Nevada Department of Transportation

NEVADA DOT

Storm Water Quality Manuals

Planning and Design Guide

January 2006

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Acknowledgements

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The content was developed from a variety of sources, written and unwritten. A Steering and a Technical Committee provided review of the document throughout its development. Special thanks are due to the committee members who spent many long sessions reviewing the material.

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It has been our pleasure to develop this document for NDOT. We believe it will provide a valuable source of information to help NDOT minimize short and long-term water quality impacts from water and air-borne sediment and other constituents of concern, and to provide NDOT with assistance in compliance with applicable Federal, State, and local storm water regulatory requirements.

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NEVADA DEPARTMENT OF TRANSPORTATION

STORM WATER QUALITY HANDBOOKS
PLANNING AND DESIGN GUIDE

PREFACE

This manual is to provide employees and other users with general information relevant to the storm water activities and responsibilities of the Nevada Department of Transportation. It is intended to provide guidance and reasonably uniform procedures and guidelines to affect an efficient and standardized application of permanent storm water Best Management Practices (BMPs) on the State's highway system. Since conditions may vary dramatically throughout the state, it may be appropriate to modify procedures in the field.

Design managers are encouraged to make the manual available to all employees so they may familiarize themselves with construction site BMPs. A thorough understanding of policies and procedures will greatly assist the Department in meeting its objectives, and enable employees seeking advancement to enhance these opportunities.

Many state and NDOT manuals govern the operation of the Department. In some cases these documents are described; in others only a reference is made to the information and where it may be located.

This manual is not intended to establish a legal standard of care of conduct. It is a guide subject to modification and revision as conditions warrant.

Hard copies of this manual are available for purchase from NDOT Administrative Services. The manual will also be available for download from the NDOT website.

NEVADA DEPARTMENT OF TRANSPORTATION

STORM WATER QUALITY HANDBOOKS
PLANNING AND DESIGN GUIDE

PROCEDURE FOR MANUAL REVISIONS

This manual was developed to reflect current policies, procedures, and practices. It is intended that the manual be periodically revised. Two procedures are included. For edits or updates, contact Thresa Zylstra, NDOT Hydraulics Administrative Assistant, at 775-888-7619. All updates will be available on the NDOT website which should be visited regularly for updated information.

Temporary Revisions

As new policies, procedures, and directives are developed, it is sometimes necessary to provide this information to field personnel prior to a scheduled revision. To expedite distribution of revisions, the Water Quality, Erosion and Sediment Control (WQESC) Implementation Team will issue "Temporary Revisions" as needs arise. The "Temporary Revision" should be inserted in the manual prior to the page it modifies.

Scheduled Revisions

In October of each year, the Implementation Team will review the manual to determine if revisions are required. The Implementation Team is comprised of staff from design, construction, maintenance, environmental services, materials, and FHWA and NDEP if necessary.

Revisions affecting department policies and procedures proposed by the Implementation Team will be reviewed by a Steering Committee. Results of the Steering Committee Meeting will be provided to the Implementation Team. After revisions have been approved, the Implementation Team will initiate the changes and distribute them to all holders of the manual. Revisions will be transmitted under a cover memorandum. Each page of the revision will contain a revision date. It will be the manual holders' responsibility to insert the new material in the manual.

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Introduction

1.1 Overview

This Project Planning and Design Guide (PDG) provides guidance for incorporating permanent storm water quality controls into new projects during the planning and design phases. The PDG addresses key regulatory, policy, and technical requirements to implement permanent storm water Best Management Practices (BMPs) into the design of all NDOT projects.

This manual describes the process for selecting and designing BMPs and incorporating them into the appropriate documents. Such documents include the Alternative Design Field Survey Report (ADFS), Preliminary Design Field Study Report (PDFS), the Environmental Documents, and the Plans, Specifications, and Estimates (PS&E).

The planning and design approach described herein has been developed for use in conjunction with NDOT's Roadway Design and Drainage Design Manuals. The PDG also provides guidance for incorporating requirements in the PS&E to ensure that the contractor complies with applicable permits and NDOT policy, and implements appropriate Construction Site BMPs.

1.1.1 Planning and Design Guide Organization

The PDG is organized as follows:

Section 1 – Introduction: Presents the goals and objectives of the manual, an overview of water quality in the planning and design process, summarizes relevant regulations and permits, the roles and responsibilities of NDOT staff and contractors for compliance. This section also presents the organization of this handbook.

Section 2 – Storm Water Quality Considerations During Project Planning: Provides project engineers and planners guidance on defining and avoiding potential project impacts, and reviews requirements of environmental studies and permits to determine if additional project-specific controls are required. This section also addresses the preliminary sizing of permanent treatment control devices.

Section 3 – Storm Water Quality Considerations During Project Design: Presents information on the delineation of drainage areas and disturbed areas associated with construction, considerations of the need for treatment controls, climatic and site-specific drainage area conditions, general design practices and design of permanent BMPs. This section also addresses the preparation of Standard Special Provisions or Pull Sheets, and outlines contractor responsibilities for the preparation of the SWPPP to be included in the bidding documents.

Section 4 – Guidance for Selection and Design of Permanent BMPs: Describes general design practices for permanent soil stabilization, streambank and open channel erosion controls, and permanent treatment control BMPs.

Section 5- Information needed for Construction Phase: Describes the information requirements that NDOT needs to supply to the contractor for the preparation of the Storm Water Pollution Prevention Plan and the planning and design staff's responsibilities for incorporating temporary BMP requirements in the PS&E.

Appendix A – Environmental categorization Score Sheet, TRPA/NDOT MOU, TRPA Initial Environmental Checklist, TRPA Permit Guidelines for Linear Public Service Projects, TRPA Guidelines for Exempt or Qualified Exempt Projects: This appendix contains copies of the Project Categorization Score Sheet and Instructions, copies of the TRPA's Initial Environmental Checklist and instructions for completion and other relevant TRPA permitting guidelines.

Appendix B – Working Details for Permanent BMPs: Contains Fact Sheets and details for approved permanent source and treatment control BMPs.

Appendix C – Design Examples for Permanent Treatment BMPs: A hypothetical design example is presented to illustrate the calculation of Water Quality Volume and Flow (WQV and WQF), Sand Storage Volume, Infiltration Basin Surface Area, and Sand Trap Settling Volume.

Appendix D – Relevant Storm Water documents and Web Sites: Two tables provide a summary of relevant storm water related documents and their purposes, and links to web sites that are mentioned in this document are provided here.

1.1.2 Goals and Objectives

NDOT is developing a coordinated statewide program to prevent pollution resulting from storm water runoff and wind erosion from NDOT facilities. The goal of this PDG is to provide direction to NDOT staff on regulatory compliance and permanent BMP selection, design, implementation, operation, and maintenance. The PDG will assist NDOT staff to integrate permanent environmental quality controls and requirements for construction site (temporary) BMPs into the NDOT planning and design process and the appropriate contract documents.

The PDG is one of two manuals that have been prepared as part of NDOT's Water Quality and Erosion and Sediment Control Program. The second, the Construction Site Best Management Practices Manual, provides direction for the use of temporary BMPs to prevent pollution from runoff and wind during construction activities and for the preparation of Storm Water Pollution Prevention Plans (SWPPPs). SWPPPs are required as part of the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit) for projects disturbing greater than 1 acre of soil. The overall objective of these manuals is to minimize short and long-term water quality impacts from water and air-borne sediment and other constituents of

concern and to provide NDOT with assistance in compliance with applicable regulatory requirements.

1.1.3 Storm Water Pollutants

Discharges from storm water drainage systems associated with highways and highway-related properties, facilities, and activities can contain a variety of pollutants that have the potential to adversely impact receiving waters. Of primary concern is the accelerated soil erosion and sedimentation that results from exposing or disturbing land areas by construction or maintenance activities or from the increased surface runoff that results from the creation of areas that are impervious to the infiltration of storm water such as newly paved surfaces. Other storm water pollutants can include biological nutrients, exhaust products, brake and tire materials, oil and grease, leaks and spills of fuels, oil, antifreeze, litter, and many other materials.

1.1.4 Project Development and Design Overview

The development of a new NDOT project typically consists of a project planning and scoping phase, followed by the preliminary and final design phases.

During initial project development and scoping, a reasonable number of alternatives are generally developed and reviewed. For NDOT projects this includes the Alternatives Design Field Study (ADFS). In this project phase, engineering studies are conducted to compare alignments and their associated impacts. Additionally, an effort is made to design the project to take advantage of the topography, soils, waterways, and natural vegetation at the site and minimize impacts on the existing environment. For any project involving a federal action or receiving federal funding, an environmental document is prepared in accordance with the National Environmental Policy Act (NEPA) (see Section 1.2.1.2).

Following the design alternative selection process, a Preliminary Design Field Study (PDFS) meeting is held, where the various NDOT divisions and other interested agencies meet to refine the project scope. Following the PDFS, recommendations for improvements are included in a PDFS Report, which identifies the major project design features. A public meeting may be held to solicit input/comments to the design features.

Following the approval of the PDFS Report, the Road Design Division, with input from other divisions, develops the 30%, 60%, 90%, 100% and final PS&E. Construction, Maintenance, Hydraulics, Environmental, Materials, Safety-Traffic, and other affected NDOT divisions normally perform a detailed review at the 60% and/or 100% design submittals.

NDOT's *"Project Design Development Manual"*(PDDM) illustrates the design process with a detailed flowchart that is hyperlinked to various sources for further explanations. NDOT design procedures are covered within this document as they pertain to water quality and other environmental issues only. For more detailed guidance on the design process, see the PDDM.

1.1.5 Permanent BMP Selection and Design Process

For the scope of this manual, permanent BMPs are those facilities and features designed into the project to control erosion and sedimentation and protect water and air quality after construction activities have been completed. Permanent BMPs are always part of the project design and are incorporated into the PS&E. Since they are treated similarly to other permanent design features, the procedures for detailing, specifying, and ensuring proper construction is familiar to NDOT designers and resident engineers.

During the design phase, specific permanent erosion, sediment, and water quality control features are incorporated into the project plans. Depending on the nature of the project and how extensive the need is for such controls, these design features may be included at any stage prior to 60% design. Incorporating permanent BMPs into the PS&E is performed primarily by the Hydraulics Section, with input and support of other sections.

The Road Design Division prepares the structure list and compiles the quantity estimates, and the items and quantities are shown on the plans as well as in the structure list. The project contributors also coordinate with the Specifications Section, which maintains the Standard Specifications, the Pull Sheets, the Standard Plans, CADD standards, and writes the contract special provisions. The PS&E package provides clear direction to both the contractor and the resident engineer as to how the project must be constructed.

1.2 Regulations and Permits

Regulations and permits are effective tools utilized by public agencies with regulatory powers for the protection of the environment. This section summarizes Federal, State, and Local regulations and permits applicable to NDOT construction, maintenance and operations activities.

1.2.1 Federal Regulations

1.2.1.1 Intermodal Surface Transportation Efficiency Act (ISTEA)

- Section 1057 of the Intermodal Surface Transportation Efficiency Act (ISTEA) requires the Federal Highway Administration (FHWA) to develop erosion and sediment control guidelines for states to follow on highway projects using federal funding (funded under title 23 United States Code).

- In a revision to 23 CFR 650, subpart B, FHWA has adopted the American Association of State Highway and Transportation Officials (AASHTO) highway drainage guidelines to comply with the ISTEA. The revision requires states to either apply these guidelines or to develop their own, more stringent, guidelines to develop standards and practices for the control of erosion.

In compliance with the above regulations, NDOT is developing and implementing the water quality control guidelines contained within these manuals.

1.2.1.2 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires that all federal agencies identify the environmental impacts of proposed activities, including impacts to water and air quality. This requires the agency to conduct a preliminary investigation of potential effects of their actions, and decide whether further investigation is warranted.

NDOT projects are subject to NEPA requirements when Federal funds or actions are involved. Some projects could be considered for categorical exclusion (CE) status if a federal agency determines that the project will not have a significant impact on the environment. NEPA provides for CE of certain activities such as emergency repair work and maintenance activities.

An Environmental Assessment (EA) is prepared for projects that are expected to have some impacts and a Finding of No Significant Impact (FONSI) is issued by the FHWA when minimal or no adverse impacts are identified. The EA also includes procedures to minimize and/or mitigate the identified impacts.

An Environmental Impact Statement (EIS) is prepared for complex projects expected to have a significant impact to the human and natural environment. A Record of Decision detailing project activities and mitigation commitments is issued by the FHWA. An EIS is a detailed document that describes project alternatives to minimize the identified impacts and is subjected to comments from interested outside parties.

1.2.1.3 Clean Water Act

The 1972 Federal Water Pollution Control Act (FWPCA) was amended in 1977 and subsequently referred to as the Clean Water Act (CWA). The 1987 Water Quality Act (WQA) also amends the 1972 FWPCA and forms the legislative basis for all federal storm water regulations. The 1987 amendments require NPDES permits for storm water discharges from municipal separate storm sewer systems (MS4s) and industrial activities including construction. In 1990, the U.S. Environmental Protection Agency (EPA) issued the final NPDES regulations governing storm water discharges. Storm water NPDES permitting was implemented in two phases.

Phase I permits were issued in 1990 and were required for:

- Facilities previously permitted for storm water discharges.
- Industrial activities, including construction sites disturbing 5 acres or more, and transportation facilities.
- Large (pop.>250,000) and Medium (100,000<pop.<250,000) Municipal Separate Storm Sewer Systems (MS4s). Drainage systems for roads and highways are generally considered MS4 systems.
- Facilities determined to be "significant contributors" of pollutants to waters of the United States (U.S.)

Phase II permitting became effective on March 10, 2003 and permit coverage is required for:

- Regulated small MS4s (Population greater than 50,000 and density of 1,000 people/sq. mi.).
- Industrial activities, including construction sites disturbing 1 acre or more and transportation facilities.

1.2.1.4 Clean Water Act, Section 404

Under Section 404 of the Clean Water Act, the United States Army Corps of Engineers (USACE) issues permits to allow discharges of dredged or fill material to waters of the United States, including oceans, lakes, streams, and wetlands. There are two basic types of 404 permits, an individual permit and a general permit. Section 404 permits can be categorized into two basic types as follows:

- **Individual Permits:** Individual permits are typically required for projects that have potentially significant impacts to the environment. There are two types of individual permits: Standard Permits and Letters of Permission. A Standard Permit is one that has been processed through the public interest procedures, including a public notice and receipt of comments. A Letter of Permission is issued through an abbreviated processing procedure, which includes a public interest evaluation, but no individual public notice.
- **General Permits:** General permits are divided into two categories: Regional Permits and Nationwide Permits. Regional Permits are issued by the USACE District or Division Engineers on a regional basis. Nationwide Permits are issued by the USACE Chief of Engineers through publication in the Federal Register and are applicable throughout the nation. Regional Permits and Nationwide Permits cover discharges that are similar in nature, and will cause only minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effect on the environment, as determined by the USACE.

Application Procedures:

The USACE District Engineer or regulatory staff is available for pre-application consultation. Upon receipt of the permit application, the USACE District Engineer will notify affected agencies (federal, state, or local) and the public. If preparation of an environmental document is required, the District Engineer will contact the applicant and advise them of the requirements. The application form includes a complete description of the proposed activity including necessary drawings, sketches, or plans sufficient for public notice. Applications are determined to be complete when sufficient information has been submitted to issue a public notice, and the appropriate fee has been received. There is no fee if the permit is withdrawn prior to the issuance of the permit or if the permit is denied.

If an application has been approved, the permittee is required to show that they are avoiding wetland impacts where practicable, minimizing potential impacts to

wetlands, and providing mitigation for unavoidable impacts, to comply with the Corps' 'no net loss' standards for wetlands. (For more information on obtaining a 404 permit see Code of Federal Regulations Title 33 Parts 320-331 and Section 404 of the Clean Water Act). NDOT Standard Specifications Section 108 contains contractor requirements for permit compliance.

The 404 Permit includes any special conditions included in the local 401 certification (See Section 1.2.1.5), and if threatened or endangered species may be affected, the US Fish and Wildlife Service will be consulted, as well as Nevada Department of Wildlife (NDOW), and the Nevada Division of Forestry (NDF). An effort is made to align the 404 Permit requirements with other regulatory requirements through early coordination with the involved agencies.

1.2.1.5 Water Quality Certification (CWA Section 401)

Projects requiring a Section 404 Permit (See Section 1.2.1.4) must also obtain State certification that the proposed activity will not contribute to or cause violations of, State and Federal water quality standards. The CWA addresses the following:

- Beneficial Uses of Water – benefits to aquatic life, agriculture, recreation, water supply, industrial supply, and propagation of wildlife must be protected;
- Water quality standards – numeric and narrative limits or bans on substances or processes that alter concentrations of dissolved oxygen, temperature, and turbidity; and
- Anti-degradation – requires that surface waters whose quality is higher than the applicable standards must be protected.

NDOT's Environmental Section typically obtains coverage under this permit, and NDEP is the agency responsible for certification. The 401 certification often includes special conditions in order to remove or mitigate potential impacts to water quality standards. These may include but are not limited to seasonal limits on when work can be performed, incorporation of water pollution controls (BMPs), and treatment of sediment impacted water prior to release. Water quality monitoring upstream and downstream of the work may also be a requirement to ascertain whether the project is impacting the receiving water.

1.2.2 Nevada Regulations

The State of Nevada has adopted narrative and numeric water quality standards to protect the designated beneficial uses for water bodies in the state. The narrative standards are applicable to all surface waters of the state and consist of statements requiring waters to be free from various pollutants including those that are toxic. The numeric standards are assigned by class. Classes of water are listed from A to D, with A being the highest quality.

Additionally, site-specific numeric standards for certain constituents have been developed for major water bodies (e.g. Lake Tahoe, Lake Mead). Water quality

standards for surface waters in the state of Nevada are published in the Nevada Administrative Code (NAC), Chapter 445A.119-445A.225.

Total maximum daily loads (TMDLs) are an assessment of the amount of pollutant a water body can receive and not violate water quality standards. Nevada is required by section 303(d) of the CWA to identify and prioritize waters that are impaired for one or more pollutants. Following identification of impaired waters, TMDLs are goals developed for the pollutant, with the scheduling of TMDLs, based on the prioritization. Adoption of the TMDL results in an implementation plan, generally enforced through permits, to achieve the targeted reduction in pollutants in the TMDL. TMDLs are currently implemented through NPDES permits for point source discharges and voluntary non-point source control programsUnder the current TMDL program, numeric standards for storm water runoff have not been developed in Nevada because storm water runoff from highways and highway facilities is highly variable. To address highway runoff, the NPDES program has emphasized implementation of BMPs and monitoring. Current and tentative TMDL information can be obtained from the Nevada Division of Environmental Protection (NDEP).

1.2.2.1 General Permit for Storm Water Discharges Associated with Construction Activity

1.2.2.1.1 Permit Background

NDEP updated the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit) in September 2002 to include Phase II of NPDES storm water permitting as discussed in Section 1.2.1.3. Construction projects that disturb one acre or more of land require coverage under this permit.

Disturbance is defined as clearing, grading, or excavating underlying and/or surrounding soil as part of the repaving operation. NDEP may also require general permit coverage if repaving operations create loose fine-grained material (e.g. asphalt millings) that is not immediately disposed of and/or is stockpiled on the site. If the material is immediately overlaid or hauled off-site, a permit may not be required depending on site-specific conditions. The use of asphalt millings as a permanent soil stabilization method by immediately spreading and compacting is approved by NDEP and NDOT (see permanent BMP fact sheet for hard surfaces in Appendix B). Contact NDEP's Storm Water Coordinator prior to the start of construction if general permit coverage is questionable for a particular project.

Temporary concrete, asphalt, and material plants or operations also require permit coverage. If the plant or operation is dedicated to a permitted construction project, the permit covers storm water discharge. However, a separate SWPPP must be prepared to address storm water controls specific to the plant or operations.

Construction activity that results in soil disturbances of less than one acre is subject to this General Permit if the construction activity is part of a larger common plan of development or sale totaling one acre or more of soil disturbing activities, or if there is the potential for significant water quality impairment resulting from the activity as determined by the NDEP.

1.2.2.1.2 NDOT Policy for General Permit Compliance

For all NDOT projects disturbing one acre of more, the contactor is required to obtain coverage under the General Permit by submitting a Notice of Intent (NOI) and the appropriate filing fee with the NDEP two (2) days prior to the start of construction. In addition, a SWPPP must be completed by the contractor and be available for review at the project site prior to filing the NOI. The SWPPP is not submitted to NDEP for review and approval but must be present at the construction site and presented to NDEP inspectors upon request. The contractor is fully responsible for the SWPPP development, implementation and update, and any fines imposed. NDOT requires the contractor to employ a Professional Engineer (PE) to prepare the SWPPP for all high potential impact projects (see Section 3.7) and for BMP design as specified in the Construction Site BMP Manual.

The contractor is responsible for construction of the final stabilization measures needed for the construction site to meet NPDES General Permit requirements including seeding for re-vegetation or other appropriate stabilization as specified in the contract. The contractor is responsible for identifying pre-construction and post-construction vegetation coverage for the project and must submit this information to the RE. The information will be forwarded to District Maintenance after the contract is closed out.

Upon District acceptance of the contract (contractor completion), the contractor will submit the Notice of Termination (NOT) to the NDEP. This ends the contractor's responsibilities with respect to permit compliance. If final stabilization has not yet been achieved per NDEP requirements, permit coverage is transferred to NDOT until 70% re-vegetation is established. This requires written notification to NDEP from NDOT at the time the contractor submits the NOT to formally transfer control of the General Permit designating NDOT as the permittee.

The project is then turned over to District Maintenance who, under the Environmental Division's direction, will be responsible for additional seeding or irrigation or performing other necessary activities to fulfill the 70% re-vegetation requirement to achieve site stabilization. During this time, all of the requirements of the General Permit still apply to the project including inspecting and maintaining the appropriate temporary BMPs. After final site stabilization has been completed, District Maintenance will remove the temporary BMPs and file the NOT, which will release NDOT from General Permit coverage. An outside contractor may also be hired to perform the final stabilization work.

In some cases, the NDEP may view two (2) or more small projects (less than 1 acre of soil disturbance) in the same corridor as part of a larger common plan of development and therefore require General Permit coverage. If multiple contractors are used, special arrangements may be required to determine responsibilities for SWPPP preparation and General Permit compliance. Additional guidance to contractors on permit compliance and SWPPP preparation is presented in the Construction Site BMP Manual.

1.2.2.2 Other NDOT NPDES Permits

As discussed in Section 1.2.1.3, NDOT is subject to NPDES permits authorizing storm water discharges from industrial activities including construction (Section 1.2.2.1) and from MS4s. This section addresses the following two NPDES permits that are in addition to the General Permit discussed above:

- National Pollutant Discharge Elimination System Permit for Discharges from Nevada Department of Transportation Municipal Separate Storm Sewer Systems (NV0023329) or (Statewide MS4 Permit), and

- Stateline Stormwater Association and Members, Authorization to Discharge (NV0023051) or (Stateline Permit).

Both of these permits require extensive Departmental and interagency coordination to achieve compliance through integrated planning. Both permits are managed by the Environmental Services Division's Water Quality Specialist (WQS).

1.2.2.2.1 Statewide MS4 Permit

NDOT is currently regulated by a statewide National Pollutant Discharge Elimination System for Discharges from Nevada Department of Transportation Municipal Separate Storm Sewer Systems (NPDES Permit No. NV0023329) authorizing discharges from NDOT MS4s. This permit authorizes NDOT to discharge storm water and certain non-storm water runoff to waters of the United States. The permit includes conditions that are intended to protect the quality of the receiving waters. These conditions include:

- Special considerations and actions for discharges to impaired water bodies included on the State of Nevada 303(d) list;

- Development, implementation, and enforcement of a Statewide Storm Water Management Program (SWMP). Program elements include:

  - Public Outreach and Education,

  - Intergovernmental Coordination,

  - Best Management Practices,

  - Illicit Discharge Detection and Elimination,

  - Construction Site BMP Program,

  - Maintenance Program Management (including the development and implementation of Maintenance Facility Pollution Prevention Plans),

  - Reviewing and updating the SWMP through monitoring, record keeping and reporting evaluations of obligate measurable goals outlined in the SWMP,

- Development, implementation, and enforcement of a separate, specific SWMP for Clear Creek.

Coverage under this permit must be maintained by submission of applications and fees per the schedule specified in the existing permit. Important information required in the applications includes information regarding receiving waters and their 303(d) status and information on BMPs, their goals and identification of the person(s) responsible for the SWMP.

1.2.2.2.2 Stateline Permit

NDOT is also regulated by a specific NPDES Permit that authorizes storm water discharges from U.S. Highway 50 to a central storm water treatment unit, which in turn flows to the Edgewood Creek watershed in South Lake Tahoe. NDOT is a co-permittee with several private entities and Douglas County (collectively the Stateline Storm Water Association), who share operation and maintenance responsibilities for the common facilities of the storm water treatment system.

This permit uses numerical water quality criteria developed by the TRPA for surface and groundwater discharges. For reasons that are described in the permit, the groundwater discharge criteria are applied as limits, and surface water discharge criteria are applied as goals, with the requirement to attempt improvements should exceedances persist.

The permit requires implementation of a Monitoring Plan, an Operation and Maintenance Plan and submission of annual reports that include plans to improve the system performance if exceedances persist or if reasonable improvements can be made. At the present time (2004), a consultant retained by the Stateline Stormwater Association is implementing the monitoring plan and managing the operation and maintenance requirements including reporting. The Environmental Services Division coordinates with District II to manage this permit.

1.2.2.3 Temporary Work in Waterways/Discharge Permit (Formerly Rolling Stock Permit)

A Temporary Working in Waterways/Discharge Permit is required by NDEP for work within or immediately adjacent to, live streams or water bodies. Permits are issued for both routine maintenance (culvert cleaning, clearing and snagging, etc.) and for short-term construction projects. NDEP issues individual temporary permits valid for no longer than six months. The Environmental Services Division is working with the Districts to obtain General Permits for Routine Maintenance Activities Working in Waters of the State. They are valid for (5) years and can be renewed. NDEP issued Maintenance General Permit No. GNV9800002 to District III on April 5, 2004. NDEP reviews and approves the submitted Temporary Working in Waterways/Discharge Permit application before work can start. For projects that require General Permit coverage in addition to this permit, the SWPPP may be submitted to the NDEP as part of the Temporary Working in Waterways/Discharge Permit application. For NDOT projects the contractor is responsible for obtaining this

permit, where applicable, and the NDOT Water Quality Specialist provides oversight of the process if necessary.

The Temporary Working in Waterways/Discharge Permit application must include a detailed description of the BMPs to be implemented during the disturbance and/or work activities proposed in and along the stated water body for: water quality protection; erosion control; sediment control; riparian stream zone protection and restoration; streambank stabilization/protection/rehabilitation, water pollution control/prevention, dewatering controls, etc. Water quality monitoring may also be a permit requirement to verify compliance with the applicable receiving water standards.

An effort is made to align the permit requirements with any required 404 Permit and 401 Certification (see below). For projects that require these permits and coverage under the General Permit, the SWPPP may be submitted to the NDEP as part of the Rolling Stock Permit BMP description requirements.

1.2.3 Lake Tahoe Regulations and Permitting

1.2.3.1 Background

Congress created the Tahoe Regional Planning Agency (TRPA) in 1969 with the enactment of the Tahoe Regional Planning Compact (Compact). The bi-state agency's mission, as outlined in the Compact, includes the establishment of Environmental Threshold Carrying Capacities, and a Regional Plan and Code of Ordinances "which will achieve and maintain such capacities while providing opportunities for orderly growth and development consistent with such capacities".

The environmental thresholds have been developed in the following nine areas:

- Water Quality
- Air Quality
- Soil Conservation
- Vegetation
- Fish Habitat
- Wildlife Habitat
- Noise
- Scenic resources and
- Recreation

As outlined in the Regional Plan, the TRPA has also developed an Environmental Improvement Program (EIP) that identifies programs, projects, and studies that are intended to attain, maintain, or surpass the environmental thresholds. NDOT is

participating in the EIP through the development and implementation of the NDOT Tahoe Master Plan.

As a regulatory agency, the TRPA reviews and permits construction projects, and seeks to minimize environmental impacts of new projects. Permits issued include Standard Conditions of Approval and Special Conditions for individual projects. Permanent and temporary erosion control devices are required for applicable projects.

In September of 1990 NDOT and the TRPA entered into a Memorandum of Understanding (MOU) that lists certain activities, such as routine maintenance, as not requiring TRPA review and approval, provided that they do not result in the creation of additional land coverage or relocation of land coverage. A copy of the MOU is provided in Appendix A.

There are numerous differences between typical TRPA construction permit conditions and those in the Nevada General Construction Permit. The TRPA permits are issued individually and are generally more stringent and include the following major differences:

- An expanded definition of stream environment zones (SEZs),
- With limited exceptions, no ground disturbances are allowed between October 15 and May 1,
- Projects are required, where feasible, to incorporate permanent facilities capable of retaining and treating the volume of a 1-hour, 20-year storm event (approximately 1-inch of rain in a one hour period).
- Completion of the Initial Environmental Checklist (IEC) for projects not covered under the NDOT/TRPA MOU or Qualified Exempt activities is required. Large projects may require an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). These documents are similar to, yet separate from the NEPA environmental documents, however, they may be combined into a joint document to satisfy both NEPA and TRPA requirements if appropriate. A copy of the IEC is provided in Appendix A.
- A verification of the land capability and existing impervious coverage may also be required within the project's limits.

1.2.3.2 Permitting Policy and Procedures

All projects in the Lake Tahoe Basin are considered to be high potential impact projects per the Project Categorization Score Sheet (for additional information regarding the Score Sheet see section 3.6.1). The following procedure applies to in-house design and consultant projects in the Lake Tahoe Basin. For typical maintenance activities within the Tahoe Basin, see Section 1.3.7.3.

For applicable projects not covered under the NDOT/TRPA MOU or qualified exempt activities, the following procedure applies. The project coordinator/manager or engineering consultant, with input from Environmental staff and the Lake Tahoe EIP coordinator, will complete the TRPA IEC and compile supporting documentation required for permit submittal. The checklist will be submitted along with required documentation to the Tahoe EIP coordinator for initial review. Upon the initial review, concurrence on the IEC will be sought from the Chief Environmental Engineer. The Tahoe EIP coordinator will prepare and submit the application to TRPA. A complete application must be submitted at or prior to the 60% design level. Allow three months for final TRPA approval and acquisition of this permit from the time application is initially submitted. The Hydraulics Section will develop temporary soil and sediment control items and plans for inclusion in the final PS&E.

Prior to 90% design, the Lake Tahoe EIP coordinator will submit TRPA's permit requirements to the following division chiefs for their review: Environmental, Hydraulics, Roadway Design, Construction-Materials, Maintenance and Right-of-way. Upon approval by the division chiefs, the Chief Hydraulic Engineer will sign the TRPA permit. The Lake Tahoe EIP coordinator will include all applicable permit requirements in the final PS&E package.

A copy of TRPA Guidelines for obtaining a construction permit or for determining whether an activity is Exempt or Qualified Exempt from such permitting is included in Appendix A.

The Contractor:

- Complies with all conditions of the construction permit.
- The contractor's engineer attends the pre-grade meeting with TRPA and their contract compliance officer to identify all other BMP items required by TRPA.
- Includes any additional BMP requirements in the contractor's SWPPP prior to submittal to NDEP.

1.2.4 Irrigation Districts

Irrigation Districts may also have pollution control requirements for work performed within their boundaries. For example, the Truckee-Carson Irrigation District requires a construction license for projects that include road crossings over irrigation ditches or drainage ways. The licenses typically include requirements for bank stabilization and pollution prevention to the irrigation water. As part of the project planning process, local irrigation district offices should be contacted to determine the specific water pollution control requirements.

1.2.5 Air Quality Permits

1.2.5.1 Background

NDOT projects may also require coverage under various Air Quality or Dust Control Permits. NDOT contractors are responsible for obtaining these permits from the appropriate agency.

