS

SEDIMENT BASIN

STANDARD

TEMPORARY SEDIMENT TRAPS

Definition: A temporary sediment trap is a small ponding basin formed by an embankment or excavation to capture sediment.

Purpose: To detain sediment-laden runoff and trap the sediment to protect receiving streams, lakes, drainage systems, and protect adjacent property.

Conditions Where Practice Applies: At the outlets of diversions, channels, slope drains, or other runoff conveyances that discharge sediment-laden water.

- Below areas that are 5 acres or less.
- Where access can be maintained for sediment removal and proper disposal.
- In the approach to a storm water inlet located below a disturbed area as part of an inlet protection system.
- Structure life limited to 2 years.

Planning Considerations: Select locations for sediment traps during site evaluation. Note natural drainage divides and select trap sites so that runoff from potential sediment-producing areas can easily be diverted into the traps. Ensure the drainage areas for each trap does not exceed 5 acres.

Make traps readily accessible for periodic sediment removal and other necessary maintenance. Plan locations for sediment disposal as part of trap site selection. Clearly designate all disposal areas on the plans.

In preparing plans for sediment traps, it is important to consider provisions to protect the embankment from failure from storm runoff that exceeds the design capacity. Consider nonerosive emergency spillway and bypass areas, particularly if there could be severe consequences from failure. If a bypass is not possible and failure would have severe consequences, consider alternative sites.

Sediment trapping is achieved primarily by settling within a pool formed by an embankment. The sediment pool may also be formed by excavation, or by a combination of excavation and embankment. Sediment-trapping efficiency is a function of surface area and inflow rate. Therefore, maximize the surface area in the design. Installations

that provide pools with large length to width ratios reduce short circuiting and allow more of the pool surface area for settling. This optimizes efficiency.

Because well-planned sediment traps are key measures to preventing off-site sedimentation, they should be installed in the first stages of project development.

Design Criteria: Ensure drainage area for a sedimentation trap does not exceed 5 acres.

Storage capacity— Keep the minimum volume of the sediment trap at 1800 ft^3/acre based on disturbed area draining into the basin. Measure volume below the crest elevation of the outlet. The volume of a natural sediment trap may be satisfactorily approximated by the equation:

$$\text{volume } (ft^3) = 0.4 \times \text{surface area } (ft^2) \times \text{maximum pool depth } (ft)$$

Trap cleanout—Remove sediment from the trap and restore the capacity to original trap dimensions when sediment has accumulated to one-half the design depth.

Embankment—Ensure that embankments for temporary sediment traps do not exceed 5 feet in height measured at the center line from the original ground surface to the top of the embankment. Additional freeboard may be added to the embankment height to allow flow through a designated bypass location. Construct embankments with a minimum top width of 5 feet and side slopes of 2:1 or flatter. Machine compact embankments.

Excavation—Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 or flatter for safety.

Outlet section—Construct the sediment trap outlet using a stone section of embankment located at the low point in the basin. The stone section serves two purposes: (1) the top section serves as a nonerosive spillway outlet for flood flows, and (2) the bottom section provides a means of dewatering the basin between runoff events.

Stone size—Construct the outlet using well-graded stones with a d_{50} size of 9 inches (class B erosion control stone is recommended), and a maximum stone size of 14 inches. A 1-foot thick layer of 3/4 - inch aggregate should be placed on the inside face to reduce drainage flow rate.

Side slopes—Keep the side slopes of the spillway section at 2:1 or flatter. To protect the embankment, keep the sides of the spillway at least 21 inches thick.

Depth—Keep the crest of the spillway outlet a minimum of 1.5 feet below the settled top of the embankment.

Protection from piping—Place filter cloth on the foundation below the riprap to prevent piping. An alternative would be to excavate a keyway trench across the riprap foundation and up the sides to the height of the dam.

Weir length and depth—Keep the spillway weir at least 4 feet long and sized to pass the peak discharge of the 10-year storm. A maximum flow depth of 1 foot, a minimum freeboard of 0.5 feet, and maximum side slopes of 2:1 are recommended. Weir length may be approximated from table shown.

Design of Spillways

Drainage Area (acres)	Weir Length* (ft)
1	4.0
2	6.0
3	8.0
4	10.0
5	12.0

* Dimensions shown are minimum

Construction Specifications:

1. Clear, grub, and strip the area under the embankment of all vegetation and root mat. Remove all surface soil containing high amounts of organic matter and stockpile or dispose of it properly. Haul all objectionable material to the designated disposal area.

2. Ensure that fill material for the embankment is free of roots, woody vegetation, organic matter, and other objectionable material. Place the fill in lifts not to exceed 9 inches and machine compact it. Over fill the embankment 6 inches to allow for settlement.

3. Construct the outlet section in the embankment. Protect the connection between the riprap and the soil from piping by using

filter fabric or a keyway cutoff trench between the riprap structure and the soil.

- Place the filter fabric between the riprap and soil. Extend the fabric across the spillway foundation and sides to the top of the dam; or

- Excavate a keyway trench along the centerline of the spillway foundation extending up the sides to the height of the dam. The trench should be at least 2 feet deep and 2 feet wide with 1:1 side slopes.

4. Clear the pond area below the elevation of the crest of the spillway to facilitate sediment cleanout.

5. All cut and fill slopes should be 2:1 or flatter.

6. Ensure that the stone (drainage) section of the embankment has a minimum bottom width of 3 feet and maximum side slopes of 1:1 that extend to the bottom of the spillway section.

7. Construct the minimum finished stone spillway bottom width, as shown on the plans, with 2:1 side slopes extending to the top of the over filled embankment. Keep the thickness of the sides of the spillway outlet structure at a minimum of 21 inches. **The weir must be level and constructed to grade to assure design capacity.**

8. Material used in the stone section should be a well-graded mixture of stone with a d_{50} size of 9 inches (class B erosion control stone is recommended) and a maximum stone size of 14 inches. The stone may be machine placed and the smaller stones worked into the voids of the larger stones. The stone should be hard, angular, and highly weather-resistant.

9. Ensure that the stone spillway outlet section extends down stream past the toe of the embankment until stable conditions are reached and outlet velocity is acceptable for the receiving stream. Keep the edges of the stone outlet section flush with the surrounding ground and shape the center to confine the outflow stream.

10. Direct emergency bypass to natural, stable areas. Locate bypass outlets so that flow will not damage the embankment.

11. Stabilize the embankment and all disturbed areas above the sediment pool and downstream from the trap immediately after construction.

12. Show the distance from the top of the spillway to the sediment cleanout level (one-half the design depth) on the plans and mark it in the field.

Maintenance: Inspect temporary sediment traps after each period of significant rainfall (1" in 24 hours). Remove sediment and restore the trap to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Place the sediment that is removed in the designated disposal area and replace the contaminated part of the gravel facing.

Check the structure for damage from erosion or piping. Periodically check the depth of the spillway to ensure it is a minimum of 1.5 feet below the low point of the embankment. Immediately fill any settlement of the embankment to slightly above design grade. **Any riprap displaced from the spillway must be replaced immediately.**

After all sediment-producing areas have been permanently stabilized, remove the structure and all unstable sediment. Smooth the area to blend with the adjoining areas and stabilize properly.

Source: North Carolina Erosion and Sediment Control Planning and Design Manual.

STANDARD

TEMPORARY EXCAVATED IMPOUNDMENTS

Definition: A temporary excavation is a small temporary sediment trap formed by excavation and/or construction of an embankment around existing storm drains. Temporary excavations are smaller than sediment basins and sediment traps and are used for drainage areas of less than 2 acres.

Purpose: Temporary excavated impoundments are intended to intercept sediment-laden runoff, pond the water, and allow the sediment to fall out. This standard applies to all temporary sediment traps with a drainage area of less than 2 acres and have:

- been constructed by excavation or building an embankment;
- an existing storm drain inlet that can be utilized as an outlet

Design Considerations: Design considerations should include the following:

- phased construction to utilize an existing storm drainage system;
- drainage area of less than 2 acres;
- design capacity - 312 sq. ft./acre;
- clean-out intervals - frequent;
- embankment and/or excavation specifications;
- outlets or dewatering devices for the accumulated water between storms;
- soil erodibility, settleability, and accumulation rate.

The fundamental difference between sediment traps and sediment basins is the size of the contributing area. Temporary excavated impoundments serve a smaller area, under 2 acres, and can be adequately sized using the same criteria for designing a sediment basin. The example below illustrates how to size a temporary excavated impoundment.The area was calculated by using the following equation:

$A = \frac{1.2\,(Q)}{Vs}$ where $Q = C \times i \times A$ $Q = .5(.5"/hr)1ac = .25\ ft^3/sec$

where Vs = settling velocity .02mm particle =.00096 ft/sec

therefore: $A = \frac{1.2(.25\ ft^3/sec)}{.00096\ ft/sec} = 312\ ft^2$ surface area

This was calculated for a 10-year, 6-hour precipitation for an area north of Redding by applying the rational method—the runoff coefficient (C=.5) was chosen to represent a smooth graded area with no vegetation. The calculations indicate that there should be 312 ft^2 of sediment trap surface area (when trap is full of water) for each acre of area draining to the to the trap.

Temporary impoundments can be as simple as excavations around existing drop or curb inlets, constructed before final grade and paving is complete. A series of traps can be efficient in trapping the larger to medium sized particles if constructed in gently sloping areas and deep enough to allow the sediment-laden water to pond before being discharged. Sediment traps and excavations are not generally designed to dewater so considerations must be given to release ponded water yet not release sediment.

On a small construction site, sediment traps and temporary impoundments can capture sediment and prevent much of it from leaving the site. However, if the capture of very fine soil particles is essential and frequent clean-out is not possible, a carefully designed sediment basin must be used so the basin has the proper settling velocity for the design particle size, proper capacity, and dewatering capabilities. See Temporary Sediment Basin

Inspection and Maintenance: Inspect temporary sediment traps after each period of significant rainfall (1" in 24 hours). Remove sediment and restore the trap to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Place the sediment removed to an area that can be stabilized and not allow transport of the spoils off-site.

After all sediment-producing areas have been permanently stabilized, remove the structure and all unstable sediment. Smooth the area to blend with the adjoining areas and stabilize properly. If sediment traps and excavations have been paved over but there is still a risk of sediment entering the storm drains, then Curb and Drop Inlet Sediment Barriers should be installed.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA adapted from Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky

STANDARD

STRAW BALE DIKE

Definition: A straw bale dike is a temporary barrier consisting of straw bales installed across a slope, at the toe of a slope, and/or around the perimeter of the construction site.

Purpose: A straw bale dike intercepts and detains small amounts sediment transported by sheet flow type runoff. The dikes detain sediment by ponding water and allowing sediment to settle out. Straw bale dikes also slow runoff velocities, thus reducing sheet and rill erosion. Straw bale dikes are also useful for erosion and sediment control around the perimeter of a construction site. Straw bale dikes may be used where the following conditions apply:

- The area draining to the barrier is 1 acre or less
- The maximum slope gradient behind the barrier is 2:1
- The maximum slope length above the barrier is 100 ft
- Sheet and rill erosion would occur

Design Considerations: A formal design is not required. The bales are to be placed along the slope contour or at the toe of the slope. The principal mode of action is to pond water and allow particles to settle. Straw bale dikes are not designed to withstand high heads of water, therefore they should be located where shallow pools can form and the bales do not always need to be anchored. The straw bales are either wire-bound or nylon string tied. Wire-bound bales may deteriorate rapidly if the wire is placed in contact with the soil. Straw bales have a useful life of less than 6 months, however, the life is extended when used with filter fabric.

Construction Standards:

1. The bales shall be placed on the slope contour or around the perimeter of the construction site. If the dike is constructed at the toe of a slope, place it 5 to 6 ft away from the slope if possible (see detail).

2. Do not construct the dike more than one bale high.

3. Bales shall be placed in a row with the ends tightly abutting.

4. Each bale shall be embedded in the soil a minimum of 4-inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

5. If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

6. The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least 18 inches into the ground.

7. The straw bales do not need to be anchored if the following conditions apply:

   - the slope has a gradient of less than 5%,
   - the slope length is less than 100 feet,
   - the bales are properly embedded, and
   - the straw bale dike is inspected regularly, the trapped sediment is removed when required, and repairs are made promptly.

   or

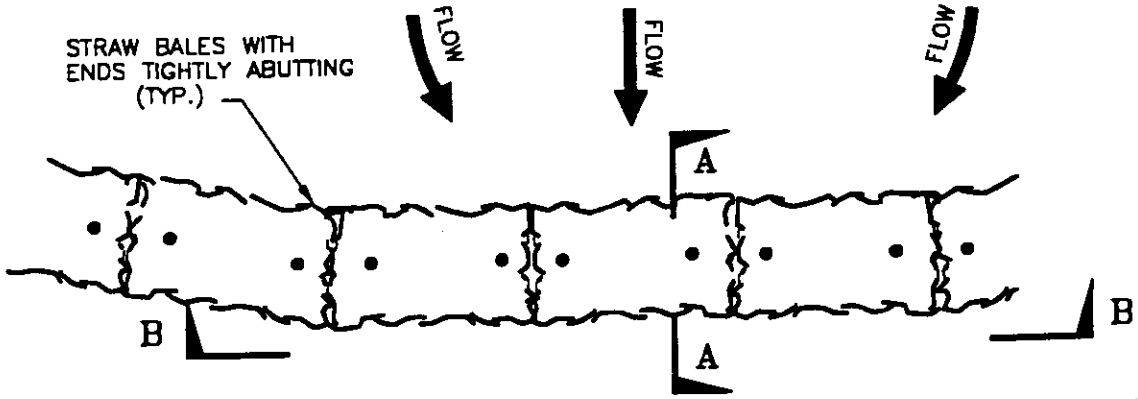
   - if the bales are to be removed and replaced daily to facilitate construction.

Inspection and Maintenance: The straw bale dikes shall be inspected periodically during the winter and after each significant storm (1" in 24 hr). Repairs and/or replacement shall be made promptly. Remove the straw bales when the upslope areas have been permanently stabilized.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; Adapted from Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky

NOTE:

BALES TO BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING. USE STRAW, ROCKS, OR FILTER FABRIC TO FILL GAPS BETWEEN THE BALES AND TAMP THE BACKFILL MATERIAL TO PREVENT EROSION OR FLOW AROUND BALES.



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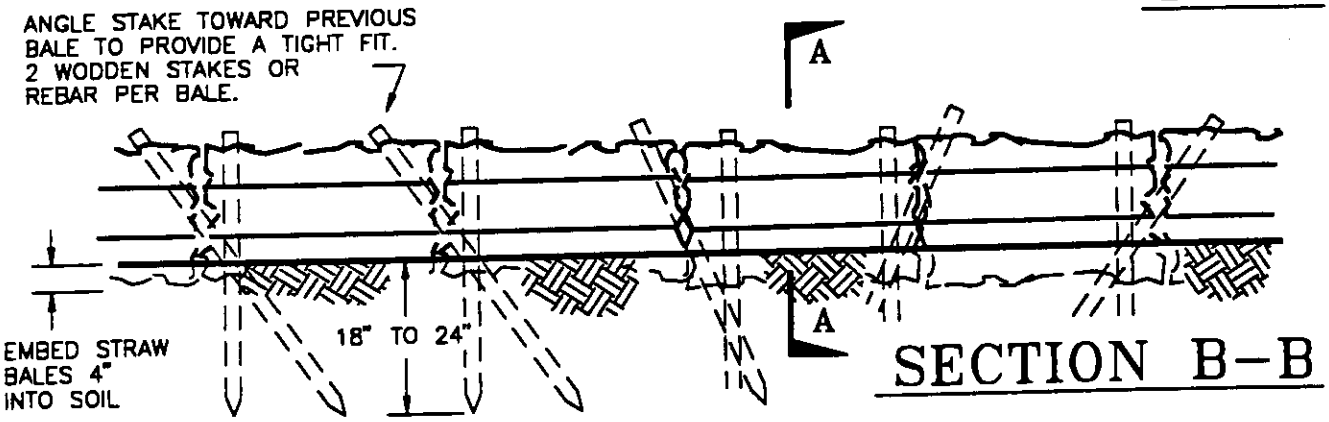
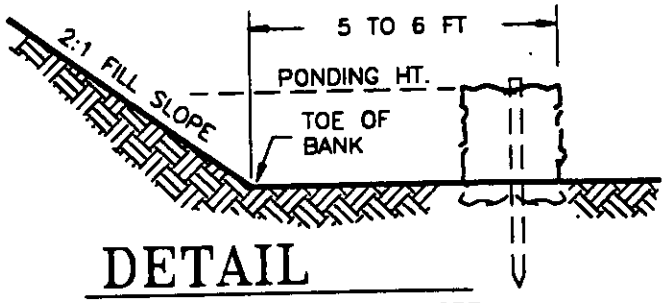


SECTION B–B

NOTES:

1. EMBED BALES 4" INTO THE SOIL.
2. THE STRAW BALES SHALL BE PLACED ON SLOPE CONTOURS OR AROUND THE PERIMETER OF THE SITE.
3. IF BALES ARE WIRE BOUND, THEY SHALL SHALL BE ORIENTATED SO THE BINDINGS ARE AROUND THE SIDES RATHER THAN THE TOP AND BOTTOM OF BALE TO PREVENT BINDINGS FROM RUSTING FROM CONTACT WITH THE SOIL.
4. IF DIKE IS CONSTRUCTED AT TOE OF SLOPE, PLACE IT 6 FT. MIN. AWAY FROM THE SLOPE IF POSSIBLE (SEE DETAIL)



DETAIL

WHEN PLACED AT TOE OF SLOPE

DWG DATE 1992	SCALE NTS		
		APPROVED BY	STRAW BALE DIKE
MARK	DATE	REVISION	

STANDARD

STRAW BALE SEDIMENT BARRIERS

Definition: A straw bale sediment barrier is a temporary barrier consisting of straw bales placed across small drainages or gently sloping swales.

Purpose: Straw bale sediment barriers are intended to intercept and detain small amounts of sediment while allowing runoff to flow through or over the barrier. The barriers also slow runoff velocities thus reducing channel erosion downslope. Straw bale sediment barriers may be used where the following conditions apply:

- The drainage area is 1 acre or less
- The maximum slope gradient for the swale above the barrier is 2:1
- The maximum slope length above the barrier is 100 feet
- Less than 1 ft^3/sec flow

Design Considerations: The straw bales are either wire-bound or nylon string tied. Wire-bound bales may deteriorate rapidly if the wire is placed in contact with the soil. Straw bales have a useful life of less than 6 months, however the life is extended when used with filter fabric. Design considerations should include the following:

- drainage area;
- runoff velocities;
- secure installation;
- compatibility with existing topography;
- spillways or energy dissipators;
- use of extraneous materials such as rocks and/or filter fabric;
- accessibility for maintenance, repairs, and cleaning.

Construction Standards:

1. Place bales in a single row, lengthwise, oriented perpendicular to the flow, and with ends of adjacent bales tightly abutting one another.

2. Each bale shall be embedded in the soil a minimum of 4 inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

3. The barriers shall not be constructed more than one bale high (24-inch maximum height).

4. If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

5. The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least 18 inches into the ground. Proper staking is particularly important in channel flow applications.

6. Extend the barrier, across the swale, to such a length that the bottoms of the end bales are at a higher elevation than the top of the lowest middle bale (spillway) to assure that sediment-laden runoff will flow either through or over the barrier but not around it (see detail). Rock and/or filter fabric placed over and immediately downstream of the middle bale will dissipate the energy of the falling water and reduce downstream erosion.

Inspection and Maintenance: The straw bale barriers shall be inspected periodically during the winter and after each significant storm (1" in 24 hr). Repairs and/or replacement shall be made promptly. Sediment shall be removed when the barrier is 60% full. This sediment shall be placed in an area where it will not re-enter the barrier or a waterway, and then be stabilized. Remove the straw bales when the upslope areas have been permanently stabilized.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; Adapted from Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG); Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky

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STD. NO.
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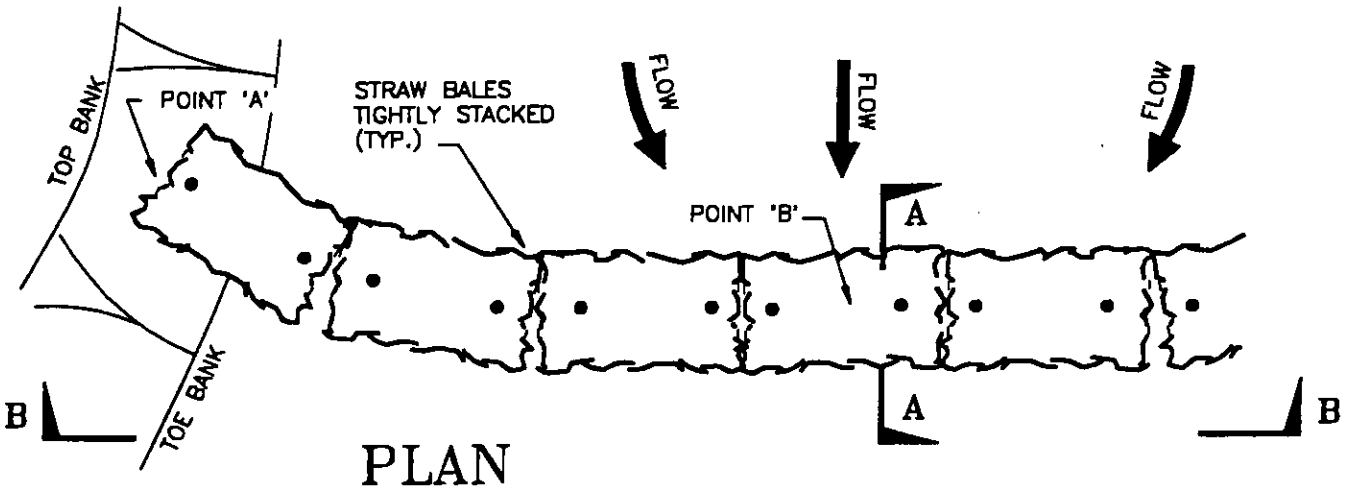
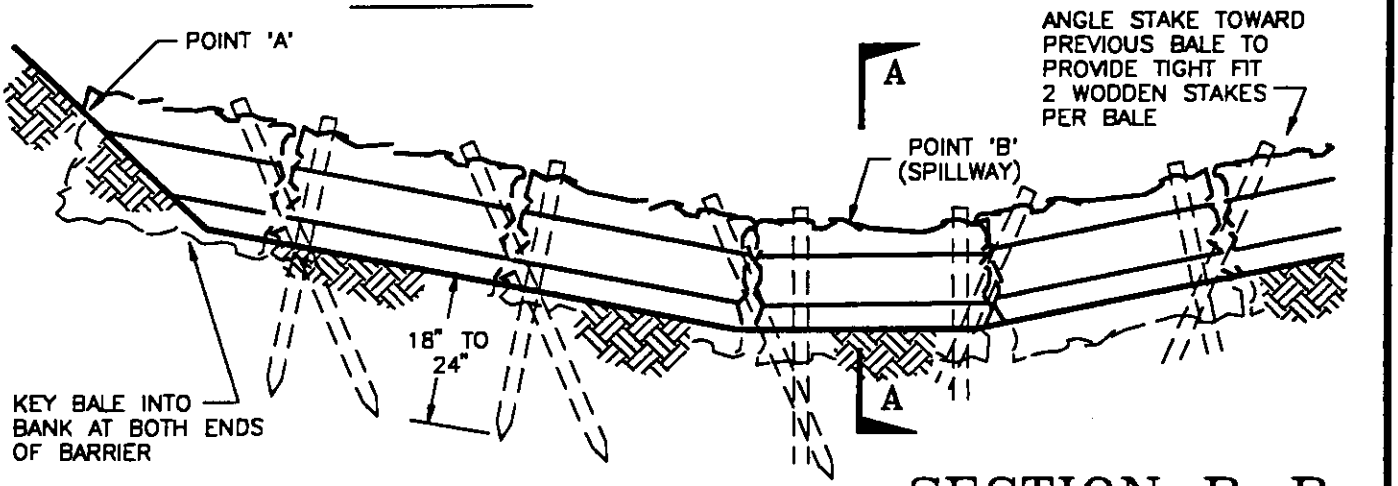
NOTE:
BALES TO BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING. USE STRAW ROCKS, OR FILTER FABRIC TO FILL GAPS BETWEEN THE BALES AND TAMP THE THE BACKFILL MATERIAL TO PREVENT EROSION OR FLOW AROUND BALES.



PLAN



SECTION B–B

NOTES:

1. EMBED THE BOTTOM OF THE BALES 4" INTO THE SOIL AND KEY BALES INTO THE BANK AT EACH END.
2. POINT 'A' SHALL BE HIGHER THAN POINT 'B' (SPILLWAY).
3. THE STRAW BALES SHALL BE PLACED ON SLOPE CONTOUR OR PERPENDICULAR TO THE FLOW.
4. IF BALES ARE WIRE BOUND, THEY SHALL BE ORIENTATED SO THE BINDINGS ARE AROUND THE SIDES RATHER THAN THE TOP AND BOTTOM OF BALE TO PREVENT BINDINGS FROM RUSTING FROM CONTACT WITH THE SOIL.
5. SPILLWAY HEIGHT SHALL NOT EXCEED 24 INCHES.
6. INSPECT BARRIERS AFTER EACH SIGNIFICANT STORM (1" IN 24 HRS.). MAINTAIN AND REPAIR PROMPTLY.
7. REMOVE SEDIMENT WHEN BASIN IS 60% FULL.

DWG DATE 7–89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
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STRAW BALE SEDIMENT BARRIER

STANDARD

SEMI-PERVIOUS SEDIMENT BARRIERS

Definition: A semi-pervious sediment barrier is a temporary barrier consisting straw bales and a rock semi-pervious spillway placed across small drainages or gently sloping swales.

Purpose: Semi-pervious straw bale sediment barriers are intended to intercept and detain small amounts of sediment while allowing runoff to flow through or over the barrier. These barriers are suited for small channel flow situations. The semi-pervious sediment barriers can be used in situations having expected flows that are larger than those appropriate for **Straw Bale Barriers**.

The rock size can be enlarged to accommodate the larger flows. Since the rock is more permeable these structures do not restrict flows. The barriers also slow runoff velocities thus reducing channel erosion downslope. Semi-pervious straw bale sediment barriers may be used where the following conditions apply:

- The drainage area is 1 acre or less
- The maximum slope gradient for the swale above the barrier is 2:1
- The maximum slope length above the barrier is 100 ft
- Less than 2 ft^3/sec flow

Design Considerations: The straw bales are either wire-bound or nylon string tied. Wire-bound bales may deteriorate rapidly if the wire is placed in contact with the soil. Straw bales have a useful life of less than 6 months, however the life is extended when used with filter fabric. If used, the filter fabric should cover the bales, be enveloped in the rock at the spillway in order to better filter out fine soil particles, and extend beyond the spillway to act as an energy dissipator. Design considerations should include the following:

- drainage area;
- runoff velocities;
- secure installation;
- compatibility with existing topography;
- spillways or energy dissipators;
- use of extraneous materials such as rocks and/or filter fabric;
- accessibility for maintenance, repairs, and cleaning.

Construction Standards:

1. The rock spillway shall be constructed of graded drain rock,1 1/2" minimum, that is sized according to expected flows. Filter fabric

may be used to cover the bales and be enveloped in the rock spillway. Filter fabric will greatly increase the useful life of the barrier (1 year).

2. The rock spillway shall be constructed to a height of 2/3 that of the straw bales.
   a. The maximum height of the spillway shall be 2 feet.
   b. Place bales in a single row, lengthwise, oriented perpendicular to the flow, and with ends of adjacent bales tightly abutting one another.

2. Each bale shall be embedded in the soil a minimum of 4 inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

3. If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

4. The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least 18 inches into the ground. Proper staking is particularly important in channel flow applications.

5. Extend the barrier, across the swale, to such a length that the bottoms of the end bales are at a higher elevation than the top of the rock spillway to assure that sediment-laden runoff will flow either through or over the barrier but not around it (see detail). Rock and/or filter fabric placed immediately downstream of the rock spillway will dissipate the energy of the falling water and reduce downstream erosion.

Inspection and Maintenance: The semi-pervious straw bale barriers shall be inspected periodically during the winter and after each significant storm (1" in 24 hr). Repairs and/or replacement shall be made promptly. Sediment shall be removed when the barrier is 60% full. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized. Remove the straw bales and rock when the upslope areas have been permanently stabilized.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; Adapted from Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG); Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky

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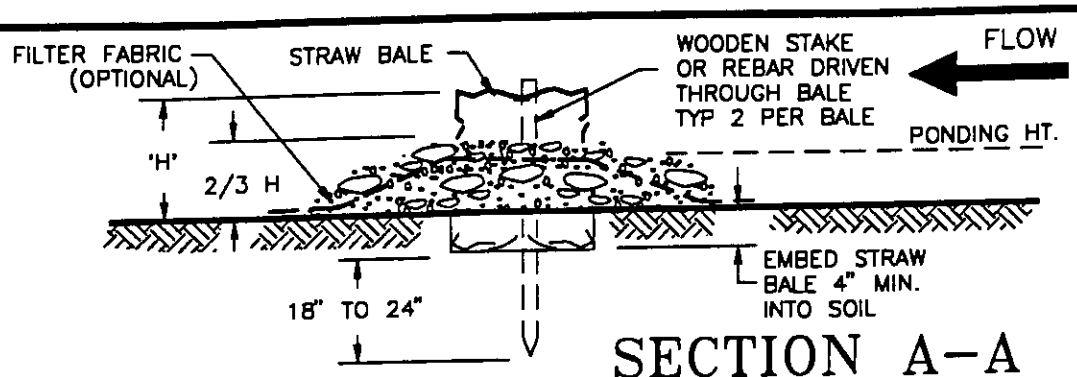
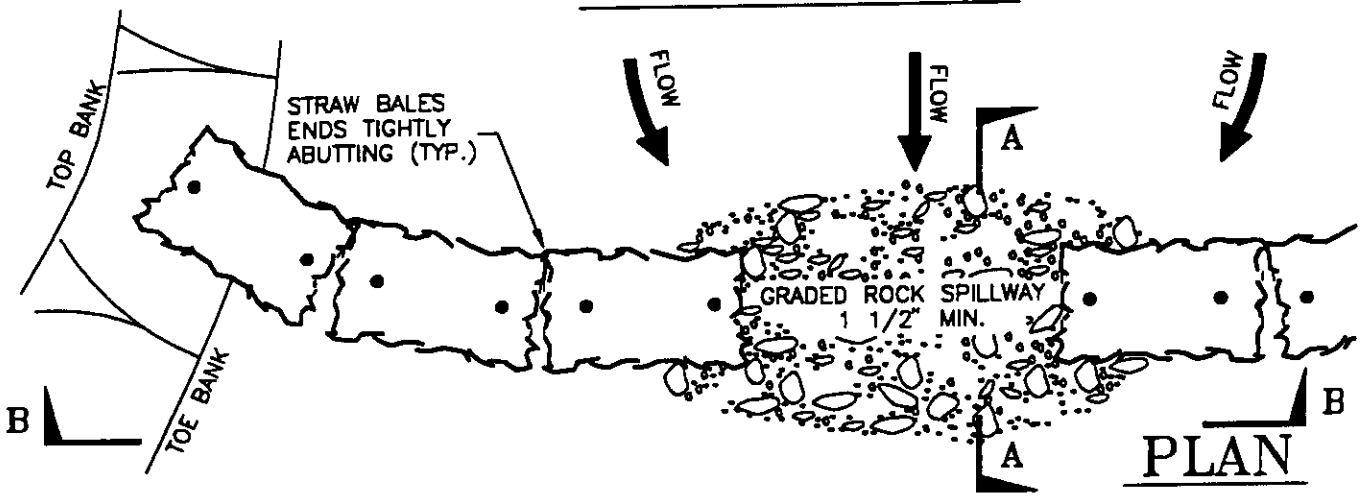
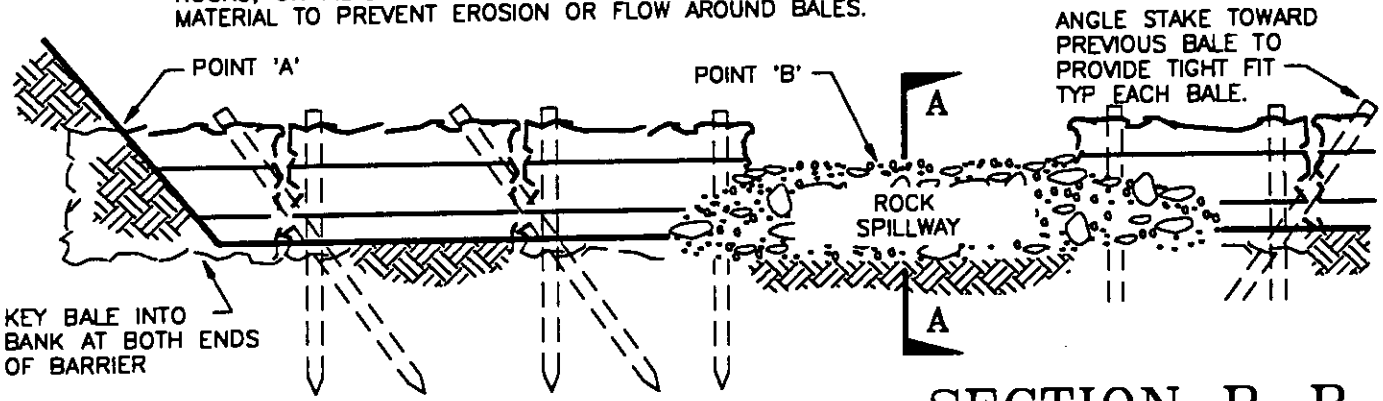


SECTION A–A



PLAN

NOTE:
BALES TO BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING. USE STRAW, ROCKS, OR FILTER FABRIC TO FILL GAPS BETWEEN THE BALES AND TAMP THE MATERIAL TO PREVENT EROSION OR FLOW AROUND BALES.



SECTION B–B

NOTES:

1. EMBED THE BOTTOM OF THE BALES 4" INTO THE SOIL AND KEY END BALES INTO BANK AT EACH END.
2. THE STRAW BALES SHALL BE PLACED PERPENDICULAR TO FLOW.
3. POINT 'A' SHALL BE HIGHER THAN POINT 'B'.
4. IF BALES ARE WIRE BOUND, THEY SHALL BE ORIENTED SO THE BINDINGS ARE AROUND THE SIDES RATHER THAN ALONG THE TOP AND BOTTOM OF THE BALE TO PREVENT BINDINGS FROM RUSTING FROM CONTACT WITH THE SOIL.
5. SPILLWAY HEIGH SHALL NOT EXCEED 24 INCHES.
6. INSPECT BARRIER AFTER EACH SIGNIFICANT STORM (1" IN 24 HOURS). MAINTAIN AND REPAIR PROMPTLY.
7. REMOVE SEDIMENT WHEN BASIN IS 60% FULL.

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SEMI–PERVIOUS
STRAW BALE SEDIMENT BARRIER
WITH SAND AND GRAVEL SPILLWAY

STANDARD

ROCK, LOG, AND STRAW BALE CHECK DAMS

Definition: A check dam is a small temporary dam constructed across a swale, gully, or drainageway.

Purpose: A check dam is used to protect a drainage channel from erosion by reducing the velocity of flow. A check dam will trap and store larger-sized particles but it is not intended to be a sediment-trapping device. A check dam is a grade stabilization structure that can be used temporarily until the drainageway is permanently stabilized. Check dams should not be used in small streams. The following conditions apply:

- the drainage area is less than 2 acres
- the drainageway is not a perennial stream.

Since these structures are located in watercourses, take special precautions to prevent erosion and sedimentation during construction of the structures. Permits may be required from the state Fish and Game.

Design Considerations: An engineered design is not required. Check dams are an expedient way to reduce gullying in the bottom of channels that will be stabilized or filled at a later date. It is usually better to line the channel or divert the flow to stabilize the channel than to install check dams. If these alternatives are not feasible, then check dams are very helpful.

Design Criteria: The following criteria shall be used when designing a check dam:

- Ensure that the drainage area is less than 2 acres
- The maximum height of the check dam center shall be 2 ft.
- The center of the check dam shall be 6 inches lower than the outer edges.
- Stabilize the overflow areas along the channel to resist erosion caused by the check dam by extending rock spillways and/or building more check dams such that the maximum spacing between dams places the toe of the upstream dam dam at the same elevation as the top of the downstream dam (see detail).

- Obtaining appropriate permits and approvals for working in a stream channel, if necessary.

Construction Standards:

1. Obtain appropriate permits or approvals from California Department of Fish and Game.

2. The check dam must be centered in the drainageway so that flows will not go around the ends.

3. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam. (See sample drawing)

4. Rock dams shall be constructed of 2-to 15-inch rock. Keep the center rock section at least 6 inches lower than the outer edges, where the rock dam meets the natural channel edge. Extend the abutments 18" into the channel bank. Hand or mechanical placement will be necessary to achieve complete coverage and insure that the center is lower than the outer edges.

5. Log check dams shall be constructed of 4- to 6-inch logs that are salvaged from the site, if possible. The logs shall be embedded into the soil at least 18 inches. The center must be 6 inches lower than the outer edges. (See sample drawing)

6. Straw bale check dams shall be constructed as follows:

    a. Bales shall be placed in a single row, lengthwise, oriented perpendicular to the flow, with the ends of adjacent bales tightly abutting one another.

    b. The dam shall be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale spillway to insure that sediment-laden runoff will flow either through or over the barrier, but not around it.

    c. Each bale shall be embedded in the soil a minimum of 4 inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

    d. If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact

with the soil soon disintegrate and may allow the bale to fall apart.

e. The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least 18 inches into the ground. Proper staking is particularly important in channel flow applications.

f. Rock and/or filter fabric placed immediately downstream of the spillway will dissipate the energy of the falling water and reduce downstream erosion.

Inspection and Maintenance: The check dams shall be inspected for damage periodically during the winter and after each significant storm (1" in 24 hours) Prompt repairs shall shall be made to ensure that center of the dam is lower than the edges and any erosion caused by flows around the edges of the dam shall be corrected immediately.