In Nevada, air quality is regulated by the NDEP or, within Washoe and Clark Counties, by each county's Air Quality Management Divisions. Permit requirements for the different jurisdictions are discussed below.

Air quality permits will also typically require some type of permanent soil stabilization after construction is complete. This stabilization may or may not be sufficient to satisfy the final stabilization requirements of the General Permit. The following methods shall be used to satisfy the final soil stabilization requirement of air quality permits for NDOT Projects:

- In northern areas of Nevada, where re-vegetation is feasible, seeding, slope paving, and application of millings to the shoulders will be the methods of stabilization.

- In southern urban areas, where re-vegetation is not successful, slope paving or rock mulch will be the methods of stabilization for cut and fill slopes. For aesthetic reasons, in an area contained within the landscape master plan, millings are not appropriate.

- In southern rural areas, soil stabilizers, slope paving, or application of millings will be the methods of soil stabilization.

Northern areas may be approximately defined as NDOT Districts 2 and 3, while southern areas consist mainly of District 1. The Project Manager/Coordinator should contact the Hydraulics section to determine the appropriate stabilization method. When seeding or rock mulch is required, Hydraulics will contact the NDOT Landscape Architect to develop a seed mix, application specification, or rock mulch color scheme.

1.2.5.2 NDEP

NDEP requires a Surface Area Disturbance Permit if land disturbance equals or exceeds five (5) acres. If the disturbed soil area exceeds twenty (20) acres, a dust control plan must also be submitted.

1.2.5.3 Clark County Department of Air Quality Management

In Clark County, the following construction activities require a Dust Control Permit:

- Soil disturbing or construction activity greater than or equal to one-quarter acre,

- Mechanized trenching greater than or equal to 100 feet in length, or

- Mechanical demolition of any structure larger than or equal to 1,000 ft^2.

In Clark County, a Dust Mitigation Plan is required for all projects and a Site Specific Dust Mitigation Plan is required for sites greater than 10 acres. Construction site superintendent(s), foremen and other designated on-site representatives, as well as the water truck/pull drivers are required to complete the Clark County Dust Control Class.

A Dust Control Monitor is required for all construction sites having 50 acres or more of actively disturbed soil at any given time. The Dust Control Monitor must also complete the required Clark County Dust Control Classes. The Monitor shall be present at all times during construction activities, and is required to do visual inspections, record keeping, deployment of resources, and shutdown or modification of construction activities as needed. Wind conditions can cause construction activity to cease if dust emissions are in excess of 20% opacity using the Time Averaged Method, in excess of 50% opacity using the Instantaneous Method, or are 100 yards or more in length from the point of origin. Refer to the Clark County Air Quality Regulations for additional guidance on dust control regulations.

Clark County Dust Control Permits require explicit payment for temporary and permanent dust control in contract estimates. To comply with this requirement, NDOT includes a lump sum bid item for these controls on all projects. This item is estimated as $1,000.00 plus 0.1% of the total project construction cost.

1.2.5.4 Washoe County District Health Department Air Quality Management Division

In Washoe County, a Dust Control Plan is required for projects disturbing more than one acre of soil. The Dust Control Plan must be present at all times at the construction site.

It is the responsibility of the contractor to be in compliance with the dust control regulations at all times. The contractor must agree to implement an acceptable method to prevent particulate matter from becoming airborne, such as the use of water trucks, windscreens, and speed limits. Additional precautions as reasonably prescribed by the Air Quality Management Division must be performed.

The site is subject to the right of inspection by an Air Pollution Investigator at any time. Acceptable control of airborne particulates must be in place or the construction activities can be suspended by the Air Pollution Inspector. Effective dust control must be in place 7 days a week, 24 hours a day from commencement of the project to final completion. Additional information regarding the Washoe County air quality requirements can be found in the Washoe County Dust Control Plan.

1.3 Permitting Roles and Responsibilities

Implementation of an NDOT water quality program requires teamwork and cooperation between all NDOT divisions, especially Environmental, Hydraulics,

Construction, Roadway Design, Specifications and District Maintenance staff. This section defines general divisional roles and responsibilities regarding BMP implementation and regulatory compliance.

1.3.1 Environmental Division

1.3.1.1 Permits

The Environmental Division is responsible for securing and/or providing oversight of all regulatory permits relative to water quality with the exception of the TRPA Construction Permit and Dust Control Permits. The Environmental Services' WQS is the primary contact for regulatory permit compliance particularly with the SWMP and construction issues associated with the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit). With aid from the Hydraulics Section, the Environmental Division oversees development of Storm Water Pollution Prevention Plans (SWPPPs) and Temporary Working in Waterway/ Discharge Permit BMP Plans for NDOT maintenance projects. Environmental and Hydraulics staff will work together as a team to identify and consult other Divisions to resolve all potential regulatory, construction, and maintenance issues.

1.3.1.2 BMPs and Specifications

The Environmental Division incorporates specific regulations and procedures into NDOT's Standard Specifications and project Special Provisions. Environmental Services often works with Hydraulics to identify and resolve potential regulatory, construction, and maintenance issues. This includes updating the Storm Water Quality Manuals and the Standards. All non-structural temporary BMPs and their associated specifications are also incorporated into the contract documents by the Environmental Division working with the Specifications Section. Responsibility is shared with Hydraulics for some structural BMPs, as shown in Table 1-1.

1.3.1.3 Monitoring

Environmental and Hydraulics staff will work together to perform necessary environmental monitoring associated with projects.

1.3.1.4 Construction Support

The Environmental Division's Water Quality Specialist is the primary contact for all unanticipated construction issues associated with General Permit or other regulatory requirements, and compliance. The Hydraulics Section will be contacted for support.

1.3.1.5 Maintenance Support

The WQS is the primary contact for water pollution control issues relative to maintenance practicesand oversees, with the aid of the Hydraulics Section, development of Storm Water Pollution Prevention Plans (SWPPPs) and Temporary Working in Waterway/Discharge Permit BMP Plans for NDOT maintenance projects.

1.3.1.6 Standards and Manuals

Environmental and Hydraulics staff work together to develop and maintain the BMP manuals, guidelines, and standards.

1.3.2 Hydraulics Section

The Hydraulics Section is responsible for determining water flows, drainage structure sizes, impacts to floodways and flood plains, slope renovation, road surface water treatment methods, and temporary and permanent erosion control.

1.3.2.1 Erosion Control Plans

For projects categorized as having a high potential for environmental impacts (see section 3.6.1), Hydraulics is responsible for development of a comprehensive erosion control and water quality plan to encompass all aspects of a project. When necessary, Hydraulics staff may consider phasing construction of permanent BMPs to accommodate implementation of temporary ones.

1.3.2.2 Permits

The Lake Tahoe EIP Coordinator will be responsible for securing TRPA construction permit.

Senior Hydraulic Engineers will provide technical support to Environmental staff to identify or resolve potential regulatory, construction, and maintenance issues.

1.3.2.3 BMPs and Specifications

Hydraulics is responsible for all permanent BMPs and all structural temporary BMPs and associated specifications. Responsibility is shared with the Environmental Division for some procedural and structural temporary BMPs (see Table 1-1).

1.3.2.4 Monitoring

Environmental and Hydraulics staff will work together to perform necessary environmental monitoring associated with projects. Hydraulics will be responsible for the coordination of all environmental monitoring in the Lake Tahoe Basin.

1.3.2.5 Research

Hydraulics is responsible for all research associated with structural BMP effectiveness and performance.

1.3.2.6 Standards and Manuals

Environmental and Hydraulics staff work together to develop and maintain the BMP manuals, guidelines and standards. See Section 1.4 for more details.

1.3.2.7 Design

The Hydraulics section is responsible for design of structural BMPs included in the project PS&E.

Table 1-1 on the following pages defines specific BMP management responsibilities of the Hydraulics Section and Environmental Division. The table outlines responsibility for a BMP when its modification, implementation, or deletion is questioned.

Table 1-1

Hydraulics and Environmental Temporary BMP Management Chart

Section 3 – Temporary Soil Stabilization BMPs		**Hydraulics**	**Environmental**
SS-1	Scheduling	X	X
SS-2	Preservation of Existing Vegetation	X	X
SS-3	Hydraulic Mulch	X	X
SS-4	Hydroseeding	X	X
SS-5	Soil Binders	X	
SS-6	Straw Mulch	X	X
SS-7	Geotextiles, Plastic Covers & Erosion Control Blankets / Mats	X	X
SS-8	Wood Mulching	X	X
SS-9	Earth Dikes / Drainage Swales & Lined Ditches	X	
SS-10	Outlet Protection / Velocity Dissipation Devices	X	
SS-11	Slope Drains	X	
SS-12	Streambank Stabilization		X
SS-13	Wind Erosion Control	X	X
Section 4 – Temporary Sediment Control BMPs		**Hydraulics**	**Environmental**
SC-1	Silt Fence	X	X
SC-2	Sediment Basin	X	
SC-3	Sediment Trap	X	
SC-4	Check Dam	X	
SC-5	Sediment Logs	X	X
SC-6	Gravel Bag Berm	X	X
SC-7	Street Sweeping and Vacuuming		X
SC-8	Storm Drain Inlet Protection	X	X
Section 5 – Tracking Control BMPs		**Hydraulics**	**Environmental**
TC-1	Stabilized Construction Entrance / Exit		X
TC-2	Stabilized Construction Roadway		X
TC-3	Entrance / Outlet Tire Wash		X
Section 6 – Non-Storm Water Management BMPs		**Hydraulics**	**Environmental**
NS-1	Water Conservation Practices		X
NS-2	Dewatering Operations	X	X

Table 1-1

Hydraulics and Environmental Temporary BMP Management Chart

NS-3	Paving and Grinding Operations		X
NS-4	Temporary Stream Crossing	X	X
NS-5	Clear Water Diversion	X	X
NS-6	Illicit Connection / Illegal Discharge Detection and Reporting		X
NS-7	Potable Water / Irrigation		X
NS-8	Vehicle and Equipment Cleaning		X
NS-9	Vehicle and Equipment Fueling		X
NS-10	Vehicle and Equipment Maintenance		X
NS-11	Pile Driving and Drilling Operations		X
NS-12	Concrete Curing		X
NS-13	Concrete Finishing		X
NS-14	Material and Equipment Use Over Water		X
NS-15	Structure Demolition / Removal		X
NS-16	Temporary Batch Plants		X
Section 7 –Waste Management & Materials Pollution Control BMPs		**Hydraulics**	**Environmental**
WM-1	Material Delivery and Storage		X
WM-2	Material Use		X
WM-3	Stockpile Management		X
WM-4	Spill Prevention and Control		X
WM-5	Construction Debris and Litter Management		X
WM-8	Concrete Waste Management		X
WM-9	Sanitary / Septic Waste Management		X
WM-10	Liquid Waste Management		X

1.3.3 Construction Division

The Construction Division performs construction for projects where no contractor is used and provides contractor oversight on contracted projects. This Division also performs constructability reviews during project development and design to address issues such as project phasing and contractor staging logistics.

1.3.3.1 SWPPP

The Construction Division is responsible for obtaining a copy of the SWPPP from the contractor or District for inclusion in the project files, as well as the following:

1.3.3.2 BMPs and Specifications

Construction is responsible for implementation and enforcement of BMPs specified for Lake Tahoe projects or on large projects where line items are included.

1.3.3.3 Implementation

Construction is responsible for monitoring BMP implementation on lump sum projects for purposes of payment.

1.3.4 Roadway Design Division

The Roadway Design sections have the overall responsibility for the preparation of highway construction plans and specifications in-house or through consultants.

1.3.4.1 Project Categorization

The Roadway Design Division is responsible for categorizing projects into No, Low, Medium, or High potential environmental impacts by completing the Project Categorization Score Sheet (Appendix A). The procedures for completing the Score Sheet are discussed in Sections 2, 3, and 5 of this manual. The Project Manager/Coordinator may consult with Environmental or Hydraulics as appropriate to accurately categorize the project.

Roadway Design also calculates and includes costs and necessary bid items in the PS&E document for all no, low, and medium impact projects.

1.3.4.2 BMPs and Specifications

The Landscape Architect will be responsible for development of seed specifications (seed mix, soil amendments, etc.)

1.3.5 Specifications Division

The Specifications Division generates and reviews general specifications to be included or updated in these NDOT Water Quality Handbooks.

1.3.6 Districts

1.3.6.1 General Permit Termination

If a construction project has not been stabilized upon contractor release, General Permit responsibility is relinquished to District Maintenance. District staff is responsible for filing the NOT after final site stabilization has been achieved.

1.3.6.2 Maintenance

District staff is responsible for establishing and maintaining re-vegetation after the contractor has been released. Additionally, the SWPPP, including temporary BMPs, must be inspected and maintained until coverage under the General Permit is terminated.

1.3.6.3 Monitoring

Monitoring post-project vegetation success is the responsibility of district staff. Environmental is available for assistance if needed.

1.3.7 Maintenance Projects

1.3.7.1 General Permit Compliance

For maintenance projects Hydraulics, Environmental, and District staff will work together to comply with the necessary regulatory requirements. Districts will be responsible for filing of the NOI, payment of the filing fee, preparation and updates of the Storm Water Pollution Prevention Plan (SWPPP), implementation of temporary BMPs, inspection and maintenance, final site stabilization, and filing of the NOT.

Hydraulics and Environmental staff will provide technical support as necessary to District Maintenance for development & implementation of SWPPP.

The primary contact for SWPPP development is the Environmental Division's Water Quality Specialist.

1.3.7.2 Clark County PM-10 Attainment

For maintenance projects where no contractor is involved, District I will be responsible for applying and obtaining the Clark County PM-10 Air Quality permit.

1.3.7.3 Lake Tahoe

For maintenance projects in the Lake Tahoe Basin, Hydraulics will obtain TRPA's construction permit for District II. Environmental will be responsible for all other permits except Dust Control.

1.3.7.4 Work in Waterways

Until General Permits are secured for each District, , District Maintenance is responsible for obtaining the Temporary Work in Waterways/Discharge Permit (formerly the Rolling Stock Permit) for maintenance projects in or near WOUS. Environmental is available for assistance if needed.

1.4 Water Quality, Erosion, and Sediment Control (WQESC) Program Responsibilities

NDOT has created a WQESC Implementation Team and a Steering Committee to develop and implement the WQESC program. It is important to coordinate activities, ensure identified processes are implemented, progress measures are developed and used, and corrective actions are made in a timely manner. This section describes the responsibilities and authority for ensuring that the goals and objectives of the program are developed with input from all users, and implemented throughout NDOT.

1.4.1 WQESC Implementation Team Responsibilities

The Implementation Team is tasked with ensuring elements of the program are reviewed and implemented, including specific actions, performance measures, targets, and milestones for meeting each program objective. This will include providing guidance and implementing policies and procedures, and providing suggestions and backup for changing policies. Changes affecting policy, funding and fiscal budgets will require Steering Committee (see section 1.4.2) input and approval. The Implementation Team will meet monthly, or as needed to meet its responsibilities.

The Implementation Team is comprised of technical staff selected by the Steering Committee, representing the following divisions or sections:

- Construction
- District Maintenance
- Environmental Services
- Federal Highway Administration
- Headquarters Maintenance
- Hydraulics
- Materials
- Roadway Design
- Specifications

A chairperson for the team is responsible for distributing agendas and minutes for meetings, and will be the point of contact for the Steering Committee. The chairperson will typically serve for one calendar year, at the end of which a new chairperson can be selected.

1.4.2 WQESC Steering Committee Responsibilities

The WQESC Steering Committee is comprised of Assistant Directors, Division Heads, and Assistant District staff representing the divisions and sections listed above for the Implementation Team. They will authorize additional or continued resources as needed to maintain or enhance the program objectives, and support or take corrective action based on the Implementation Team's input. The Steering Committee will meet quarterly, or as required to meet the WQESC program requirements. The Implementation Team members will attend these meetings, and will provide the agenda and information to be discussed.

Section 2
Storm Water Quality Considerations During Project Planning

2.1 Introduction

This section presents information to help project engineers and planners in defining and avoiding potential water quality impacts from NDOT projects during the planning phase of a project. Guidance is also provided for evaluating the need for permanent (design) BMPs in NDOT projects and for identifying these controls during the planning phase.

Preliminary sizing, use and placement guidance is provided for permanent BMPs that require more advanced planning such as infiltration or detention basins. Additionally, NDOT procedures for defining design responsibilities of temporary (construction site) BMPs and estimating their costs are outlined.

Storm water quality must be considered during all stages of project planning (e.g. Planning Studies, Purpose and Need Statements, Alternative Design Field Studies [ADFS], Preliminary Design Field Studies [PDFS], Environmental Documents, and other scoping documents). The primary storm water quality objectives during the project planning phase are to:

1. Identify potential storm water quality impacts and develop/evaluate options to avoid, reduce, or minimize the potential for these impacts;

2. Ensure that the programmed project includes sufficient right-of-way and budget for the required storm water controls;

3. Identify project-specific permanent and temporary BMPs that may be required to mitigate impacts.

Table 2-1 summarizes the storm water related activities that should be performed during the project planning process to meet these objectives. The remainder of Section 2 explains these activities in detail. The responsibility for storm water quality planning is shared mainly among the NDOT Hydraulics Section and Environmental Division with input from Roadway Design and Maintenance Sections.

Table 2-1
Storm Water Related Activities During Project Planning

- Determine potential storm water quality impacts associated with the proposed project and develop/evaluate options to avoid or reduce these impacts
- Review the regulatory requirements and findings from environmental studies to determine which project-specific storm water controls (permanent and temporary) are required. (i.e. mitigation requirements from the NEPA process)
- Develop preliminary size, location and cost of permanent controls (e.g. infiltration and detention devices) – if needed
- Develop planning-level cost for construction site (temporary) BMPs
- Incorporate findings into a final report or scoping document

2.2 Defining and Avoiding Potential Impacts

The project planning phase provides the greatest opportunity to avoid adverse water quality impacts as alignments and right-of-way requirements are developed and refined. Avoiding impacts may reduce or eliminate the need for permanent treatment controls and other mitigation-type BMPs. (See Section 2.3 for identifying and avoiding potential impacts.) By addressing these issues during this phase of the project, right-of-way and easement needs and their estimated costs can be defined so that property acquisition issues do not delay or prevent project construction.

2.2.1 Defining Potential Impacts

In many areas of Nevada the need for physical water quality BMPs is limited because of minimal precipitation and lack of direct discharge to receiving waters. In these areas, more appropriate temporary BMPs may be limited to proper construction scheduling, sweeping, and general site housekeeping. Permanent controls in these areas are typically limited to soil stabilization to comply with the NPDES and air quality regulations.

To conserve resources and reduce unnecessary placement of BMPs, the following process has been developed to evaluate the need for these controls in NDOT projects. This process generally involves the following steps:

- Consideration of the project's location with respect to sensitive receiving waters,
- Evaluation of other project specific characteristics that may influence BMP requirements,
- Review of current regulations for any additional BMP requirements.

The primary consideration in determining the nature and extent of BMP implementation is the project's location. Figure 2-1 is a map that identifies water bodies known to be impaired as defined by Nevada's 2002; 303(d) list (see

Section 2.3.3). For clarity, the map only includes waters impaired by pollutants that are most commonly generated by transportation facilities and their construction (i.e. sediment and turbidity). It is important to realize that the list is updated every two years and that additional water bodies are 303(d) listed as impaired by other pollutants that are not typically generated by transportation projects. For a complete listing of impaired waters and their pollutants of concern, the 303(d) list is available from the NDEP website or by contacting the NDEP Bureau of Water Quality Planning. The 2004 303(d) list is in draft form and should be released by the next Manual revision.

If projects fall within the identified areas in Figure 2-1, implementation of more comprehensive temporary and/or permanent water quality BMPs (e.g. water quality detention basins, etc.) should be considered. For projects outside these areas, permanent erosion control measures may still be needed and temporary construction BMPs will need to be implemented as appropriate for site conditions. It is also important to remember that even though a project may have little to no potential water quality impacts, wind erosion and impacts to air quality may still require temporary and permanent stabilization measures.

After considering the project's general location, more specific project characteristics should be evaluated. Table 2-2 identifies many of the project features and potential impacts that should be considered for each project or alternative. The Project Coordinator or Project Manager should confer with other sections or divisions, such as Landscape Architecture, Hydraulics, Environmental, Right of Way, Materials, Construction, and Maintenance, as needed to accurately identify and define these items. This will usually be accomplished by submitting the Project Categorization Score Sheet (see Section 2.5 and Appendix A), layouts/base maps, environmental documents, and other information to Hydraulics and Environmental to determine potential water and air quality impacts and appropriate control measures.

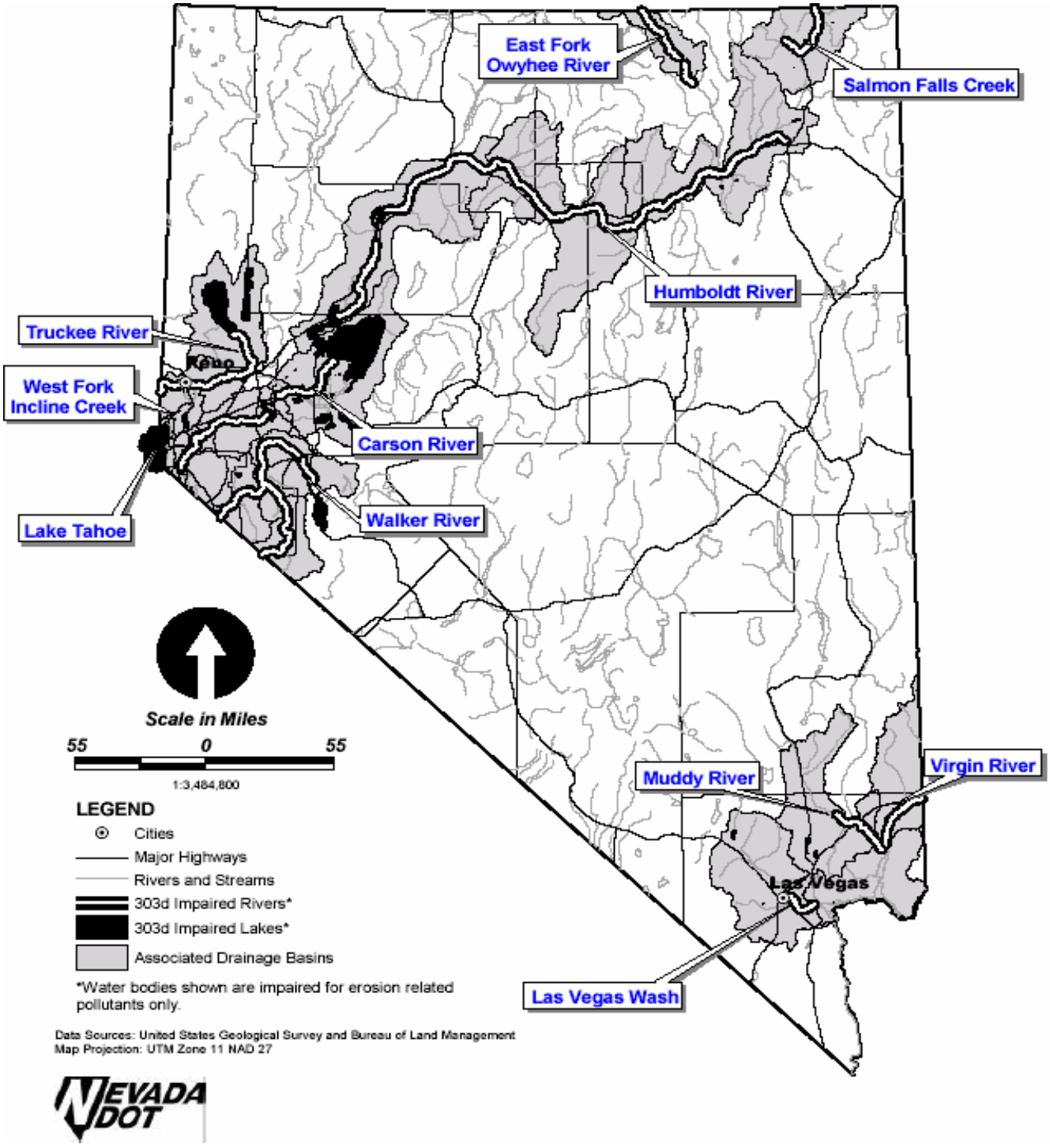


Figure 2-1
State of Nevada 2002, 303 (d) Listed Waters

Table 2-2
Project Features and Potential Impacts to be Considered During Project Planning

Features and potential impacts to be considered	Reasons why they must be considered
Special regulatory requirements (e.g. Treatment of 20–yr., 1–hr. storm in Tahoe Basin)	May impact permanent and temporary BMP requirements.
Identify receiving waters and all other waters that may affect, or may be affected by, the project. Consider aquifers, wells, streams, lakes, reservoirs, wetlands, and waters both fresh and saline. Consider impacts throughout the project's lifecycle, including construction, maintenance, and operation.	It is the first step in identifying impacts and potential control measure requirements.
Will construction require work in, above, or directly adjacent to the water bodies listed above?	Could require additional environmental permits/agreements and control measure requirements.
Are any of the receiving waters or watersheds a source for domestic water supplies?	
Are any sensitive fisheries, wildlife, recreational, agricultural, or industrial aquatic resources located in the vicinity of the projects? Will the project disturb the migratory path of birds or waterfowl? Will project cause any problems either during or after construction to fish passage?	
Are any of the receiving waters impaired (303d listed) for sediment, silt, turbidity, or clarity? (Discharges to impaired water bodies may be subject to strict numeric water quality standards and prescribed treatment controls.)	Supplemental controls may be required to further reduce pollutants, meet numeric water quality standards, waste load allocations, or requirements of an adopted watershed plan.
What is NDOT's contribution, expressed as a percentage of total flow, to receiving waters that are impaired or "sensitive"?	Used to determine if permanent treatment controls are required.
What is the unit cost for additional right-of-way (easements, acquisitions) should it be needed for treatment controls?	Used to estimate costs if temporary and / or permanent treatment controls are required.
Will the project increase the potential for downstream erosion by adding impervious surfaces, decreasing the time of concentration, or redirecting flows?	May need to implement detention devices to prevent damage to off-site stream banks or channels.
Does the project discharge to lined, engineered drainage facilities or unlined, natural channels?	Consideration for implementing detention device for stream bank protection.
Identify general soil types and vegetation within the project site.	Basic information needed for geometric and slope design and slope protection plans.
How difficult will it be to re-establish vegetation following construction?	
How long will it take for the new vegetation to establish?	
What are the steepest slopes that should be allowed?	
What vegetation, if any, should be preserved?	
Determine the general climate, annual rainfall, and typical seasonal rainfall patterns for the project area.	
Determine the proposed project slopes, and areas of cut and fill.	
Does the project include contaminated or hazardous soils or groundwater as identified in the initial site assessment or environmental documents?	May impact project construction activities and deployment of temporary controls during construction.
Will the contractor's yard be located within the State's right-of-way or otherwise be arranged for or provided by NDOT? If so, What are the potential impacts?	May impact deployment of temporary controls during construction.
Do seasonal construction restrictions exist? (e.g. Lake Tahoe grading season is from May 1 to October 15)	May impact project construction activities and deployment of temporary controls during construction.
Is the project located in an area where special air quality regulations are in place (e.g. Clark County PM-10 Regulations)	May impact post-construction permanent soil stabilization requirements

2.2.2 Options for Avoiding or Reducing Potential Impacts

Table 2-3 provides guidelines for consideration to avoid or reduce potential water quality impacts identified under Section 2.2.1. These planning considerations should be weighed carefully through a collaborative process among all of the involved NDOT divisions. Cost–benefit analyses and other evaluations will affect the feasibility of implementing these alternatives and decisions must be made through the proper and established NDOT procedures.

Table 2-3
Guidelines for Avoiding or Reducing Potential Impacts During Project Planning

Relocate or realign the project, while upholding safe design standards, to avoid or reduce impacts to receiving waters.
Design or locate structures and bridges to reduce work in live streams and minimize construction impacts.
Adjust the horizontal and vertical alignment, without jeopardizing safe design standards, to minimize erosion from slopes.
Disturb existing slopes and other soil areas only when necessary.
Minimize cut and fill areas to reduce slope lengths.
Consider retaining walls to reduce the steepness of, or shorten, exposed slopes.
Acquire right-of-way easements (such as grading easements) to reduce steepness of slopes.
Avoid soils or formations that will be particularly difficult to re-stabilize.
Provide cut and fill slopes flat enough to allow re-vegetation and limit erosion to pre-construction rates.
Provide benches or terraces on long cut and fill slopes to reduce concentration of flows.
Provide rounding and shaping of slopes to reduce concentrated flow.
Collect and convey concentrated flows in stabilized drains and channels.
Retain natural vegetation where feasible.
Utilize alternative materials or facilities to reduce future maintenance impacts on water quality (i.e. use of textured concrete in lieu of painted materials).
Schedule and/or phase the project to minimize soil-disturbing work during the rainy season.
Install permanent storm water controls (especially basins) and conveyance systems early in the construction process to provide additional protection and to possibly utilize them in addressing construction storm water impacts.

2.3 Review Requirements from Environmental Studies and Permits to Determine if Additional Project-Specific Controls are Required

During early project planning, storm water activities focus on identifying and avoiding impacts where practical and, if necessary, cost effective incorporation of permanent treatment BMPs into the project that may require additional right-of-way. This identification, avoidance, and incorporation process continues during the environmental studies phase, to determine if treatment controls or additional mitigation-type BMPs will be required.

Issues that are identified during environmental studies or project scoping may result in the need for project-specific permanent or temporary BMPs. Table 2-4 describes some of the typical issues that should be considered during the environmental studies phase. Much of this information will become available during studies performed for the National Environmental Policy Act (NEPA) process.

Where special water quality issues are present, the Project Manager/Coordinator should coordinate with NDOT Hydraulics and Environmental staff. For most NDOT projects, water and air quality controls are developed on a case-by-case basis through coordination and discussions with involved agencies.

Table 2-4
Environmental and Permit Issues

Environmental or Permit Issues that May Require Project-Specific Permanent BMPs	Environmental or Permit Issues that May Require Project-Specific Construction Site (Temporary) BMPs
Significant, unavoidable impacts to receiving waters	Significant, unavoidable impacts to receiving waters
Discharges of dredge or fill material into navigable waters (404 Permit/401 Certification)	Discharges of dredged or fill material into navigable waters (404 Permit/401 Certification)
Working in Waterways Permit (Rolling Stock Permit) for work within, next to, or immediately adjacent to live streams or water bodies.	Working in Waterways Permit (Rolling Stock Permit) for work within, next to, or immediately adjacent to live streams or water bodies.
Post-construction dewatering requirements	BMPs for stockpiling, handling, and transporting contaminated soils
Variances for lead contaminated soils	BMPs and local permits for temporary construction dewatering
BMPs to meet numeric standards for an impaired (303d listed) water body	Project-specific for specifying temporary BMPs
Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or ground water recharge facilities (well head protection areas)	Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or ground water percolation facilities (well head protection areas)
Specific NDEP requirements	Specific NDEP requirements

It is important to note that if a project is delayed or shelved permits can expire and must be re-evaluated, re-issued, or renewed. If this occurs, the Project Manager/Coordinator should consult with the Environmental Division Staff to verify permit compliance.

The following sections discuss regulations and permits that may require the incorporation of permanent pollution control BMPs into NDOT projects. Table 2-5 summarizes the currently defined permanent air and water quality control requirements for NDOT projects.

2.3.1 Circumstances for Considering Treatment Controls

This section summarizes the various regulatory and permitting situations that may require permanent treatment controls to be included in projects.

2.3.1.1 NDOT Policy and NEPA

NDOT's general policy for including permanent treatment controls is to consider treatment devices (i.e., infiltration and detention basins) for water quality control if major sediment transport is expected and would have a considerable impact on streams, lakes, or adjacent property. This policy is in general agreement with NEPA.

NDOT projects are subject to NEPA requirements when Federal actions or funding are involved. Permanent treatment control BMPs may be required if the NEPA process determines that the project causes significant, unavoidable impacts to receiving waters without incorporation of such controls in the project. For additional information on the NEPA process see Section 1.

2.3.1.2 Discharges of Dredged or Fill Material into Navigable Waters (404 Permit/401 Certification)

Projects that discharge dredged or fill materials into navigable waters are required to obtain a Section 404 permit from the US Army Corps of Engineers, and a 401 Water Quality Certification from the NDEP. Site-specific BMPs may be required for 401 certification to address discharges during construction and operation. For detailed information on 404/401 regulations, see Section 1.

2.3.1.3 Section 303(d) Listed Waters

Section 303(d) of the Clean Water Act requires states to identify waters that do not meet State water quality standards even after pollution point sources have been addressed with appropriate controls. Once a water body is listed as impaired, states must establish a Total Maximum Daily Load (TMDL) to define how much of the pollutant can be discharged to the water body without exceeding the water quality standards. The TMDL is then used to allocate pollutant loads, or Waste Load Allocations (WLAs), among the identified pollution sources in a watershed. To date NDOT has not been assigned any Waste Load Allocations (WLAs) to control pollutant discharge to an impaired water body. It is possible that in the future NDOT may be

required to participate in the development of TMDLs and WLAs that may affect future permit requirements for NDOT discharges. Under the current TMDL program, numeric standards for storm water runoff have not been developed in Nevada because storm water runoff from highways and highway facilities is highly variable. To address highway runoff, the NPDES program has emphasized implementation of BMPs and monitoring.

In Nevada, there are two established TMDLs for Total Suspended Solids (TSS) for the Walker and the Humbolt Rivers. In regards to both of these TMDLs, the director of the NDEP has stated that the existing TMDLs oversimplify a complex situation and do little to characterize sources to the level needed for a meaningful implementation plan. Additional work is needed to better identify sources in terms of their contributions and locations, and to better characterize beneficial use impairment (particularly aquatic life).

NDEP is currently studying these rivers to identify sources, contributions, and locations and to better characterize the impairment to the river's beneficial uses. Additional TMDLs for sediment and other erosion related pollutants are currently being developed for Lake Tahoe, the East Fork Owyhee River and Mill Creek.

Where TMDLs have not been developed for waters that exceed state water quality standards and the water is 303(d) listed or otherwise determined to be impaired, NDOT will support watershed planning efforts to identify additional controls that may be necessary to prevent or reduce discharges of the target pollutant from the completed project. The 303(d) list is updated by the NDEP every two years and the most current version is available from their website or by contacting the NDEP Bureau of Water Quality Planning. The 2004 303(d) list is in draft form and should be released by the next Manual revision.

2.3.1.4 Permanent BMPs Prescribed by Other Permits

Other state and local permits, as outlined in Section 1, may also require that permanent water and/or air quality controls be included in the project. These include the NDEP General Construction and MS4 Permits, Clark and Washoe County dust control and emissions regulations, and Irrigation District licensing. Table 2-5 below summarizes the currently defined permanent air and water quality control requirements for NDOT projects.

Table 2-5
NDOT Project Requirements

Agency	Permit/Regulation	Permanent water/air quality control requirements
NDEP	General Construction Permit	■ 70% re-establishment of pre-construction perennial vegetation or other appropriate measures
NDEP	MS4 Permit	■ Development of a Storm Water Management Plan
TRPA	Code of Ordinances	■ Retain and treat 20 Year/1 Hour Storm ■ EIP Implementation
Clark County	Air Quality/Dust Control	■ Dust Control Plan for soil disturbances greater than ¼ acre ■ Dust Mitigation Plan for projects larger than 10 acres ■ Dust Control Monitor for projects larger than 50 acres
Washoe County	Air Quality/Dust Control	■ Dust Control Plan for soil disturbances greater than 1 acre
Irrigation Districts	Irrigation District Construction Licenses	■ Bank stabilization when working over irrigation ditches
USACE	Clean Water Act Section 404 Permit*	■ Any final stabilization or other pollution control as required by the specific permit
NDEP	401 Water Quality Certification	■ Temporary erosion and sediment controls
NDEP	Temporary Work in Waterways/Discharge Permit (Rolling Stock Permit)*	■ Any final stabilization or other pollution control as required by the specific permit
NDEP	Dewatering Permit*	■ Any final stabilization or other pollution control as required by the specific permit

* These permits typically have no permanent BMP requirements; however, permits are issued individually and should be carefully reviewed to insure compliance with all requirements.

2.4 Preliminary Sizing for Permanent Treatment Control Devices

Section 2.3 discussed determining when treatment control BMPs (e.g. infiltration and detention basins) may be required for storm water pollution control as identified by reviewing the project's characteristics, the environmental documents and other prescriptive permit requirements. Treatment control BMPs are intended to improve water quality by treating storm water prior to discharge. Treatment devices may also be required to provide hydrologic control to prevent increased peak flow rates and erosion in downstream watercourses as a result of increases in magnitude and frequency of storm flows.

If it is determined, by Hydraulics and Environmental, that treatment control BMPs are required, the scope of work, right-of-way needs, and cost estimates should be identified as soon as possible in the planning stage of the project. This information is required to be accurate and complete by the 60% design stage. The Project Manager/Coordinator should coordinate with the Landscape Architect to determine

aesthetic aspects of basin location and layout, and follow the respective working details in Appendix B for more detailed design guidelines.

When permanent treatment control devices are required, consider the following:

- Availability of suitable land
- Peak discharge rate to downstream watercourses
- Maintenance access and costs. District Maintenance should be consulted when these devices are designed.
- Soil conditions appropriate for the BMP. Check with the Materials Division for project-specific soil conditions.

A reasonable design goal for hydrologic erosion control (stream or channel erosion control) is to limit the peak runoff rate for a 2-year storm to the pre-development rate, thus reducing in-stream channel erosion problems. Note that this design goal is different from, and in addition to, the flood control design requirements in NDOT drainage design manual.

See the working details for treatment control BMPs in Appendix B and the sizing example in Appendix C for guidance. The resulting facility size(s) should be used as a basis for developing cost estimates and right-of-way requirements for inclusion in the 60% Design Report.

2.4.1 Treatment BMP Use and Placement Considerations

Several factors must be considered to determine which BMPs are suitable for a given application. Site-specific conditions can affect operations, maintenance, construction costs, safety, and aesthetics. The Project Manager/Coordinator together with the Hydraulics Section must determine if sufficient right-of-way is available for the desired BMP, or if the benefits associated with a potential BMP justify the consideration of acquiring additional right-of-way.

The physical dimensions of a BMP may have an important bearing on the factors identified in this section. The size of many BMPs is determined by the amount of runoff the system will be required to treat. The amount of runoff is affected by the location, land use, drainage area, storm intensity, topography, soil characteristics, and the extent of impervious areas. For the design of infiltration or detention basins, Hydraulics staff should be consulted.

Both storm volume and peak flow conditions must be considered in the evaluation of runoff conditions. Unlike flood control measures that are typically designed to store or convey the peak flow rates or detain sufficient volume to reduce the peak flow rate of infrequent storm events, treatment BMPs are designed to treat the runoff of more frequent much smaller storm events. The target treatment volume or flows associated with the frequent events are commonly referred to as the Water Quality Volume

(WQV) for BMPs designed based on volume, and Water Quality Flow (WQF) for BMPs designed based on flow.

Treatment BMPs are sized to accommodate the WQF or WQV from the contributing drainage area. Flows in excess of these values are diverted around or through the treatment BMP. Methods for determining the WQV are generally tied to an analysis of rainfall depths generated over 24-hour periods (with the exception of Lake Tahoe where the 20-year, 1-hour event is used). WQV is used to size infiltration, detention, and retention treatment control devices. See Appendix C for a WQV design example that utilizes the Rational Method.

The WQV of Treatment BMPs is based on using either of the following methods:

- Where they are established, sizing criteria from local regulatory agency will be used (currently only the Lake Tahoe Basin has established a basis for calculating the WQV); and

- Where no sizing criterion is established, the following method is recommended:

The maximized detention volume is determined by the 85th percentile runoff capture ratio. This method is described in Chapter 5 of the *Urban Runoff Quality Management WEF Manual of Practice No. 23,* 1998, published jointly by the Water Environment Federation (WEF) and the American Society of Civil Engineers (ASCE). This method requires the designer to assume a drawdown time. Drawdown time between 2 and 7 days can be used (the 2 day limit provides adequate settling and the 7 day maximum addresses vector concerns).

Alternatively, a WQV may be established by NDOT, subject to the review and approval of the NDEP and other involved agencies, if the site area is limited and cannot accommodate a treatment BMP sized according to the method described above.

The WQF is the primary design criteria used for various types of flow-through treatment control devices, such as swales, sand traps, and gross solids removal devices (GSRDs). Various methodologies exist for calculating the WQF and the approved methods are listed in the NDOT Drainage Manual. The Rational Method is probably the most common but its use is limited to watershed drainage areas of 200 acres or less. Intensity, duration, frequency (IDF) curves, or basin specific standards, provide values of rainfall intensity to be used in the Rational Formula (Q=CiA) to estimate peak flow runoff from areas discharging to the treatment device. Resulting runoff rates would be the design WQF to be used at any specific site.

In addition to designing for the WQF, the Hydraulics designer must also insure that flow-through treatment devices include a bypass or an overflow device to convey peak discharges from larger design storms consistent with Table 6.1 of the NDOT Drainage Manual.

2.5 Planning Level Cost for Construction Site (Temporary) BMPs

NDOT has adopted a policy of categorizing all construction projects as having no, low, medium or high potential for water quality impacts based on the results obtained from completing the Project Categorization Score Sheet. The score sheet and supplemental instructions for completion are included in Appendix A. Project Category general definitions are as follows:

- **No impact**: Projects with ground disturbance less than one acre or no potential discharge into Waters of the U.S. (WOUS).

- **Low Impact**: Projects usually with less than one acre ground disturbance and low potential for discharge of sediment into WOUS.

- **Medium Impact**: New construction or reconstruction projects with potential discharge of sediments into a WOUS. Ground disturbance is not excessive, construction phasing is simple, and construction duration is usually less than two years.

- **High Impact**: Projects with major ground disturbance, high potential of sediment discharge, complex construction staging, and construction duration may be longer than two years. All projects in the Lake Tahoe Basin are classified in this category.

To establish planning level costs, an initial pass through the score sheet should be made during the planning phase and cost estimates developed as follows:

- **No Impact Projects:** Include 637 0003 Temporary Pollution Control (Lump Sum) in the amount of $500 in the project estimate.

- **Low Impact Projects:** Include 637 0003 Temporary Pollution Control (Lump Sum) in the amount of $5,000 in the project estimate.

- **Medium Impact Projects:** Include 637 0003, Temporary Pollution Control (Lump Sum) in the project estimate according to Table 2-7 below.

- **High Impact Projects:** NDOT's Hydraulic section may develop an estimate based on an assumed phasing sequence, and include bid items in the final PS&E document. Plan sheets may be developed to show anticipated BMPs for one of the phases from the assumed sequencing, which the contractor can use in developing the Storm Water Pollution Prevention Plan. A table can be provided to show estimated quantities for the phases not shown on the plans. There may be instances for which utilizing the lump sum item and refraining from plan development will be more appropriate. The Hydraulics Section will consult with Construction for their input early in this process. As an initial guideline refer to Sections 2.5.1 and Table 2-6 below.

A second, more detailed, pass through the score sheet is made during the design phase (see Section 3) after drainage areas and other project characteristics are more accurately defined. The second pass is used to make the final determination of who will be responsible for the design of the temporary BMPs.

The project cost should include estimates for SWPPP development and estimates to implement construction site BMPs during project construction as required by the Permit. Provided below are guidelines that will assist designers in estimating the planning level costs to implement (i.e., construct, maintain, and remove) construction site BMPs.

2.5.1 Estimating Cost for Implementation of Construction Site BMPs

Planning level BMP implementation costs can be estimated from Table 2-6. These same estimated costs will be included in the engineer's estimate for the lump sum Temporary Pollution Control bid item for No, Low, and Medium Impact projects, as determined by the Project Categorization Score Sheet. Planning level cost for implementation of construction site BMPs on High Impact projects can be calculated as a percentage of total construction costs. This estimate will typically be replaced with BMP bid items in the Plans, Specifications and Estimate (PS&E). In general, higher elevations and higher annual rainfall totals will result in higher construction site BMP costs.

Table 2-6
Estimated Cost for Implementation of Construction Site BMPs

Type of Project		Temporary Pollution Control (TPC) Estimate
No Impact	Projects disturbing less than one acre, no discharge to WOUS	Include $500 Lump Sum
Low Impact	Projects with little disturbed area, low potential for water quality impacts	Include $5,000 Lump Sum
Medium Impact	Projects with moderate disturbed area, simple phasing	See Table 2-7 below for Lump Sum estimate
High Impact (Planning level cost only)	Projects within the Lake Tahoe Basin	2% of construction estimate ($15,000 min.)
High Impact (Planning level cost only)	Projects with considerable staging, borrow/fill sites and projects requiring significant import or export of soil material	0.5% of construction estimate ($30,000 min.)

If the project is categorized as Medium impact per the Project Categorization Score Sheet found in Appendix A, Temporary Pollution Control will be paid with a lump sum bid item, the amount of which will be estimated from Table 2-7 below. Table 2-7 should be used in the following manner:

Column 1 Select a project type that most closely represents the subject project.
Column 2 This column represents the TPC cost of a typical project in this category.
Column 3 If the construction duration spans two wet seasons as defined in the BMP Manual, increase the TPC estimate by $5,000.
Column 4 If commitments or requirements by another governing entity dictate more effort than the BMP Manual minimum implementation requirements, coordinate the TPC estimate with the Hydraulic Engineer. This will rarely be necessary.

Table 2-7

Temporary Pollution Control (TPC) Lump Sum Estimate for Medium Impact Projects

Project Type	Typical Project TPC Estimate	2 Wet Season Construction Duration*	Commitments / Requirements Above Manual Minimums
Small – Medium Widening 3R w/ Drainage Improvements	$15,000	Add $5,000	Coordinate TPC Estimate with Hydraulics Engineer
Bridge over Creek or River New Alignment Roadbed Mod/Crack & Seat Small-Medium Interchange Over/Undercrossing	$25,000	Add $5,000	

*See BMP Manual Section 2.3.4 for Wet Season determination.

2.5.2 Estimating Costs for Air Quality BMPs

For the purpose of planning level costs, a lump sum prorated item 6370090 for Dust Control has been set at $1,000 plus 0.1% of total project costs and is included in all projects statewide. NDOT's estimating system calculates and includes this item automatically. This includes considerations for developing dust control plans, acquiring and applying dust control products, and meeting all state and local permit requirements. Permanent soil stabilization measures will be a separate bid item payment, to be included in the Plans, Specifications and Estimate (PS&E).

2.6 Incorporate Results into Final Report or Scoping Document

The information collected and developed during the planning phase will provide the basis for detailed design during the PS&E phase. All data, decisions, and assumptions must be carefully documented by the Project Manager/Coordinator and included in the final report or scoping document.

Section 3
Storm Water Quality Considerations During Project Design

This section presents design guidance for incorporating storm water pollution controls in the Plans, Specifications and Estimates (PS&E) and performing other storm water related activities for NDOT projects. The primary objectives during this phase are to:

- Make a final determination of the permanent BMPs required for the project and the feasibility of including such controls,
- Develop the necessary information to design the permanent BMPs,
- Address the need to include construction site (temporary) BMPs in the bid documents

The storm water related activities to accomplish during the project design phase are shown in Table 3-1:

Table 3-1
Storm Water Related Activities
During Project Design

- Delineate drainage areas and define total disturbed area
- Review and update the determination of the need for treatment controls
- Define climatic conditions of the project
- Determine site hydrology
- Apply general design practices and design permanent BMPs
- Determine need to design and specify Construction Site (Temporary) BMPs
- Prepare Storm Water Quality Special Provisions
- Prepare Supplemental Storm Water Quality Information for Construction Phase

A detailed checklist of these storm water related activities, and responsibilities for their completion, for use during project design is provided at the end of this section (Table 3-5). The checklist in Table 3-5 may be used by the Project Manager/Coordinator as a check that the important storm water issues have been addressed. This checklist is not a mandatory part of all project files, but is intended to provide an additional level of quality control for more environmentally sensitive projects.

3.1 Delineate Drainage Areas and Define Total Disturbed Area

Various characteristics of the project drainage area can influence the project's potential to impact water quality and the associated water quality controls that will be required. This section outlines procedures to characterize and define the project drainage area to provide information to be used in the design of water quality controls.

3.1.1 Delineate Drainage Areas

Delineate the drainage information shown in Table 3-2 on the drawing(s) of the drainage system. Show both pre-project and post-project drainage, if possible, on the same drawing; or if necessary for clarity, on separate drawings. Also, this information can be supplied as part of the storm water quality information package, or can be used to create SWPPPs (see Section 3.8).

Table 3-2
Features to Show On Drainage Area Drawings

Drainage areas	Existing and Planned Drainage Facilities
■ Drainage boundaries & areas to each outfall (on-site and off site) ■ Drainage pattern arrows for overland flow	■ Curbs/Inlets ■ Underground storm drains ■ Ditches/swales ■ Channels ■ Basins and other flow controls ■ Drainage outfalls from structures (i.e. bridges) ■ Streams and Lakes

3.1.2 Define Total Disturbed Area

Estimate the total area of soil disturbance expected to result from construction activities related to the project. A preliminary estimate should be made in the planning phase in order to assess the project's potential for water quality impact (see Project Categorization Score Sheet, Appendix A). A revised calculation should be made at 60% to confirm the Score Sheet impact level, and additionally when changes are made that could effect the Impact Level. The following are examples of areas that should be included in the estimate of land likely to be disturbed by construction activities:

- Areas to be cleared and/or grubbed
- Areas to be excavated, filled, or otherwise graded
- Areas designated for construction staging or storage, if soil is exposed

- Areas designated for access/haul roads or borrow/spoil sites, if soil is exposed
- Areas of utility relocation

3.2 Review and Update the Need to Consider Storm Water Quality Treatment Control BMPs

The following steps should be taken to confirm the need for treatment controls before beginning the final design process.

1. Determine, on a drainage area basis, the need to consider storm water controls on the project using the protocol laid out in Section 2.3.

2. If it is determined that treatment controls must be considered, the procedure described in Section 2.4 for preliminary sizing of treatment control facilities can be used to determine an approximate area required.

3. Include items that have been confirmed as being required for the project in the final design.

3.3 Define Climatic Conditions

The following climatic data must be collected to aid in the selection and design of storm water pollution controls:

- **Average Annual Rainfall and Evaporation.** This information is required for the design and specification of vegetative erosion controls. It is necessary to determine whether there is sufficient moisture naturally to maintain the vegetation in a sufficiently healthy state to serve the intended purpose or whether supplemental watering will be needed. The General Permit states that in arid areas (areas with an average annual rainfall of 0 to 10 inches), semi-arid areas (areas with an average annual rainfall of 10 to 20 inches), and areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable. Arid areas are generally located in southern Nevada and low-lying areas of northern Nevada, while semi-arid areas are typically located in northern Nevada. For information regarding Nevada's climate and revegetation guidance, see *University of Nevada Reno's Mapping Ecosystems Along Nevada Highways and the Development of Specifications for Vegetation Remediation,* and the National Weather Service's Climate Prediction Center.

  The State of Nevada's average annual precipitation is shown in Figure 3-1. Figure 3-2 shows average annual evaporation for the State of Nevada.

- **2-Year Storm.** This storm, defined by Intensity-Duration-Frequency (IDF) curves, is recommended for use in checking for erosive velocities in earthen channels and in receiving waters.

- **Treatment Design Storm.** This information is needed if treatment controls are to be considered, and is used in conjunction with required sediment storage volumes to determine the volume of the treatment device. See Section 2.4.

- **20-year, 1-hr Storm**. This information is needed for projects in the Lake Tahoe Basin to determine the treatment design storm. For projects in the Lake Tahoe Basin, it may be assumed to be equal to one inch of rain falling in one hour (assumption valid in the Lake Tahoe Basin only).

3.3.1 Rainy Seasons

The state of Nevada can be divided into three different rainfall regions as shown in Figure 3-3, which was adopted from the 1986 NDOT *Roadway Design Manual*. The rainfall season in Nevada is from October 1st to May 1st; however, the average annual rainfall amounts vary by region. The Sierra Nevada region is subject to floods in the late fall and winter from rain and snowstorms from the Pacific Ocean. The Northern Nevada region is subject to winter snow and the resulting snowmelt runoff. Southern Nevada storms, observed mainly in the summer months, are usually generated by rainstorms from the Gulf of Mexico or the Pacific Ocean. The Project Manager/Coordinator should check with the Hydraulics Division for any specific requirements and verify that the necessary edits are made in the Contract Documents.

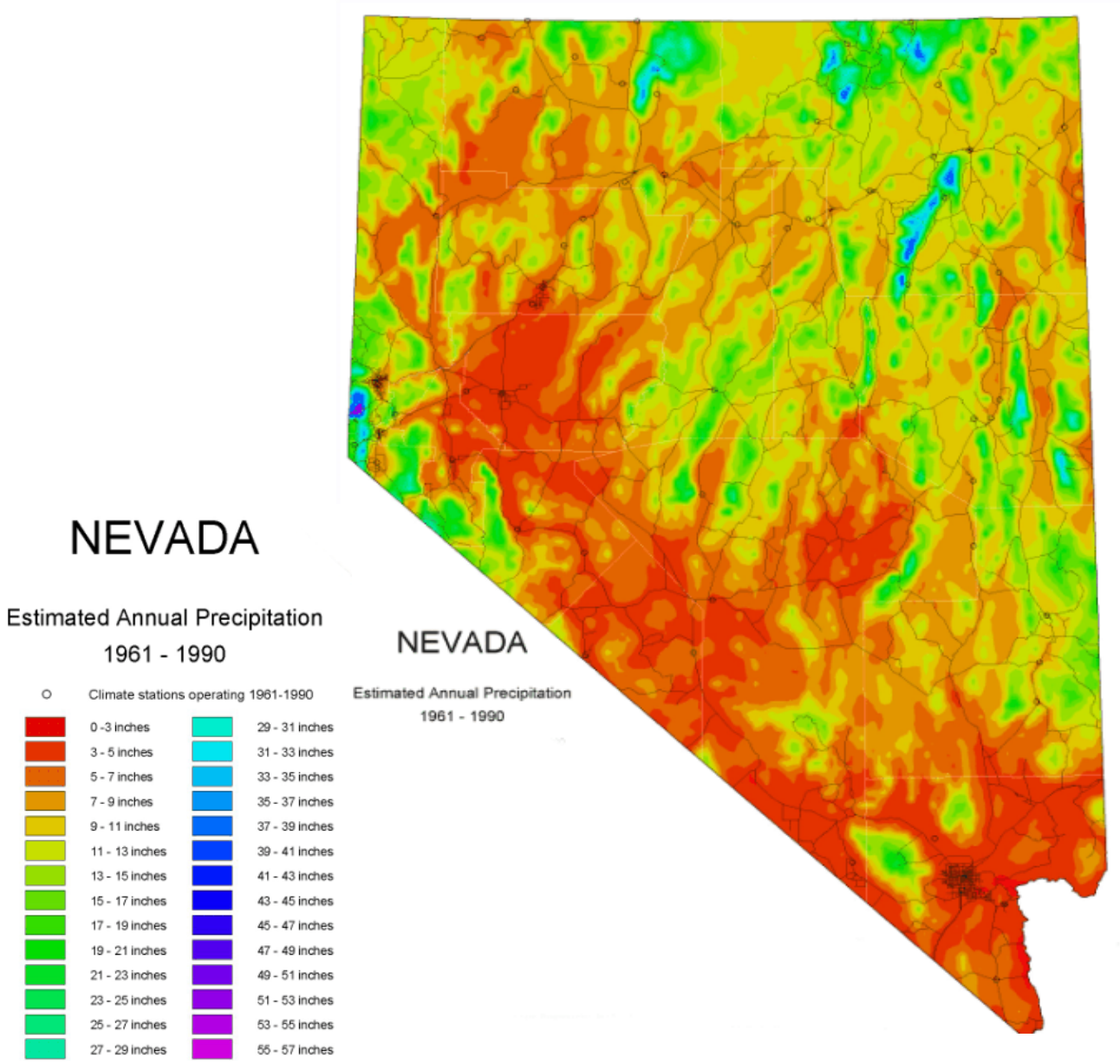
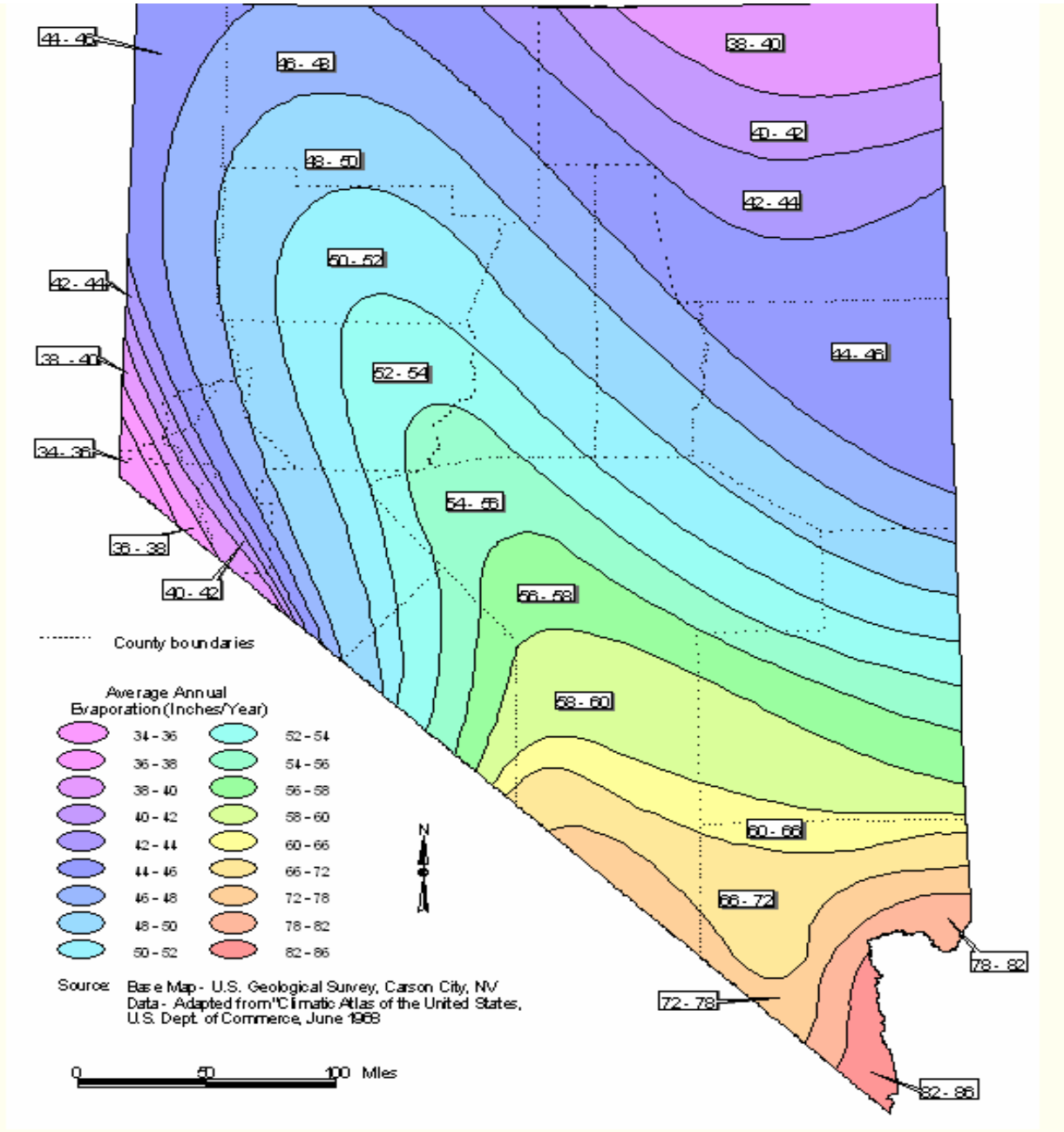


Figure 3-1
State of Nevada Average Annual Precipitation



Source: Base Map by U.S. Geological Survey, Carson City, Nevada. Data from "Climate Atlas of the United States, U.S. Department of Commerce, June 1968.

Figure 3-2

State of Nevada Average Annual Evaporation

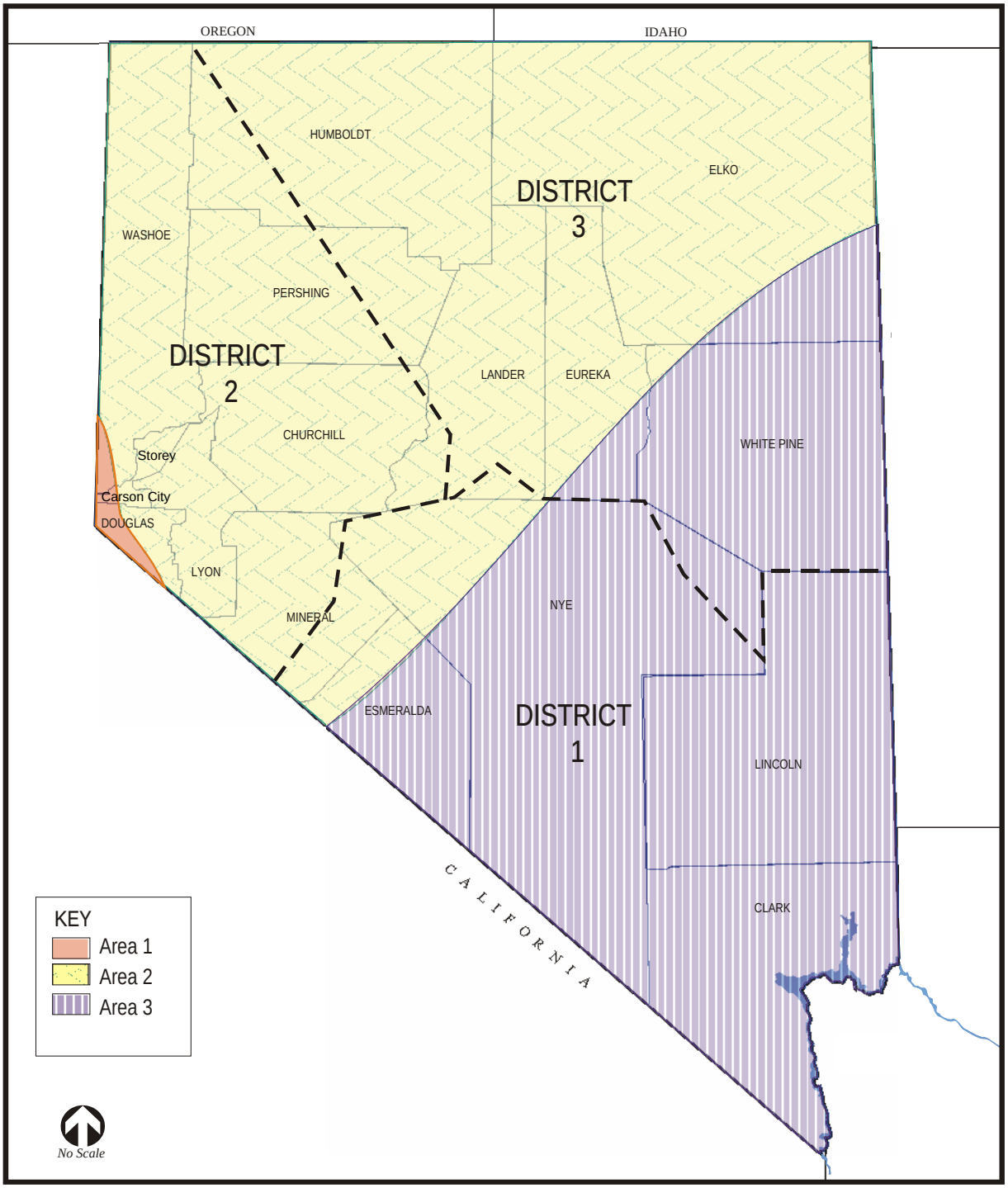


Figure 3-3
State of Nevada Homogenous Rainfall Zones

3.4 Determine Site Hydrology

Gather additional information about the project site in order to select, locate, and design appropriate storm water quality controls. Use Table 3-3 to identify physical attributes of site drainage areas that may affect the selection, location, and design of many storm water pollution controls. Attributes with an * are optional depending on the particular controls being considered for application. Required data can be gathered first, leaving optional data for later in the design process if the specific control is selected. Table 3-4 shows an example of a worksheet that may be used to summarize drainage area attributes by drainage area.