Remove sediment from behind the dams when they become 60% full, or as needed, to prevent damage to channel vegetation, and to allow the channel to flow through the check dam, and to prevent high flows from carrying sediment over the dam. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized.

Source: Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG) and John McCullah, C.P.E.S.C, #311, Redding, CA, and Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky

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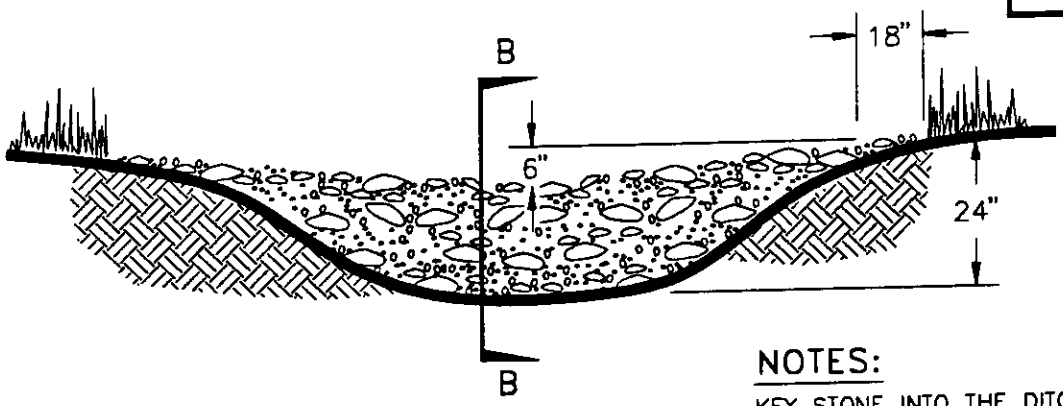
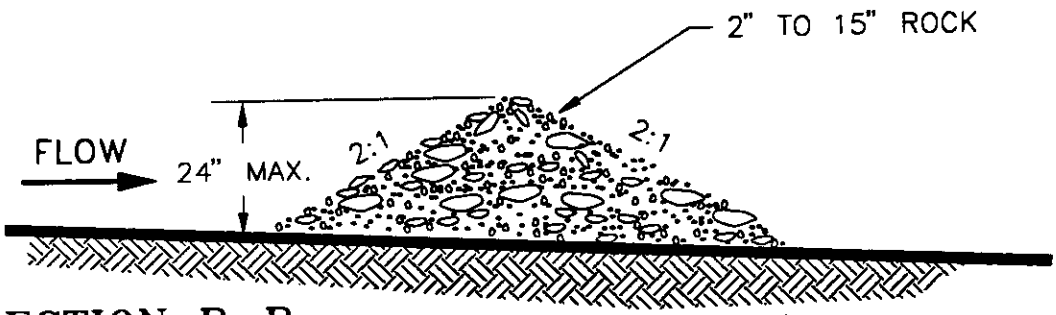


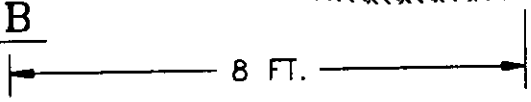
VIEW LOOKING UPSTREAM

NOTES:

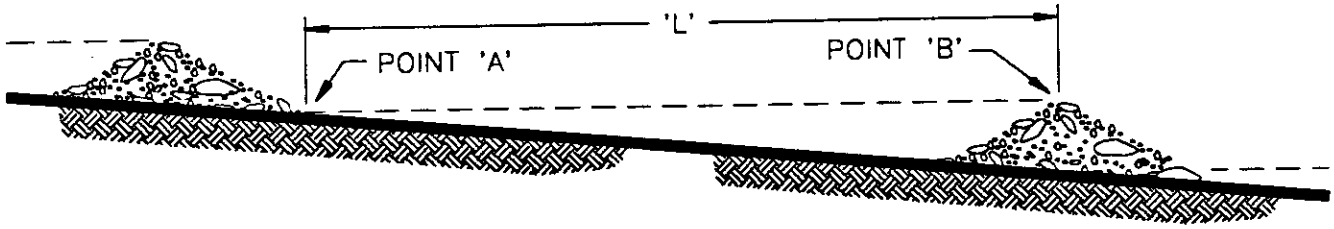
KEY STONE INTO THE DITCH BANKS AND EXTEND IT BEYOND THE ABUTMENTS A MINIMUM OF 18" TO PREVENT OVER FLOW AROUND DAM.



SECTION B-B



'L' = THE DISTANCE SUCH THAT POINTS 'A' AND 'B' ARE OF EQUAL ELEVATION



SPACING BETWEEN CHECK DAMS

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ROCK CHECK DAM

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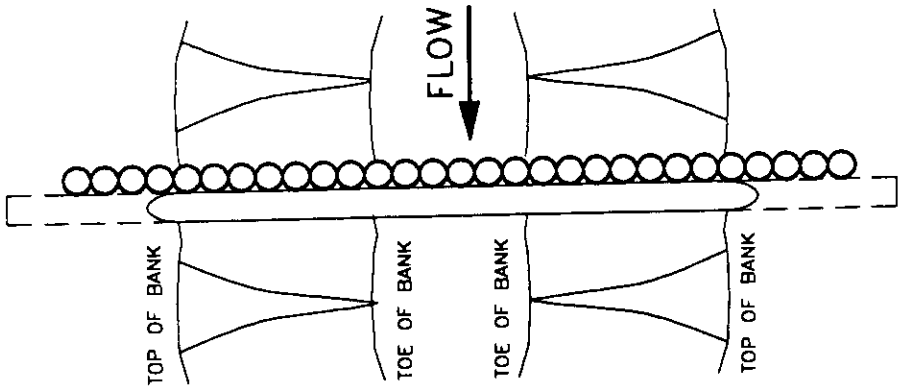
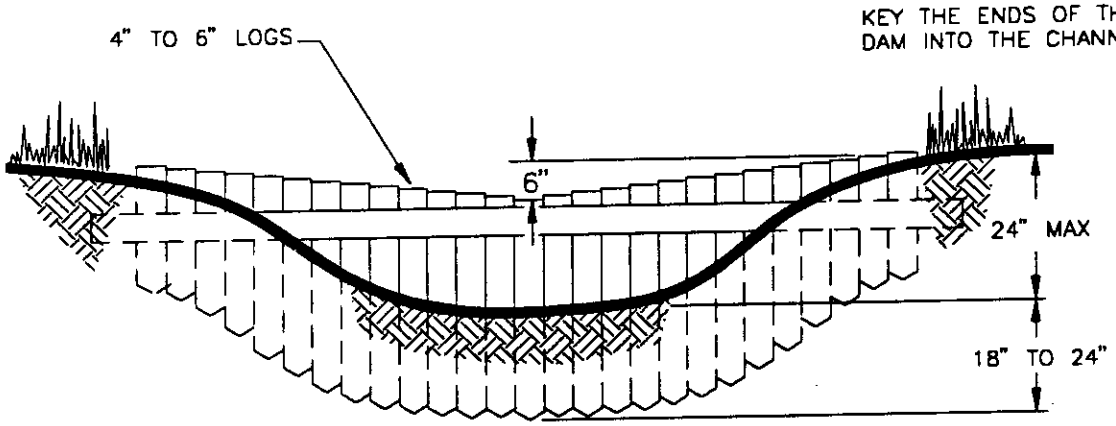
STD. NO.
EC-6



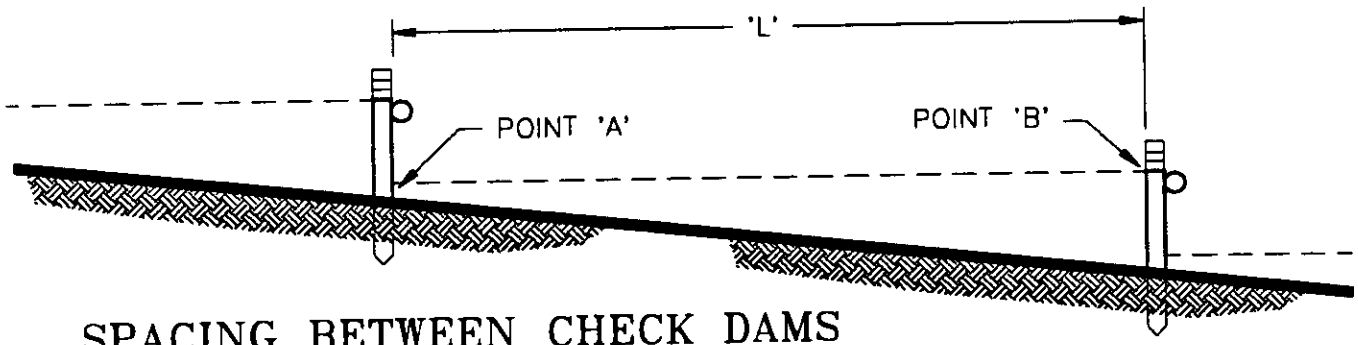
PLAN VIEW

NOTE:
KEY THE ENDS OF THE CHECK DAM INTO THE CHANNEL BANK



VIEW LOOKING UPSTREAM

'L' = THE DISTANCE SUCH THAT POINTS 'A' AND 'B' ARE OF EQUAL ELEVATION



SPACING BETWEEN CHECK DAMS

DWG DATE 7-89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
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MARK	DATE / REVISION	DIRECTOR OF PUBLIC WORKS

LOG CHECK DAM

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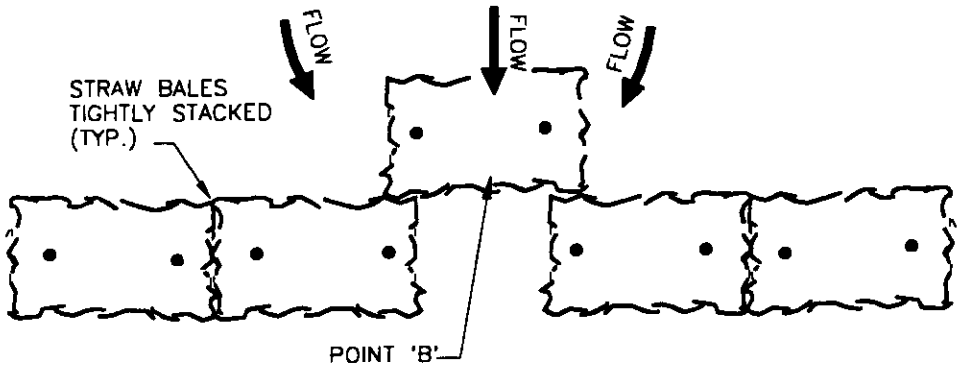
STD. NO.
EC-7

NOTE:

1. EMBED THE BOTTOM OF THE BALES 4" INTO THE SOIL AND KEY BALES INTO BANK AT EACH END.
2. BALES TO BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING. USE STRAW, ROCKS, OR FILTER MATERIAL TO FILL GAPS BETWEEN BALES AND TAMP THE BACKFILL MATERIAL TO PREVENT EROSION OR FLOW AROUND BALES.
3. IF BALES ARE WIRE BOUND, THEY SHALL BE ORIENTATED SO THAT THE BINDINGS ARE AROUND THE SIDES RATHER THAN THE TOP AND BOTTOM OF THE BALE TO PREVENT BINDINGS FROM RUSTING FROM CONTACT WITH THE SOIL.
4. EMBED BALES 4" INTO SOIL AND KEY BOTH ENDS INTO BANK.
5. SPILLWAY HEIGHT NOT TO EXCEED 24 INCHES.
6. INSPECT AFTER EACH SIGNIFICANT STORM (1" IN 24 HOURS). MAINTAIN AND REPAIR PROMPTLY.
7. REMOVE SEDIMENT WHEN BASIN IS 60% FULL.



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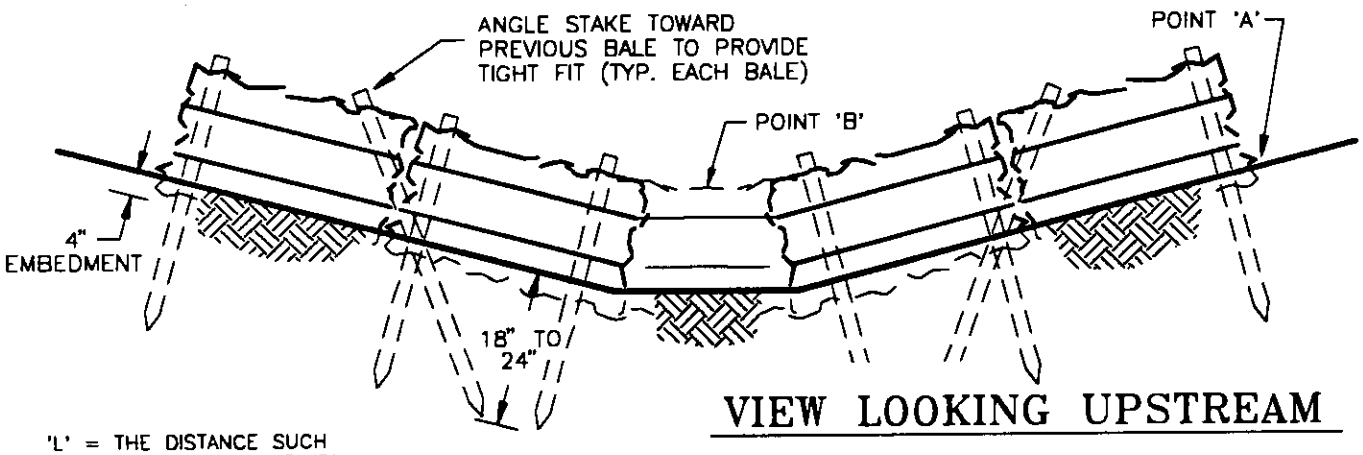
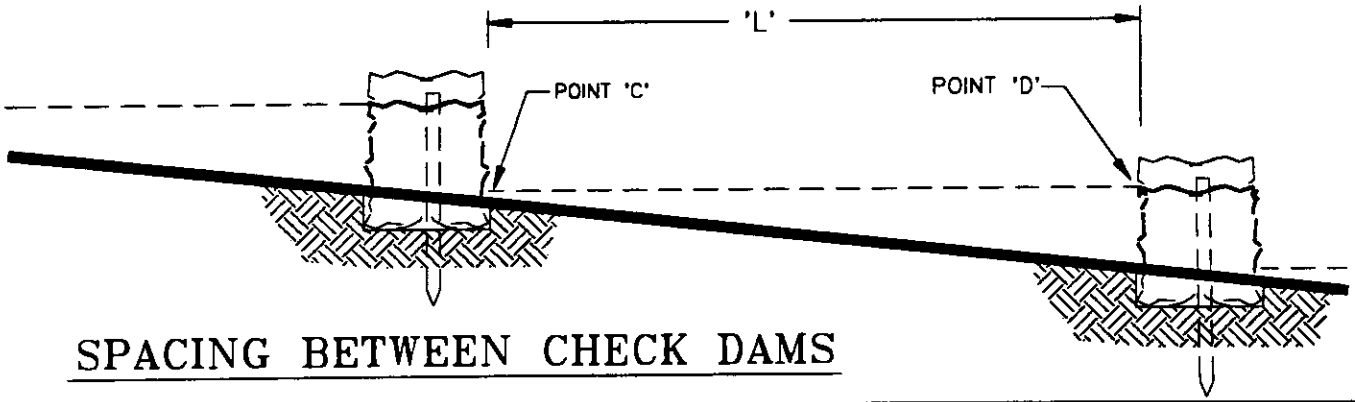


VIEW LOOKING UPSTREAM

'L' = THE DISTANCE SUCH THAT POINTS 'C' AND 'D' ARE OF EQUAL ELEVATION



SPACING BETWEEN CHECK DAMS

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STRAW BALE CHECK DAM

STANDARD

SILT FENCE

Definition: A silt fence is a temporary sediment barrier placed on the slope contours, consisting of filter fabric and wire mesh attached to supporting posts and entrenched. Extra-strength filter fabrics do not require wire mesh but they do require closer spacing of the support posts.

Purpose: A silt fence detains sediment by ponding water behind it and allowing sediment to settle out. They may be used to divert sediment-laden water if placed slightly off the contour. It can be used where:

- sheet and rill erosion would occur;
- protection of adjacent property or areas beyond the limits of grading is needed (perimeter control);
- the size of the drainage area is no more than 1/4 acre per 100 linear feet of silt fence.;
- the maximum flow path length behind the barrier is 100 feet;
- the maximum slope gradient behind the barrier is 2:1;
- small swales are carrying silt, the slope is less than 2%, and the drainage area is less than 2 acres;
- no practice other than a silt fence is feasible.

Design Considerations: No formal design is required. Silt fences have a useful life of one season. Their principal mode of action is to slow and pond the water and allow particles to settle. Silt fences are not designed to withstand high heads of water, therefore they should be located where only shallow pools can form. Their use is limited to situations in which sheet or overland flows are expected.

Silt fences should be placed on contour to be most effective. Site perimeters and property boundaries rarely follow slope contour. If silt fences are placed along property boundaries, water may be diverted to the low point and failure may occur.

Silt fences normally cannot filter the volumes generated by channel flows. When installed across a concentrated flow path, undercutting of the fence often occurs. Silt fences should **not** be designed to impound sediment or water more than 18" high. Sediment shall be cleaned from behind the fence when it reaches 50% of the designed impoundment height (9").Design considerations include:

- type, size and spacing of fence posts;
- type of filter cloth;
- size of woven wire support fence if required;
- method of anchoring filter cloth.

Construction Standards:

1. The height of a silt fence shall not exceed 36 inches. Storage height shall never exceed 18". On slopes, the fence line shall follow the contour as closely as possible.

2. If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a minimum 6-inch overlap and both ends securely fastened to the post.

3. Posts shall be spaced a maximum of 10 feet apart and driven securely into the ground (minimum of 12 inches). When extra-strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet.

4. A trench shall be excavated approximately 4 inches wide and 6 inches deep along the line of posts and upslope from the barrier.

5. When standard-strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

6. The standard-strength filter fabric shall be stapled or wired to the fence, and 6 inches of the fabric shall extend into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

7. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts with all other provisions of No. 6 above applying.

8. The trench shall be backfilled and the soil compacted over the toe of the filter fabric.

9. Silt fences placed at the toe of a slope shall be set at least 6 feet from the toe in order to increase ponding volume.

10. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

Inspection and Maintenance:

1. Silt fences and filter barriers shall be inspected immediately after each significant storm (1" in 24 hr.) and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

2. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the barrier's expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

3. Remove sediment deposits as necessary to provide adequate storage volume for the next rain and reduce pressure on the fence. Sediment deposits should be removed when they reach a height of 9 inches. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized.

4. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall conform with the existing grade and be vegetated or otherwise stabilized.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA.:adapted from North Carolina Erosion and Sediment Control Planning and Design Manual and Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)

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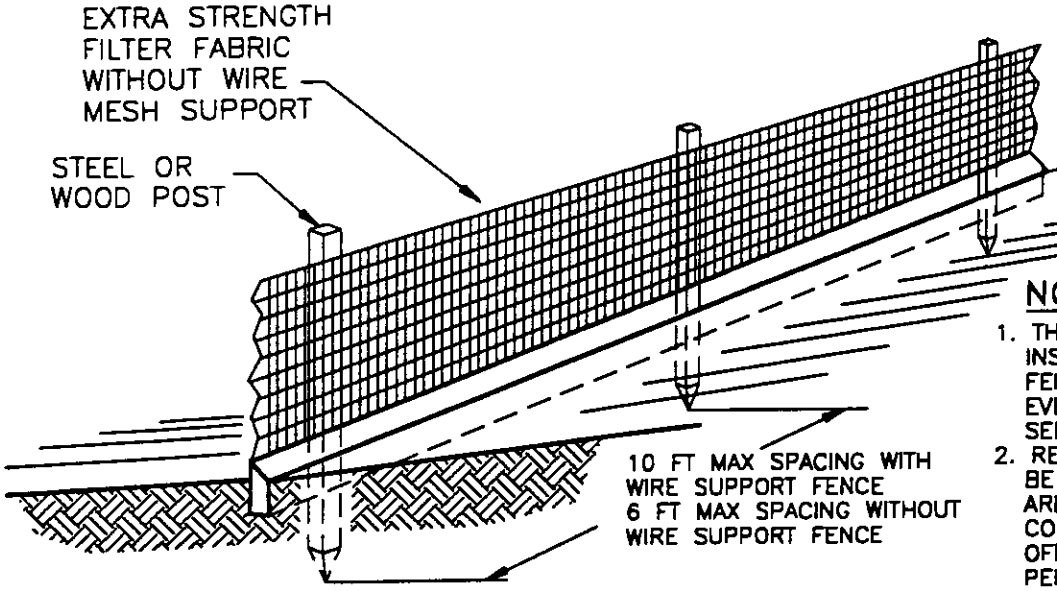
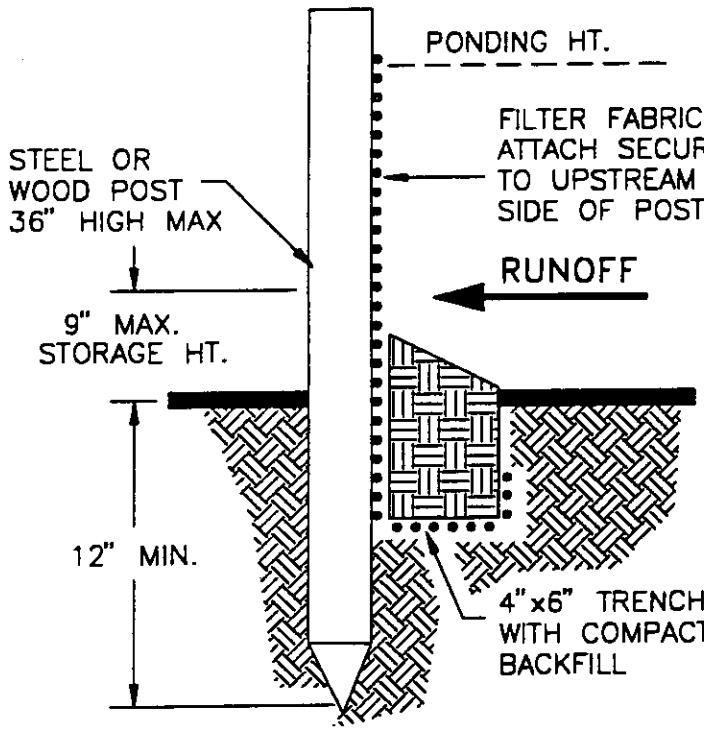


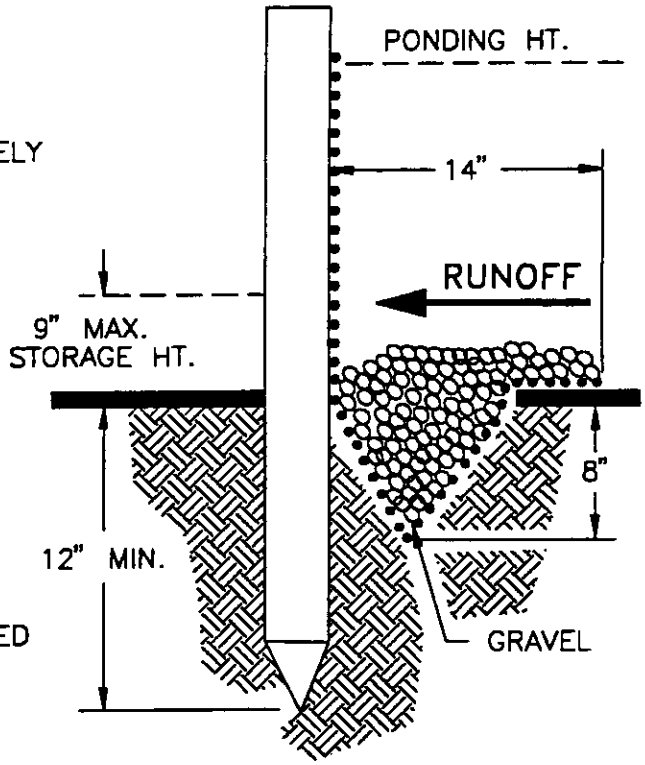
NOTE:

1. THE CONTRACTOR SHALL INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN NECESSARY.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMUM PONDING EFFICIENCY.



STD. DETAIL

TRENCH WITH NATIVE BACKFILL



ALT. DETAIL

TRENCH WITH GRAVEL

DWG DATE 7-89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
MARK	DATE / REVISION	DIRECTOR OF PUBLIC WORKS

SILT FENCE

STANDARD

DROP INLET SEDIMENT BARRIERS

Definition: A drop inlet sediment barrier is a temporary barrier placed around a drop inlet. The sediment barrier may be constructed of straw bales and gravel, gravel and stone, block and gravel, or silt fence material.

Purpose: To prevent sediment from entering the storm drains during construction operations. This practice allows early use of the storm drain system and is applicable for the phased construction schedule of a wet weather plan. Sediment-laden runoff is ponded before entering the storm drain, thus allowing some sediment to fall out of suspension.

Design Considerations: A straw bale drop inlet sediment barrier can be used where the inlet is intended to drain a relatively flat disturbed area (slopes less than 5 %) in which runoff is low—less than 0.5 ft^3/sec occurs. Barriers of this type should not be placed around inlets receiving concentrated flows such as those along major streets or highways. This practice must not be used near the edge of fill material and must not divert water over cuts or fills.

Drainage area is 1 acre maximum. The ponding area shall be relatively flat (less than 1%) with sediment storage of 35 cubic yard/acre disturbed.

As an optional design, the straw bales may be omitted and the entire structure made of gravel and stone. A structure made entirely of stone is commonly called a "gravel doughnut" The top elevation of the structure must be at least 6 inches lower than the ground elevation downslope from the inlet. It is important that all storm flows pass over the structure and into the storm drain, and not past the structure. Temporary diking below the structure may be necessary to prevent bypass flow. Material may be excavated from inside the sediment pool for this purpose.

Construction Standards:

1. Excavate a 4-inch deep trench around the inlet and make the trench as wide as a straw bale.in order to embed the bales properly. If silt fence is used, embed fabric 12" minimum.

2. Orient straw bales with the bindings around the sides of the bales rather than over and under the bales so the wire does not come in contact with the soil.

3. Place bales lengthwise around the inlet and press the ends of adjacent bales together. The bales may be loosely joined and more gravel utilized if heavier sheet flows are expected.

4. Drive two 2-by 2-inch stakes through each bale to anchor the bale securely in place.

5. Support posts for silt fence must be steel fence posts or 2- by 4-inch wood, length 3' minimum, spacing 3' maximum, with a top frame support recommended. (See detail)

6. Height of the silt fence shall be 1.5' maximum, 1' minimum, measured from the top of the inlet.

7. Backfill the excavated soil and compact it against the bales. Crushed rock (4" minimum) or compacted soil (12' minimum) is required backfill for silt fences.

8. Utilize 3/4" to 2" gravel to fill the void spaces between the bales if necessary to dewater the ponded area more rapidly.

9. **Gravel doughnut**—Keep the stone slope toward the inlet at 3:1 or flatter to help prevent stone from being washed into the drop inlet. A minimum 1-foot wide level area set 4 inches below the drop inlet crest will add further protection against the entrance of material. Stone on the slope toward the inlet should be 3 inches or larger for stability, and 1 inch or smaller on the slope away from the inlet to control flow rate. Wire mesh with 2-inch openings may be placed over the drain grating, but must be inspected frequently to avoid blockage by trash.

Inspection and Maintenance: Inspect the barrier after each rain and promptly make repairs as needed. Sediment shall be removed after each significant storm (1" in 24 hours) to provide adequate storage volume for the next rain. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; adapted from North Carolina Erosion and Sediment Control Planning and Design Manual; and, Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky.

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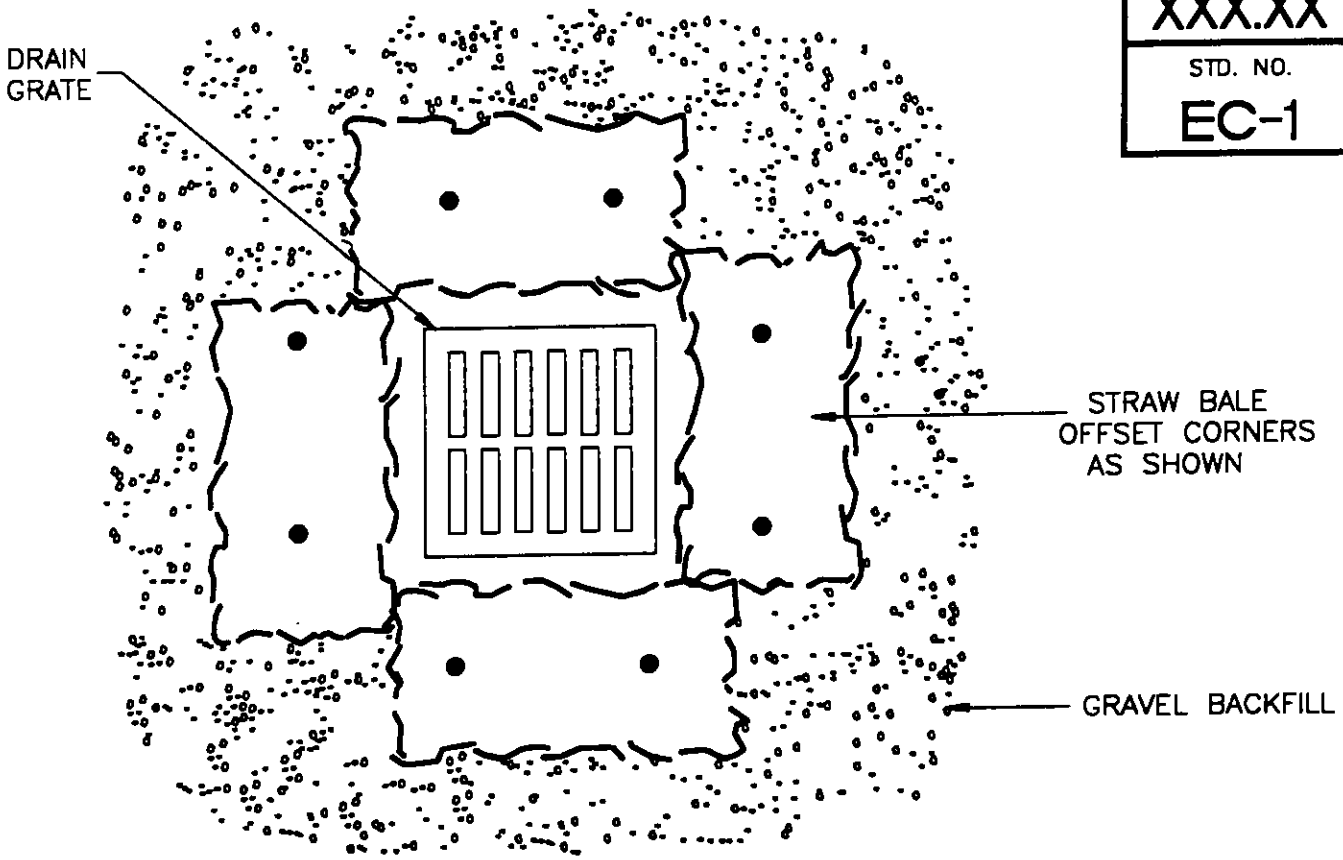
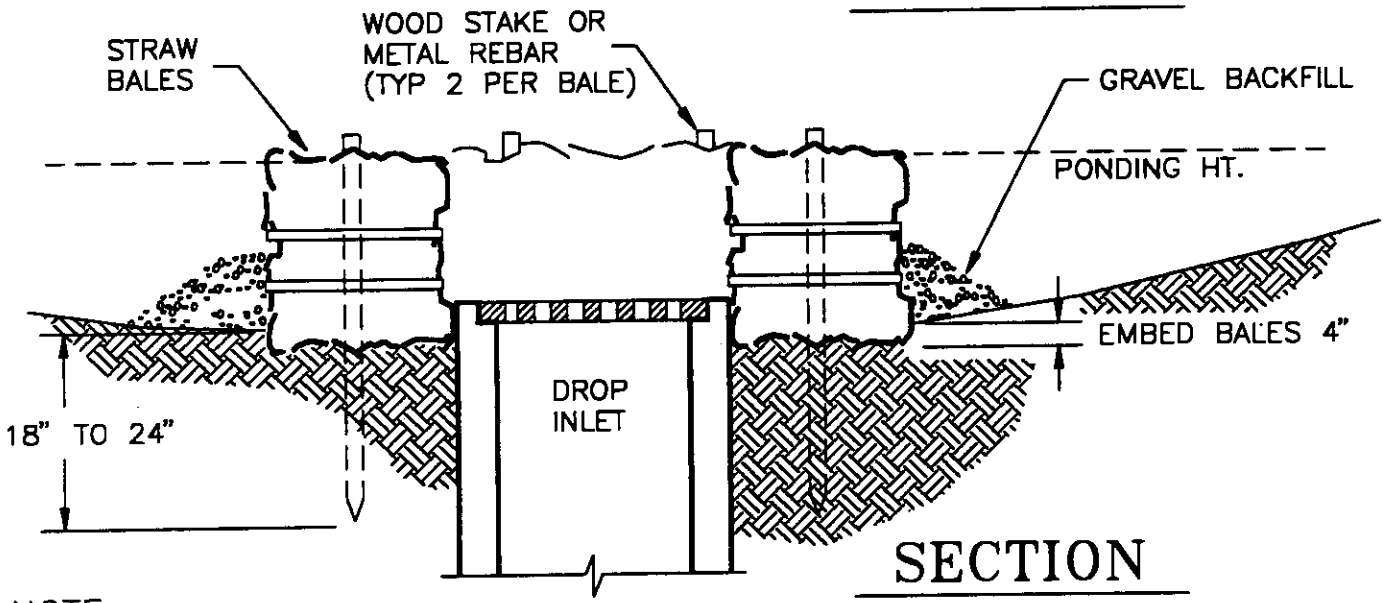


PLAN VIEW



SECTION

NOTE:
TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS (LESS THAN 5%) AND AREA IMMEDIATELY ADJACENT TO INLET SHOULD BE RELATIVELY FLAT (LESS THAN 1%)

DWG DATE 1-92	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
MARK	DATE / REVISION	DIRECTOR OF PUBLIC WORKS

TEMPORARY STRAW BALE/GRAVEL DROP INLET SEDIMENT BARRIER

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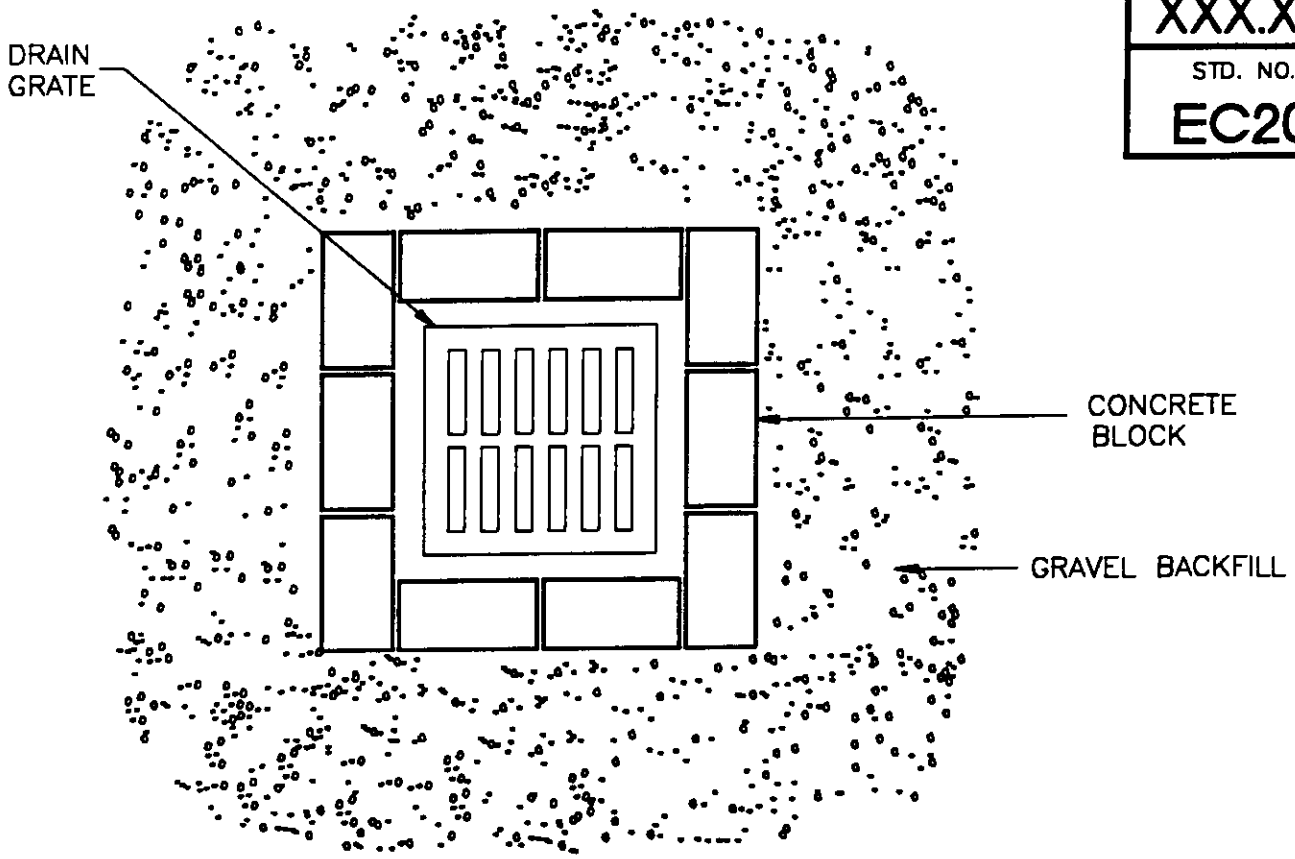
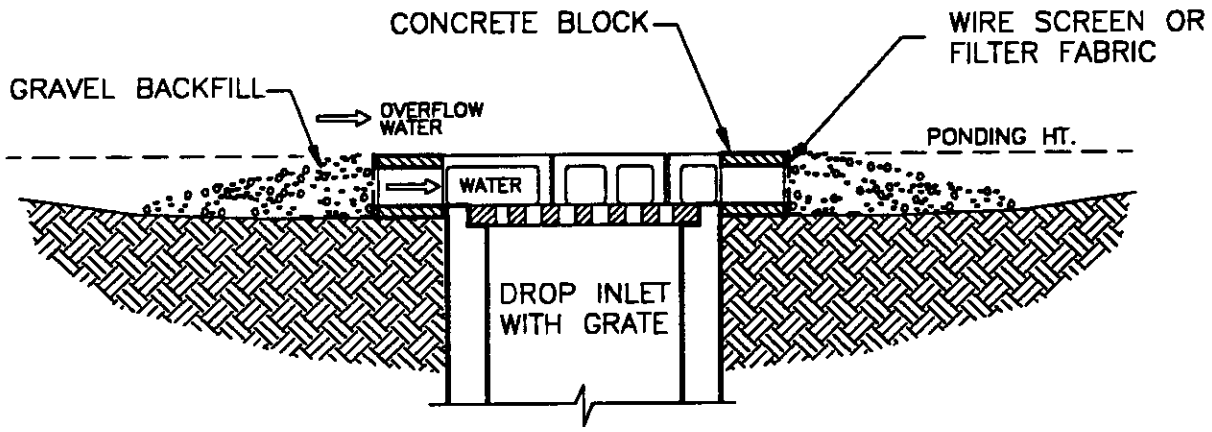