Table 3-3
Drainage Area Attributes and Their Effect on Storm Water Pollution Controls

Attribute	Information Source	Effect on Design and Use of Pollution Controls
Drainage area size	Measured	Used to select suitable treatment controls and size them.
Slopes	Topographic maps Aerial Photographs Field Reconnaissance Contour Grading Plans	Used to identify slopes that require controls to prevent erosion. Limits use of certain controls on or adjacent to slopes.
Site permeability (runoff coefficients)	Aerial Photographs Satellite Imagery NRCS Soil Surveys GIS Maps Hydraulic Studies	Use to determine runoff flows and therefore sizing of many controls. The percentage of the drainage area covered by pavement, buildings, concrete, or other impermeable materials significantly affects the size of controls.
Soil Texture and Saturated Soil Infiltration Rate *	Materials Reports Hydraulic Studies NRCS Soil Surveys Field Measurements	Used to size the surface area of infiltration devices.
Depth to Groundwater *	Well Records Environmental Site Investigations for Hazardous Wastes	Limits use of infiltration at sites with shallow groundwater tables. In areas with shallow groundwater tables consider detention basins.
Precipitation/Evaporation	Field Measurements Rainfall Maps GIS Maps NWS Climate Prediction Center Figures 3-1 and 3-2	Used to select suitable treatment controls and size them. Used to determine runoff flows
Existing Vegetation/Ground Cover	Aerial Photographs Field Reconnaissance Pre-project site photos Record Drawings GIS maps Satellite Imagery NRCS Survey Maps	Used to identify drainage areas with significant amounts of unstable soil and to determine re-vegetation quantities necessary for permit compliance.

*These data are necessary only if treatment controls (i.e. infiltration or detention basins) are being considered

Table 3-4
Summary Sheet for Defining Drainage Area Conditions

Project name: _____

County:_____ **Route**:_____ **MP:**_____ **Project No.:**_____

Mean Annual Rainfall (in/yr): _____ **Mean Annual Evaporation (in/yr.):** _____

Scenario: ❒ **Pre-Construction Conditions** ❒ **Post-Construction Conditions**

Drainage Area ID	Area (Ac)	Hydrologic soil group (A,B,C,D)	Predominant Soil Texture	Saturated Soil Infiltration Rate (in/hr)	Depth to Groundwater (ft)	Slopes in Drainage area (% slope)	Ground Cover	Impervious Surfaces (%)

3.5 Apply General Design Practices to Design Permanent BMPs

Select and design the specific controls suited to site conditions, as follows:

- Soil Stabilization. The Project Manager/Coordinator should consult with Landscape Architecture and Materials on the selection and design of final soil stabilization controls.
- Treatment Controls (see Sections 2.4 and 4.6)
- Streambank Erosion Controls (see Section 4.3)

Working details for the permanent BMPs approved by NDOT can be found in Appendix B of this guide. Section 4 contains guidance for selection and design of permanent BMPs.

3.6 Determine Need to Design Construction Site (Temporary) BMPs

Project-specific conditions and NDOT policy will determine:

- The level of temporary BMP implementation,
- The responsibility for temporary BMP design, and
- The method of payment for temporary BMPs.

Some regions (i.e. Lake Tahoe) have adopted regulations requiring NDOT to incorporate construction site (temporary) BMPs into bidding information materials or into the PS&E.

3.6.1 Project Categorization Score Sheet

The Project Categorization Score Sheet discussed in Section 2.5 and provided in Appendix A, should be updated during final design after drainage areas and other project characteristics are more accurately defined. For projects categorized as having low or medium potential impacts, the contractor is responsible for SWPPP development including design of temporary BMPs. See Section 1.2.2.1.2 for additional contractor responsibilities for General Permit compliance.

For projects categorized as having a high potential for water quality impacts, the Hydraulics Section or a contracted consultant will develop temporary erosion control plans for temporary BMPs for one possible construction phase and will include bid items to be included in the final PS&E document. These plans will then be used by the contractor's Professional Engineer (PE) to develop the SWPPP in compliance with the General Permit and the *Construction Site BMPs Manual*.

NDOT will include specific temporary BMPs in the design under any of the following conditions:

- The project is categorized as having high potential for water quality impacts,
- Specific construction site (temporary) BMPs are prescribed by the NDEP, TRPA, or other environmental permits or certifications,
- The NEPA process has identified sensitive receiving waters or valuable habitats requiring special protection.
- There are site-specific conditions or sources of pollution that would not be adequately addressed by "typical" SWPPP deployment strategies.

Designers should consult with the Hydraulics Section and Construction Division when specifying project-specific temporary BMPs and for specific cost estimation guidelines. For guidance on how to design construction site (temporary) BMPs, see the NDOT *Construction Site BMP Manual*. The Project Manager/Coordinator must

also keep in mind that in certain parts of the state (e.g. Tahoe Basin) the project may require scheduling or phasing to minimize or eliminate soil-disturbing activities during the rainy season.

For projects categorized as having a medium or high potential for environmental impacts, the Environmental Division is responsible for consulting NDEP and any other involved agencies prior to the 60 percent design level to determine any specific permitting requirements. The Project Manager/Coordinator must then see that any additional storm water quality controls as identified by NDEP are incorporated into the project plans.

3.7 Prepare Storm Water Quality Special Provisions

Special Provisions addressing specific project conditions may be necessary to supplement and modify Standard Specification Section 637 for temporary pollution control. Ensure that the contract documents clearly set forth the contractor's responsibilities. These responsibilities will include preparation and implementation of a SWPPP when the project will disturb one or more acres of soil, or if the project will disturb less than one acre but is in or near Waters of the U. S. A Special Provision for water pollution control has been developed specifically for this purpose.

The Water Pollution Control Special Provision includes a reference to the NDOT *Construction Site Best Management Practices Manual* for the minimum implementation of temporary BMPs.

3.8 Prepare Storm Water Quality Information for Construction Phase

Once the PS&E package is finalized, the Project Manager/Coordinator should prepare/develop a supplemental storm water quality information package. This information will be used by the contractor to prepare the final SWPPP and by the RE to help verify payment for the various storm water controls. Information which may be included in the storm water information package is listed below:

- The single phase temporary erosion control plans including general layout, locations, and limits for the BMPs identified in the PS&E (High impact projects only).

- A brief explanation of any construction site (temporary) BMPs that are specified in the PS&E.

- A description of permanent BMPs including an explanation of the technical basis used to select the practices to control pollution where flows exceed predevelopment levels. This information is required in the SWPPP.

- Any additional information that is necessary for the contractor to bid the project accurately and implement the required pollution controls during the construction project.

The checklist in Table 3-5 may be used by the Project Manager/Coordinator as a check that the important storm water issues have been addressed. This checklist is not a mandatory part of all project files, but is intended to provide an additional level of quality control for more environmentally sensitive projects.

Table 3-5
NDOT Storm Water Quality Handbooks – Planning and Design Guide
Check List for Storm Water Quality Activities During Project Design

Storm Water Quality Activity during PS&E	Completed	Date	Name
Delineate Drainage Areas (Hydraulics)			
Drainage Areas			
Drainage boundaries to each outfall			
Drainage area downstream each outfall (on-site and off-site)			
Drainage pattern arrows for overland flow			
Detention basins and other flow controls			
Existing and Planned Drainage Facilities			
Curbs/Inlets			
Underground storm drains			
Ditches/swales			
Channels			
Detention basins and other flow controls			
Drainage outfalls from structures (i.e. bridges)			
Define Total Disturbed Area (Roadway Design)			
Areas to be cleared and/or grubbed			
Areas to be excavated, filled or otherwise graded			
Areas designated for construction staging or storage, if soil is exposed			
Areas designated for access/haul roads or borrow/spoil sites, if soil is exposed			
Areas of utility relocation			
Review and Update Need to Consider Storm Water Quality Treatment Control BMPs (Hydraulics)			
Determine, on a drainage area basis, the need to consider treatment controls on the project (Use the protocol laid out in Section 2.3.)			
If treatment controls must be considered, determine approximate area required.			
Incorporate items identified during the pre 60% NDEP consultation			
Define Climatic Conditions of the Project (Hydraulics)			
Mean Seasonal Rainfall and Evaporation			
2-year storm			
Treatment Design Storm			
20-year, 1-hour storm			

Table 3-5
NDOT Storm Water Quality Handbooks – Planning and Design Guide

Check List for Storm Water Quality Activities During Project Design

Storm Water Quality Activity during PS&E	Completed	Date	Name
Determine site conditions of drainage area (Hydraulics)			
Complete Table 3-3			
Apply General Design Practices and Design Permanent BMPs (PDG Section 4) (Hydraulics)			
Soil Stabilization and Slope Protection			
Avoid Existing Slopes			
Minimize Erosion on Slopes – Slope Design			
Streambank Erosion Control			
Erosion Control for Concentrated Flows			
Preservation of Existing Vegetation and Re-stabilizing Remaining Disturbed Areas			
Permanent Treatment Controls			
Determine Need to Design Construction Site (Temporary) BMPs (Hydraulics)			
Check for Specific Regional Requirements			
Check for Specific NDEP Requirements			
Check if the NEPA Process has Identified Areas Requiring Special Attention			
Check for Other Site Specific Conditions or Sources of Pollution not Adequately Covered by SWPPP and WPCP Deployment strategies			
Prepare Storm Water Quality Standard Special Provisions (Hydraulics)			
Prepare WPCP SP			
Prepare SWPPP SP			
Prepare SPs for Construction Site (Temporary) BMPs			
Prepare SWQ Information for Construction Phase (Hydraulics)			
Layout Sheets with Suggested BMP Locations			
Brief Explanation of Permanent and Temporary (if any) BMPs Specified			
Additional information that may be needed by the contractor or RE			

Section 4
Guidance for Selection and Design of Permanent BMPs

This section provides a discussion of the critical design considerations for permanent storm water quality controls (BMPs) for NDOT projects. More detailed guidance on the design of the specific BMPs introduced in this section is provided in Appendix B.

4.1 Permanent Best Management Practices (BMPs)

Almost all projects will include some level of permanent water or air quality control design features (e.g. soil stabilization). The permanent BMPs addressed in this section are organized within the following categories:

- Permanent soil stabilization (erosion control),
- Streambank erosion control,
- Preservation of existing vegetation, and
- Storm water treatment control.

Designers must evaluate these BMPs for applicability and then incorporate them into the PS&E during the design process. This manual presents BMPs that have been evaluated and approved by NDOT. New technologies are constantly being tested and a wide variety of proprietary products are also available. BMPs that are not included in this manual should be carefully evaluated and approved by the NDOT Hydraulic, Environmental, and Construction divisions before specifying them in any project PS&E.

4.2 General Design Practices for Permanent Soil Stabilization (Erosion Control)

The goal of an effective erosion control strategy is to maintain or re-establish natural, pre-construction erosion rates to the maximum extent practicable. In order to accomplish this goal, designers should develop a strategy for permanently re-stabilizing all disturbed areas of the project by selecting appropriate BMPs for disturbed areas and drainage systems that accomplish the following objectives:

- Preserve existing vegetation to the maximum extent possible,
- Minimize areas disturbed by the project,
- Re-stabilize disturbed areas that are substantially complete for each phase and stage of construction,

- Control or minimize erosion potential in cuts, fills, and drainage paths,

- In more sensitive environments, such as Lake Tahoe, re-stabilize identified sediment source areas from earlier disturbances with permanent controls.

The PS&E must be sufficiently detailed to prescribe construction requirements to implement the BMPs.

4.2.1 Soil Stabilization (Erosion Control) Strategies

Figure 4-1 presents a decision tree for developing an effective erosion source control design strategy and indicates BMPs to consider for various project conditions. In some cases it may be necessary to demonstrate a net sediment reduction or that there will be no net sediment increase for post-development vs. pre-development conditions. Information on the soils, slopes, vegetation, and climatic conditions of the project site can be used to estimate the difference in erosion and sedimentation with and without the project. This involves using a sediment/discharge relationship (e.g. the Revised Universal Soil Loss Equation – RUSLE) to estimate differences in pre-construction and post-construction sediment yield.

Based on the results of the sediment yield calculation, additional erosion control methods may be needed to further reduce soil loss as illustrated in Figure 4-1 and the soil stabilization BMPs presented in Appendix B. This process requires coordination among all NDOT design sections, the Materials Division, the Environmental Division, and the project's Landscape Architect.

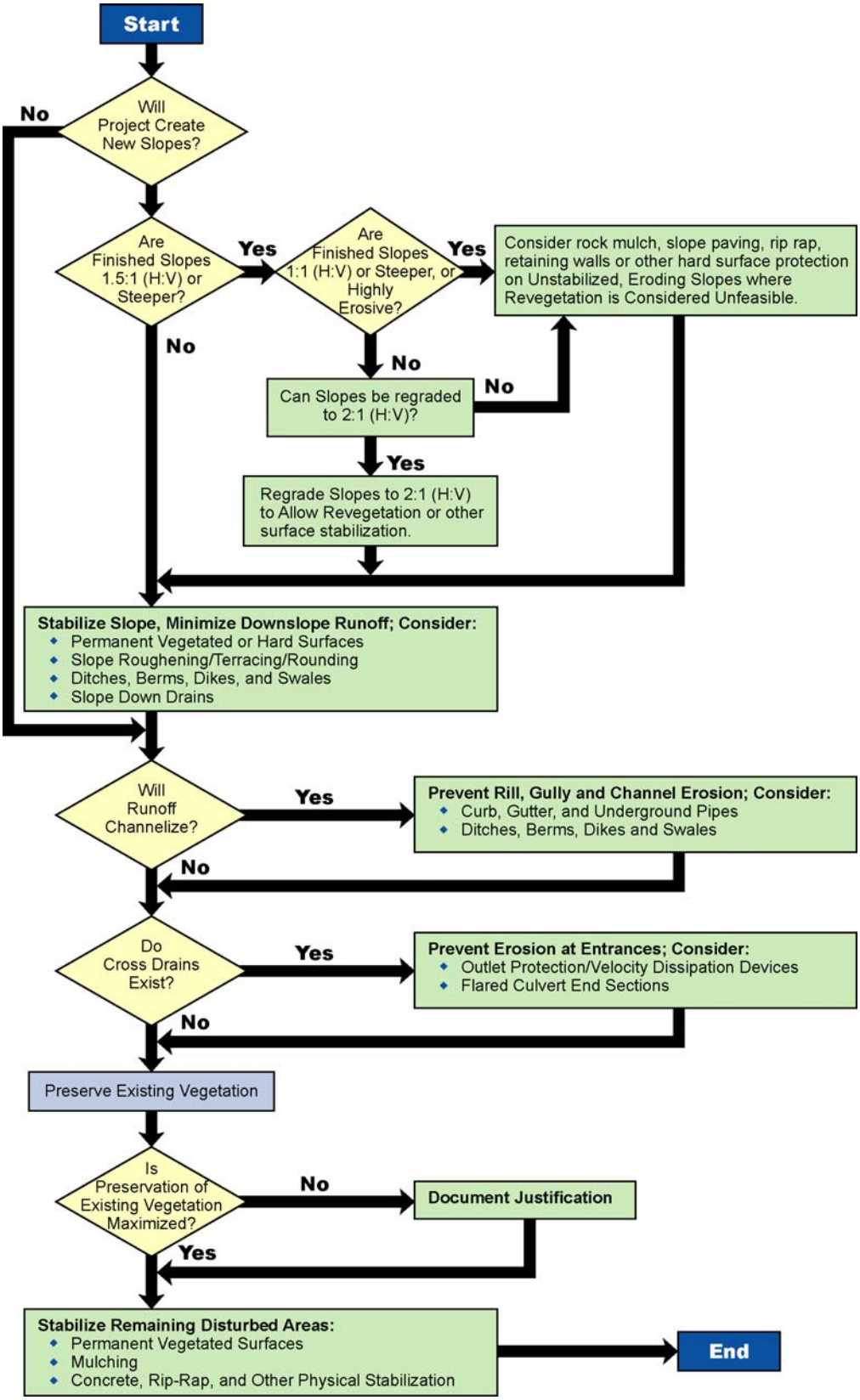


Figure 4-1

Decision Tree for Developing and Effective Soil Stabilization Strategy

4.2.2 Protection of Slopes

Identifying potentially erosive slopes is the first step to ensure their protection. A site investigation of existing slopes on the project or in the immediate vicinity should be made. A visual inspection of areas with similar combinations of slope, soil, vegetation, and rainfall characteristics, should be performed to observe signs of erosion and to identify effective erosion controls.

Rill and gully erosion are the most obvious signs of erosive slopes. Rill and gully erosion occurs where sheet flow becomes concentrated in small, defined channels. Rills are typically only a few inches deep while gullies are much larger.

Also, the project soils and/or geotechnical report should be reviewed to determine the maximum steepness for slope stability, considering both the surface erosion properties of the soils, as well as the structural integrity of the slope.

Impacts on existing slopes should be avoided or minimized to the maximum extent practicable. The following general strategies for minimizing erosion of slopes should be used:

- Disturb existing slopes or create new slopes only if necessary,
- Establish a vegetative cover on the slope(s) or provide other materials to control erosion due to rainfall,
- Minimize the slope(s) steepness and length,
- Prevent runoff from concentrating by collecting runoff in stabilized channels or drains and diverting around or off of the slope(s).

Avoiding Existing Slopes: The first goal in project design should be to minimize disturbance of existing slopes to the maximum extent practical, particularly where the existing slopes have a well-established vegetative cover; however, in some cases it may be desirable to remove existing vegetation if the result is a flatter, more stable slope.

If the preliminary geometric design of the project would potentially impact existing slopes (i.e. requiring grading and/or clearing), determine if the alignment and/or the geometric cross section can be changed, or if retaining walls should be constructed to minimize the impact on existing slopes. In addition, grading easements should be considered in order to decrease slope angle and erosion potential.

If impacts on existing slopes cannot be avoided, then the project must include selection and design of permanent soil stabilization BMPs for both disturbed existing slopes and newly created slopes. If applicable, project staging should also be planned to minimize the impact on existing slopes.

Slope Protection in Desert Environments: The majority of the State of Nevada is characterized by very limited precipitation, extreme temperatures, and harsh growing conditions during many times of the year. For this reason, the use of the permanent seeding or planting methods described above often has high maintenance requirements (i.e. frequent irrigation, replacement of dead plants, and reseeding).

Because of these conditions, it becomes even more critical to avoid or minimize the disturbance of slope and soils areas. In many desert areas where vegetation is sparse, a natural "desert pavement" exists and is the result of many years (sometime thousands) of wind and other erosion having removed surface fines and leaving a layer of larger gravels and heavier particles. Extreme care should be taken in such situations, as disturbing the desert pavement can cause damage that can only be repaired by natural processes taking many years. The use of rock mulch surface protection sometimes mimics the desert pavement but is typically expensive to implement.

In situations where permanent seeding and planting is considered infeasible, rock slope protection (riprap), rock mulches, slope paving, and asphalt millings provide alternative methods that may be suitable for the protection of slopes. In general, steeper slopes require larger size classes of stone for riprap. Reference NDOT's Standard Specifications for specific construction and materials requirements (see Appendix B for working details regarding riprap).

Minimizing Erosion on Slopes: The procedures and limitations for selection and design of soil stabilization BMPs for slope protection generally depend on soil type and slope steepness and length, and are described as follows:

- ***Slopes 4:1 or flatter*** – Project design staff can select and design appropriate BMP protection from the BMPs described herein and the working details in Appendix B.

- ***4:1 < Slopes < 1.5:1*** –A slope-specific soil stabilization design based upon appropriate BMPs described herein and the working details in Appendix B should be prepared. Designs for these slopes should include stabilizing the slope toe and apply re-vegetation or spot revegetation if slope contains greater than 70% rock facing. If re-vegetation is not feasible due to climatic or other conditions, hard surface protection (e.g. rock mulch, slope paving, etc.) should be considered.

- ***1.5:1 < Slopes < 1:1*** – A slope-specific soil stabilization design based upon appropriate BMPs described herein and the working details in Appendix B should be prepared. If the probability of vegetative success is better on flatter slopes, slope design in this steepness range should include re-grading to 2:1, if feasible. If the slope is less than 10 ft. high and uphill topography is flat enough so as not to increase slope length, then re-vegetate where feasible. If re-vegetation is not feasible due to climatic or other conditions, hard surface protection (e.g. rock mulch, slope paving, etc.) should be considered.

- ***Slopes 1.5:1 or steeper*** – If sloughing and rilling is occurring, toe stabilization cannot be maintained through other means, probable long-term success of re-vegetation efforts is estimated to be poor, or available soil for seed bedding is shallow or non-existent, then rock rip-rap or other hard surface stabilization BMPs should be used to stabilize the slope.

The BMPs described below should be considered for minimizing erosion on slopes; general guidance on each BMP is given. More detailed guidance can be found under each individual BMP described in Appendix B.

Slope Roughening/Terracing/Rounding

- Reduce slope steepness and length sufficiently to prevent runoff from concentrating and causing rill/gully erosion. Flatter slopes and terraces establish vegetation more readily, absorb rainfall impact, promote infiltration, and reduce runoff.

- All slopes should be rounded, with no sharp breaks, as described in NDOT Standard Specifications Section 204.

- Terraces or benches should be considered to keep uninterrupted slope heights less than 30 ft. In highly erosive soils, it may be necessary to decrease the maximum uninterrupted slope heights to 15 ft. or less.

- Runoff from terraces and steps should flow into diversion ditches installed where the terrace meets the slope. These diversion ditches should have a cross slope of at least 2%.

- Diversion ditches should be stabilized.

- Slope surfaces should be left rough to improve seed germination and plant growth.

- Design of slopes should be in conformance with NDOT Standard Plans and Specifications.

- For permanent seeding and planting, consult the Landscape Architect for seed and planting specifications

- Per the General Permit, final stabilization is defined as: "a uniform (e.g. evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures have been employed". All disturbed areas must be planted or stabilized by other equivalent means. If work in an area is substantially complete, the Permit requires stabilization with permanent controls within fourteen (14) days.

- Grasses and mulches are the most effective and quickest treatment for initial erosion control. Trees and shrubs alone are not effective for initial erosion control and should be supplemented with appropriate vegetation, mulches, or blankets.

- To preserve the nutrient rich topsoil layer, the first 6 inches of soil[1] (duff), or as required by the project specifications, should be stockpiled and replaced prior to placing permanent vegetative controls.

- See *Mapping Ecosystems along Nevada Highways and the Development of Specifications for Vegetation Remediation*, (DRAFT) by University of Nevada Reno for planting specifications and maintenance guidance that is specific to the different ecosystems of Nevada.

Ditches, Berms, Dikes and Swales

- Top, toe, and mid-slope diversion ditches, berms, dikes, and swales, should be used to intercept runoff and direct it away from critical slopes. Typically mid-slope diversion ditches should have a cross slope of 2%, and should be concrete, rock, or vegetation lined.

- Top of slope diversions should be paved along cut slopes where the slope length above the cut is greater than 40 ft.

- Earthen diversion ditches, berms, dikes, and swales concentrate flow and should be stabilized to prevent erosion.

- Alternatively, drop structures can be placed along the diversion to maintain a grade sufficiently mild to prevent erosive velocities, or a slope down drain can be placed down the side of the fill before the accumulated runoff in the diversion is sufficient to cause erosive velocities.

Slope Down Drains

- Slope down drains are usually pipes or lined swales that convey runoff from the top of slopes to a stable channel or drain at the base of the slope.

- Size slope down drains to convey large, infrequent storms down or around the slope. Additional design guidance for slope down drains is also provided in the NDOT Drainage Manual and Roadway Design Manual.

- Slope down drains in landscaped areas should be concealed by burial or other means.

- Design top and toe of slope diversion ditches/berms/dikes/swales to flow directly into slope down drains.

- Provide for outlet protection and energy dissipation devices at the outlet of the drain, where needed.

[1] Varies with project location—reference project specifications for more information

- Refer to NDOT Standard Plans and Specifications for additional requirements on construction and materials used in slope down drains.

4.3 General Design Practices for Streambank Erosion Control

The project design must be developed to limit the potential for increased downstream streambank erosion to the maximum extent practical as a result of future discharges from the project. The major hydrologic changes which may affect channel stability as a result of changes in the highway drainage system relate to:

- The rate and volume of runoff, due to changes in the land surface.
- The sediment load from upstream, due to changes in land surface erosion and upstream channel aggradation or degradation.
- Hydraulic changes due to stream encroachments or crossings (constriction or expansion), or due to changes in the alignment of the channel itself.
- Significant storm events. The frequency of storm events has a large effect on small stream channel stability. When considering storm water management for channel stability, events with return periods on the order of 2 years can be significant.

4.3.1 Opportunities for Streambank Erosion Control

In principle, the designer may have control over any of the factors governing sediment transport capacity, but is commonly constrained by site limitations. These limitations may include factors such as grade restrictions imposed by the topography of the site, the nature of the native soils and streambed materials, and hydraulic structures that constrict or force bends in the channel.

As a result, controls intended to limit erosion must be placed in a way that is sensitive to the specific conditions encountered in the particular site. Additional information and procedures for design of erosion control for channel and streambank protection is found in the NDOT *Drainage Manual* and the *Construction Site Best Management Practices Manual*.

Hydraulic Control

Hydraulic design for channels within the project site, which are materially modified from their natural state, must incorporate appropriate considerations of flow velocities and bed materials. After evaluating the peak rates of flow, design the channel section and bed materials so that the flow velocities generated by runoff events will not be sufficient to cause damage to the channel. Achieving this objective of long-term channel stability may require changes in channel shape, so that the channel section area is adequate, or may require channel lining, so that the channel itself is resistant to erosion.

Erosion and Sediment Control

Consider permanent soil stabilization practices set forth in Section 4.2 to reduce sediment loads in runoff from adjacent sites and from the project, to pre-project levels both during and after construction. This will reduce the chance of significant deposition and blockage in the downstream channel.

Hydrologic Control

The criterion applied to hydrologic control, which is targeted at long-term channel stability, is as follows:

- Evaluate velocity to ensure no net erosive impact. Runoff generated by the 2-year return period storm, calculated for conditions where antecedent moisture conditions are of average dryness, can generally be controlled by design of the drainage system and storm water BMPs so that the peak flow rate for each event after a project is complete does not exceed the peak flow rate generated by the same event prior to the project.

- To achieve this objective may require the incorporation of a detention or infiltration (retention) basin to reduce the peak flow rate. Infiltration provides the added benefit of reduction or the total volume of flow, but will not be possible to incorporate in some cases, due to physical site constraints. For this reason, the minimum criterion is, as stated in (1) above, related to peak flow rates.

4.4 General Design Practices for Soil Stabilization for Concentrated (Channelized) Flows

Sheet flow runoff will concentrate when flow rates, velocities, and depths are large enough for the flow regime to become turbulent. The point where sheet flow becomes turbulent and begins to channelize is difficult to predict, but it rarely exceeds a flow path length of 200 ft. and occurs in much shorter lengths on steeper, smoother, or less porous surfaces. The following BMPs should be considered to prevent erosion when concentrated flow is expected:

- Ditches, Berms, Dikes and Swales,

- Slope Down Drains and Flared End Sections,

- Outlet Protection/Velocity Dissipation Devices.

Additional detailed procedures for the design of erosion control for channel and streambank protection is found in Appendix B.

4.5 Preservation of Existing Vegetation and Re-stabilizing Remaining Disturbed Areas

Once special conditions of erosion of slopes, channels, and cross drains are addressed, the design must address stabilization of the remainder of the site by evaluating areas

of the site other than slopes and maximizing the preservation of existing vegetation. Once the design has been established, and the area of actual construction known, the limits of the construction site must be established to provide some area for contractor operations, storage, etc.

The construction site limits should be restricted to minimize disturbance of existing vegetation, particularly on areas of the site that would present the greatest challenge to re-stabilize (e.g. desert pavement areas, problematic soil conditions, and sites where floodplains, wetlands, streambanks, perennial receiving waters, or other critical resources are on or adjacent to the site and would receive runoff directly from the disturbed areas). Areas that will be disturbed must be clearly marked on the plans and access limitations should be shown on the plans and the Specifications Section must describe the areas in the Special Provisions (see Permanent BMP Fact Sheet SS2 in Appendix B).

If preservation of existing vegetation cannot be maximized, the designer must document the justification for disturbing greater areas of the project site. Items to consider when preserving existing vegetation and re-stabilizing the remainder of the project site include:

- Existing vegetation should provide erosion and sediment control.
- The decision to save existing vegetation should include, at a minimum, the following considerations: age and life expectancy, health, aesthetic value, wildlife benefits of vegetation, and noxious weed abatement program.
- Vegetation to be preserved should be shown on the plans.
- Soil stabilization (permanent) is required on all disturbed areas.
- The use of native plants is appropriate for the project except for highly erosive slopes and channels; where denser, deep-rooted species may be required to compensate for the higher, more erosive flow velocities in these areas.
- Mulches and other forms of physical stabilization (e.g., rock, rip-rap, and geotextile materials) should be considered for portions of the site where vegetation cannot be easily established or where it would require permanent irrigation, increase highway maintenance costs, and/or interfere with highway operations.
- Combinations of vegetation and stabilization methods as noted in the examples above.
- Stabilizers with rough surfaces and/or pores that store runoff and promote infiltration are preferable to paved or other smooth liners that tend to increase runoff and potentially pass erosion problems downstream.

4.6 General Design Practices for Permanent Treatment Control BMPs

Where permanent treatment control BMPs are required, they should be used in combination with permanent soil stabilization BMPs and special hydrologic design considerations such as promoting infiltration or avoiding concentration of flows. Soil stabilization practices are generally much less expensive to construct and maintain than treatment controls. These methods control sediment at the source and will enhance the effectiveness of treatment controls and reduce their maintenance needs.

Special hydrologic design considerations can also increase treatment control effectiveness by reducing the volume of water that requires treatment. If feasible, efforts should be made during design to enhance infiltration of runoff as close to the source as possible by encouraging slow or sheet flow over permeable and stable soils wherever possible (e.g. well vegetated flat areas). Also, clean runoff entering the project site from streams or undisturbed upgradient areas should be kept separate from site runoff that is being directed to treatment control devices.

General treatment control BMPs include: infiltration and detention facilities, traction sand trap devices, and gross solids removal devices. Working details and design guidance for these controls are provided in Appendix B and in the NDOT *Drainage Manual*.

Additionally, there are a growing variety of proprietary storm water treatment devices that may be effective in special cases, where water quality protection is of the highest priority. The general hydrologic and hydraulic design guidance in Appendix B and in the NDOT *Drainage Manual* should be followed to size the devices in conjunction with the manufacturer's recommendations for proper installation and maintenance.

Special Circumstances for Considering Infiltration and Detention Basins

NDOT considers permanent treatment control devices for water quality control if major sediment transport is expected and would have a considerable impact on streams, lakes, or adjacent property. More specifically, the following cases may warrant the inclusion of these devices in project:

- Runoff from the completed facility will discharge to areas of highly valuable habitat in which Federal- or State-listed aquatic resources have been identified, or will discharge to a storm drain that drains directly to such habitat, and;
- NDOT runoff constitutes a substantial portion of the total flow (not including flows from undisturbed areas) to such habitat,
- Projects within the Lake Tahoe Basin.

Traction Sand Traps

Traction sand trap devices are considered for roadways in the following locations where sand is applied for traction control:

- The Lake Tahoe and Truckee River hydrologic units in District 2,
- Elevations above 7,000 ft,
- The Carson River East Fork and West Fork hydrologic units in District 2,
- Other areas where NDOT runoff discharges to sensitive receiving waters or habitat.