PLAN VIEW



SECTION

DWG DATE 1-92	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
MARK	DATE	REVISION
		DIRECTOR OF PUBLIC WORKS

TEMPORARY BLOCK AND GRAVEL DROP INLET SEDIMENT BARRIER

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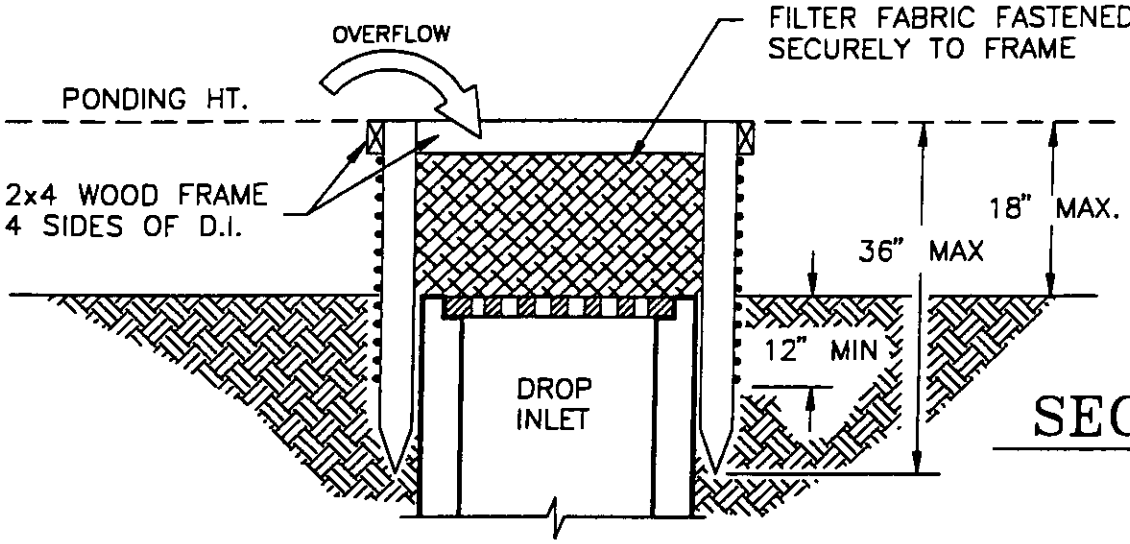
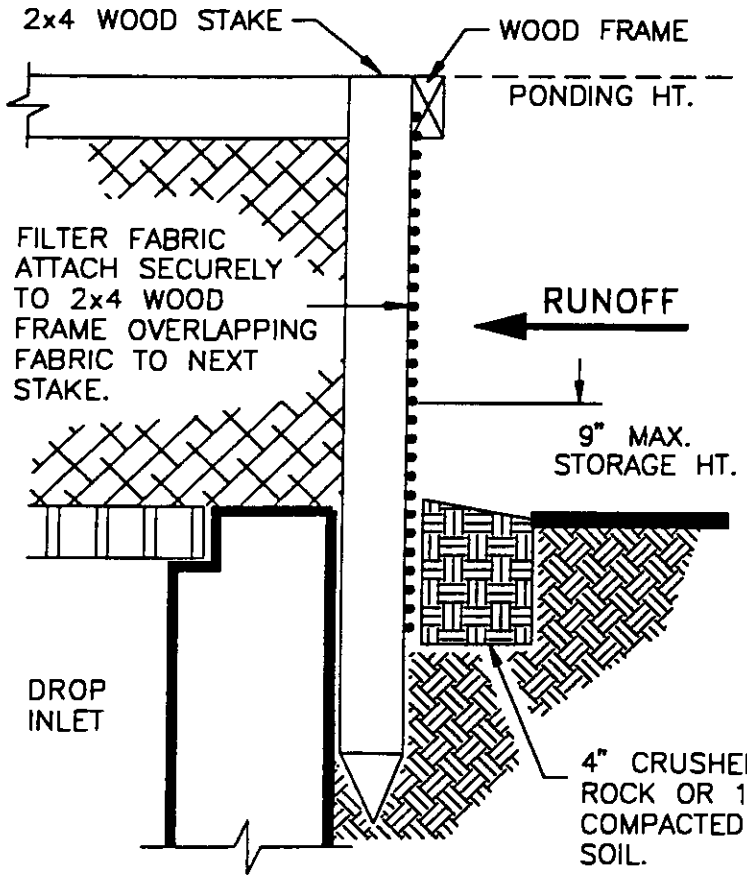


SECTION



BACKFILL DETAIL

TRENCH WITH NATIVE BACKFILL

NOTES:

1. TO BE USED FOR SMALL, NEARLY LEVEL DRAINAGE AREAS (LESS THAN 5%) AND AREA IMMEDIATELY ADJACENT TO INLET SHOULD BE RELATIVELY FLAT (LESS THAN 1%)
2. FOR STAKES, USE 2x4 INCH WOOD (PREFERED) OR EQUIVALENT METAL WITH MIN. LENGTH OF 3 FT.
3. SPACE STAKES EVENLY AROUND PERIMETER OF INLET A MAXIMUM OF 3 FT APART.
4. FASTEN 2x4 WOOD FRAME AROUND TOP OF STAKES TO INSURE STABILITY.
5. MAXIMUN OVERFLOW HEIGHT 18" ABOVE DROP INLET GRATE.
6. THE TOP OF THE FRAME AND FABRIC MUST BE WELL BELOW THE GROUND ELEVATION DOWNSLOPE FROM THE DROP INLET TO KEEP RUNOFF FROM BY-PASSING THE INLET. IT MAY BE NECESSARY TO BUILD A TEMPORARY DIKE ON THE DOWN SLOPE SIDE OF THE STRUCTURE.

DWG DATE 7-89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
MARK	DATE	REVISION
		APPROVED BY DIRECTOR OF PUBLIC WORKS

TEMPORARY SILT FENCE DROP INLET PROTECTION

STANDARD

CURB INLET SEDIMENT BARRIERS

Definition: Curb inlet sediment barriers are temporary barriers constructed from concrete block and gravel or gravel filled sandbags.

Purpose: Curb inlet sediment barriers are intended to reduce the sediment discharged into storm drains by ponding the runoff and allowing the sediment to settle out. The structures allow for overflow from high runoff events and the gravel allows the ponds to dewater rapidly.

Design Considerations: The sandbag curb inlet and block and gravel sediment barrier can be used at curb inlets on gently sloping, paved streets where:

- water can pond and allow sediment to separate out of suspension
- runoff is relatively low—less than .5 ft^3/sec

Once the small catchment areas behind the sandbags or block and gravel fill with sediment, future sediment-laden runoff will enter the storm drain without being desilted. Therefore, sediment must be removed from these structures during or after each storm. Additional storage can be obtained by constructing a series of sandbag barriers along the gutter so that each barrier traps small amounts of sediment.

Construction Standards:

1. Place on gently sloping streets where water can pond.
2. Barriers shall allow for overflow from a severe storm event. Slope runoff shall be allowed to flow over blocks and gravel and not be bypassed over the curb. A spillway shall be constructed with the sandbag structures to allow overflow.
3. The sandbag should be of woven-type geotextile fabric since burlap bags deteriorate rapidly.
4. Sandbags shall be filled with 3/4" drain rock or 1/4" pea gravel.
5. The sandbag shall be placed in a curved row from the top of curb at least 3 feet into the street. The row should be curved at the ends, pointing uphill.
6. Several layers of bags should be overlapped and packed tightly.

7. Leave a one-sandbag gap in the top row to act as a spillway.

For Block and Gravel type:

1. Place two concrete blocks on their sides perpendicular to the curb at either end of the inlet opening. These will serve as spacer blocks.

2. Place concrete blocks on their sides across the front of the inlet and abutting the spacer blocks. The openings in the blocks should face outward, not upward.

3. Cut a 2- by 4-inch stud the length of the curb inlet plus the width of the two spacer blocks. Place the stud through the outer hole of each spacer block to help keep the front blocks in place.

4. Place wire mesh over the outside vertical face (open ends) of the concrete blocks to prevent stone from being washed through the blocks. Use chicken wire, hardware cloth with 1/2-inch openings, or filter fabric.

5. Pile 1 1/2- to 3-inch gravel against the wire to the top of the barrier.

Inspection and Maintenance: Inspect and clean barrier after each significant storm (1" in 24 hours) and remove sediment from behind sandbag structure after every storm. Sediment and gravel shall be immediately removed from the traveled way of roads. Removed sediment shall be placed where it cannot enter a storm drain, stream, or be transported off site.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA; adapted from Erosion and Sediment Control Handbook by Goldman, Jackson, and Bursztynsky; North Carolina Erosion and Sediment Control Planning and Design Manual; Handbook of Best Management Practices, TRPA; Soil Conservation Service, Redding, California.

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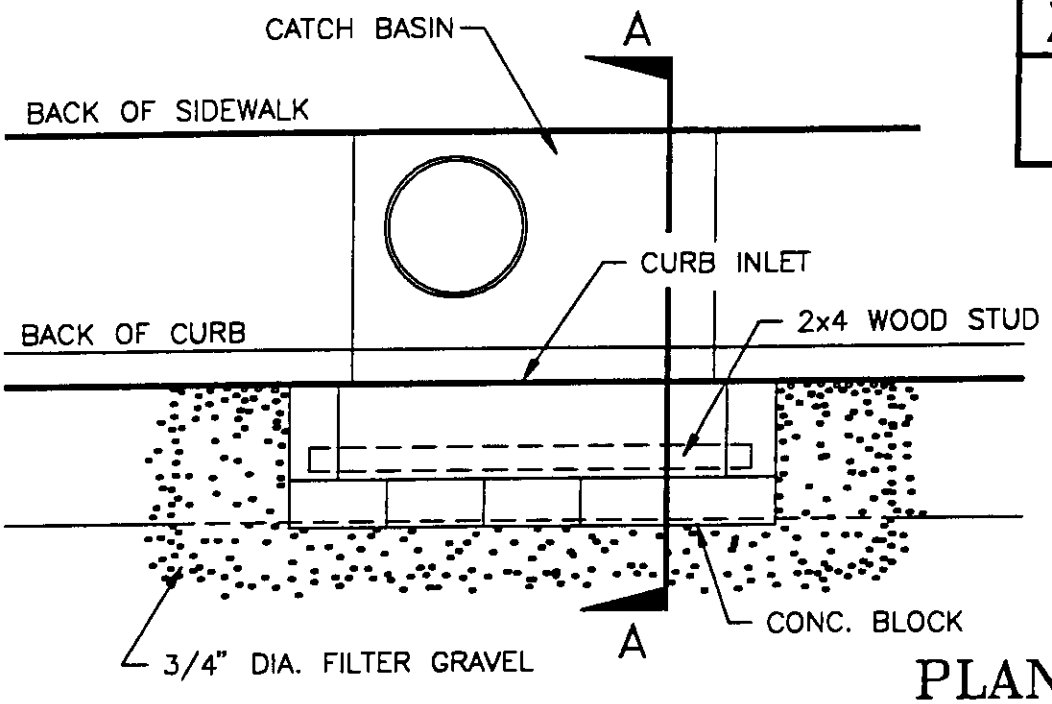
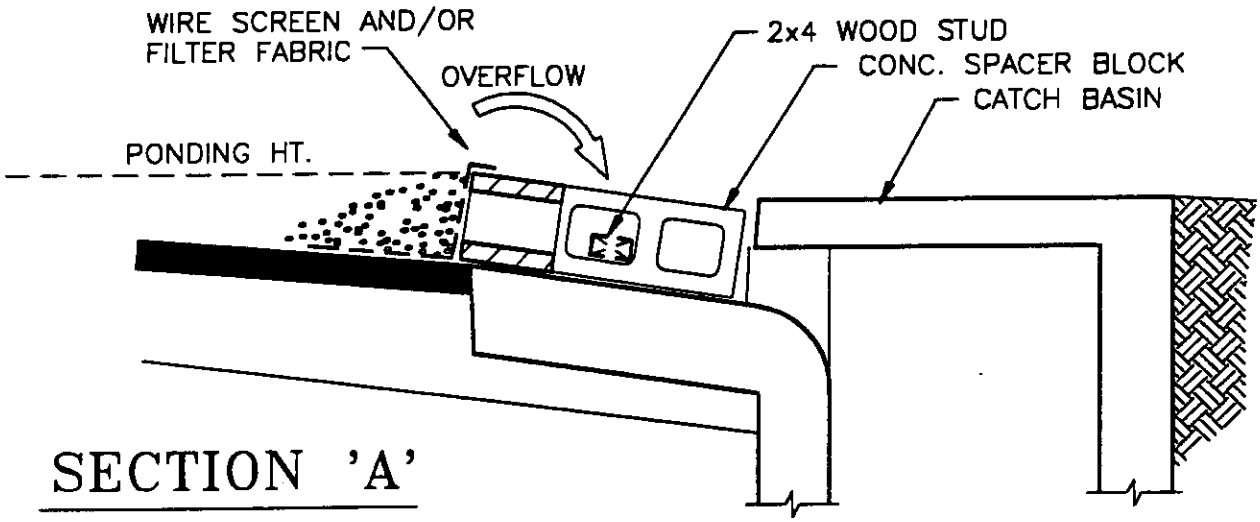


PLAN



SECTION 'A'

NOTES:

1. PLACE ON GENTLY SLOPING STREETS WHERE WATER CAN POND AND ALLOW THE SEDIMENT TO SEPERATE OUT OF SUSPENSION.
2. BARRIER SHALL ALLOW FOR OVERFLOW FROM A SEVERE STORM EVENT.
3. INSPECT AND REPAIR BARRIERS AFTER EACH STORM EVENT. REMOVE SEDIMENT WHEN PONDING HEIGHT IS EXCEEDED.
4. SEDIMENT AND GRAVEL SHALL BE IMMEDIATELY REMOVED FROM TRAVELED WAY OF ROADS. SEDIMENT SHALL BE DEPOSITED TO AN AREA TRIBUTARY TO A SEDIMENT BASIN OR OTHERWISE PROTECTED.

DWG DATE 7-89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION	
		APPROVED BY	CURB INLET SEDIMENT BARRIER
MARK	DATE / REVISION	DIRECTOR OF PUBLIC WORKS	(BLOCK & GRAVEL TYPE)

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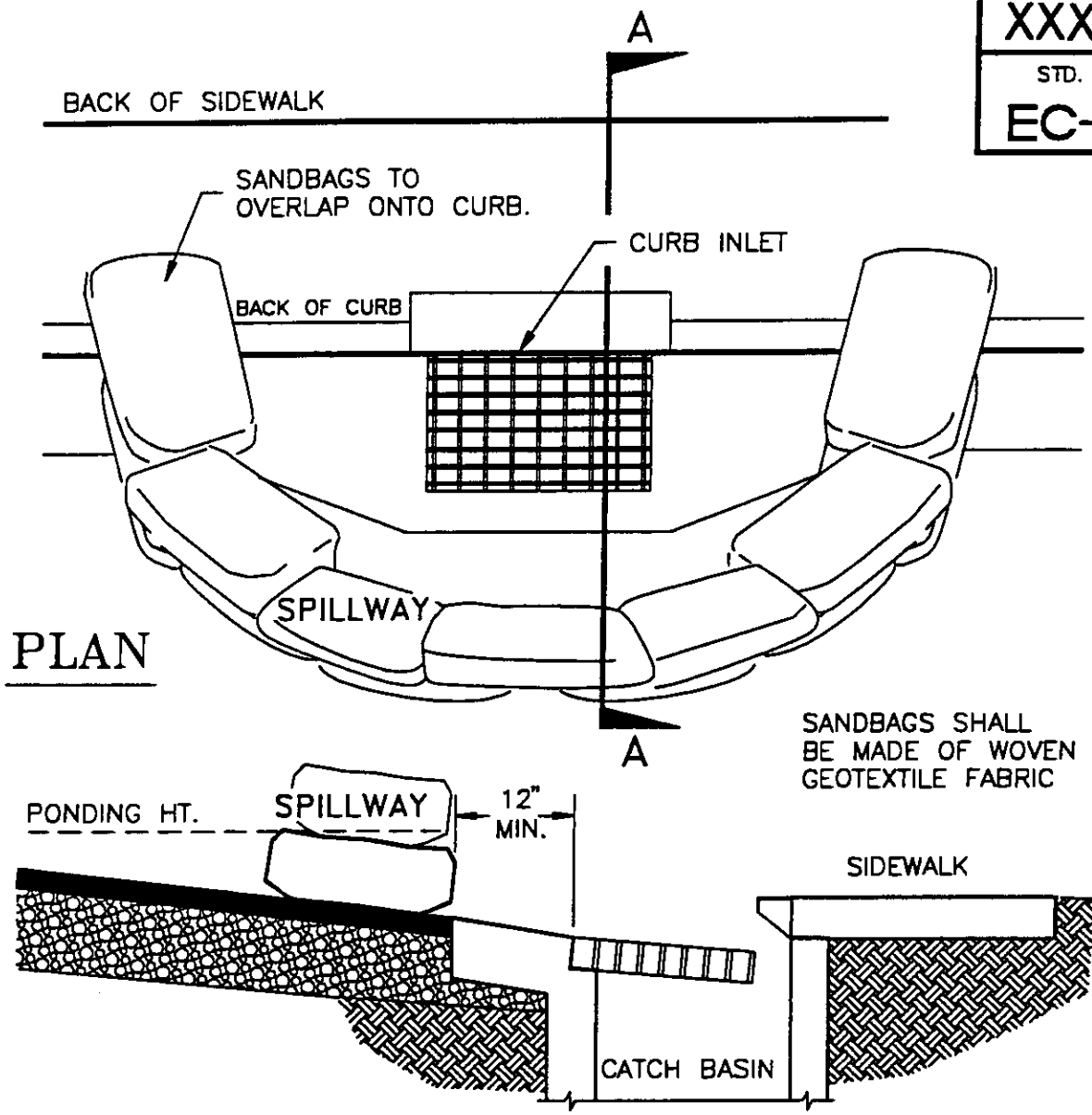

PLAN

SANDBAGS SHALL
BE MADE OF WOVEN
GEOTEXTILE FABRIC

SECTION 'A–A'

NOTES:

1. SANDBAGS SHALL BE WOVEN GEOTEXTILE FABRIC.
2. CONSTRUCT ON GENTLY SLOPING STREETS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPERATE OUT OF SUSPENSION.
3. LEAVE A GAP OF ONE BAG IN THE MIDDLE OF THE TOP ROW OF BAGS TO SERVE AS THE SPILLWAY. SPILLWAY HEIGHT SHALL BE LOWER THAN CURB HEIGHT AND SUFFICIENT IN SIZE TO PASS FLOWS FROM SEVERE STORM EVENT.
4. PLACE 2 LAYERS OF SANDBAGS, OVER LAPPING BAGS AND PACK THEM TIGHTLY TOGETHER TO MINIMIZE THE SPACE BETWEEEN BAGS. FILL BAG WITH 3/4" DRAIN ROCK OR 1/4" PEA GRAVEL.
5. INSPECT AND REPAIR FILTERS AFTER EACH STORM EVENT. REMOVE SEDIMENT WHEN ONE HALF OF THE FILTER DEPTH HAS BEEN FILLED. REMOVED SEDIMENT SHALL BE DEPOSITED IN AN AREA TRIBUTARY TO A SEDIMENT BASIN OR OTHER FILTERING MEASURE.
6. SEDIMENT AND GRAVEL SHALL BE IMMEDIATELY REMOVED FROM TRAVELED WAY OF ROAD.