Other Considerations for Treatment Control Devices

In addition to the above circumstances, treatment control devices may also be required by regulatory actions such as TMDL development, special permitting or the environmental review process (NEPA) as discussed in Section 2.3. Of particular interest are TMDLs that are either established or under development for waters listed as impaired for sediment or turbidity.

Figure 2-1 provides a general idea of areas where water quality protection from erosion and sedimentation is an increased concern. Projects adjacent to or draining to waters impaired by sediment may have additional water quality protection requirements imposed by the NDEP or other agencies.

4.6.1 Selecting the Appropriate Treatment Controls

When the need for treatment controls has been identified and it has been determined which BMP is best suited for the site, the Hydraulics designer must then examine the facility for fitting into the available right-of-way while providing access for maintenance, and estimate the cost to construct and maintain the facility. Unless the treatment control BMP has been previously identified, and right-of-way space reserved for this purpose, the feasibility of including such control measures at the detailed PS&E stage is often controlled by available right-of-way space as defined during development of the final geometric base maps. For this reason the NDOT design process must include a specific effort to identify the need for treatment controls and their respective Right-of-Way requirements prior to the 60% design stage.

One possible exception would be when an opportunity is identified for developing an off-site joint-use drainage and/or water quality control feature as part of a cooperative agreement with a local jurisdiction or private entity. This would require project-specific negotiations and coordinated design efforts. If the need to consider an infiltration basin is first determined during the detailed PS&E stage, the financial feasibility must also be assessed. Selection and design of treatment controls must be performed in coordination with the NDOT Roadway Design, Right-of-Way, Environmental, and Hydraulics Divisions.

4.6.2 Integrating Treatment Controls with Other Facilities

In many instances, and especially in areas where available right-of-way is limited, treatment control BMPs can be integrated into common project features such as medians, shoulders, setbacks, interchange areas, landscaped areas, parking areas and unused right-of-ways. Treatment control BMPs may be considered for any available open areas alongside the road, but safety considerations and access for maintenance must be fully considered when selecting the location.

In some cases, drainage, flood control, and storm water pollution controls can be integrated into a single facility that achieves all objectives cost-effectively. The design guidelines laid out in the individual BMPs contained in Appendix B must be carefully followed to minimize the chance that the large storms used to size the drainage and flood control portion of these sediment basins do not "flush out" the pollutants previously captured and stored in the facility. Alternatively, the large storms may be bypassed around the water quality control facility.

Design and siting of storm water quality controls should be consistent with normal NDOT design and maintenance practices. Final layout and design of treatment controls must be coordinated with the NDOT Roadway Design, Right-of-Way, Landscape, District Maintenance, Environmental, and Hydraulics Divisions.

4.6.3 Detention Strategies

Where needed, combination drainage, flood control, and storm water pollution control basins must provide separate storage volumes and outlet controls for each objective, each sized as if they were separate basins and then "stacked" in a manner that meets all objectives as noted below:

- The objective of storm water detention for flood control, sometimes referred to as "peak shaving", is to reduce the peak rate of runoff from relatively intense, infrequent design storms (e.g., a 10-year storm or larger). Generally, the runoff from smaller storms passes through these basins without significantly altering the discharge hydrograph or removing pollutants.

- Storm water treatment controls employ a different storage strategy; they capture and detain almost all runoff from a water quality design storm that is typically much smaller than the flood control design storms while the larger, infrequent storms are bypassed.

4.6.4 Incorporating Maintenance Access

Treatment control BMPs will require on-going inspection and maintenance once construction is completed. The design staff should assemble information to be turned over to District Maintenance staff upon project closeout. This information should include O&M procedures for the permanent BMPs. Some of this information can be obtained from the Inspection and Maintenance sections of the BMPs found in Appendix B of this guide. Other information, such as site-specific access issues or special maintenance requirements, needs to be developed on a project-by-project basis.

Appendix A

This Appendix contains the following documents:

- Project Categorization Score Sheet and Instructions
- A copy of the NDOT/TRPA MOU
- A blank TRPA Initial Environmental Checklist
- TRPA Guidelines for Applying for a TRPA Permit for a Linear Public Service Project
- TRPA Guidelines for Exempt or Qualified Exempt Projects

Please Note: The Documents provided in this appendix may be subject to change. Copies of the most current documents can be accessed on the TRPA website.

Project Categorization Score Sheet and Instruction

Guideline for Project Categorization Score Sheet

The following information is intended to provide additional clarification and guidance for the completion of the NDOT Project Categorization Score Sheet.

Questions 1 and 2

The first two questions are intended to determine if the project may be categorized as having no impact to waters of the United States (WOUS) as defined in 40 CFR § 122.2. Projects with ground disturbance less than one acre or no direct discharge into WOUS may be placed in this category and it is then unnecessary to complete the remainder of the score sheet. Discharges to storm drain systems that in turn discharge to WOUS are considered to be discharges to WOUS. It is vitally important to evaluate the project for any conceivable discharge that may occur to WOUS including intermittent streams and/or ephemeral water bodies that are dry at the time of evaluation. NDEP may require General Permit coverage for a project not impacting a WOUS or that disturbs less than one acre, however this is rare. Coordinate the determination of WOUS impact with the Water Quality Specialist.

Disturbed soil areas (DSAs) are areas of exposed, erodible soil, including stockpiles, that are within the construction limits and that result from construction. Disturbance is also defined as clearing, grading, or excavating underlying or surrounding soil as part of a repaving operation. Repaving areas that create fine-grained material (e.g. asphalt millings) that are not immediately disposed of or are stockpiled on site are considered DSAs. The following are examples of areas that should be included in the estimate of land likely to be disturbed by construction activities:

- Areas to be cleared and/or grubbed
- Areas to be excavated, filled, or otherwise graded
- Areas designated for construction staging or storage, if soil is exposed
- Areas designated for access/haul roads or borrow/spoil sites, if soil is exposed
- Areas of utility relocation

Categorizing a project as having no water quality impacts should be carefully documented in the project files with a statement that justifies the finding and contains the name of the person responsible for this finding.

Question 3

This question is intended to quickly classify all Lake Tahoe projects as having a high potential for environmental impact.

Question 4

- Enter the score corresponding to the project's total disturbed area in acres.

Question 5

Identify the number of locations where storm water runoff leaves the construction site as a concentrated flow.

Question 6

Quantify the duration of construction in years. If the duration is over one year but only includes one wet season, round the duration down to one year. If the project spans two wet seasons round the duration up to two years. Use a similar methodology for longer-term projects.

Question 7

Estimate the steepness of the slopes in the areas where soil disturbance will occur. On many projects, the slope inclination varies, so use judgment in selecting the appropriate category. If unsure in selecting an appropriate slope, the average project slope can be calculated using a weighted average.

$$S_{avg} = \Sigma(S_i * A_i) / \Sigma A_i$$

Where S_{avg} = Average project slope

S_i = The slope of an individual area

A_i = The area (sq ft) for the given individual area

For example, assume a project was determined to have 12,000 sf of slopes at approximately 1.5:1, 2,500sf at 2:1, 1,500 sf at 3:1, 2,700 sf at 4:1, and 9,000 sf at 6:1. The average slope would be calculated as follows:

Slope	Area	Slope * Area
1.5	12,000	18,000
2	2,500	5,000
3	1,500	4,500
4	2,700	10,800
6	9,000	54,000
Total =	27,700	92,300

Using the equation above, the equation output would be 92,300 / 27,700 = 3.3, or a 3.3:1 average slope. On the Score Sheet, the category 2:1 < Slope < 4:1 would be selected since the average slope is between 2:1 and 4:1.

Project Categorization Score Sheet

Project Title	
Description	
Milepost	
Project ID	
Designer	
Date	

Note: See guidance in the Strom Water Quality Handbook *Planning and Design Guide* before filling out this Score Sheet

1	**Will the total disturbed area of the project be one acre or greater? If no, categorize project as having no impact**	**Yes** **No**	**Continue** **Stop**
2	**Is there any potential for runoff to discharge to live surface water bodies or Water of the United States? If no categorize project as having no impact (See Guideline, coordinate with Water Quality Specialist)**	**Yes** **No**	**Continue** **Stop**
3	**Is the project located in the Lake Tahoe Basin? If yes, categorize project as having high environmental impact, if no, then continue**	**Yes** **No**	**Stop** **Continue**
4	**Acreage of disturbed soil areas**	**0-1** **1-5** **5-10** **10-20** **20+**	**1** **2** **3** **4** **5**
5	**Will project discharge storm water runoff to a single location (A) or multiple locations (B).**	**A** **B**	**1** **2**
6	**What is the duration of construction? (See guidance on rounding in Guideline)**	**One year or less** **Two years** **More than 2 years**	**1** **2** **3**
7	**Characterize the slopes in the disturbed area**	**Slopes 4:1 (H:V) or flatter** **4:1 < Slopes < 2:1 (H:V)** **Slopes 2:1 (H:V) or steeper**	**1** **2** **3**

Scoring:

Question	Score
#4	
#5	
#6	
#7	
Total:	
Impact Category:	

Score of 4-5 = low impact

Score of 6-9 = medium impact

Score of 10-13 = high impact

TRPA/NDOT Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING BETWEEN
TAHOE REGIONAL PLANNING AGENCY AND
NEVADA DEPARTMENT OF TRANSPORTATION

This Memorandum of Understanding is entered into this 24th day of September, 1990, by and between the TAHOE REGIONAL PLANNING AGENCY (TRPA), through its Executive Director as authorized by its Governing Board, and the NEVADA DEPARTMENT OF TRANSPORTATION (NDOT) by and through its designated representative.

All activities described in this Memorandum of Understanding (MOU) are in accordance with the Regional Plan package of TRPA as adopted by Ordinance No. 87-9, as amended. It is understood that all activities undertaken by NDOT pursuant to this MOU shall comply with applicable Best Management Practices (BMPs), the Design Review Guidelines, and all other provisions of the TRPA Code of Ordinances, except for procedural provisions replaced by this MOU.

I. EXEMPT ACTIVITIES

The following NDOT activities, in addition to those activities exempt pursuant to Section 4.2 of the TRPA Code, are not subject to review and approval by TRPA, provided that they do not result in the creation of additional land coverage or relocation of land coverage.

A. Streets, Roads, and Highways

1. Pavement restriping or remarking.

2. Correction of slick pavement.

3. Paved shoulder grooving.

4. Replacement of existing safety or protective devices, including; fencing, guardrails, barriers, energy attenuators, guide posts, markers, safety cables, ladders, light standards, hoists, traffic signals and controllers, provided replacement devices/materials are similar in size, coloration, and design to the existing protective devices.

5. Asphalt/concrete blankets with less than $25,000 in material costs, and patches on existing paved surfaces, including minor digouts of up to 7 cubic yards.

6. Repainting of bridges and other highway appurtenances.

7. Crack seals on existing pavement.

B. Water Quality Control Facilities

1. Culvert cleaning utilizing a hydro-jet vacuum system with no direct discharge of materials to the atmosphere, and provided spoils are removed to an agreed upon temporary disposal site, and are subsequently removed from the Tahoe Basin.

2. Cleaning and repairing drainage facilities provided the toe of adjacent slopes or cutbanks are not disturbed.

3. Repair and maintenance of existing asphalt/concrete roadside gutters or drainage facilities.

4. Earthslide, avalanche debris, or embankment slipout removal and stabilization, provided spoil material is removed to TRPA approved disposal sites.

C. Snow Removal Activities

1. Snow removal from roadway or highway surfaces either by use of a rotary plow, plowing snow to the edge of the paved surface, or plowing to the center of the roadway for removal to existing snow disposal sites.

D. Sidewalks, Pedestrian Facilities, and Bicycle Trails

1. Replacement of existing sidewalks, pedestrian facilities and bicycle trails.

2. Striping and marking of bicycle trails.

3. Handicapped accessibility improvement projects, including; curb cuts and wheelchair ramps.

E. Signs

1. Installation of roadside warning signs related to construction/ maintenance activities or needed for safety purposes, provided signs are removed within 10 business days following completion of the activities, or within 10 business days of the removal of the safety hazard.

F. Miscellaneous Activities

1. Monitoring of highway or roadway traffic, including the placement of portable traffic counting equipment or weighing devices.

2. Placement of traffic detection devices in the pavement of a highway or roadway for the operation of traffic control signals or for traffic monitoring.

II. QUALIFIED EXEMPT ACTIVITIES

The following NDOT activities are not subject to TRPA review or approval provided NDOT certifies, on a form provided by TRPA, that the activity does not result in the creation of additional coverage or relocation of coverage, or an increase in vehicle trips in excess of that otherwise exempt pursuant to Subsection 4.3.B of the Code, and is in conformance with the applicable provisions of the TRPA Code. The statement shall be filed with TRPA at least 5 business days before the activity commences, or in the event of an emergency, within 3 business days after the date of the emergency.

The following activities are in addition to those activities deemed qualified exempt pursuant to Section 4.3 of the Code.

A. Streets, Roads, and Highways

1. Chip seals and fog seals of the existing pavement, provided that BMPs are in place that include dust control measures which will effectively reduce the amount of entrained dust to insignificant levels.

2. Reconstruction, resurfacing or overlaying of existing pavement.

3. Replacing existing bridge rails, provided there is no increase in height, and there is no deterioration of scenic views.

4. Maintenance or repair of existing bridge structures, provided there is no change in the width or length of the existing structure.

B. Water Quality Control Facilities

1. Shoulder grading, provided the toe of adjacent embankments, slopes, or cutbanks are not disturbed, and spoil material is removed to TRPA approved temporary disposal sites and subsequently removed to outside the Tahoe Basin.

2. Embankment repair, provided the activity occurs during the grading season (May 1, to October 15) and the repaired site is stabilized either during the repair activity or within 72 hours of the repair to prevent further erosion.

C. Signs

1. Alteration of existing signs or placement of additional signs, provided NDOT determines they are needed for safety reasons.

III. LANE CLOSURES

Lane or highway closures for exempt or qualified exempt activities are limited to the minimum amount of time needed to complete the activity and do not occur during holidays or holiday weekends.

IV. LOSS OF EXEMPTION

NDOT acknowledges that any exempt or qualified exempt activity set forth herein may be designated a project requiring TRPA review if the Executive Director of TRPA determines that, because of cumulative impacts or unusual circumstances, the activity may have a substantial effect on the land, air, water, space, or any other natural resource in the Region.

V. AMENDMENT

This Memorandum of Understanding may be amended by written agreement of both parties.

VI. TERMINATION

This Memorandum of Understanding may be terminated by either party upon sixty (60) days written notice.

NEVADA DEPARTMENT OF TRANSPORTATION

Garth Dull, Director

Date: Sept. 24, 1990

TAHOE REGIONAL PLANNING AGENCY

David S. Ziegler, Executive Director

Date: Sept. 4, 1990

Approved as to Form:

Jeffrey Blanck, Agency Counsel

TRPA Initial Environmental Checklist

TRPA INITIAL ENVIRONMENTAL CHECK LIST

for

The Initial Determination Of Environmental Impact

Assessor Parcel Number(s)_____

I PROJECT NAME AND DESCRIPTION: (use additional sheets, if necessary)

_____
_____
_____
_____
_____
_____
_____

II ENVIRONMENTAL IMPACTS:

The following questionnaire will be completed by the applicant based on evidence submitted with the application. **All "yes" and "no, with mitigation" answers will require further written comments.**

1 Land

Will the proposal result in:

a. Compaction or covering of the soil beyond the limits allowed in the land capability or Individual Parcel Evaluation System (IPES)?

Yes	No	No, with Mitigation	Data Insufficient

b. A change in the topography or ground surface relief features of site inconsistent with the natural surrounding conditions?

Yes	No	No, with Mitigation	Data Insufficient

c. Unstable soil conditions during or after completion of the proposal?

Yes	No	No, with Mitigation	Data Insufficient

d. Changes in the undisturbed soil or native geologic substructures or grading in excess of 5 feet?

Yes	No	No, with Mitigation	Data Insufficient

e. The continuation of or increase in wind or water erosion of soils, either on or off the site?

Yes	No	No, with Mitigation	Data Insufficient

f. Changes in deposition or erosion of beach sand, or changes in siltation, deposition or erosion, including natural littoral processes, which may modify the channel of a river or stream or the bed of a lake?

Yes	No	No, with Mitigation	Data Insufficient

g. Exposure of people or property to geologic hazards such as earthquakes, landslides, backshore erosion, avalanches, mud slides, ground failure, or similar hazards?

Yes	No	No, with Mitigation	Data Insufficient

2 Air Quality

Will the proposal result in:

a. Substantial air pollutant emissions?

Yes	No	No, with Mitigation	Data Insufficient

b. Deterioration of ambient (existing) air quality?

Yes	No	No, with Mitigation	Data Insufficient

c. The creation of objectionable odors?

Yes	No	No, with Mitigation	Data Insufficient

d. Alteration of air movement, moisture or temperature, or any change in climate, either locally or regionally?

Yes	No	No, with Mitigation	Data Insufficient

e. Increased use of diesel fuel?

Yes	No	No, with Mitigation	Data Insufficient

3 Water Quality

Will the proposal result in:

a. Changes in currents, or the course or direction of water movements?

Yes	No	No, with Mitigation	Data Insufficient

b. Changes in absorption rates, drainage patterns, or the rate and amount of surface water runoff so that a 20 yr. 1 hr. storm runoff (approximately 1 inch per hour) cannot be contained on the site?

Yes	No	No, with Mitigation	Data Insufficient

c. Alterations to the course or flow of 100-year flood waters?

Yes	No	No, with Mitigation	Data Insufficient

d. Change in the amount of surface water in any water body?

Yes	No	No, with Mitigation	Data Insufficient

e. Discharge into surface waters, or in any alteration of surface water quality, including but not limited to temperature, dissolved oxygen or turbidity?

Yes	No	No, with Mitigation	Data Insufficient

f. Alteration of the direction or rate of flow of groundwater?

Yes	No	No, with Mitigation	Data Insufficient

g. Change in the quantity of groundwater, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?

Yes	No	No, with Mitigation	Data Insufficient

h. Substantial reduction in the amount of water otherwise available for public water supplies?

Yes	No	No, with Mitigation	Data Insufficient

i. Exposure of people or property to water related hazards such as flooding and/or wave action from 100-year storm occurrence or seiches?

Yes	No	No, with Mitigation	Data Insufficient

j. The potential discharge of contaminants to the groundwater or any alteration of groundwater quality?

Yes	No	No, with Mitigation	Data Insufficient

4 Vegetation

Will the proposal result in:

a. Removal of native vegetation in excess of the area utilized for the actual development permitted by the land capability/IPES system?

Yes	No	No, with Mitigation	Data Insufficient

b. Removal of riparian vegetation or other vegetation associated with critical wildlife habitat, either through direct removal or indirect lowering of the groundwater table?

Yes	No	No, with Mitigation	Data Insufficient

c. Introduction of new vegetation that will require excessive fertilizer or water, or will provide a barrier to the normal replenishment of existing species?

Yes	No	No, with Mitigation	Data Insufficient

d. Change in the diversity or distribution of species, or number of any species of plants (including trees, shrubs, grass, crops, micro flora and aquatic plants)?

Yes	No	No, with Mitigation	Data Insufficient

e. Reduction of the numbers of any unique, rare or endangered species of plants?

Yes	No	No, with Mitigation	Data Insufficient

f. Removal of streambank and/or backshore vegetation, including woody vegetation such as willows?

Yes	No	No, with Mitigation	Data Insufficient

g. Removal of any native live, dead or dying trees 30 inches or greater in diameter at breast height (dbh) within TRPA's Conservation or Recreation land use classifications?

Yes	No	No, with Mitigation	Data Insufficient

h. A change in the natural functioning of an old growth ecosystem?

Yes	No	No, with Mitigation	Data Insufficient

5 Wildlife

Will the proposal result in:

a. Change in the diversity or distribution of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms, insects, mammals, amphibians or microfauna)?

Yes	No	No, with Mitigation	Data Insufficient

b. Reduction of the number of any unique, rare or endangered species of animals?

Yes	No	No, with Mitigation	Data Insufficient

c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?

Yes	No	No, with Mitigation	Data Insufficient

d. Deterioration of existing fish or wildlife habitat quantity or quality?

Yes	No	No, with Mitigation	Data Insufficient

6 Noise

Will the proposal result in:

a. Increases in existing Community Noise Equivalency Levels (CNEL) beyond those permitted in the applicable Plan Area Statement, Community Plan or Master Plan?

Yes	No	No, with Mitigation	Data Insufficient

b. Exposure of people to severe noise levels?

Yes	No	No, with Mitigation	Data Insufficient

c. Single event noise levels greater than those set forth in the TRPA Noise Environmental Threshold?

Yes	No	No, with Mitigation	Data Insufficient

7 Light and Glare

Will the proposal:

a. Include new or modified sources of exterior lighting?

Yes	No	No, with Mitigation	Data Insufficient

b. Create new illumination which is more substantial than other lighting, if any, within the surrounding area?

Yes	No	No, with Mitigation	Data Insufficient

c. Cause light from exterior sources to be cast off - site or onto public lands?

Yes	No	No, with Mitigation	Data Insufficient

d. Create new sources of glare through the siting of the improvements or through the use of reflective materials?

Yes	No	No, with Mitigation	Data Insufficient

8 Land Use

Will the proposal:

a. Include uses which are not listed as permissible uses in the applicable Plan Area Statement, adopted Community Plan, or Master Plan?

Yes	No	No, with Mitigation	Data Insufficient

b. Expand or intensify an existing non-conforming use?

Yes	No	No, with Mitigation	Data Insufficient

9 Natural Resources

Will the proposal result in:

a. A substantial increase in the rate of use of any natural resources?

Yes	No	No, with Mitigation	Data Insufficient

b. Substantial depletion of any non-renewable natural resource?

Yes	No	No, with Mitigation	Data Insufficient

10 Risk of Upset

Will the proposal:

a. Involve a risk of an explosion or the release of hazardous substances including, but not limited to, oil, pesticides, chemicals, or radiation in the event of an accident or upset conditions?

Yes	No	No, with Mitigation	Data Insufficient

b. Involve possible interference with an emergency evacuation plan?

Yes	No	No, with Mitigation	Data Insufficient

11 Population

Will the proposal:

a. Alter the location, distribution, density, or growth rate of the human population planned for the Region?

Yes	No	No, with Mitigation	Data Insufficient

b. Include or result in the temporary or permanent displacement of residents?

Yes	No	No, with Mitigation	Data Insufficient

12 Housing

Will the proposal:

a. Affect existing housing, or create a demand for additional housing?

To determine if the proposal will affect existing housing or create a demand for additional housing, please answer the following questions:

(1) Will the proposal decrease the amount of housing in the Tahoe Region?

Yes	No	No, with Mitigation	Data Insufficient

(2) Will the proposal decrease the amount of housing in the Tahoe Region historically or currently being rented at rates affordable by lower and very-low-income households?

Yes	No	No, with Mitigation	Data Insufficient

Number of Existing Dwelling Units _____

Number of Proposed Dwelling Units _____

b. Will the proposal result in the loss of housing for lower-income and very-low-income households?

Yes	No	No, with Mitigation	Data Insufficient

13 Transportation/Circulation

Will the proposal result in:

a. Generation of 100 or more new daily vehicle trip ends (DVTE)?

Yes	No	No, with Mitigation	Data Insufficient

b. Changes to existing parking facilities, or demand for new parking?

Yes	No	No, with Mitigation	Data Insufficient

c. Substantial impact upon existing transportation systems, including highway, transit, bicycle or pedestrian facilities?

Yes	No	No, with Mitigation	Data Insufficient

d. Alterations to present patterns of circulation or movement of people and/or goods?

Yes	No	No, with Mitigation	Data Insufficient

e. Alterations to waterborne, rail or air traffic?

Yes	No	No, with Mitigation	Data Insufficient

f. Increase in traffic hazards to motor vehicles, bicyclists, or pedestrians?

Yes	No	No, with Mitigation	Data Insufficient

14 Public Services

Will the proposal have an unplanned effect upon, or result in a need for new or altered governmental services in any of the following areas?

a. Fire protection?

Yes	No	No, with Mitigation	Data Insufficient

b. Police protection?

Yes	No	No, with Mitigation	Data Insufficient

c. Schools?

Yes	No	No, with Mitigation	Data Insufficient

d. Parks or other recreational facilities?

Yes	No	No, with Mitigation	Data Insufficient

e. Maintenance of public facilities, including roads?

Yes	No	No, with Mitigation	Data Insufficient

f. Other governmental services?

Yes	No	No, with Mitigation	Data Insufficient

15 Energy

Will the proposal result in:

a. Use of substantial amounts of fuel or energy?

Yes	No	No, with Mitigation	Data Insufficient

b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?

Yes	No	No, with Mitigation	Data Insufficient

16 Utilities

Except for planned improvements, will the proposal result in a need for new systems, or substantial alterations to the following utilities:

a. Power or natural gas?

Yes	No	No, with Mitigation	Data Insufficient

b. Communication systems?

Yes	No	No, with Mitigation	Data Insufficient

c. Utilize additional water which amount will exceed the maximum permitted capacity of the service provider?

Yes	No	No, with Mitigation	Data Insufficient

d. Utilize additional sewage treatment capacity which amount will exceed the maximum permitted capacity of the sewage treatment provider?

Yes	No	No, with Mitigation	Data Insufficient

e. Storm water drainage?

Yes	No	No, with Mitigation	Data Insufficient

f. Solid waste and disposal?

Yes	No	No, with Mitigation	Data Insufficient

17 Human Health

Will the proposal result in:

a. Creation of any health hazard or potential health hazard (excluding mental health)?

Yes	No	No, with Mitigation	Data Insufficient

b. Exposure of people to potential health hazards?

Yes	No	No, with Mitigation	Data Insufficient

18 Scenic Resources/Community Design

Will the proposal:

a. Be visible from any state or federal highway, Pioneer Trail or from Lake Tahoe?

Yes	No	No, with Mitigation	Data Insufficient

b. Be visible from any public recreation area or TRPA designated bicycle trail?

Yes	No	No, with Mitigation	Data Insufficient

c. Block or modify an existing view of Lake Tahoe or other scenic vista seen from a public road or other public area?

Yes	No	No, with Mitigation	Data Insufficient

d. Be inconsistent with the height and design standards required by the applicable ordinance or Community Plan?

Yes	No	No, with Mitigation	Data Insufficient

e. Be inconsistent with the TRPA Scenic Quality Improvement Program (SQIP) or Design Review Guidelines?

Yes	No	No, with Mitigation	Data Insufficient

19 Recreation:

Does the proposal:

a. Create additional demand for recreation facilities?

Yes	No	No, with Mitigation	Data Insufficient

b. Create additional recreation capacity?

Yes	No	No, with Mitigation	Data Insufficient

c. Have the potential to create conflicts between recreation uses, either existing or proposed?

Yes	No	No, with Mitigation	Data Insufficient

d. Result in a decrease or loss of public access to any lake, waterway, or public lands?

Yes	No	No, with Mitigation	Data Insufficient

20 Archaeological/Historical

a. Will the proposal result in an alteration of or adverse physical or aesthetic effect to a significant archaeological or historical site, structure, object or building?

Yes	No	No, with Mitigation	Data Insufficient

b. Is the proposed project located on a property with any known cultural, historical, and/or archaeological resources, including resources on TRPA or other regulatory official maps or records?

Yes	No	No, with Mitigation	Data Insufficient

c. Is the property associated with any historically significant events and/or sites or persons?

Yes	No	No, with Mitigation	Data Insufficient

d. Does the proposal have the potential to cause a physical change which would affect unique ethnic cultural values?

Yes	No	No, with Mitigation	Data Insufficient

e. Will the proposal restrict historic or pre-historic religious or sacred uses within the potential impact area?

Yes	No	No, with Mitigation	Data Insufficient

21 Findings of Significance.

a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California or Nevada history or prehistory?

Yes	No	No, with Mitigation	Data Insufficient

b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time, while long-term impacts will endure well into the future.)

Yes	No	No, with Mitigation	Data Insufficient

c. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environmental is significant?)

Yes	No	No, with Mitigation	Data Insufficient

d. Does the project have environmental impacts which will cause substantial adverse effects on human being, either directly or indirectly?

Yes	No	No, with Mitigation	Data Insufficient

III CERTIFICATION

I hereby certify that the statements furnished above and in the attached exhibits present the data and information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

Signature of Person Completing this Form *Date*

WRITTEN COMMENTS:(use additional sheets as necessary)

IV DETERMINATION (TO BE COMPLETED BY TRPA)

On the basis of this evaluation:

a. The proposed project could not have a significant effect on the environment and a finding of no significant effect shall be prepared in accordance with TRPA's Rules of Procedure.

Yes	No

b. The proposed project could have a significant effect on the environment, but due to the listed mitigation measures which have been added to the project, could have no significant effect on the environment and a mitigated finding of no significant effect shall be prepared in accordance with TRPA's Rules and Procedures.

Yes	No

c. The proposed project may have a significant effect on the environment and an environmental impact statement shall be prepared in accordance with this chapter and TRPA's Rules of Procedure.

Yes	No

Signature of Evaluator *Date*

Title of Evaluator

ADDENDA

FOR

TRANSFERS/CONVERSIONS OF USE

THE FOLLOWING IS TO BE USED AS A SUPPLEMENTAL CHECKLIST FOR THE TAHOE REGIONAL PLANNING AGENCY INITIAL ENVIRONMENTAL CHECKLIST (IEC). IT IS TO BE USED WHEN REVIEWING ANY TRANSFER PURSUANT TO CHAPTER 34 OF THE CODE OR CONVERSION OF USE PURSUANT TO CHAPTER 33 OF THE CODE. ANY QUESTION ANSWERED IN THE AFFIRMATIVE WILL REQUIRE WRITTEN DOCUMENTATION THAT THE IMPACTS ARE MITIGATED TO A LESS THAN SIGNIFICANT LEVEL OR ADDITIONAL ENVIRONMENTAL DOCUMENTATION SUCH AS AN ENVIRONMENTAL ASSESSMENT OR AN ENVIRONMENTAL IMPACT STATEMENT WILL BE REQUIRED. THE ASTERISK (*) NOTES THRESHOLD SUBJECTS.

a) Land*
Does the proposal result in any additional land coverage?

Yes	No	No, with Mitigation	Data Insufficient

b) Air Quality*
Does the proposal result in any additional emission?

Yes	No	No, with Mitigation	Data Insufficient

c) Water*
Does the proposal result in any additional discharge that is in violation of TRPA discharge standards?

Yes	No	No, with Mitigation	Data Insufficient

d) Does the proposal result in an increase in the volume of discharge?

Yes	No	No, with Mitigation	Data Insufficient

e) Noise*
Does the proposal result in an increase in Community Noise Equivalency Level (CNEL)?

Yes	No	No, with Mitigation	Data Insufficient

f) Aesthetics*
Does the proposal result in blockage of significant views to Lake Tahoe or an identified visual resource?

Yes	No	No, with Mitigation	Data Insufficient

g) Recreation*
Does the proposal result in a reduction of public access to public recreation areas or public recreation opportunities?

Yes	No	No, with Mitigation	Data Insufficient

h) Land Use
Is the use converted or transferred result in a use that is not consistent with the goals and policies of the Community Plan or Plan Area Statement?

Yes	No	No, with Mitigation	Data Insufficient

i) Population
Does the proposal result in an increase in the existing or planned population of the Region?

Yes	No	No, with Mitigation	Data Insufficient

j) Housing
Does the proposal result in the loss of affordable housing?

Yes	No	No, with Mitigation	Data Insufficient

k) Transportation
Does the proposal result in the increase of 100 daily vehicle trip ends (DVTE)?

Yes	No	No, with Mitigation	Data Insufficient

l) Does the proposal result in a project that does not meet the parking standards?

Yes	No	No, with Mitigation	Data Insufficient

m) Utilities
Does the proposal result in additional water use?

Yes	No	No, with Mitigation	Data Insufficient

n) Does the proposal result in the need for additional sewer treatment?

Yes	No	No, with Mitigation	Data Insufficient

o) Historical
Does the proposal result in the modification or elimination of a historic structure or site?

Yes	No	No, with Mitigation	Data Insufficient

I hereby certify that the statements furnished above and in the attached exhibits present the data and information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

Signature of Person Completing this Form	*Date*

WRITTEN COMMENTS: (use additional sheets as necessary)

TRPA Guidelines for Applying for a TRPA Permit for a Linear Public Service Project

TAHOE REGIONAL PLANNING AGENCY

LINEAR PUBLIC SERVICE PROJECT INFORMATION SHEET AND CHECKLIST

How To Apply for a Tahoe Regional Planning Agency Permit

This packet explains the Tahoe Regional Planning Agency (TRPA) permit process for new linear public service projects, additions, modifications, or rebuilds. Please read the packet thoroughly. We hope it answers most of your questions. If you have questions which are not answered here, please call TRPA at (775) 588-4547. Planners are available to assist you by phone or at the Reception Desk Monday through Friday, 9:00 a.m. to 5:00 p.m. TRPA accepts applications from 9:00 a.m. to 4:00 p.m.

Please be aware that we may require information beyond that presented in this packet. Once your application is submitted, TRPA will contact you if additional information is required to adequately review your project.

Getting Started

Before starting your application, you must determine if the project you are proposing requires TRPA review. Some linear public service activities, such as minor structural repairs or less than seven cubic yards of grading, may be considered "Exempt" or "Qualified Exempt" from TRPA review. An Exempt/Qualified Exempt Activity Reference Guide is available from TRPA. This guide and other TRPA documents can be viewed on TRPA's website (http://www.trpa.org). Generally, projects which involve the creation or relocation of land coverage or are considered scenic properties require a permit. If you have questions regarding the need for a permit, please contact TRPA.

TRPA reviews each project as quickly and efficiently as possible. Your application can make a difference in how we serve you. To do so, we ask that you do your homework. Your homework consists of several steps, all of which are critical to submitting an application with the necessary information for review. Applications which do not contain all necessary information for review may be rejected. Refer to the linear public service application checklist included in this packet for a complete list of the items that must be submitted before TRPA can review your project. Please look at the items listed below before submitting the application. All the items on the checklist must be addressed in your project submittal. Project applications without all the items on the checklist will not be accepted for review by TRPA. In addition to the TRPA requirements, the project application should also include any local jurisdiction standards. Incorporating the local jurisdiction standards into your plans will avoid costly plan revisions at a later date.

If your proposed project requires TRPA review, a land capability verification for the property must be completed by TRPA prior to application submittal. A land capability verification may have already been completed if a permit was issued for your parcel since July 1987. A land capability verification application is available at TRPA. You may also use an approved set of plans from after July of 1987 as your coverage and land capability verification. In some cases you may need to have a partial site assessment if both verifications have not been completed.

If you have an active permit from TRPA you may revise your project through the plan revision process using this application packet. An approved plan revision, however, will be tied to the original permit expiration date.

Prior to Application Submittal

☑ Check the Community Plan or Plan Area Statement. The Community Plan or the Plan Area Statement (PAS) lists the permissible uses allowed for your project. The Community Plan or the PAS may also have specific design criteria that will need to be incorporated into your project.

☑ Determine if the Project is on the Environmental Improvement Program (EIP) Project List. If the project is listed on the EIP list TRPA will be involved in the planning and permitting process at the very beginning stages. Once you have determined your project idea and prior to applying for funding, initiate an Initial Scoping meeting with the TRPA. This will ultimately save time and help plan out the project to avoid costly schedule and plan changes later on in the process. Contact the TRPA Environmental Improvement Division for additional information.

☑ Review the TRPA development standards. If you have questions regarding land coverage, height, excavation, or other TRPA standards, some basic information is in the Master Checklist/Design Criteria and Guidelines document. Contact TRPA or your local building department for additional information.

☑ Prepare a Site Plan with Topographic Survey. If you plan to submit a project application, you must have a Topographic Survey prepared including all of the existing site information listed on the enclosed checklist. This survey will be required when applying for a site assessment or land capability verification. It will also be required for your project application.

☑ Complete a Scenic Impact Assessment Form. You must complete a Scenic Impact Assessment Form for your project included in this packet. If your parcel is visible from a TRPA designated scenic roadway or resource, additional items may be required to be submitted with your application. Projects located in the *shoreland* will require a Shoreland Scenic Assessment of the Scenic Quality Baseline Conditions prior to review of the project.

☑ Have your land capability verified. The land capability verification will determine if your parcel is considered "sensitive" or "non-sensitive" in accordance with the TRPA Code of Ordinances. Parcels that have been identified as "sensitive" have development restrictions that may affect the project you are proposing. The land capability verification will also determine the allowable land coverage for your parcel which will be needed in designing your project.

☑ Existing Coverage Verification. If your project involves the creation or relocation of coverage, you may want to have your existing coverage verified prior to beginning your project design. The verification will only recognize existing coverage that was legally established or existing prior to 1972. Conducting this process prior to design will alleviate unnecessary delays and costs later on in the process

☑ Complete the Change in Operation Form. This form is required for any type of change in operation and is located in this packet. This form determines the number of daily vehicle trip ends (dvte) that are associated with your project. If your project generates more than 100 new dvte in the south shore of Lake Tahoe or 200 dvte around the rest of the lake, a traffic analysis may be required. Please contact TRPA if you project generates more than amount of dvtes required for a traffic analysis regarding what information will be needed for the review of your project.

☑ Complete the Initial Environmental Checklist (IEC). The IEC evaluates the potential environmental impacts of your project on the environment. Based on the results of the IEC and the other application materials, TRPA will make a determination on the need for additional environmental documentation for your project.

☑ Complete a Scenic Impact Assessment Form. The scenic site assessment process will help to determine the level of scenic analysis your project may require. If your parcel is visible from a TRPA designated scenic corridor or resource, additional items may be required to be submitted with your application. Projects located in the *shoreland* will require assessment of the Scenic Quality Baseline Conditions prior to review of the project. This assessment requires submittal of a separate application prior to the project application. A related scenic assessment for the proposed conditions will be required to be submitted concurrent with the proposed project application.

☑ Complete the appropriate forms. The Project Review application form must be completed, and all checklist items provided. For additional information about checklist items, refer to the TRPA Application Checklist Reference. Note that checklist item numbers may not be sequential; not all checklist items found in the TRPA Application

Checklist Reference apply to all projects. In addition to the Project Review application form and checklist, a Scenic Impact Assessment form (or a completed Scenic Assessment Application) must be submitted with each application. Please be advised that a soils/hydrologic report will also be required for your project if the proposed excavation exceeds 5 feet in depth.

☑ Obtain the required signatures. The property owner or authorized representative must sign the application and, if applicable, complete and sign the Authorization For Representation. Forms without an original signature from the property owner will not be accepted. **Faxed signatures and xerox copies will not be accepted.**

☑ Review Applicable Findings. TRPA staff must be able to make applicable findings related to your project in order to recommend approval. Contained within this packet is a table of possible findings that may be applicable to your project. It is now required that the applicant submit explanations and rationale to TRPA specific to each finding that will be required to be made. You may want to review the applicable findings in the beginning of the planning stages to allow for adjustments to the project design if necessary in order to allow TRPA to make required findings. This procedure is explained in more detail within this packet.

☑ Pre-application Project Review. Depending on the magnitude of your project and the IEC information, you may want to schedule a pre-application meeting with TRPA staff or the local jurisdiction if they are conducting the TRPA review. A Pre-Application Schedule Request is available at TRPA or the local jurisdiction. This meeting will assist with identifying the need for special environmental studies such as Cultural Resources, Biological Resources, Jurisdictional Waters issues, etc. This will also help identify other submittal items that may be required or other issues that should be addressed. Providing as much information as possible at the time of your project submittal will help alleviate delays through the process.

Required Findings

Purpose: The Tahoe Regional Planning Compact requires TRPA to make findings before taking certain actions. In addition, the Regional Plan package, including the Code of Ordinances and Plan Area Statements, sets forth other findings which must be made. TRPA Code of Ordinances Chapter 6 sets forth procedures describing how TRPA shall make the findings required. Applicable findings with the appropriate TRPA Code of Ordinance Section are shown in the Findings Table in this information packet. You only need to provide explanation as to why the finding can be made for particular findings applicable to your project.

Applicability: Prior to approving any project or taking any other action specified herein, TRPA shall make the findings required by the provisions of the Regional Plan package, including the Goals and Policies, the Code, and specifically Chapter 6 and any other requirement of law. All such findings shall be made in accordance with Chapter 6 of the TRPA Code of Ordinances.

Procedure For Findings: Findings shall be made as follows:

Written Findings: All required findings shall be in writing and shall be supported by substantial evidence in the record of review. The findings required shall be submitted with the application. TRPA must concur with the findings prior to the approval of the proposed matter.

Statement: Required findings shall be accompanied by a brief statement of the facts and rationales upon which they are based

Example Finding:

20.3.B(4) Linear Public Facilities And Public Health And Safety Facilities: The maximum land coverage (base coverage plus transferred coverage) for linear public facilities and public health and safety facilities

is limited to the minimum amount needed to achieve their public purpose. Such transfer may be permitted, provided TRPA makes the following **findings**:

(a) The project is on the list of additional public service facilities if required pursuant to Section 33.5;

(b) There is no feasible alternative that would reduce land coverage;

(c) The project, because of its unusual configuration or service requirement, requires special consideration; and

(d) The facility primarily serves the needs of persons other than those who are, or will be, residents of the lands in question, or the owners of the land in question.

Finding Rationale

(a) The project is on the list of additional public service facilities.

(b) The land coverage is necessary to construct a public road within a public right of way to provide access to existing single family residences. The road must constructed to meet County standards which are wider than the existing dirt access to the existing single family residences. Therefore, there is no feasible alternative to reduce the amount of land coverage required to meet County road standards and provide the necessary access for emergency equipment.

(c) The project is required to serve existing residential properties with adequate access to their property as well as emergency equipment. Because of this public health and safety issue requiring adequate access for emergency vehicles this project requires special consideration for the transfer of additional coverage.

(d) The land in question is owned by the County as a public right of way. This road will serve the primary needs of property owners adjacent to this right of way and not the County. There are no residents within the County right of way.

PERMIT PROCESS

Complete Application

If your project application addresses all items on the checklist, your application will be accepted by TRPA. Within 30 days of submittal, TRPA staff will review an application for completeness. If additional items are needed, a letter will be sent to you and/or your representative indicating what additional information is needed to provide a complete application. If the application is determined to be complete, a notice will be sent to you or your representative. Once complete, your application is now ready to be reviewed by TRPA staff for conformance with TRPA rules and regulations. A complete application notice is NOT a conceptual approval of your application, nor is it a determination that the information submitted for review is accurate or approvable.

Request for Additional Information

Once review has begun on your project, additional information may still be required. TRPA staff attempt to identify all information needed to review a project at the "complete application" stage, however, some items can not be identified until the review of the project has commenced. If additional information is required, you and your representative will be notified.

Project Review

The amount of time to process an individual application depends on the complexity of the project and the number of applications submitted to TRPA or the local jurisdiction for review. Submitting a clear and accurate application can speed the processing time through TRPA or the local building department. The time of year you submit your application can also influence the processing time. The summer building season is very hectic and tends to lengthen the processing time for an individual application. During winter, the presence of snow on the ground may limit TRPA's ability to evaluate the site if necessary. You are strongly encouraged to submit your application(s) well in advance of the building season. Ideally, submit your application the winter prior to the year in which you wish to build.

TRPA Review: TRPA has three review levels for projects; staff level, Hearings Officer and Governing Board. The large number of linear public service projects can be reviewed at staff level. The TRPA Governing Board typically only reviews linear public service projects identified as a "special use" in the plan area statement. The Governing Board meets once a month and projects are scheduled for the next available Governing Board hearing once the review of the project has been completed. Hearings Officer meets twice per month as needed.

Conditional Permit

Once review of your project is complete, TRPA staff will issue a conditional permit. A conditional permit is an approval of your project subject to specific conditions. The conditional permit is based on the application and plans you submitted to TRPA for review.

Final Permit Acknowledgement

Once all the conditions of the permit have been met, TRPA will provide the final acknowledgment of the permit and stamp the submitted plans. You must schedule an appointment with the TRPA planner who issued the permit to acknowledge your permit and stamp your plans. Your permit will not be acknowledged unless you have met all of the special conditions outlined on your conditional permit.

The conditional permit is valid for three years. Within the three year time period, you must demonstrate that all the conditions of approval have been met, pay any required mitigation fees, provide a project security to TRPA, acknowledge the permit, schedule and complete a TRPA pregrading (pre-construction) inspection and begin construction. Your project must be completed within two years from the date of the TRPA pregrading inspection.

Once you have received your acknowledged TRPA permit and stamped plans, review by your local jurisdiction will still be required for structural standards and other local requirements. Please check with your local building and planning departments for their processing requirements.

Mitigation Fees

Required mitigation fees, if any, will be collected by the reviewing jurisdiction.

Water quality: Water quality mitigation fees are based on the amount of new land coverage being created by your project. The fee is calculated at $1.54 per square foot of new land coverage. These fees are non-refundable. Water quality mitigation fees are held in a fund for use by local jurisdictions for major erosion control and water quality improvement projects. Refer to TRPA Code of Ordinances Section 83.3 for additional information.

Air quality: An air quality mitigation fee is required for any new commercial floor area or sometimes a change in use requiring additional daily vehicle trip ends (dvte). For new commercial floor area the fee is $30 per dvte. Contact TRPA for information on how to calculate dvtes for your project. This money is held in a fund for use by local jurisdictions for transit and other projects that improve air quality. Refer to TRPA Code of Ordinances Section 93.3.D for additional information.

Off-site land coverage: Off-site coverage mitigation fees are based on the amount of land coverage created in the public right-of-way as a result of your project. This fee is calculated at **$6.50 in California and $12.00 in Nevada** per square foot of new land coverage. As with the water quality fees, this money is held in a fund for use by local jurisdictions for erosion control and water quality improvement projects.

Excess land coverage: Excess land coverage is the amount of legally created land coverage existing within your project area that exceeds the base allowable land coverage. Not all parcels will have excess land coverage. Excess land coverage can be mitigated several ways: through a mitigation fee, by reducing land coverage on or off site, or by expanding the project area. The mitigation fee is based on the amount of excess land coverage on your parcel and the estimated construction cost of your project. The minimum excess land coverage mitigation fee is $200 per project. Refer to TRPA Code of Ordinances section 20.5 for additional information.

For information on specific projects funded by mitigation fees, please request a TRPA Annual Report.

Project Security

A project security will be collected by the reviewing jurisdiction. In most cases, the project security will be based on 110% of the cost of all required BMPs. Securities may also be required to ensure compliance with specific conditions of project approval. A security can be posted in several ways: a certificate of deposit, a hold on a personal savings account, a letter of credit, an assignment of personal savings account, a bond (only if security is estimated over $10,000), or cash. A nominal, non-refundable security administrative fee is required for all securities. The security plus any interest accrued will be returned upon a final inspection of the completed project. Contact TRPA to schedule a final inspection. Review Attachment J in the Master Findings/Design Guidelines document for additional information.

Plan Revisions

You may revise your original approval by requesting a plan revision. An approved plan revision, however, will be tied to the original permit expiration date and the conditions of the original approval. A minor plan revision generally involves small changes that do not include modifications to land coverage or the exterior dimensions of a structures. A major plan revision generally includes changes to land coverage or height calculations. Check the TRPA fee schedule for the appropriate fee amount.

Pregrading (Pre-construction) Inspection

Before you begin construction of your project, you must arrange a pregrading inspection. Contact the TRPA Environmental Compliance Division to arrange a pre-grade inspection. In some cases, the pregrading inspection

may be done via telephone. Prior to scheduling your inspection, you must have obtained all necessary TRPA and local approvals. All temporary Best Management Practices (BMPs) must be installed prior to Pregrading Inspection.

Linear Public Service Project Required Findings Table

Include an attached Written Statement and rationale for making each finding as applicable to the project proposal. Refer to the TRPA Master Findings Document to complete this portion of the application.

Applicability	Code Section
Extensions	
Approval of Time Extension	4.9.E
Environmental Document	
Environmental Impact Statement	5.2.B
Environmental Assessment	5.3
No Significant Effect	5.6
No Significant Effect - Mitigated	5.7
Finding Necessary to Approve Any Project	6.3.A
Permissible Uses	
Special Use	18.1.B
Nonconforming Use	18.1.C
Determination of Accessory Use	18.2.E
Threshold Related Research Facilities	18.2.G
Land Coverage Transfer	
Land Coverage Transfer for Linear Public Service & Public Health & Safety	20.3.B(4)
Highways, Streets and Roads	20.3B(5)
Exceptions for Transfer in Land Capability 1-3	20.4.A(3)
Water Quality Control Facilities	20.4.A(4)
Land Coverage for Stream/SEZ Crossings	20.4.B(1)
Land Coverage for Public Service in the SEZ	20.4.B(3)
Land Coverage for Water Quality Control Facilities in the SEZ	20.4.B(4)
Excess Land Coverage Mitigation Program	
Projects Within Community Plans	20.5.A(2)(e)
Relocation of Land Coverage	20.5.C
Infiltration Requirements Waiver	25.5.A(1)
Signage	
Signs in Commercial and Public Service Plan Areas	26.10.B(6)
Removal of Nonconforming Signs	26.14.C(10)
Paved Road Waiver	27.2
Water Supply Waiver	27.3.B(2)
Development, Grading and Filling in 100-Year Flood Plain	28.3.B(2), (3) and (4)
Historic Resource Protection	
Historic Resources Demolition	29.6.C
Exceptions for Historical Structures	29.7
Design Standards	
Undergrounding of Utilities Exceptions	30.13.C(1)
Additional Visual Magnitude	30.15.G(2)
Allocation of Development	
Additional Public Service Facilities	33.5.A

Applicability	Code Section
Grading Standards	
Grading Season Exceptions	64.2.B
Excavation Limitations	64.7.A and B
Tree Removal	
Conservation Standards and Recreation Lands	71.2A
General Standards	71.3.A
Logging Roads and Skid Trails	71.4.D
Tree Removal for Ski Areas and Rights-Of-Way	71.5.E
Fish Resources	
Stream Habitat	79.2.B
Water Quality Mitigation	
Mitigation Projects	82.2.A
Exemptions	82.4
Possible Contaminating Activities in Source Water Protection Zones	83.2.D

Change in Operation

A Change in Operation (CIO) form is required to be submitted for all non-residential projects and for some qualified exempt activities. A worksheet is attached to the CIO form to aid you in calculating the number of existing and proposed vehicle trips associated with your project. **Please note that any additional vehicle trips are required to be mitigated.**

The following items will help you determine the type of review that is required for your activity. Please keep in mind that **if any changes to land coverage, number of units proposed on a site, or additions or modifications to commercial floor area are being proposed, a TRPA permit will be required no matter how many vehicle trips are generated.** All proposed uses must be permissible in the plan area/community plan for the project site.

- If your proposed activity generates less than 100 additional vehicle trips, your activity is an allowed use in the plan area/community plan, and you are not changing from one major use classification to another (example: residential to commercial or commercial to tourist accommodation) then your activity is considered "qualified exempt". Please see the Qualified Exempt/Exempt Information Packet for appropriate declaration forms.
- If your proposed activity generates less than 100 additional vehicle trips, but you are doing major modifications to existing structures, adding commercial floor area, modifying the existing land coverage or changing from one major use classification to another, your activity is considered a project and requires a TRPA permit. You will need to complete the CIO form and submit the appropriate application to TRPA.
- If you proposed activity generates more than 100 additional vehicle trips but less than 200 additional vehicle trips, the activity is considered a project and requires a TRPA permit. A traffic analysis will be required if your project is located within 300 feet of U.S. Highway 50 or is located within the urbanized portions of Douglas and El Dorado Counties (air quality non-attainment areas). TRPA staff can provide the minimum traffic analysis requirements and can help you determine if your project is located within an air quality non-attainment area. A completed CIO form must be submitted regardless of whether or not a traffic analysis is required.
- If your proposed activity generates more than 200 additional vehicle trips, the activity is considered a project and requires a TRPA permit. A traffic analysis is required along with the completed CIO form.

A CIO form and worksheet to help you calculate the vehicle trips associated with your activity is found on the following pages.

Change in Operation Form

Name of Project: _____

Location of Project: _____

Assessor's Parcel Number: _____

Previous Use At Proposed Project Site

Previous Project Description: _____

_____

_____

_____

Gross Floor Area: _____ sq. ft.

Business Days and Hours: _____

# of Employees: _____

# of Business Vehicles: _____

# of Vehicle Trips Associated With Project: _____

Date Previous Use Terminated: _____

Proposed Use At Project Site

Proposed Project Description: _____

_____

_____

_____

Gross Floor Area: _____ sq. ft.

Business Days and Hours: _____

# of Employees: _____

# of Business Vehicles: _____

# of Vehicle Trips Associated With Project: _____

Change In Operation Form Worksheet

Locate the trip rate which best fits the proposed and previous or existing operations of the project site from the Trip Table located in the Master Design Checklist/Design Criteria and Guidelines. In cases where the two rates are listed, the rate generating the most vehicle trips ("worst-case") shall be used.

The existing use of the property is an important factor in calculating the number of vehicle trips associated with the new activity. The previous use for the property must have been operating 90 consecutive days within the past 24 months to receive credit for the previous vehicle trips.

Example: Jane has bought Tom's Discount Clothing Store and wants to develop a restaurant. The existing square footage for the building is 1,225 square feet and the proposed square footage is 1,500 square feet.

Previous Use:	Tom's discount Clothing Store (Discount Stores)	Trip Table Rate:	70.13/1000 s.f.
Proposed Use:	Jane's Italian Restaurant (High turnover Restaurant)	Trip Table Rate:	205.36/1000 s.f.

Previous Trips = $\frac{70.13 \times 1,225}{1,000} = 85.91$ Proposed Trips = $\frac{205.35 \times 1,500}{1,000} = 308.04$

308.4 – 85.91 = 222.13 additional vehicle trips are generated

---

Trip Rate Calculations:

Previous use: _____

Trip rate for previous use (from table)_____

Previous gross floor area: _____

Total vehicle trips for previous use:_____

Proposed use:_____

Trip rate for proposed use (from table) _____

Proposed gross floor area:_____

Total vehicle trips for proposed use: _____

*Net Change in Vehicle Trips:*_____

_____

TRPA SCENIC IMPACT ASSESSMENT FORM

Assessor's Parcel Number(s): _____

Property Address: _____

Property Owner(s): _____

Mailing Address: _____

_____

Phone: _____

Applicant's Authorized Representative: _____

I have reviewed the TRPA scenic corridors, recreation areas and bikeways and have determined that the above referenced parcel(s) is:

_____ **visible from** _____

_____ **not visible.**

Print Name: _____ Date: _____

Signature of Property Owner or Authorized Agent: _____

Project Application Checklist

If either the parcel or proposed project is visible from a scenic corridor, recreation area or bikeway, the following information shall be submitted to TRPA along with the project application. Refer to the TRPA Master Checklist for and explanation of each item.

_____ 4a. Photographs from scenic corridor, recreation area or bikeway location to project area, clearly showing all existing development within the project area.

_____ 4b. Color and material samples for proposed structures.

_____ 4c. Preliminary landscape plan (can be included on the submitted site plan).

_____ 4d. Written discussion of proposed scenic mitigation measures.

TRPA staff will determine the necessity for additional scenic analysis from the review of the submitted items and based on the staff field visit to the site.

Scenic Corridors, Recreation Areas & Bikeways

Scenic Corridors

Lake Tahoe
State Route 89
State Route 431
State Route 28
State Route 207
Pioneer Trail
U.S. Highway 50
State Route 267

Scenic Recreation Areas

Nevada Beach
Sand Harbor
Incline Beach
Agatam Beach
Lake Forest Beach
Tahoe City Commons Beach
Kaspian Recreation Area
Sugar Pine Point State Park
Vikingsholm, Emerald Bay Picnic Area
Fallen Leaf Lake Campground
Kiva Picnic Area/Tallac Historic Site
El Dorado Beach and Campground
Zephyr Cove
Hidden Beach
Burnt Cedar Beach
Patton Beach
Lake Forest Campground/Boat Ramp
William Kent Beach & Campground
Ski Homewood/Tahoe Ski Bowl
Meeks Bay Campground
Eagle Falls Picnic Area
Baldwin Beach
Camp Richardson
Heavenly Valley Ski Resort
Cave Rock
Diamond Peak
Kings Beach State Park
Moondunes Beach
Tahoe State Recreation Area
Granlibakken Ski Resort
Meeks Bay Resort
D.L. Bliss State Park
Eagle Point Campground
Taylor Creek
Pope Beach
Reagan Beach

Bikeway Segments

Tahoe City to River Ranch
Sunnyside to Timberland
City of SLT Recreation Area
Tahoe Valley to SLT City Limits
Tahoe City to Dollar Point
Timberland to Tahoe Pines
Al Tahoe Boulevard
City of SLT to Tallac Creek
Tahoe Tavern
Tahoe Pines to Tahoma
Tahoe Valley Route

Copies of the specific threshold ratings for all scenic corridor units, scenic resources, recreation areas, or bikeways listed above will be provided upon request.

LINEAR PUBLIC SERVICE APPLICATION CHECKLIST

APPLICATIONS LACKING ANY OF THE FOLLOWING ITEMS WILL NOT BE ACCEPTED. TRPA MAY REQUIRE ADDITIONAL INFORMATION, ABOVE AND BEYOND THE CHECKLIST ITEMS, TO REVIEW THIS APPLICATION.

REFER TO THE *TRPA APPLICATION CHECKLIST REFERENCE* DOCUMENT FOR ADDITIONAL EXPLANATION OF EACH CHECKLIST ITEM WITH CORRESPONDING NUMBER.

PROJECT NAME: _____

CURRENT ASSESSOR'S PARCEL NUMBER (APN): _____

PREVIOUS ASSESSOR'S PARCEL NUMBER (APN): _____

Applicant	TRPA		
_____	_____	1.	Completed application form with **original** signed authorization and checklist.
_____	_____	2.	Application fee
_____	_____	3.	Proof of land capability verification
_____	_____	4.	Scenic Impact Assessment Form
_____	_____	6.	Site Plan: Minimum 18" x 24" on blackline or blueline print paper showing the following:
		___ ___	a. All property lines and buildings setbacks
		___ ___	b. Map scale and north arrow
		___ ___	c. Assessor's Parcel Number (APN) and property address
		___ ___	d. Property owner's name
		___ ___	e. Parcel size in square feet
		___ ___	f. Best Management Practices (BMPs), both temporary and permanent
		___ ___	i. Topographic contour lines at 2' intervals
		___ ___	j. Verified backshore and Stream Environment Zone (SEZ) boundaries, including setbacks (if applicable)
		___ ___	k. High and low water lines (if applicable)
		___ ___	l. Verified land capability district boundaries (if more than one land capability district)

___ ___ m. Trees greater than 6” in diameter, trees to be removed indicated; any rock outcroppings.

___ ___ n. Location and dimensions of existing and proposed structures

___ ___ o. Driveway and driveway slope

___ ___ p. Edge of pavement at street(s)

___ ___ ri. Allowable land coverage by land capability district

___ ___ r.ii. Existing land coverage calculations by land capability district including a breakdown by type of coverage (i.e., buildings, decks, walks, etc.).

___ ___ r.iii. Proposed land coverage calculations by land capability district including a breakdown by type of coverage (i.e., buildings, decks, walks, etc.).

___ ___ r.iv. Identification of added and/or removed land coverage.

___ ___ s. Parking space calculations

___ ___ t. Location of signage

___ ___ u. Slope calculation across the building site

_____ _____ 7. Preliminary Building Elevations (existing and proposed) of all sides of the building(s) showing:

___ ___ a. Finished floor elevations (with respect to contour elevations shown on the site plan)

___ ___ b. Elevation of the highest roof ridge and lowest elevation of foundation wall at natural grade.

___ ___ c. Roof pitch of each roof plane.

___ ___ d. Allowed and proposed height calculations.

___ ___ e. Drawing scale and view aspect.

___ ___ f. Existing and proposed building signs.

_____ _____ 8. Preliminary Floor Plans (existing and proposed) showing:

___ ___ a. Scaled dimensions.

___ ___ b. TRPA-approved wood or gas space and/or water heaters (if applicable).

___ ___ c. All exterior entrances and exits.

_____ _____ 10. Grading Plan (proposed cut and fill).

_____ _____ 11. For projects requiring Hearings Officer or Governing Board review:

___ ____a. A list of names, addresses, and Assessor's Parcel Numbers of property owners within 300 feet of project area, addressed envelopes to same (with no return addresses), and postage (stamped not metered).

___ ____b. 8 ½" x11" reductions of site plan and building elevations.

_____ _____ 15. Initial Environmental Checklist.

_____ _____ 16. Change in Operation Form.

_____ _____ 18. Results of Soils/Hydrologic Report (if excavating beyond 5 feet in depth).

_____ _____ 36. Applicable Findings Explanation.

_____ _____ 47. Project Description.

TRPA Guidelines for Exempt or Qualified Exempt Projects

TAHOE REGIONAL PLANNING AGENCY

EXEMPT/QUALIFIED EXEMPT ACTIVITY INFORMATION SHEET & CHECKLIST

How To Apply for a Tahoe Regional Planning Agency Permit

This packet explains the process for activities that do not require a Tahoe Regional Planning Agency (TRPA) permit. Please read the packet thoroughly. We hope it answers most of your questions. If you have questions which are not answered here, please call TRPA at (775) 588-4547. Planners are available to assist you by phone or at the Reception Desk Monday through Friday, 9:00 a.m. to 5:00 p.m. TRPA accepts applications from 9:00 a.m. to 4:00 p.m.

Please be aware that we may require information beyond that presented in this packet. Once your application is submitted, TRPA will contact you if additional information is required to adequately review your project.

Where to go for additional information

For residential activities in the City of South Lake Tahoe, El Dorado County, Placer County, or Washoe County, please call the appropriate local building department:

City of South Lake Tahoe Building Department	(530) 542-6010
El Dorado County Building Department	(530) 573-3330
Placer County Building Department	(530) 581-6200
Washoe County Building Department	(775) 832-4140

If your property is located in Douglas County, is in the shorezone (e.g., piers and buoys), or involves a commercial, public service, recreation, or tourist accommodation use, please call TRPA at (775) 588-4547.

Getting Started

Before starting your application, you must determine if the project you are proposing requires a TRPA permit. There are three levels of TRPA review. Some small activities may not require TRPA review – these activities are considered "**exempt**". Other activities may require that a statement or "declaration" be filed with TRPA describing the proposal – these activities are considered "**qualified exempt**". Finally, a TRPA **permit** may be required for a project. This packet describes which activities may be completed without a TRPA permit, and the process for filing a declaration with TRPA, if necessary. Generally, projects which involve the creation or relocation of land coverage or are considered scenic properties require a permit. If you have questions regarding the need for a permit, please contact TRPA.

The packet is divided into four sections. This introductory section provides some general information about the TRPA review process and procedures for filing a qualified exempt declaration. The second section provides a list of exempt and qualified exempt activities. The third section discusses TRPA development standards that may be relevant for exempt or qualified exempt activities. Declaration forms, checklists, and worksheets are included in the last section.

TRPA reviews each project as quickly and efficiently as possible. In some cases a Qualified Exempt Declaration may be reviewed over the counter at TRPA or the local jurisdiction. To do so, we ask that you

do your homework. Your homework consists of several steps, all of which are critical to submitting an application with the necessary information for review. Applications which do not contain all necessary information for review may be rejected. Refer to the appropriate checklist included in this packet for a complete list of the items that must be submitted before TRPA can review your project. Please review items listed below before submitting the application. All the items on the checklist must be addressed in your project submittal. Project applications without the required items on the checklist may not be accepted for review by TRPA. In addition to the TRPA requirements, the project application should also include any local jurisdiction standards. Incorporating the local jurisdiction standards into your plans will avoid costly plan revisions at a later date.