DWG DATE 7-89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
MARK	DATE / REVISION	DIRECTOR OF PUBLIC WORKS

CURB INLET SEGIMENT BARRIER
(SANDBAG TYPE)

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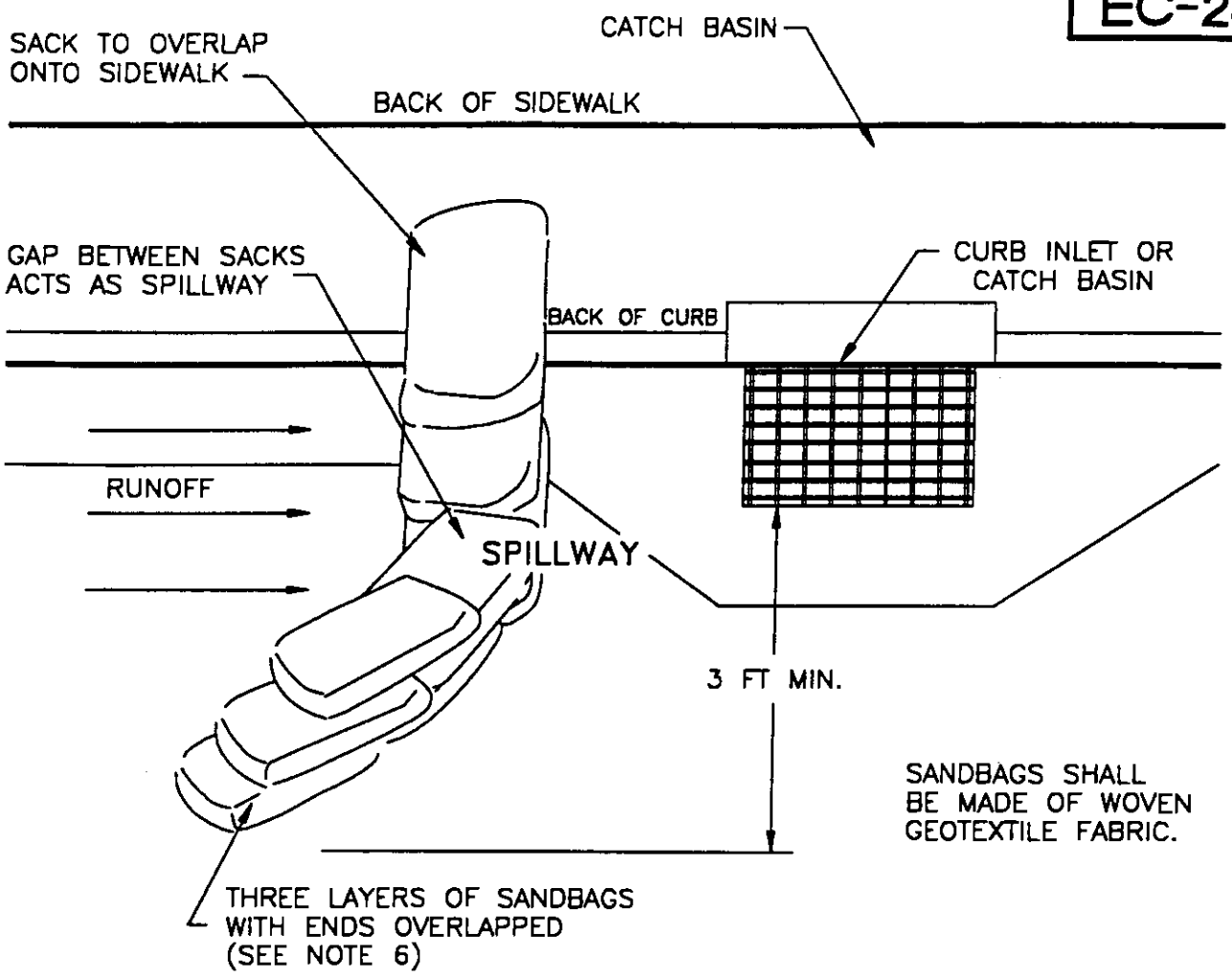


NOTES:

1. CONSTRUCT ON GENTLY SLOPING STREETS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPERATE OUT OF SUSPENSION.
2. PLACE SEVERAL LAYERS OF SANDBAGS OVER THE FIRST, OVERLAPPING BAGS AND PACK THEM TIGHTLY TOGETHER TO MINIMIZE THE SPACE BETWEEN BAGS.
3. LEAVE A GAP OF ONE SACK IN THE MIDDLE OF THE TOP ROW OF SACKS TO SERVE AS THE SPILLWAY. SPILLWAY HEIGHT SHALL BE LOWER THAN CURB HEIGHT ANS SUFFICIENT SIZE TO PASS FLOWS FROM SEVERE STORM EVENT.
4. INSPECT AND REPAIR BARRIER AFTER EACH STORM EVENT. REMOVE SEDIMENT WHEN IT REACHES TOP OF SPILLWAY (CURB HEIGHT).
5. SEDIMENT SHALL BE DEPOSITED IN AN AREA TRIBUTARY TO A SEDIMENT BASIN OR OTHER PROTECTIVE MEASURE AND WILL NOT ENTER STORM DRAIN.
6. SEDIMENT AND GRAVEL SHALL BE IMMEDIATELY REMOVED FROM TRAVELED WAY OF ROAD.
6. SANDBAGS SACKS TO BE FILLED WITH 3/4" DRAIN ROCK OR 1/4" PEA GRAVEL.

DWG DATE 7-89	SCALE NTS	CITY OF REDDING • DEPT OF PUBLIC WORKS • ENGINEERING DIVISION
		APPROVED BY
MARK / DATE / REVISION		DIRECTOR OF PUBLIC WORKS

CURB INLET SEDIMENT BARRIER (SANDBAG TYPE)

STANDARD

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT

Definition: A temporary gravel construction entrance/exit is a stabilized pad of crushed stone located at any point where traffic enters or leaves a construction site onto a public right-of-way, street, alley, sidewalk or parking area.

Purpose: A stabilized construction entrance is intended to reduce off-site sedimentation by eliminating the tracking or flowing of sediment onto public rights-of-way.

Design Considerations: Construction plans should limit traffic to properly constructed and stabilized entrances, especially during wet weather operations. Design considerations should include the following:

- locations of entrances and exits;
- proximity to an available water source;
- proximity to streams, storm drains, or other sediment delivery systems
- materials;
- dimensions of the pad;
- maintenance requirements.

Construction Standards:

1. The aggregate size for construction of the pad shall be 2-to 3-inch stone. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it

2. The thickness of the pad shall not be less than 6 inches. Use geotextile fabrics, if necessary, to improve stability of the foundation in locations subject to seepage or high water table.

3. The width of the pad shall not be less than the full width of all points of ingress or egress and not less than 12 feet.

4. The length of the pad shall be as required, but not less than 50 feet.

5. Locate construction entrances and exits to limit sediment from leaving the site and to provide for maximum utility by all construction vehicles. Avoid steep grades and entrances at curves in public roads.

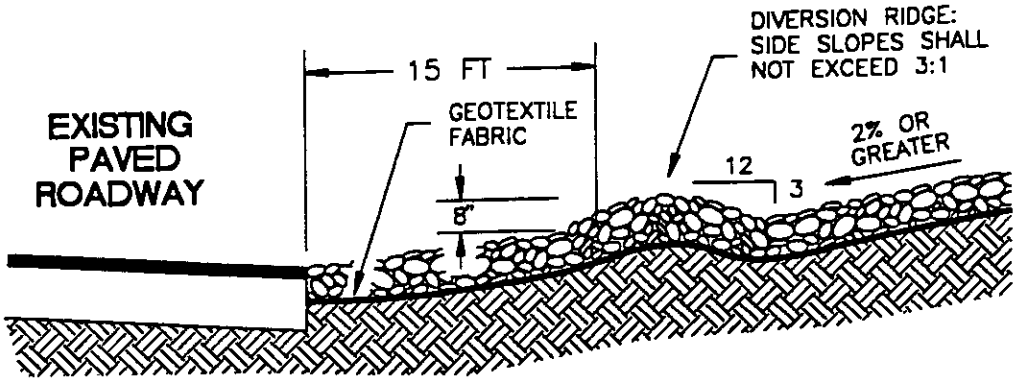
6. The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way shall be removed immediately.

7. Provide drainage to carry water to a sediment trap or other suitable outlet.

8. When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, straw bales, or other approved methods.

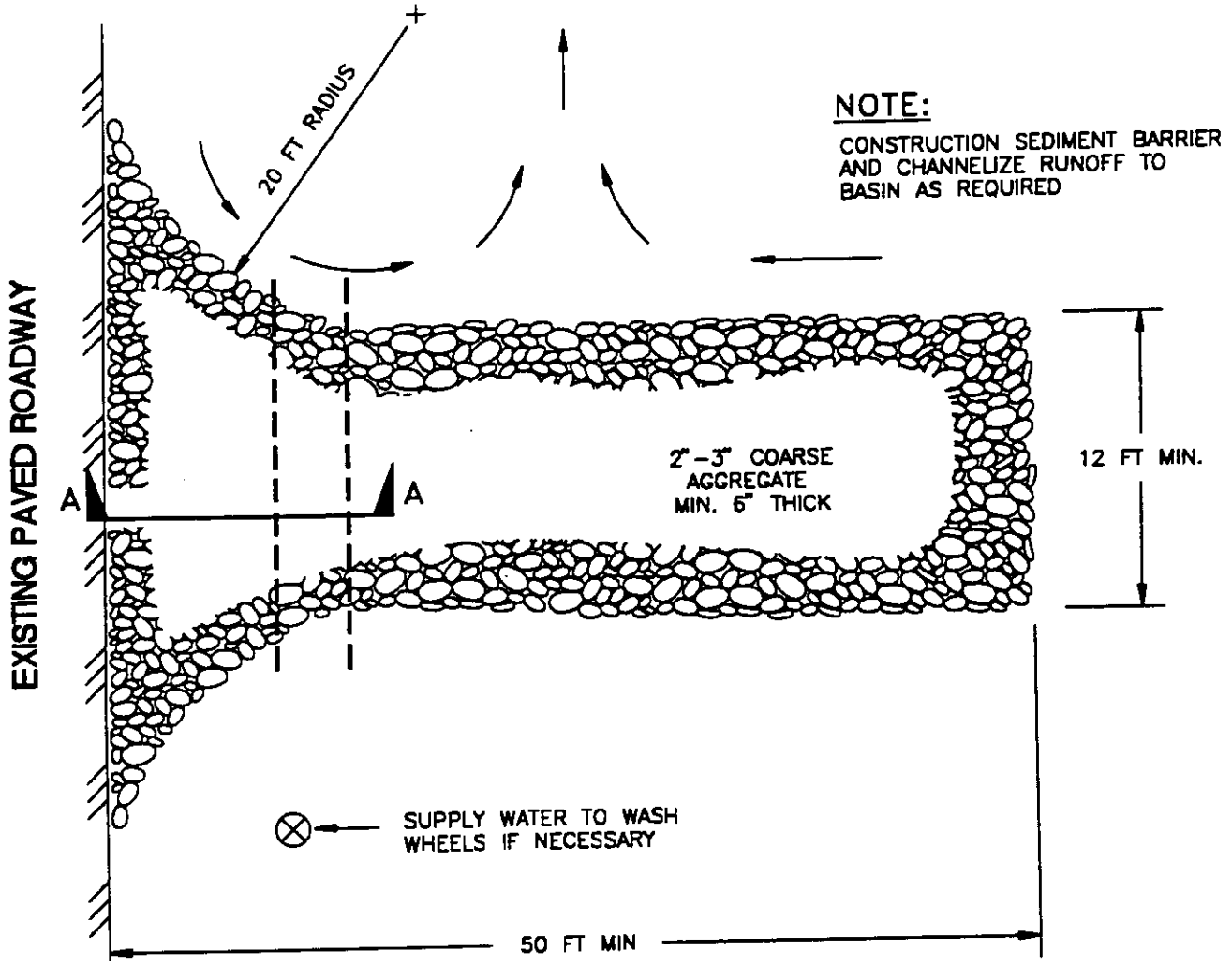
Maintenance: Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. This may require periodic topdressing with 2 inch stone. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable materials spilled, washed, or tracked onto public roadways.

Source: John McCullah, C.P.E.S.C, #311, Redding, CA.;adapted from North Carolina Erosion and Sediment Control Planning and Design Manual.and; Manual of Standards for Erosion and Sediment Control Measures—Association of Bay Area Governments (ABAG)



SECTION A-A

DIVERSION RIDGE REQUIRED
WHERE GRADE EXCEEDS 2%



PLAN

DWG DATE 1992	SCALE NTS		
		APPROVED BY	TEMPORARY GRAVEL CONSTRUCTION ENTRANCE/EXIT
MARK	DATE	REVISION	

REFERENCES

Delaware Erosion and Sediment Control Handbook, 1989, Department of Natural Resources and Environmental Control , Division of Soil and Water Conservation

Erosion and Sediment Control Handbook, 1986, Goldman, Jackson, and Bursztynsky

Field Design Manual, USDA , SCS

Ground Cover, A Planting Guide for Erosion Control in Santa Cruz County, 1980, Steven Singer, Erosion Control Specialist, Santa Cruz County Resource Conservation District

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Manual of Standards for Erosion and Sediment Control Measures, 1981, Association of Bay Area Governments (ABAG)

John McCullah, C.P.E.S.C, #311, Redding, CA

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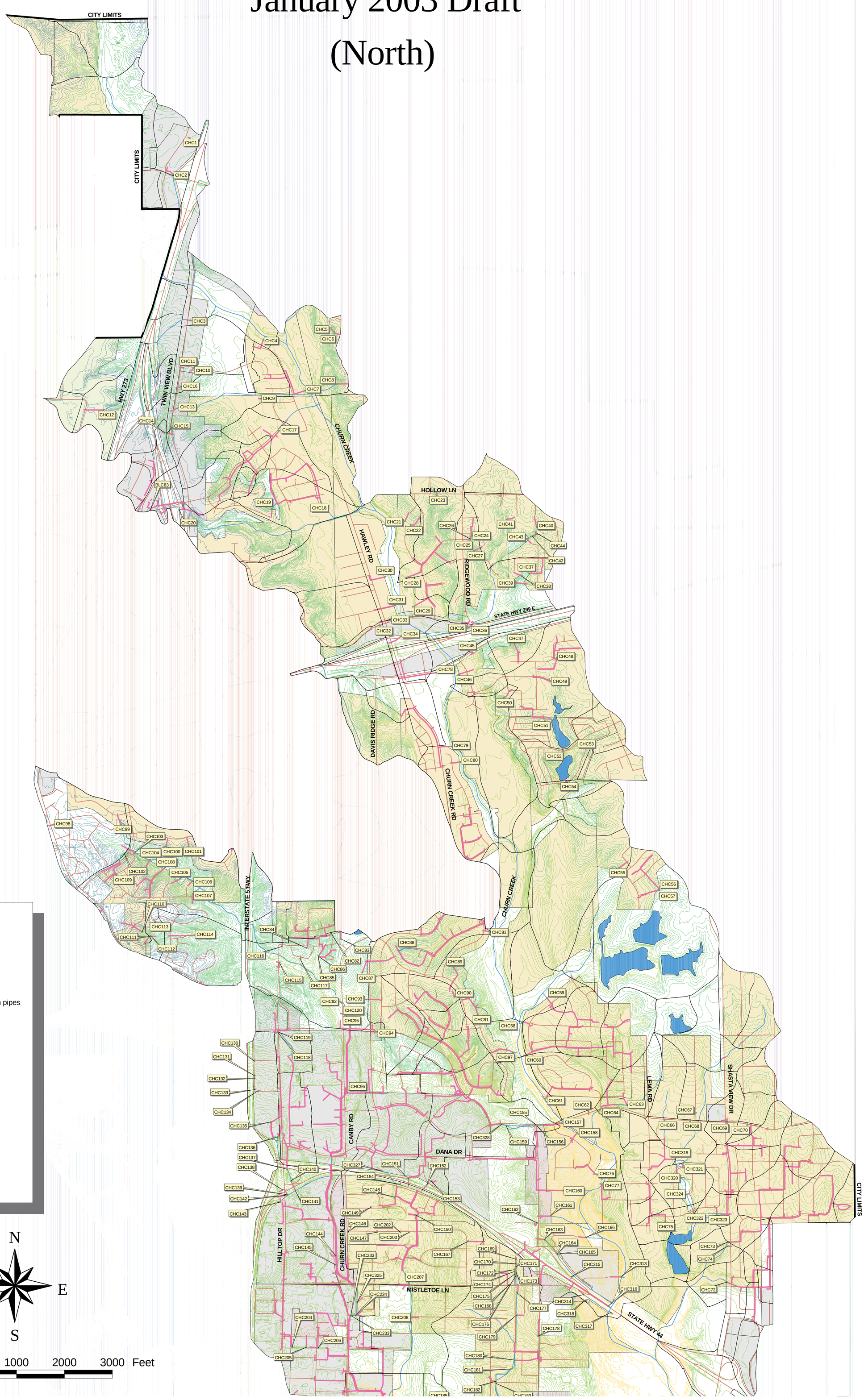
"Water Quality Management Plan for the Lake Tahoe Region", Vol II Handbook of BMP, 11/30/88, Tahoe Regional Planning Agency, (TRPA)