Prior to Application Submittal

☑ Review the list of exempt/qualified exempt activities (pg. 3). If your proposed activity is **exempt**, you may proceed without filing a declaration or obtaining a permit from TRPA. If your proposed activity is **qualified exempt**, use this packet to file the appropriate declaration with TRPA and to determine the required fees, if any. If your proposal is not included on the list of exempt/qualified exempt activities, a permit will likely be required; *all proposals which involve the creation or relocation of land coverage require a TRPA permit*. For residential activities (excluding activities in the shorezone and properties in Douglas County), contact the appropriate local building department. Otherwise, contact TRPA for application materials.

☑ Review the TRPA development standards. If you have questions regarding land coverage, height, excavation, or other TRPA standards, some basic information is in the Master Checklist/Design Criteria and Guidelines document. Contact TRPA or your local building department for additional information.

☑ Prepare a Site Plan with Topographic Survey for Structural Remodels or Additions to Existing Buildings or if a Land Capability Verification is required on the appropriate checklist. If you plan to submit a qualified exempt declaration for a structural remodel or addition to an existing building, you must have a Topographic Survey prepared including all of the existing site information listed on the enclosed checklist. This survey will be required when applying for a site assessment or land capability verification.

☑ Have your land capability verified if required on the appropriate checklist. A land capability verification will determine if your parcel is considered "sensitive" or "non-sensitive" in accordance with the TRPA Code of Ordinances. Parcels that have been identified as "sensitive" have development restrictions that may affect the project you are proposing. A land capability verification will determine the allowable land coverage for your parcel.

☑ Complete the appropriate forms. The Qualified Exempt declaration form must be completed, and all checklist items provided. For additional information about checklist items, refer to the TRPA Application Checklist Reference. Note that checklist item numbers may not be sequential; not all checklist items found in the TRPA Application Checklist Reference apply to all projects. In addition to the Qualified Exempt declaration form and checklist, an Excess Land Coverage Mitigation Fee Worksheet may be required on the appropriate checklist for your type of activity. This will determine the appropriate Excess Coverage Mitigation fee to be paid by the applicant.

☑ Obtain the required signatures. The property owner or authorized representative must sign the application and, if applicable, complete and sign the Authorization For Representation. Forms without an

original signature from the property owner will not be accepted. **Faxed signatures and xerox copies will not be accepted.**

☑ Submit your qualified exempt declaration to the appropriate agency. For residential properties (excluding activities in the shorezone) located in the City of South Lake Tahoe, El Dorado County, Placer County, or Washoe County, submit your qualified exempt declaration to the appropriate local building department. All other qualified exempt declarations shall be submitted directly to TRPA. In most cases, your declaration must be filed at least 72 hours before you begin work.

☑ Check with the appropriate city and county agencies regarding local requirements. City and county building departments and other local agencies have their own permit and review requirements. *Make sure to obtain appropriate local approvals before beginning work.* See the Shorezone Activities section (pg. 7) for information on which agencies to contact if your activity involves construction in the shorezone.

EXEMPT AND QUALIFIED EXEMPT ACTIVITIES

DEMOLITION

Demolition of Buildings Less than 50 Years Old: Demolition of structures, improvements, or facilities, less than 50 years of age is **Exempt**, provided that any associated grading is also Exempt (see Grading section, pg. 4). To obtain credit for land coverage or existing development, TRPA verification is required prior to demolition. Verification of land coverage or existing development requires a separate application to TRPA.

Demolition of Buildings Greater than 50 Years Old: Demolition of structures, improvements, or facilities, 50 years or greater in age, is considered **Qualified Exempt** by TRPA provided that the structure, improvement, or facility is not designated, or pending for designation, on TRPA's Historic Resource Map, and the associated grading, excavation, and filling is Exempt (see Grading section, pg. 4), and *the Qualified Exempt declaration form is submitted to TRPA at least three working days prior to demolition.* To obtain credit for land coverage or existing development, TRPA verification is required prior to demolition. Verification of land coverage or existing development requires a separate application to TRPA.

Demolition of Structures in the Shorezone: See Shorezone Activities section (pg. 7).

FENCES

Fence Repair and Replacement (Non-shorezone): Repair or replacement of existing fences that are not located in Stream Environment Zones (SEZs), the backshore, or bodies of water is considered **Exempt** by TRPA provided that any associated grading does not exceed 3 cubic yards.

Fence Repair in the Shorezone: See Shorezone Activities section (pg. 7).

Construction of New Residential Fences (Non-shorezone): Construction of new residential fences is considered **Exempt** by TRPA, provided that:

- The fence is not more than six feet high;
- The fence does not obstruct the public's view of Lake Tahoe;
- The fence will not be located in a Stream Environment Zone (SEZ), the backshore, or a body of water; and

- Any associated grading, excavation, or filling is also Exempt (Grading section, pg. 4).

GRADING, EXCAVATION, AND FILLING

Grading, Excavation, or Filling Less than 3 Cubic Yards: Grading, excavation, or filling less than 3 cubic yards is considered **Exempt** by TRPA, provided that:

- The associated grading, excavation, or filling does not exceed 3 cubic yards;
- The work is completed within 48 hours;
- The site is stabilized to prevent erosion;
- The grading, excavation, or filling does not occur during periods of precipitation, when the site is covered with snow, or is in a saturated, muddy or unstable condition; and
- The grading, excavation, or filling is not part of a series of excavations that, when viewed as a whole, would require a TRPA permit.

Grading, Excavation, or Filling Less Than 7 Cubic Yards: Grading, excavation, or filling less than 7 cubic yards is considered **Qualified Exempt** by TRPA, provided that:

- The grading, excavation, or filling occurs between May 1st and October 15th;
- The grading, excavation, or filling occurs on high capability land (Class 4-7) or on a parcel with a buildable IPES score;
- The site is stabilized within 48 hours to prevent erosion;
- The grading, excavation, or filling does not occur during periods of precipitation, when the site is covered with snow, or is in a saturated, muddy or unstable condition; and
- The grading, excavation, or filling is not part of a series of excavations that, when viewed as a whole, would require a TRPA permit.

LANDSCAPING

Landscaping and Gardening: Landscaping and gardening is considered **Exempt** by TRPA, provided that:

- The landscaping is in accordance with the TRPA *Handbook of Best Management Practices* requirements for fertilizer use and the TRPA plant list;
- There is no creation or relocation of land coverage (e.g., pathways);
- Any associated grading, excavation, or filling is Exempt (see Grading section, above); and
- The natural slope of the site is maintained (i.e., no terracing or recontouring).

REPAIRS AND REMODELING

Interior Remodel: Interior remodeling is considered **Exempt** by TRPA, provided that:

- There is no change or intensification of use or increase in density; and

- Structural remodeling of a commercial or tourist accommodation structure does not exceed $20,000.

Ordinary Maintenance and Repair: Ordinary maintenance and repair, defined as the upkeep, or preservation of the condition of property is considered **Exempt** by TRPA. Maintenance and repair includes the replacement of, or modification to, parts of a structure that do not affect the weight bearing or strength capacity of the structure provided there is no additional land coverage or an increase in the dimensions of the structure including height, width, and length. Maintenance and repair activities include: painting, re-roofing, replacement of windows, siding, doors, construction of overlays upon existing paved surfaces, and replacement or repair of air conditioning, sewer, water, electrical equipment, and other fixtures.

Mail Box Receptacles: Mail delivery receptacles and support structures are considered **Exempt** by TRPA, provided that:

- The receptacle and support structure(s) comply with all U.S. Postal standards;
- The location of the receptacle and support structure(s) will not cause compaction or disturbance of previously uncompacted or undisturbed areas; and
- Dark shades or earthtone colors and matte finishes are used if the receptacle is located along Highways 28, 50, 89, 207, 267, or 431, or Pioneer Trail.

Replacement of Combustion Heaters and Woodstoves: Replacement of combustion heaters (water or space) and woodstoves with units on TRPA's list of approved combustion heaters is considered **Exempt** by TRPA.

Exterior Structural Repair: Exterior structural repairs that cost less than $10,000 per year are considered **Qualified Exempt** by TRPA, provided that:

- Any associated grading, excavation, or filling is Exempt (see Grading section, pg. 4);
- There is no change or intensification of use or increase in density;
- There is no increase in commercial floor area;
- There is no creation or relocation of land coverage; and
- There is no increase in the dimensions of the structure (For activities which increase the dimensions of the structure, see Structural Remodels or Additions to Existing Structures, pg. 6).

Required Structural Modifications: Structural modifications to existing structures ***required*** *to comply with local building department and/or Uniform Building Code (UBC) standards* are considered **Qualified Exempt** by TRPA, provided that:

- Documentation is provided by the local building department demonstrating the modification is **required** by the UBC or local building standards;
- The modification is the **minimum necessary** to meet local building department and/or UBC standards;
- Any associated grading, excavation, or filling is Exempt (see Grading section, pg. 4);
- There is no creation or relocation of land coverage;
- There is no increase in the dimensions of a structure visible from the waters of Lake Tahoe; Highways 28, 50, 89, 207, 267, or 431; Pioneer Trail; or a TRPA- designated Recreation Area or Bike Trail;

- The height does not exceed the maximum height allowed under the TRPA Code of Ordinances (see TRPA Development Standards, pg. 11);
- There is no change or intensification of use or increase in density; and
- There is no increase in commercial floor area.

Structural Remodels or Additions to Existing Buildings: Remodeling that requires exterior structural modifications or building additions are considered **Qualified Exempt** by TRPA, provided that:

- The addition or remodel is attached to an existing building;
- There is no increase or relocation of land coverage;
- There is existing paved access;
- A Best Management Practices (BMP) plan and schedule are submitted to TRPA (see TRPA Development Standards, pg. 11);
- The required excess coverage mitigation fee, if any, is submitted to TRPA (see TRPA Development Standards, pg. 11);
- Any associated grading, excavation, or filling is Exempt (see Grading section, pg. 4);
- There is no increase in the dimensions of a structure visible from the waters of Lake Tahoe; Highways 28, 50, 89, 207, 267, or 431; Pioneer Trail; or a TRPA- designated Recreation Area or Bike Trail;
- The height does not exceed the maximum height allowed by the TRPA Code of Ordinances (see TRPA Development Standards, pg. 11);
- There is no change or intensification of use or increase in density; and
- There is no increase in commercial floor area.

SHOREZONE ACTIVITIES

The shorezone includes the nearshore, foreshore, and backshore. The nearshore is defined as the relatively shallow area of the lake below the low water line (Elevation 6223') to Elevation 6193'. The foreshore is defined as the area between the high and low water lines (Elevation 6229' and Elevation 6223', respectively). The backshore encompasses the area from the high water line (Elevation 6229') upland beyond the area of instability and/or the area impacted by wave action along the shoreline.

Please note that if your activity involves construction in the shorezone, the following agencies should be contacted prior to beginning work:

In California:	In Nevada:
California State Lands Commission	Nevada Division of State Lands
California Fish and Game	U.S. Army Corps of Engineers
U.S. Army Corps of Engineers	

Replacement and Repair of Mooring Buoys: The replacement and repair of mooring buoys (not involving any relocation), excluding their anchoring devices, is **Exempt** from TRPA review

Replacement and Repair of Buoy Anchor: The replacement and repair of mooring buoy anchoring devices (not involving any relocation) is considered **Qualified Exempt** by TRPA if the buoy was previously permitted by TRPA.

Demolition of Structures in the Shorezone: Demolition of structures, improvements, or facilities in the shorezone (for example, piers or boathouses) is considered **Qualified Exempt** by TRPA provided that the structure, improvement, or facility is not designated or pending for designation or TRPA's Historic Resource Map, and the associated grading, excavation, or filling is Exempt (see Grading section, pg. 4), and *the Qualified Exempt declaration form is submitted to TRPA at least 3 working days prior to demolition.* TRPA verification is required prior to demolition to gain credit for land coverage or existing development. Verification of land coverage or existing development requires a separate application to TRPA.

Fence Repair in the Shorezone: The repair of fences in the shorezone is considered **Qualified Exempt** by TRPA, provided that:

- Fences in the nearshore and foreshore are at least 90 percent open and kept free of debris;
- The color of the fence is earthtone, blends with the surroundings and does not contrast with existing vegetation and earth hues;
- Wooden fences are used whenever possible; and
- Cyclone fences must be coated with brown, black, or dark green vinyl, including fence poles.

Minor Structural Repair in the Shorezone: Minor structural repair of shorezone structures is considered **Qualified Exempt** by TRPA provided that the repair meets the qualifications outlined below. Minor structural repair is defined as the replacement or reconstruction of, or modification to, the members of a structure that affect the weight bearing or strength capacity of the structure. Painting, staining, re-roofing, re-siding, and the installation or replacement of deck coverings is also considered **Qualified Exempt** by TRPA, provided that:

- The cost to replace, reconstruct, or modify structural members that affect the weight bearing or strength capacity of the structure does not exceed $5,000 (labor and materials);
- The color of the structure is earthtone, blends with the surroundings, and does not contrast with existing vegetation and earth hues;
- Roofs are composed of nonglare earthtone or woodtone materials which minimize reflectivity; and
- The work does not result in a change in use or an increase in the dimensions of the structure including height, width, and length.

TEMPORARY ACTIVITIES

General Temporary Activities: A temporary activity which meets the following criteria is considered **Exempt** by TRPA:

- Does not cause parking on unpaved areas;
- Does not create or relocate land coverage or disturbance;

- Does not require closure of a traffic lane or intersection of a state or federal highway for more than one hour, or the closure of U.S. Highway 50 at any point between the South Wye and Kingsbury Grade for any period of time;
- Does not create noise in excess of the limits allowed in Chapter 23 of the TRPA Code of Ordinances;
- Does not exceed fourteen consecutive calendar days in duration and will not occur more than four times in a calendar year; and
- If the location of the activity is unpaved, it has not been used for temporary projects more than four times the past calendar year.

Special Event Areas: Temporary activities in TRPA-designated special event areas are considered **Exempt** by TRPA. In general, designated special event areas only exist within TRPA-approved Community Plans (see TRPA Development Standards, pg. 11). Designated special event areas typically have adequate facilities (e.g., parking, bathrooms) for temporary events.

TREE REMOVAL

For additional information on tree removal, please request "A Property Owner's Guide to Cutting Trees" from TRPA.

Dead Tree Removal on Parcels Less than 5 Acres: Removal of dead trees on parcels of five acres or less is considered **Exempt** by TRPA.

Dead Tree Removal on Parcels Greater than 5 Acres: Dead tree removal on parcels greater than 5 acres is considered **Qualified Exempt** by TRPA provided that the trees are approved and marked by the appropriate state forestry agency and the tree removal does not constitute substantial tree removal (i.e., 100 or more trees) as defined in Subsection 71.3.I of the TRPA Code of Ordinances.

Removal of Tree Limbs: The removal of dead limbs and the removal of live limbs not resulting in material damage to a tree is considered **Exempt** by TRPA. Material damage is defined as any of the following alterations to a live tree at least six inches diameter at breast height (dbh): (1) topping; (2) the removal of live limbs within the upper two thirds of the total tree height; (3) girdling; (4) the application of harmful chemicals; (5) purposefully exposing the cambium layer; or (6) other damage to the tree that will potentially result in death or disfigurement, or in a significant increase in its susceptibility to insects or disease. *The removal or trimming of trees for the purposes of view enhancement is prohibited and is considered a violation.*

Live Tree Removal: Moving, removing, or materially damaging a live tree six inches dbh or larger is considered **Qualified Exempt** by TRPA provided that the tree is marked and approved for removal by the appropriate state forestry agency and the tree removal does not constitute substantial tree removal (i.e., 100 or more trees) as defined in Subsection 71.3.I of the TRPA Code of Ordinances. *The removal or trimming of trees for the purposes of view enhancement is prohibited and is considered a violation.*

OTHER ACTIVITIES

Home Occupations: Incidental occupation, secondary to the use of a dwelling, are considered **Exempt** by TRPA, provided that:

- There are no sales of products not produced on the premises, unless the sales are done by written order with no commodities or displays on the premises;
- There is employment of no more than one person other than the dwelling residents;
- There are no signs or structures advertising the occupation;
- There is no more than one home occupation carried on in the dwelling; and
- There is no outside storage of materials or supplies incidental to the home occupation.

Seasonal Lighting Displays: Seasonal lighting displays which are displayed between Thanksgiving and March 1st of the following year are considered **Exempt** by TRPA.

Parcel Consolidations: Parcel consolidations are considered **Exempt** by TRPA provided that deed restrictions permanently consolidating the parcels are recorded by the affected owner(s).

TRPA credit for any development rights that may be associated with the parcels must be obtained prior to the consolidation; a separate TRPA application is required to bank a development right.

Mobile Home Replacement: Replacement of an existing mobile home in a legally-established mobile home space, which does not result in a change in use or new or relocated land coverage is considered **Qualified Exempt** by TRPA.

Outdoor Retail Sales: An outdoor retail sales use associated with a state or federal holiday is considered **Qualified Exempt** by TRPA, provided that:

- The use does not cause parking on unpaved areas;
- The use does not operate for more than six consecutive weeks in a twelve month period; and
- The use is located in a plan area designated commercial, public service, or tourist accommodation.

Changes in Operation: A change in operation is any modification, change, or expansion of an existing or previous use. *A Change in Operation form is not included in this packet; please request this form from TRPA.* In addition, if your activity requires a sign change, please request a Sign Application Packet. Changes in operation resulting in the generation of less than 100 additional vehicle trips, in connection with a commercial, tourist accommodation, recreation, or public service use, are considered **Qualified Exempt** by TRPA, provided that:

- There is no change from one major use classification to another (e.g., from recreation to commercial);
- The proposed use is an allowed use in the applicable TRPA Plan Area Statement (see TRPA Development Standards, pg. 11); and
- The required air quality mitigation fee, if any, is paid for each additional vehicle trip generated due to the change in operation (see Change in Operation form, available at TRPA).

Signs: Please refer to Sign Application Packet (available at TRPA). For signs in the City of South Lake Tahoe, please contact the City of South Lake Tahoe Planning Department. For signs within adopted Community Plan areas within Placer County, contact the Placer County Building Department.

EXEMPT/QUALIFIED EXEMPT PROCESS

If you have determined your project or activity to be exempt, you do not need to do anything with TRPA. However, your project or activity may still require a permit from the local jurisdiction. You can submit your

project to the local jurisdiction according to their rules and they will review the project as a TRPA exempt project.

If you have determined that your project is a qualified exempt project you must submit the Project Review Application with the Qualified Exempt box checked to the local jurisdiction for residential projects and TRPA for all other projects and if the project is located in Douglas County. The qualified exempt application will be reviewed over the counter, unless more time is needed to determine if it is qualified exempt. In some cases, it may take up to 30 days to determine if the project is qualified exempt.

When the project or activity is determined to be qualified exempt, you will be required to pay the application mitigation fees. At that point the TRPA or the local jurisdiction will stamp the application form and plans as "Qualified Exempt". This is your proof to any other permitting agency that the project does not require a TRPA permit. Other permitting agencies may require a copy of stamped Project Review Application Form prior to issuing their permits.

Mitigation Fees

Required mitigation fees, if any, will be collected by the reviewing jurisdiction.

Air quality: If your project involves a Change in Operation you may need to pay an air quality mitigation fee. An air quality mitigation fee is required for any new commercial floor area or sometimes a change in use requiring additional daily vehicle trip ends (dvte). Contact TRPA for information on how to calculate dvtes for your project. This money is held in a fund for use by local jurisdictions for transit and other projects that improve air quality. Refer to TRPA Code of Ordinances Section 93.3.D for additional information.

Excess land coverage: If your project involves a Structural Remodel or Addition to an Existing Building you may need to pay an excess land coverage mitigation fee. Excess land coverage is the amount of legally created land coverage existing within your project area that exceeds the base allowable land coverage. Not all parcels will have excess land coverage. Excess land coverage can be mitigated several ways: through a mitigation fee, by reducing land coverage on or off site, or by expanding the project area. The mitigation fee is based on the amount of excess land coverage on your parcel and the estimated construction cost of your project. The minimum excess land coverage mitigation fee is $200 per project. Refer to TRPA Code of Ordinances section 20.5 for additional information.

For information on specific projects funded by mitigation fees, please request a TRPA Annual Report.

QUALIFIED EXEMPT ACTIVITY DECLARATION

OWNER(S) OF RECORD:

Name(s): _____ Phone: ( ) _____

Mailing Address: _____

City: _____ State: _____ Zip Code:_____

PERSON AUTHORIZED TO REPRESENT THE ACTIVITY:

Name(s): _____ Phone: ( ) _____

Mailing Address: _____

City: _____ State: _____ Zip Code:_____

LOCATION OF ACTIVITY:

Assessor's Parcel Number (APN): _____ County: _____

Street Address: _____

DETAILED DESCRIPTION OF ACTIVITY (Be Clear, Detailed, and Specific):

_____

_____

_____

_____

_____

PRIOR APPROVALS (List any prior CTRPA/TRPA approvals/permits received for the subject property):

Permit: _____ Approval Date: _____ Expiration Date: _____

Permit: _____ Approval Date: _____ Expiration Date: _____

LOCAL JURISIDICTION REQUIREMENTS: Please be advised that your activity may require approval from local agencies (i.e., Building Department) – *make sure to obtain appropriate local approvals prior to beginning work.*

If your activity involves construction in the shorezone, the following agencies should be contacted:

In California: California State Lands Commission
California Fish and Game
U.S. Army Corps of Engineers

In Nevada: Nevada Division of State Lands
U.S. Army Corps of Engineers

AUTHORIZATION FOR REPRESENTATION:

The following person(s) own the subject property (APN _____) or have a sufficient interest therein to make application to TRPA:

Print Owner(s) Name(s):

_____

_____

I/We authorize

_____

to act as my/our representative in connection with this application to TRPA for the subject property and agree to be bound by said representative. I understand that additional information may be required by TRPA, beyond that submitted by my representative, to review this activity. Any cancellation of this authorization shall not be effective until receipt of written notification of same by TRPA. I also understand that should any information or representation submitted in connection with this application be incorrect or untrue, TRPA may rescind any approval or take other appropriate action. I further accept that if this activity is approved, I, as the permittee, will be held responsible for any and all permit conditions.

Owner(s) signature(s): **(Original signature required.)**

_____ Date _____

_____ Date _____

I hereby declare under penalty of perjury that this application and all information submitted as part of this application is true and accurate, to the best of my knowledge. I have been authorized in writing by the owner(s) of the subject property to represent this application, and understand that should any information or representation submitted in connection with this application be incorrect or untrue, TRPA may rescind any approval or take other appropriate action. I further understand that additional information may be required by TRPA to review this activity.

Signature: **(Original signature required.)**

_____ at _____ on _____

Person preparing application | County | Date

FOR OFFICE USE ONLY

APN: _____ County: _____

Applicant: _____ Date Received: _____

QE Code: _____ Received By: _____

Excess Coverage Mitigation Fee: _____ BMP Retrofit: _____

Excess Coverage Mitigated: _____

QE1: Residential
QE2: Commercial
QE3: Public Service
QE4: Tourist Accommodation
QE5: Recreation
QE6: Resource Management
QE7: Shorezone

Filing Fee: $ _____ Receipt No. _____

QUALIFIED EXEMPT APPLICATION CHECKLIST

APPLICATIONS LACKING ANY OF THE FOLLOWING ITEMS WILL NOT BE ACCEPTED. TRPA MAY REQUIRE ADDITIONAL INFORMATION, ABOVE AND BEYOND THE CHECKLIST ITEMS, TO REVIEW THIS APPLICATION.

REFER TO THE *TRPA APPLICATION CHECKLIST REFERENCE* DOCUMENT FOR ADDITIONAL EXPLANATION OF EACH CHECKLIST ITEM WITH CORRESPONDING NUMBER.

PROJECT NAME: _____

CURRENT ASSESSOR'S PARCEL NUMBER (APN): _____

PREVIOUS ASSESSOR'S PARCEL NUMBER (APN): _____

Choose the appropriate category for your project and include all the items on the checklist.

DEMOLITION

- Demolition of Buildings Greater than 50 Years Old

Applicant	TRPA		
_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	40a.	Photographs showing all sides of the structure.
_____	_____	40g.	Structure checked against TRPA Historic Resource Map.
_____	_____	40h.	Estimate of associated grading, excavation or filling in cubic yards.
_____	_____	40i.	Written history of the building (date constructed, etc.).
_____	_____	40r.	Date when demolition will commence: _____

- Demolition of Structures in the Shorezone: See Shorezone Activities.

FENCES

- Fence Repair in the Shorezone: See Shorezone Activities.

GRADING/EXCAVATION

- Grading/Excavation Less than 7 Cubic Yards

_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	3.	Proof of Land Capability/Backshore Boundary Verification or IPEs Score.
_____	_____	40b.i.	Site drawing showing area to be graded/excavated including dimensions and quantity of material.
_____	_____	40b.ii.	Erosion control barrier downslope of disturbed area(s) (include on site drawing).
_____	_____	40b.iii.	Description of planting material used for revegetation (include on site drawing).
_____	_____	40b.vi.	Vegetation Protection Fencing.
_____	_____	40d.i.	Photograph(s) of area(s) to be graded/excavated.
_____	_____	40s.	Origin/disposal location of cut/fill material.
_____	_____	40t.	Date grading is to occur: _____

REPAIRS AND REMODELING

- Exterior Structural Repair

Also include the checklist items for Grading and Excavation as applicable.

_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	40e.	Existing use: _____
_____	_____	40e.	Proposed use: _____
_____	_____	40f.	Itemized structural cost list prepared by a qualified professional.

- Structural Modifications required to comply with local building department and/or UBC standards

Also include the checklist items for Grading and Excavation as applicable.

_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	40e.	Existing use: _____
_____	_____	40e.	Proposed use: _____
_____	_____	40j.	Documentation from local building department requiring modification.

_____ _____ 40k.i Excess coverage mitigation fee worksheet and fee.

_____ _____ 40u. If the activity involves a change in height, TRPA requires the submittal of accurately scaled elevation drawings showing existing and proposed height (see TRPA Development Standards, pg. 11).

- Structural Remodels or Additions to Existing Buildings

Also include the checklist items for Grading and Excavation as applicable.

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 2. Application Fee

_____ _____ 3. Proof of TRPA Land Capability Verification or IPES score (or assume worst case, 1% allowable land coverage).

_____ _____ 6. Site Plan(3 copies): Minimum 18" x 24" on blackline or blueline print paper showing the following:

_____ ____ a. All property lines and setbacks.

_____ ____ b. Map scale and north arrow

_____ ____ c. Assessor's Parcel Number (APN) and property address

_____ ____ d. Property owner's name

_____ ____ e. Parcel size in square feet

_____ ____ f. Best Management Practices (BMPs), both temporary and permanent

_____ ____ i. Topographic contour lines at 2' intervals

_____ ____ j. TRPA verified backshore and Stream Environment Zone (SEZ) boundaries, including setbacks (if available)

_____ ____ k. High and low water lines (for lakefront parcels)

_____ ____ l. TRPA verified land capability districts (if available)

_____ ____ m. Trees greater than 6" in diameter and rock outcroppings, trees to be removed indicated

_____ ____ n. Location and dimensions of existing and proposed structures

_____ ____ o. Driveway location and slope

_____ ____ p. Edge of pavement at street(s)

_____ ____ q. Location of all easements (if applicable)

_____ ____ r.i. Allowable land coverage by land capability district (if available)

_____ ____ r.ii. Existing and proposed land coverage calculations by land capability district (with breakdown of type of coverage, i.e. buildings, paving, etc.). Include overhang reductions.

_____ ____ u. Slope calculation across the building site

_____ _____ 7. Preliminary Building Elevations (existing and proposed) of all sides of the building(s) showing:

___ ___ a. Finished floor elevations (with respect to contour elevations shown on the site plan)

___ ___ b. Elevation of the highest roof ridge and lowest elevation of foundation wall at natural grade.

___ ___ c. Roof pitch of each roof plane.

___ ___ d. Allowed and proposed height calculations.

___ ___ e. Drawing scale and view aspect.

___ ___ f. Existing and proposed building signs.

_____ _____ 8. Preliminary Floor Plans (existing and proposed) showing:

___ ___ a. Scaled dimensions.

___ ___ b. TRPA-approved wood or gas space and/or water heaters (if applicable).

___ ___ c. All exterior entrances and exits.

___ ___ f. Existing and proposed sinks, refrigerators and cooking facilities.

_____ _____ 40d.ii. Photograph(s) clearly showing the area where the addition will be placed.

_____ _____ 40d.iii. Photograph(s) showing existing paved access and parking.

_____ _____ 40e. Existing use: _____

_____ _____ 40e. Proposed use: _____

_____ _____ 40k.i Excess coverage mitigation fee worksheet and fee.

_____ _____ 40l. BMP retrofit plan schedule (See Master Checklist/Design Criteria and Guidlines, page 59).

_____ _____ 40m. Complete BMP spreadsheet that indicates the required infiltration facilities are sufficiently sized to handle a 20-year one-hour storm event. Please contact TRPA for a copy of this spreadsheet.

PERMANENT BMP INSTALLATION	COMPLETION DATE
Revegetation of Barren Areas	_____
Dripline Infiltration Trenches	_____
Driveway Infiltration:	
Swale/Slotted Drain	_____
Drywell	_____
Infiltration Trenches	_____
Parking Barriers	_____
Slope Stabilization Measures	_____
Other (please specify)	_____

_____ _____ 40k.i. Completed excess land coverage mitigation fee worksheet, including a construction cost estimate (structural) from a qualified professional and fee.

SHOREZONE ACTIVITIES

- Demolition of Structures in the Shorezone

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 40a. Photographs showing all sides of structure.

_____ _____ 40g. Structure checked against TRPA Historic Resource Map.

_____ _____ 40h. Estimate of associated grading, excavation or filling in cubic yards.

_____ _____ 40r. Date when demolition will commence: _____

- Fence Repair in the Shorezone

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 40d.iv. Photograph(s) of existing fence.

_____ _____ 40o. Proposed color and materials of fence after repair

- Minor Structural Repair in the Shorezone

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 40b.iv. Site plan showing existing structure and area of proposed repair work.

_____ _____ 40d.v. Photographs depicting the existing condition of the structure.

_____ _____ 40n. A statement from a qualified professional attesting to the cost of the proposed repair work.

_____ _____ 40o. Proposed colors and materials of repaired structure.

- Replacement and Repair of Buoy Anchor

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 40p.i. Evidence of a TRPA permit allowing the placement of the buoy in its present location.

TREE REMOVAL

- Dead Tree Removal on Parcels Greater than 5 Acres

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 40p.ii. Copy of permit from appropriate state forestry agency for the removal of dead tree(s).

_____ _____ 40v. Method of tree removal.

- Live Tree Removal

_____ _____ 1. Completed application form with **original property owner(s)** signature(s) and checklist.

_____ _____ 40p.ii. Copy of permit from appropriate state forestry agency for the removal of live tree(s).

_____ _____ 40v. Method of tree removal.

OTHER ACTIVITIES

- Mobile Home Replacement

_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	40d.vi.	Photograph and dimensions of existing mobile home.
_____	_____	40w.	Dimensions of replacement mobile home.

- Changes in Operation

_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	16.	Completed Change in Operation form (this form is not included in this packet; please request this form from TRPA).
_____	_____	40b.v.	Site drawing showing location and dimensions of commercial or other space proposed for change in operation.
_____	_____	40e.	Existing Use: _____
_____	_____	40e.	Proposed Use: _____
_____	_____	40k.ii.	Air quality mitigation fee payable to TRPA (if applicable).

- Outdoor Retail Sales

_____	_____	1.	Completed application form with **original property owner(s)** signature(s) and checklist.
_____	_____	40d.vii.	Photographs showing paved parking and sales area for customers/employees.
_____	_____	40q.	Statement describing use, association with federal/state holiday, and duration of retail sales operation (six weeks maximum).