CHURN CREEK BASIN

Storm Drain System

January 2003 Draft

(North)



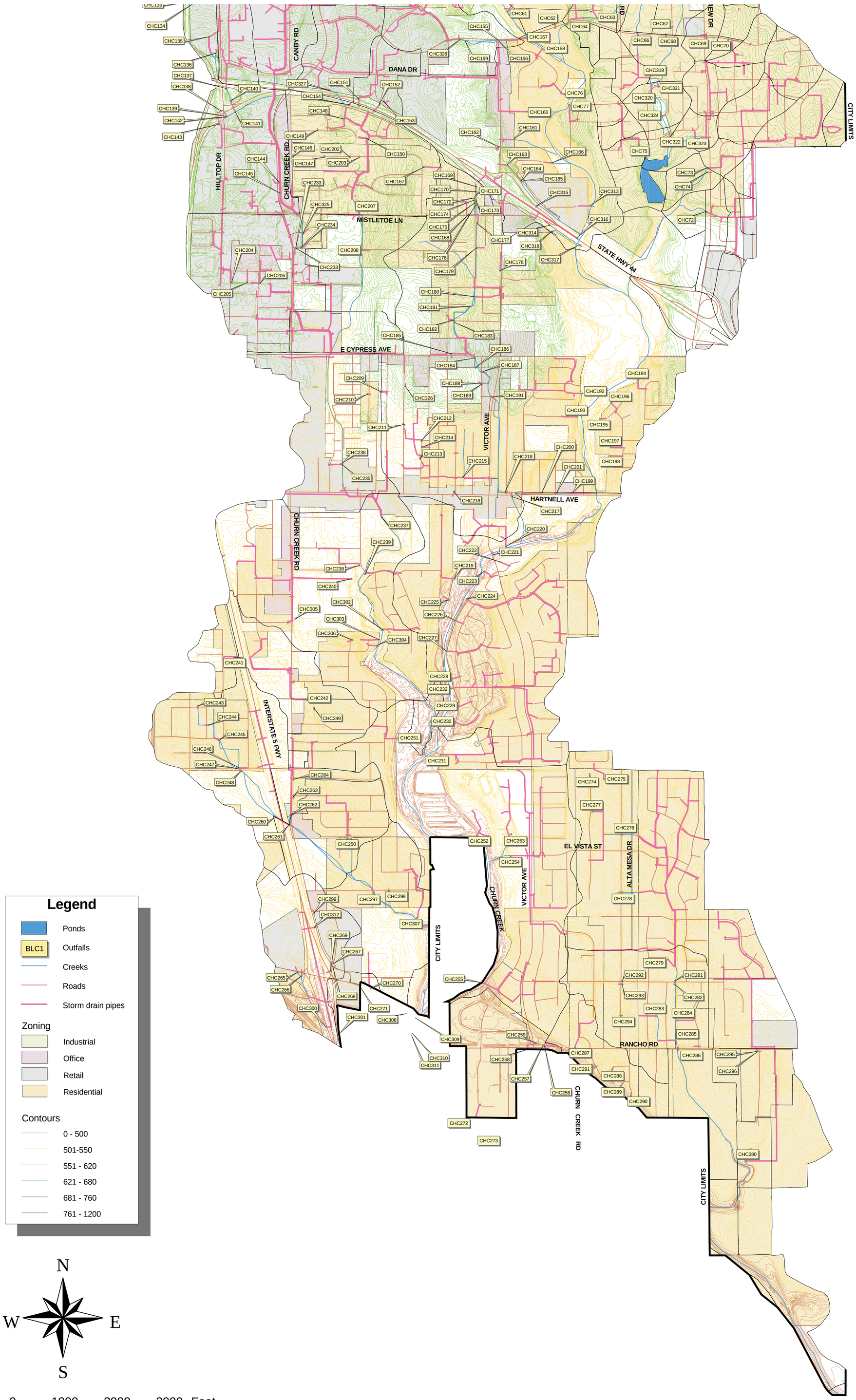
City of Redding, Development Services, Engineering Division

CHURN CREEK BASIN

Storm Drain System

January 2003 Draft

(South)

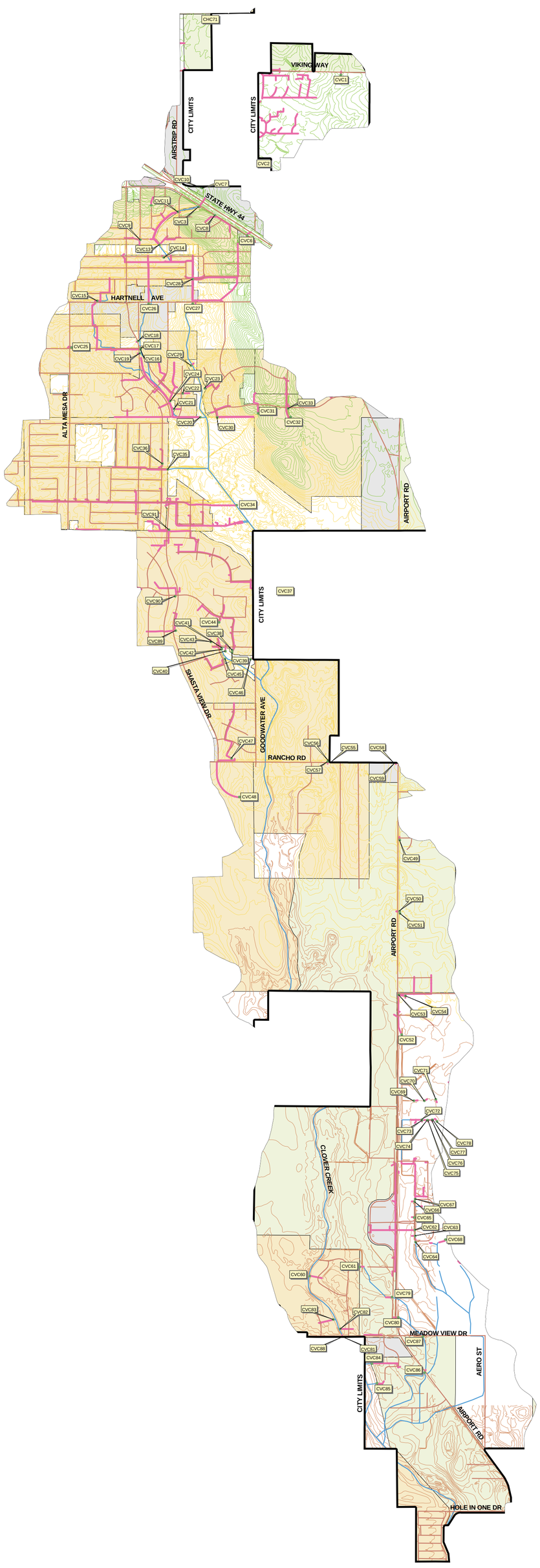


City of Redding, Development Services, Engineering Division

CLOVER CREEK BASIN

Storm Drain System

January 2003 Draft



Legend

- Ponds
- Outfalls (BLC1)
- Creeks
- Roads
- Storm drain pipes

Zoning

- Industrial
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N W E S

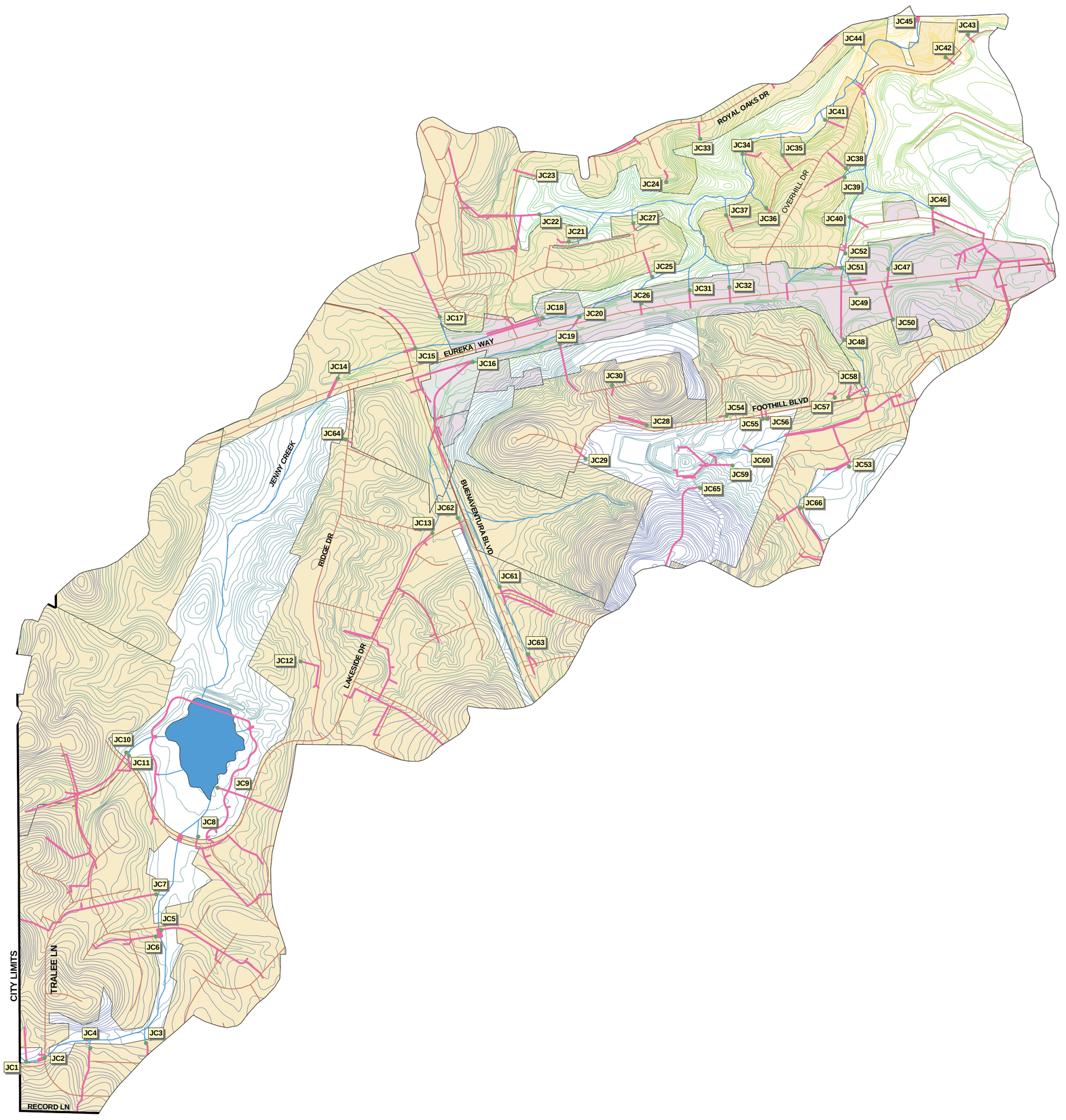
1600 0 1600 3200 4800 6400 Feet

City of Redding, Development Services, Engineering Division

JENNY CREEK BASIN

Storm Drain System

January 2003 Draft



Legend

- Ponds
- JC1 — Outfalls
- Creeks
- Roads
- Storm drain pipes

Zoning

- Industrial
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N W E S

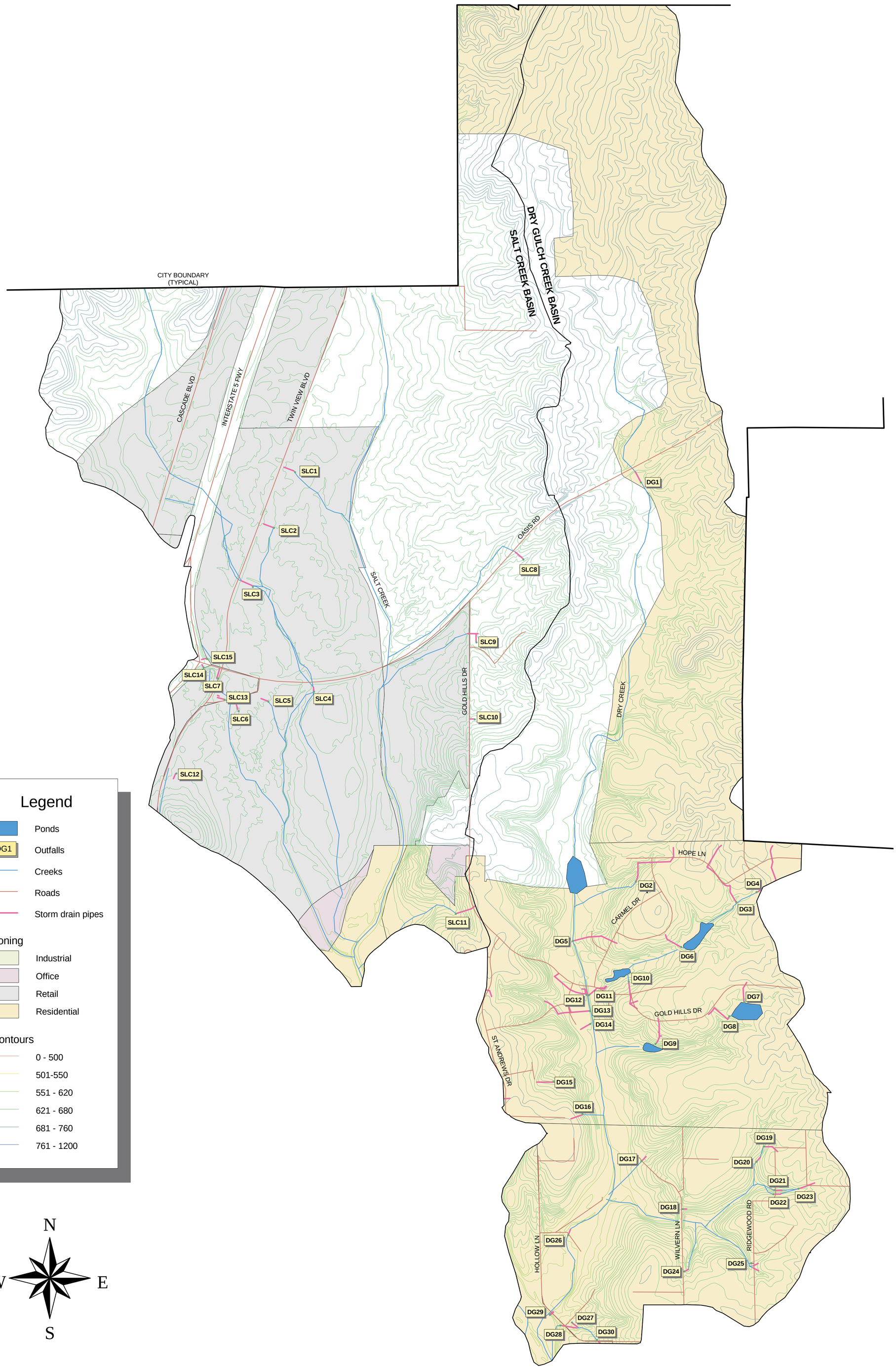
600 0 600 1200 1800 2400 3000 Feet

City of Redding, Development Services, Engineering Division

NORTHEAST CREEK BASINS

Storm Drain Systems including Dry Gulch and Salt Creek

January 2003 Draft

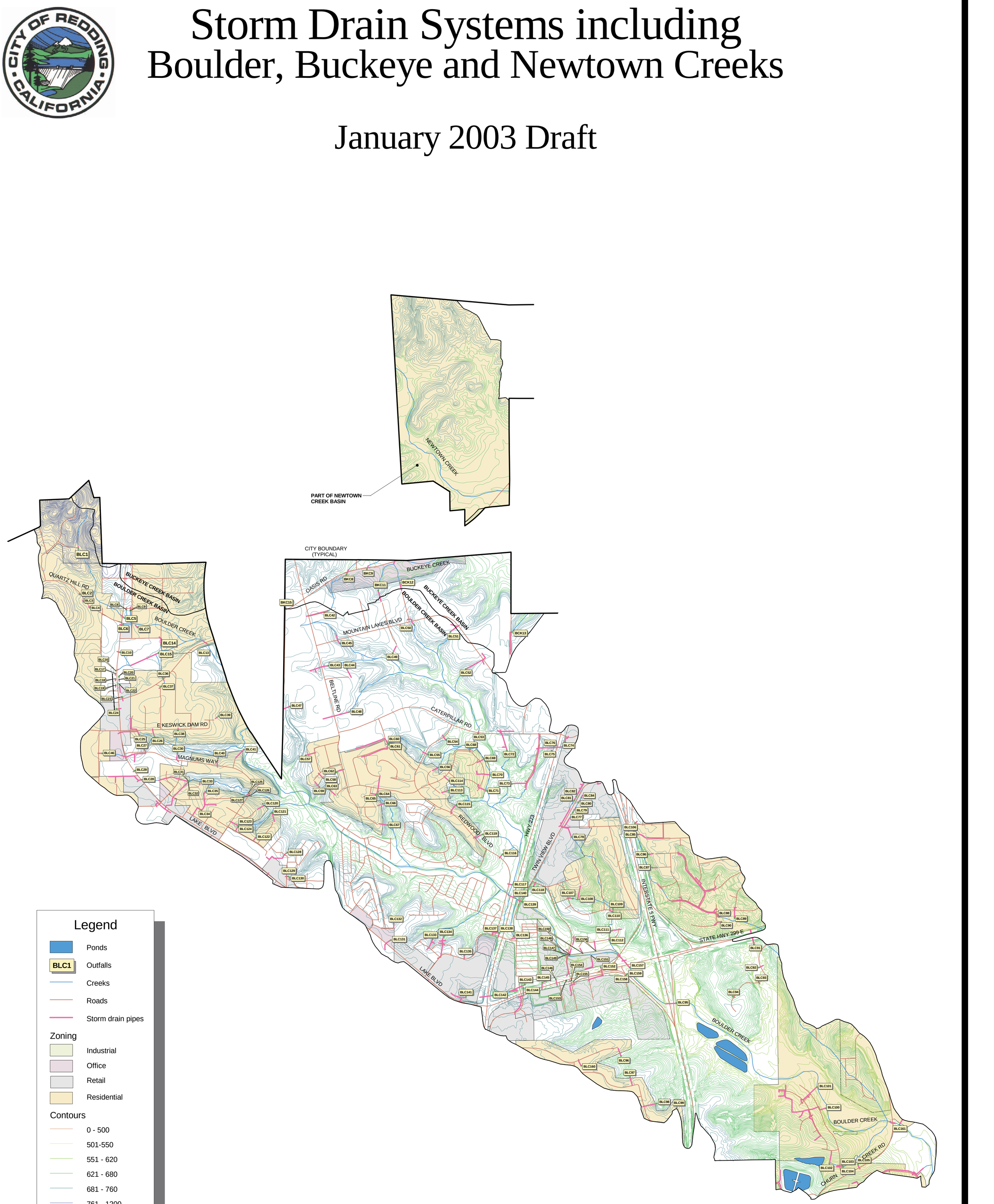


City of Redding, Development Services, Engineering Division

NORTHWEST CREEK BASINS

Storm Drain Systems including
Boulder, Buckeye and Newtown Creeks

January 2003 Draft

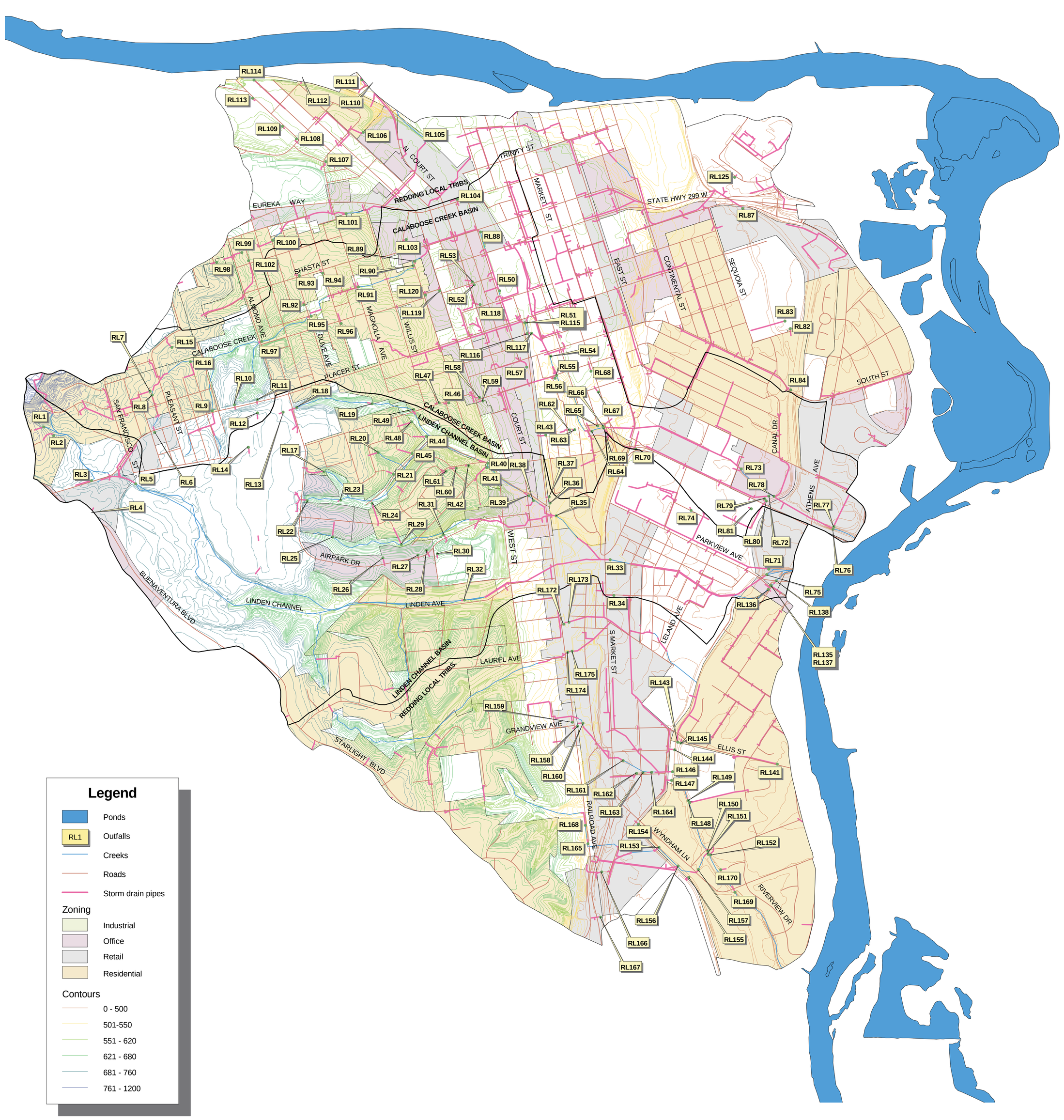


City of Redding, Development Services, Engineering Division

REDDING LOCAL BASIN

Storm Drain System

January 2003 Draft



Legend

- Ponds
- RL1 — Outfalls
- Creeks
- Roads
- Storm drain pipes

Zoning

- Industrial
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N

W E

S

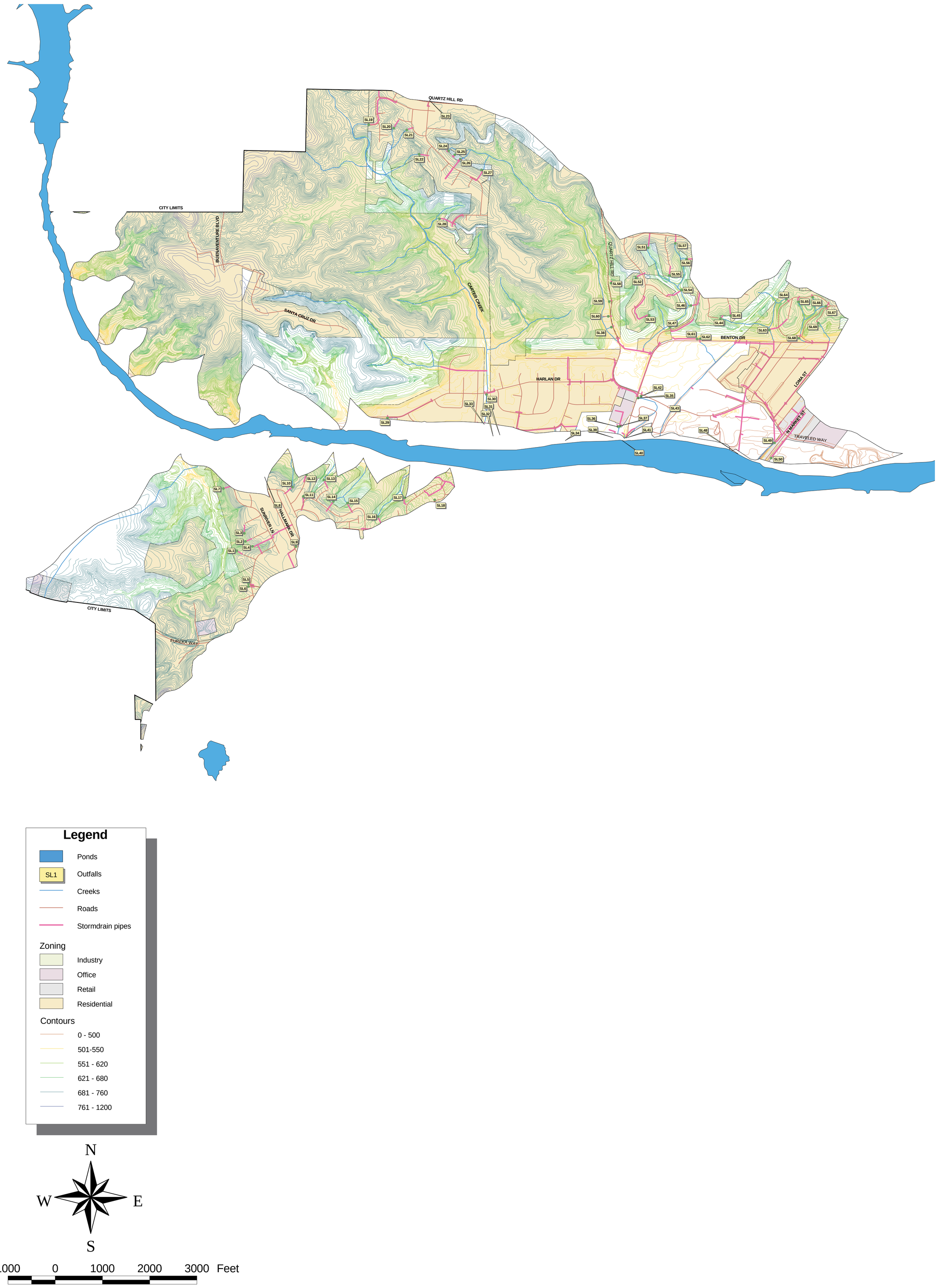
800 0 800 1600 2400 3200 Feet

City of Redding, Development Services, Engineering Division

SACRAMENTO LOCAL BASINS

Storm Drain System

January 2003 Draft



Legend

- Ponds
- SL1 — Outfalls
- Creeks
- Roads
- Stormdrain pipes

Zoning

- Industry
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N

W E

S

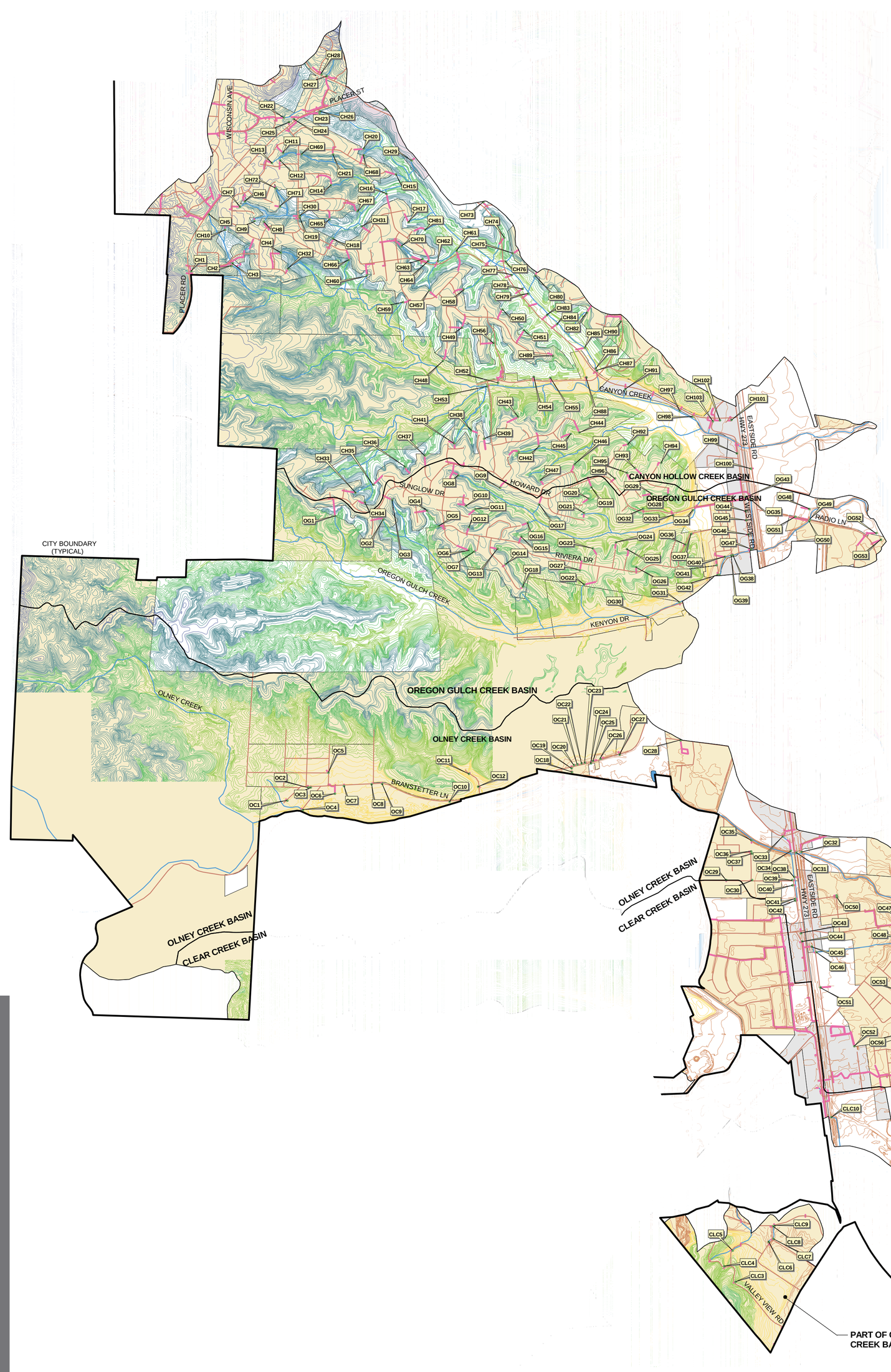
1000 0 1000 2000 3000 Feet

City of Redding, Development Services, Engineering Division

SOUTHWEST CREEK BASINS

Storm Drain Systems including Canyon Hollow, Clear, Olney and Oregon Gulch Creek

January 2003 Draft



Legend

- Ponds
- BLC1 — Outfalls
- Creeks
- Roads
- Storm drain pipes

Zoning

- Industrial
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N W E S

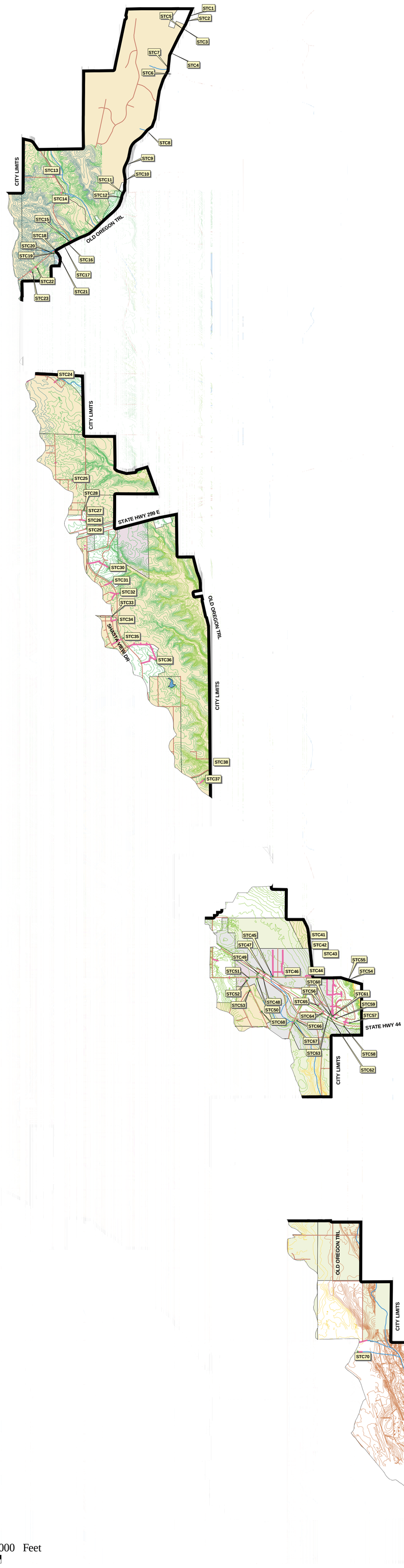
1500 0 1500 3000 4500 6000 Feet

City of Redding, Development Services, Engineering Division

STILLWATER CREEK BASIN

Storm Drain System

January 2003 Draft



Legend

- Ponds
- STC1 — Outfalls
- Creeks
- Roads
- Storm drain pipes

Zoning

- Industrial
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N W E S

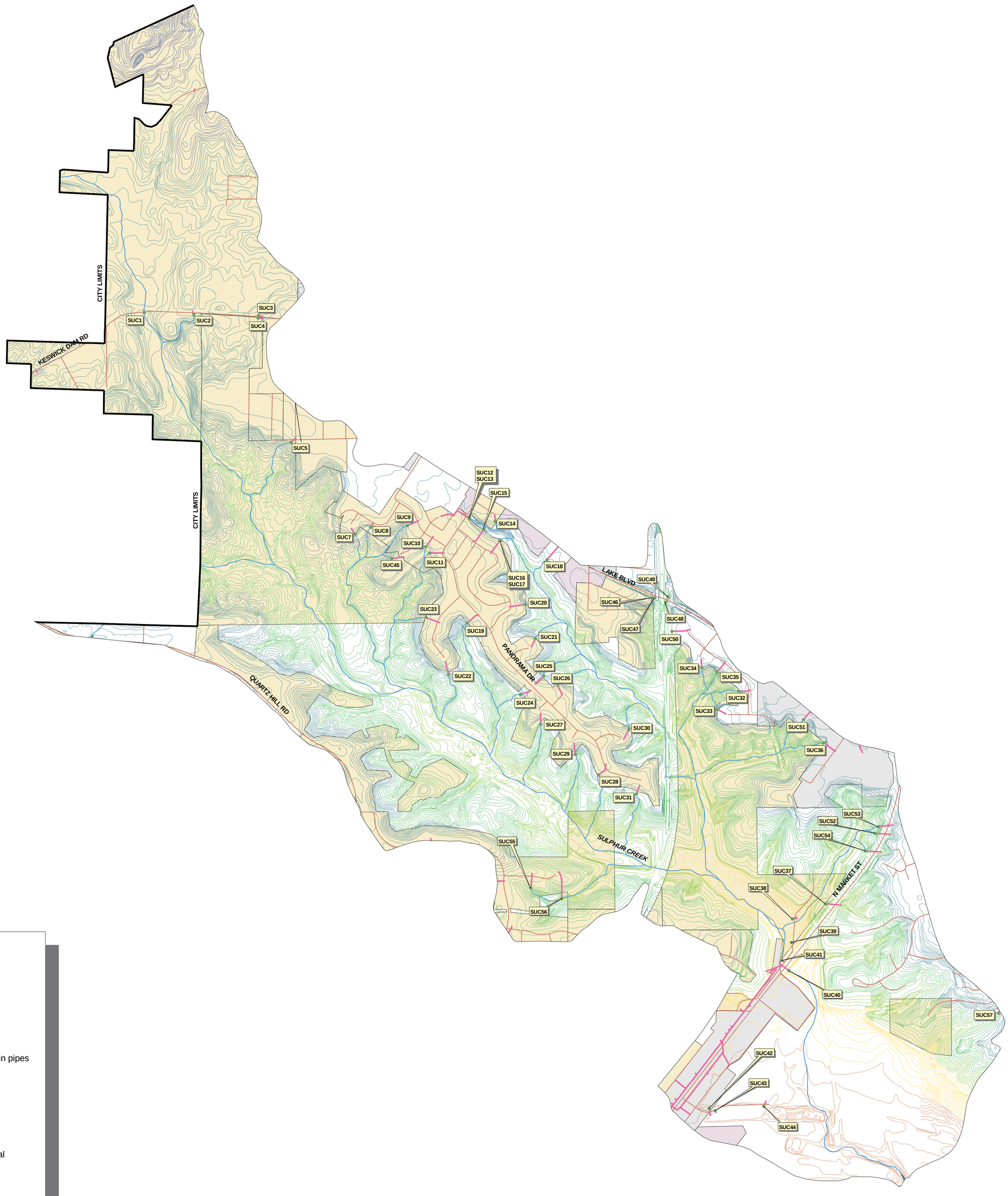
2400 0 2400 4800 7200 9600 12000 Feet

City of Redding, Development Services, Engineering Division

SULPHUR CREEK BASIN

Storm Drain System

January 2003 Draft



Legend

- Ponds
- SUC1 — Outfalls
- Creeks
- Roads
- Storm drain pipes

Zoning

- Industrial
- Office
- Retail
- Residential

Contours

- 0 - 500
- 501-550
- 551 - 620
- 621 - 680
- 681 - 760
- 761 - 1200

N

W E

S

800 0 800 1600 2400 3200 4000 Feet

City of Redding, Development Services, Engineering Division