EXCESS LAND COVERAGE MITIGATION FEE WORKSHEET

1. Parcel size: _____ s.f.

2. Allowable land coverage: _____ s.f.

   To calculate allowable land coverage, multiply your parcel size by the percent allowable land coverage.

   Parcel size: _____ s.f. ´ Percent allowable land coverage: _____%

   See your TRPA Land Capability Verification or Site Assessment for the percent allowable land coverage on your property. *If you have not completed a TRPA land capability verification or site assessment for your parcel, assume a worst case of 1% allowable land coverage*. If you have more than one land capability district on your parcel, calculate total allowable land coverage by multiplying the percent allowable for each land capability district by the area of each land capability district.

3. Existing land coverage: _____ s.f.

4. Excess land coverage: _____ s.f.

   To calculate excess land coverage, subtract allowable land coverage from existing land coverage.

   Existing land coverage: _____ s.f. - Allowable land coverage: _____ s.f.

   If this number is zero or less, your parcel does not have excess land coverage, and no mitigation fee is required. If an excess coverage mitigation fee was previously paid on this property, you may reduce your total remaining excess land coverage. If the fee was paid prior to July 23, 2001, divide the amount of the previously paid excess coverage mitigation fee by $5 per square foot. If the previous fee was paid on or after July 23, 2001, divide the amount by $6.50 per square foot if in California, and $12.00 per square foot if in Nevada. Subtract that amount from your total excess land coverage to determine your remaining excess land coverage. For example, if your total excess land coverage is 100 s.f., and you previously paid an excess coverage mitigation fee of $200 prior to July 23 2001, remaining excess land coverage is (100 – [200/5]) or 60 s.f.

5. Once your have determined the square footage of excess land coverage on your parcel, use the table below to determine which factor will be used to calculate the required mitigation fee.

Square Feet of Excess Coverage	Factor	Square Feet of Excess Coverage	Factor
400 or less	0.0006	11,001 - 15,000	0.0250
400 - 600	0.0012	15,001 - 18,000	0.0275
601 - 1,000	0.0025	18,001 - 21,780	0.0300
1,001 - 1,500	0.0050	21,781 - 43,560	0.0325
1,501 - 2,000	0.0075	43,561 - 65,340	0.0350
2,001 - 2,800	0.0100	65,341 - 87,120	0.0375
2,800 - 3,800	0.0125	87,121 - 108,900	0.0400
3,801 - 5,000	0.0150	108,901 - 130,680	0.0425
5,001 - 6,400	0.0175	130,680 - 152,460	0.0450
6,401 - 8,000	0.0200	152,461 - 174,240	0.0475
8,001 - 11,000	0.0225	174,241 or greater	0.0500

6. To calculate the excess land coverage mitigation fee, multiply the estimated project construction cost (labor and materials to construct the bearing elements of a structure) by the appropriate factor from the table above, and divide by the mitigation factor of 8. The resulting number represents the square footage of land coverage that must be mitigated with this project. This number must then be multiplied by the coverage mitigation cost fee ($6.50 per square foot in California, $12.00 per square foot in Nevada). Please provide a construction cost estimate by your licensed contractor, architect or engineer. In no case shall the mitigation fee be less than $200.00.

   (Construction cost estimate (attached): $_____) × (Factor _____) / 8 =

   _____ × (__$6.50 in California, __$12.00 in Nevada) =

   Excess land coverage mitigation fee required: $_____

Appendix B
Fact Sheets for Permanent Best Management Practices (BMPs)

Permanent BMPs may be classified into two general categories:

- Soil Stabilization (SS) BMPs, and
- Treatment Control (TC) BMPs.

SS BMPs involve the various procedures and considerations that aim to control the sources of pollution. In general, these BMPs treat soils and vegetation as a valuable resource and aim to conserve them. These permanent BMPs should be considered and developed early in the project planning and design process. For example, developing project alternatives that minimize increases in surface runoff and subsequent erosion, or planning a project such that minimal vegetation must be removed.

TC BMPs focus on the removal of pollutants from storm water and reducing pollutant loads to receiving waters. These BMPs treat soils as a pollutant and aim to remove them from runoff. Captured sediments must then often be disposed of properly. These BMPs must also be planned and designed as an integral component of the project. For example, detention or infiltration basin design must consider the amount of paving or other impervious area that may be associated with the project.

TC BMPs are generally less effective and more expensive than SS BMPs. For this reason, SS BMPs should be considered first and TC BMPs should be considered as a second line of defense. TC BMPs should always be used in combination with SS BMPs, however; it may be acceptable to implement SS BMPs on their own in some cases.

B.1 Soil Stabilization Best Management Practices

Project planners and designers must consider and, as appropriate, incorporate certain SS BMPs into a project to minimize impacts to water and air quality. These BMPs were developed in response to the three following design objectives:

- **Prevent Downstream Erosion:** Storm water drainage systems will be designed to avoid causing or contributing to downstream erosion;
- **Stabilize Disturbed Soil Areas:** Disturbed soil areas will be appropriately stabilized to prevent erosion after construction; and
- **Maximize Vegetated Surfaces:** Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from storm water.

The SS BMPs listed in Table B-1 and described in the following sections are designed to accomplish these objectives.

Table B-1
Soil Stabilization BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow
Preservation of Existing Vegetation
Concentrated Flow Conveyance Systems
■ Ditches, Berms, Dikes and Swales
■ Slope Down Drains
■ Flared Culvert End Sections
■ Outlet Protection/Velocity Dissipation Devices
Slope/Surface Protection Systems
■ Vegetated Surfaces
■ Mulches
■ Roughening, Terracing and Rounding
■ Hard Surfaces
Retaining Walls
■ Standard Cantilever Walls
■ Modular Gravity Walls
■ Mechanically Stabilized Earth (MSE) Walls
■ Soil Nail Walls
■ Cantilever Soldier Pile Walls
■ Ground Anchored Walls

B.2 Treatment Control Best Management Practices

Treatment control BMPs, also referred to as structural controls have the objective of protecting receiving waters by:

- Reducing the concentrations of pollutants of concern in storm water runoff through physical, biological, or chemical processes; and/or
- Reducing pollutant loads transported by surface water runoff by infiltrating storm water into the soil and evapotranspiration.

The treatment control (TC) BMPs listed in Table B-2 of this document will be considered for projects discharging directly or indirectly to receiving waters. Treatment controls should be considered for projects where requirements from permits, environmental studies, or total maximum daily load (TMDL) waste load allocations necessitate consideration of these BMPs for projects in specific receiving waters.

Treatment controls are generally more expensive and less effective in protecting water quality than the Soil Stabilization (SS) BMPs. They should therefore be considered as a second line of defense and should not to be used as a substitute for appropriate SS BMPs. Treatment controls are intended to be used in conjunction with SS BMPs to further reduce the impact of storm water on receiving waters when deemed necessary.

Table B-2
Treatment Control Best Management Practices

Biofiltration Swales and Strips
Infiltration Basins
Detention Basins
Traction Sand Traps
Gross Solids Removal Devices

B.3 Runoff Coefficients

The following information may be used to assist the designer with developing permanent BMPS:

- An estimate of the construction site area in acres (see Section 3.1);
- An estimate of the runoff coefficient of the construction site before and after construction (the form shown in Table B-3 may be used to develop the necessary information for runoff coefficients; Tables B-4 and B-5 provide supporting information for the calculation of runoff coefficients); and an estimate of the percentage of the area of the construction site that is impervious (e.g., pavement, building, etc.) before and after construction.

Table B-3
Computation Sheet for Determining Runoff Coefficients

Total Site Area	= _____(A)
Existing Site Conditions	
Impervious Site Area[1]	= _____(B)
Impervious Area Runoff Coefficient[2,4]	= _____0.95_____ (C)
Pervious Site Area[3]	= _____(D)
Pervious Site Area Runoff Coefficient[4]	= _____(E)
Existing Runoff Coefficient = $\frac{(BxC) + (DxE)}{A}$	= _____(F)
Proposed Site Conditions (After Construction)	
Impervious Site Area[1]	= _____(G)
Impervious Site Runoff Coefficient[2,4]	= _____(H)
Pervious Site Area[3]	= _____(I)
Pervious Site Runoff Coefficient[4]	= _____(J)
Proposed Runoff Coefficient = $\frac{(GxH) + (IxJ)}{A}$	= _____(K)

(1) Includes paved areas, areas covered by buildings, and other impervious surfaces.

(2) Use 0.95 unless lower or higher runoff coefficients can be verified.

(3) Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.

(4) See Table B-4 and B-5 for runoff coefficients

Table B-4
Runoff Coefficients for Undeveloped Areas Watershed Types

	Extreme	High	Normal	Low
Relief	0.28 - 0.35 Steep, rugged terrain with average slopes above 30%	0.20 - 0.28 Hilly, with average slopes of 10 to 30%	0.14 - 0.20 Rolling, with average slopes of 5 to 10%	0.08 - 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 – 0.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	0.08 – 0.12 Slow to take up water, clay or shallow soils of low infiltration capacity, imperfectly or poorly drained	0.06 – 0.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	0.04 – 0.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	0.12 – 0.16 No effective plant cover, bare or very sparse cover	0.08 – 0.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	0.06 – 0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04 – 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface storage	0.10 – 0.12 Negligible surface depression few and shallow; drainage-ways steep and small, no marshes	0.08 – 0.10 Low; well defined system of small drainage ways; no ponds or marshes	0.06 – 0.08 Normal; considerable surface depression storage; lakes and pond marshes	0.04 – 0.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes

Given: An undeveloped watershed consisting of:

1) Rolling terrain with average slopes of 5%,

2) Clay type soils,

3) Good grassland area, and

4) Normal surface depressions

Find: The runoff Coefficient, C, for the above watershed

Solution:

Relief	0.14
Soil Infiltration	0.08
Vegetal Cover	0.04
Surface Storage	0.06
	C=0.32

Table B-5
Runoff Coefficients for Developed Areas

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 – 0.95
Neighborhood areas	0.50 – 0.70
Residential:	
Single-family areas	0.30 – 0.50
Multi-units, detached	0.40 – 0.60
Multi-units attached	0.60 – 0.75
Suburban	0.25 – 0.40
Apartment dwelling areas	0.50 – 0.70
Industrial:	
Light areas	0.50 – 0.80
Heavy areas	0.60 – 0.90
Parks, cemeteries:	0.10 – 0.25
Playgrounds:	0.20 – 0.40
Railroad yard areas:	0.20 – 0.40
Unimproved areas:	0.10 – 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 – 0.10
Sandy soil, average, 2-7%	0.10 – 0.15
Sandy soil, steep, 7%	0.15 – 0.20
Heavy soil, flat, 2%	0.13 – 0.17
Heavy soil, average, 2-7%	0.18 – 0.25
Heavy soil, steep, 7%	0.25 – 0.35
Streets:	
Asphaltic	0.70 – 0.95
Concrete	0.80 – 0.95
Brick	0.70 – 0.85
Drives and Walks	0.75 – 0.85
Roofs:	0.75 – 0.95

Consideration of Downstream Effects Related to Potentially Increased Flow

SS-1

Definition and Purpose

This BMP outlines planning and design considerations that may be incorporated into new projects to mitigate the downstream effects of increased flow.

The effects of new construction and development on downstream areas require careful evaluation at the project planning and design level. New impervious surfaces such as roadways, parking lots and buildings inhibit infiltration and cause increased surface flows discharging from these areas. Additionally, new construction often causes changes in the velocity or volume of runoff or sediment load, or other hydraulic changes resulting from stream encroachments, crossings or realignment may affect downstream channel stability.

As part of the NDOT project planning and design process, an evaluation of the effects on downstream channel stability and/or other storm water facilities should be performed. After characterizing these effects the applicable mitigation measures described under the planning and design section of this BMP should be considered for incorporation into the project.

Appropriate Applications

During the design of both new and reconstructed facilities, NDOT may include new road surfaces, additional paving or other structures to enhance the operational safety and functionality of the facility. When designing these new facilities, the engineer must also consider the effect of collecting and concentrating flows in roadside ditches, storm drain systems, or the effect of re-directing flow. Diversions or overflows from large storm events may create concentrated discharges in areas that have not historically received these flows.

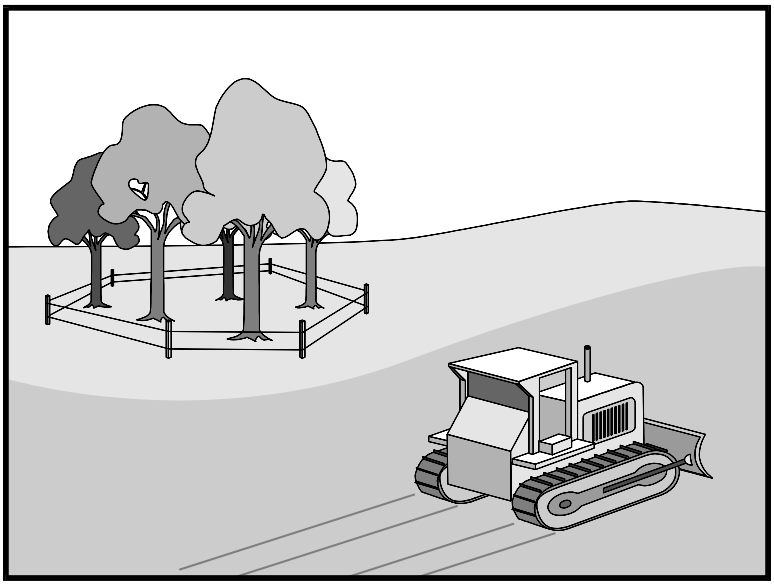
Design Guidance

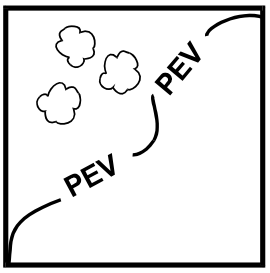
If the project results in an increased potential for downstream effects in channels, consider the following:

- Modifications to channel lining materials (both natural and man-made), including vegetation, geotextiles and riprap;
- Energy dissipation devices at culvert outlets;
- Smoothing the transition between culvert outlets/headwalls/wing walls and channels to reduce turbulence and scour; and
- Incorporating detention and/or infiltration facilities into designs to reduce peak discharges.

Preservation of Existing Vegetation

SS-2





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

Vegetation, especially in Nevada, is often highly sensitive, scarce and very difficult to maintain and/or re-establish. Vegetation limits erosion by protecting the ground surface from the impact of rain and the forces associated with flowing water and wind. Vegetation reduces runoff through transpiration and promoting infiltration. It also provides habitat and food for animals and is a critical component of a healthy ecosystem.

For these reasons, it is important to consider means to preserve existing vegetation as much as possible during the planning phase of a project. This BMP describes the process and rationale for preserving existing vegetation at new construction project locations.

Appropriate Applications

This BMP is applicable to all construction and grading sites. Areas where protecting vegetation is especially critical are floodplains, wetlands, stream banks, steep slopes, and other areas where erosion control would be difficult to establish, install, and maintain, or areas of sensitive habitat, endangered species or where there are critical resources downstream. NDOT project construction plans and specifications should always include requirements to preserve existing vegetation in the project area to the maximum extent practicable.

Preservation of existing vegetation should be practiced in the following locations:

- Areas on a site where no construction activity is planned or will occur at a later date.
- Sensitive areas where natural vegetation exists and should be preserved, such as on steep slopes, watercourses, and building sites in

wooded areas

- Within, and as a buffer to, areas where federal, state, or local government regulations require preservation, such as delineated wetlands, vernal pools, marshes, etc.

Limitations

Protection of existing vegetation requires significant planning:

- If land costs are high, it may not be practical to preserve areas of existing vegetation for a given project unless required by regulations. In this case, it may be appropriate to evaluate the existing vegetation for species type for re-vegetation in landscaping plans.
- Trees and other protected areas on a small site may be serious physical obstructions to construction equipment.
- Preservation of vegetation requires the understanding and cooperation of all construction personnel and inspectors.
- Preservation often requires an on-site meeting before construction begins to clarify the areas to be protected.

Design Guidance

Preservation of vegetation on a site should be planned before any site disturbance begins. Preservation requires good site management to minimize the impact of construction activities that may adversely affect vegetative growth.

Planning

Table SS 2-1 presents the factors that should be considered when deciding on which vegetation is to be saved.

Table SS 2-1
Suggested Selection Criteria for Vegetation to be Preserved

- Life expectancy and present age of species
- Susceptibility to health and disease
- Aesthetic values
- Wildlife benefits
- Location on the site
- Threatened species
- Adaptability to environmental changes
- Relationship to other vegetation (whether this vegetation supports the existence of the surrounding vegetation)

- Review existing vegetation in early spring to identify seasonal plant and noxious weed species.

- All vegetation to be retained should be identified and delineated in the contract documents and marked in the field prior to the start of adjacent soil disturbing activities.

- Critical areas, such as floodplains, steep slopes, and wetlands, should be left in their natural condition unless disturbance is unavoidable.

- Minimize disturbed areas by locating temporary roadways and roadways to be used by maintenance to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling.

- Locate multiple utilities in the same trench to minimize trenching. Excavations should be outside the drip line of trees.

- Maintain the grade around vegetation to be preserved; raising the grade can suffocate roots, and lowering the grade may expose roots. In paved areas, there should be at least 5 ft. of un-graded ground beyond the drip line.

- Avoid changes in soil chemistry that can result from refuse of chemicals deposited on the soil surface.

- Soil stabilization measures should be located at the limits of clearing to prevent sediment deposition within the area where vegetation is being preserved.

- When removing vegetation, consider impacts (such as increased exposure to rain and wind damage) to the adjacent vegetation that will be preserved.

- Plans for tree preservation should avoid compaction of the soil within the drip line of a tree that can block off air and water from the roots. Therefore, construction material storage and crew and vehicle paths should be noted on the site plan and located where they will not cause root compaction, and to avoid nicking or scarring of the tree trunk.

Protection Measures

- During a pre-construction conference, vegetation preservation and protection measures for that project should be reviewed with the contractor and any subcontractors.

- Responsibility for removal of all vegetation protection devices should be clearly identified as the Contractor's.

Several types of protective devices may be used, and all personnel should be instructed to honor these devices. The following are alternatives for tree and vegetation protection:

- A standard snow fence on steel posts set 6 ft. apart and at a height of 3 ft., may be placed at clearing limits.

- Plastic fencing of 3 ft. wide orange polypropylene webbing that is fully stabilized against ultraviolet light, with openings not larger than 2 in. by 2 in., shall be used at clearing limits. The fence posts can be either wood or metal at the Contractor's option and shall be suitable for the purpose intended. The post spacing and depth shall be adequate to completely support the fence in an upright position.

- An earth berm may be constructed according to specifications, but only if its presence does not conflict with drainage patterns. The base of the berm on the tree or vegetation side shall be located at the clearing limits.

- Additional, "expendable" trees between the trunks of retained trees and the clearing limits may be left standing as protection. Trees in this buffer zone should be a maximum of 6 ft apart so that equipment and material cannot pass. These trees should be re-examined before construction is completed to check for and ensure survival or be removed.

Note: Any retained trees located within 40 ft of a proposed building or excavation should be protected by fencing.

Grade Protection

- It is best to perform the construction activities in the tree's vicinity during the tree's dormant period.

- If the grade is being lowered, trees can be protected by constructing a surrounding wall of large stones, brick, or block, and then backfilled. Fertilizer and water should be applied thoroughly and drainage provided so that water does not accumulate.

- If the ground level must be raised around an existing tree or tree group, a tree well can be constructed. A professional arborist should be consulted if a tree well appears to be warranted or desired. A well may be created around the tree slightly beyond the drip line to retain the natural soil elevation in the area of the feeder roots.

If determined necessary, and in cooperation with the certified arborist, a tree well can be constructed using the following procedures:

- Remove vegetation and organic matter from beneath the retained tree(s) to at least 3 ft. beyond the drip line, loosening the soil to at least 3 in. in depth without damaging roots.
- Apply fertilizer to the root area according to label instructions.
- Construct a dry well to allow for trunk growth. Provide 12 in. between the trunk and the wall for older, slow-growing trees, and 24 in. for younger trees.
- The well wall should be just above the level of the proposed fill, and the wall should taper away from the trunk by 1 in/ft of wall.
- The well wall should be constructed of large stone, brick, building tile, concrete blocks, or cinder blocks, with openings left in the wall for the flow of air and water. Mortar should be used only near the top of the well and above the porous fill.
- Drain lines beginning at the lowest point inside the well should be built extending outward from the trunk in a radial pattern with the trunk as the hub. They should be made of 4 in., high-quality drain tiles, sloping away from the well at a rate of 0.125 in/ft. A circumferential line of tiles should be located beneath the drip line; vertical tiles or pipes should be placed over the intersections of the two tile systems for fills greater than 24 in. in depth, held in place with stone fill. All tile joints should be tight. Drainage may be improved by extending a few radial tiles beyond each intersection and slope sharply downward. Coarse gravel may be substituted for tile in areas where water drainage is not a problem. Stones, crushed rock, and gravel may be added instead of vertical tiles or pipes, so the upper level of these porous materials slopes toward the surface near the drip line.
- Tarpaper or an approved equivalent should be placed over the tile or pipe joint to prevent clogging, and a large stone placed around and over drain tiles or pipes for protection.
- Layer 2 in. to 6 in. of stone over the entire area under the tree from the well outward at least to the drip line. For fills up to 24 in. deep, a layer 8 in. to 12 in. should be adequate. Deeper fills require thicker layers of stone to be built to a maximum of 30 in.
- A layer of 0.75 in. to 1 in. stone covered by straw, fiberglass mat, or filter fabric should be used to prevent soil clogging between stones. Do not use cinders as fill material.
- Complete filling with porous soil (to sustain vegetation) until the desired grade is reached.

- Crushed stone should be placed inside the dry well over the openings of the radial tiles to prevent clogging of the drain lines. Vertical tiles should also be filled with crushed rock and covered with a screen.

- The area between the trunk and the well wall should be covered by an iron grate or filled with a 50-50 mixture of crushed charcoal and sand to prevent anyone from falling into the well or to prevent leaves, debris, rodents, or mosquitoes from accumulating.

- One-half of these systems may be constructed if the grade is being raised on only one side of the tree(s).

Trenching and Tunneling

- Trenches should be built as far away from tree trunks as possible, at a minimum outside of the drip line, to reduce the amount of root damage. Trenching should avoid large roots or root concentrations by curving the trench or by tunneling under large roots and concentrated root areas. Tunneling is more expensive at first, but results in less soil disturbance and impacts of the root system; this cost may offset the cost of tree removal and replacement if the tree should die. Therefore, tunneling is nearly always preferable over trenching.

- The tunnel should be at least 18 in below the ground surface, and not below the tree center to minimize impact on the roots.

- Roots should not be left exposed to air; they should be covered with soil as soon as possible, protected, and kept moistened with wet burlap or peat moss until the tunnel can be built.

- The ends of damaged or cut roots should be cut off cleanly.

- Trenches and tunnels should be filled as soon as possible. Careful filling and tamping will eliminate air spaces in the soil.

- To induce and develop root growth, peat moss should be added to the fill material.

- The tree should be mulched and fertilized to conserve moisture, and to stimulate new root growth.

- Remove any trees intended for retention if those trees are damaged seriously enough to affect their survival.* If replacement is desired, the new tree should be of similar species, and of at least 2 in. caliper. *as determined by a Certified Arborist.

For additional details regarding the implementation of temporary vegetation protection during construction see the NDOT Construction BMP Handbook.

Maintenance and Inspection

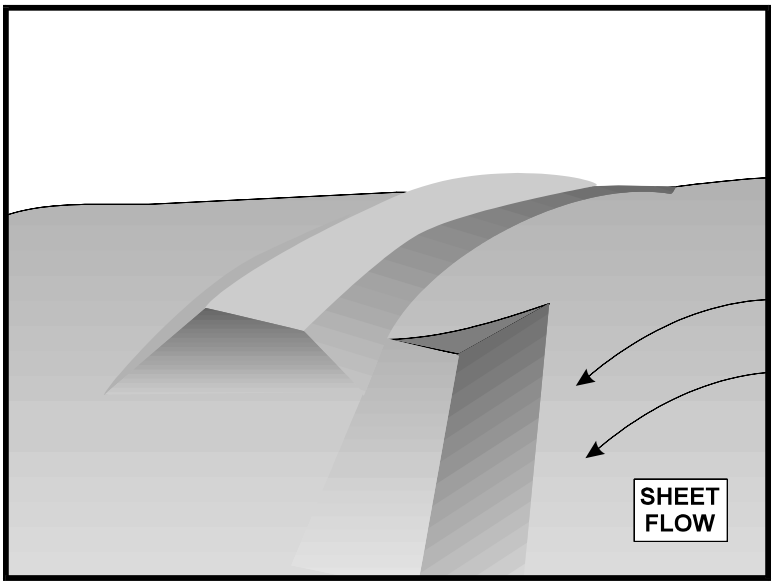
During construction, the limits of disturbance should remain clearly marked at all times. The contractor should be required to maintain existing vegetation in conformance with the requirements of the contract. Because protected trees may be destroyed by carelessness during the final cleanup and landscaping, fences and barriers should be removed last, after all other cleanup.

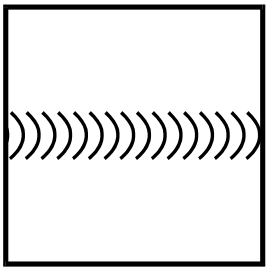
If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Soil that has been compacted over a tree's root zone should be aerated by punching holes 12 in. deep with an iron bar, possibly #4 rebar, and moving the bar back and forth until the soil is loosened. Holes should be placed 18 in. apart throughout the area of compacted soil under the tree crown.
- Any damage to the crown, trunk, or root system of a retained tree during maintenance should be repaired immediately.
- Damaged roots should be immediately cut clean, and moist soil or soil amendments shall be placed around the cut root.
- If bark damage occurs, all loosened bark should be cut back into the undamaged area, with the cut tapered at the top and bottom, and drainage provided at the base of the wood. Cutting of the undamaged area should be as limited as is possible.
- Serious tree injuries should be attended to by an arborist.

Ditches, Berms, Dikes, and Swales

SS-3





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

These permanent structures are typically used to intercept and direct surface runoff to a slope down drain (embankment protector) or other stabilized watercourse. The primary function of ditches, berms, dikes and swales is to safely convey runoff and to prevent erosion.

Appropriate Applications

Ditches, berms, dikes and swales are typically implemented in the following locations:

- At the top of slopes to divert run-on from adjacent slopes and upgradient areas,
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows,
- At other locations to convey runoff to slope down drains, stabilized watercourses, or storm water drainage systems,
- To intercept runoff from paved surfaces,
- Along roadways, other paved surfaces or impervious facilities to intercept and safely convey runoff.

Limitations

- Care must be applied to correctly size and locate earth dikes, drainage swales and lined ditches. Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
- Non-stabilized tributary areas will reduce the effectiveness of these measures due to high sediment runoff.

- These measures may cause water to pond onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.) if not properly sized and located.

- Altering existing waterways or clearing existing vegetation may require permits from the Nevada Division of Environmental Protection, or the U.S. Army Corps of Engineers.

Design Guidance

Design must be in accordance with the NDOT Drainage Manual, and NDOT Standard Plans and Specifications. Additionally, the following general guidelines should be considered:

- Select design flow and safety factors based on careful evaluation of risks due to erosion, overtopping, flow backups or washout.

- Consider outlet protection where localized scour is anticipated.

- Examine the site for run-on from off-site sources.

- Consider order of work provisions to install and utilize permanent dikes, swales and ditches early in the construction process.

- Conveyances must be lined when velocities exceed allowable limits for site soil conditions. Options for lining materials include:

  - Rock Slope Protection (RSP),
  - Geotextiles,
  - Vegetation,
  - Asphalt concrete or concrete.

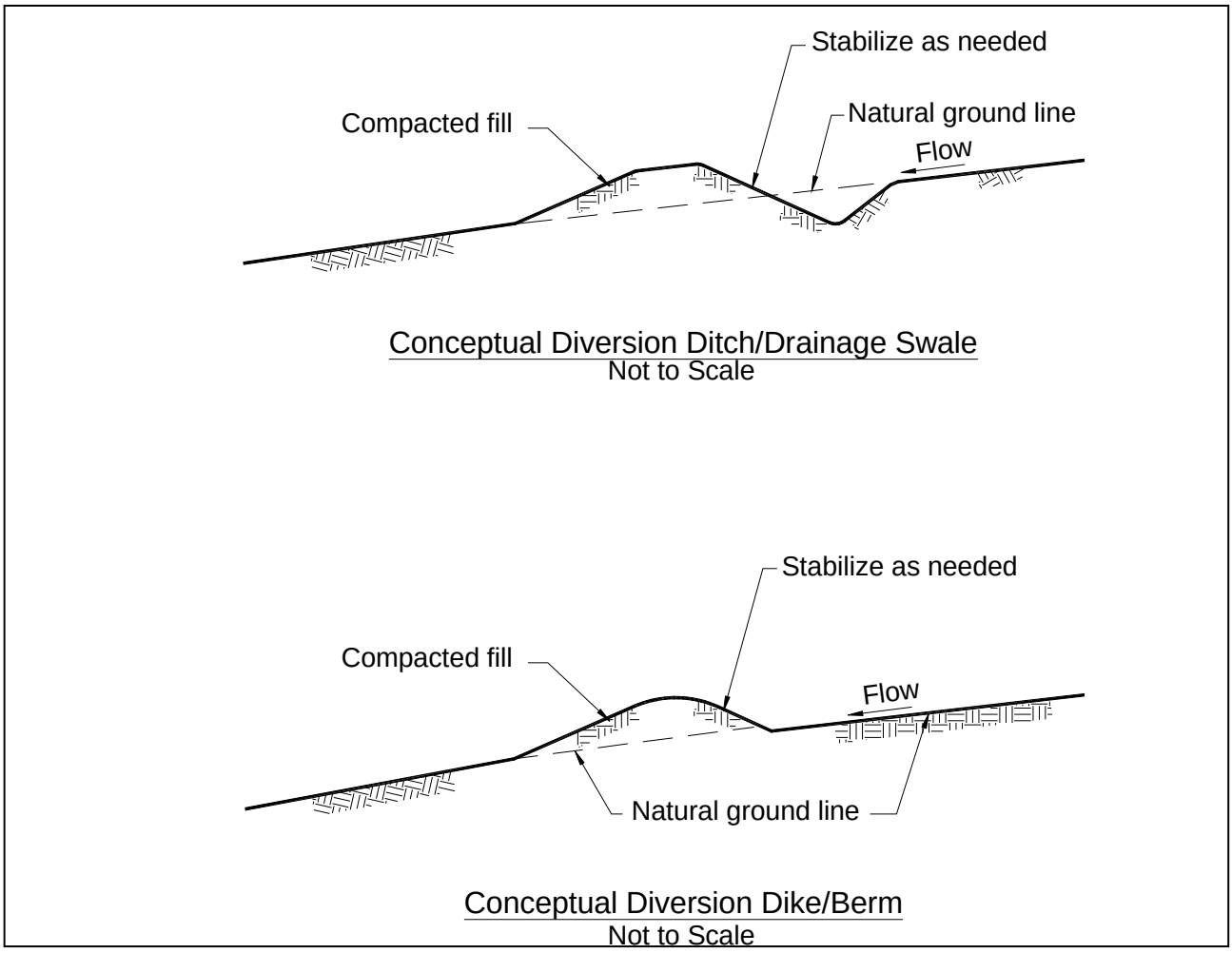
- Due to maintenance difficulties, riprap should not be used where there is a high probability that traction sand or abrasives may enter the channel.

- Top, toe and mid-slope diversion ditches, berms, dikes and swales, should be used to intercept runoff and direct it away from critical slopes. Typically mid-slope diversion ditches should have a cross slope of 2%, and should be concrete, rock, or vegetation lined.

- Drop structures can be placed along the diversion as grade control to maintain a sufficiently mild slope to prevent erosive velocities,

Figure SS 1-1 presents conceptual schematics of ditches, berms, dikes and swales. For more detailed drawings and dimensions, see the NDOT 2001 Standard Plans.

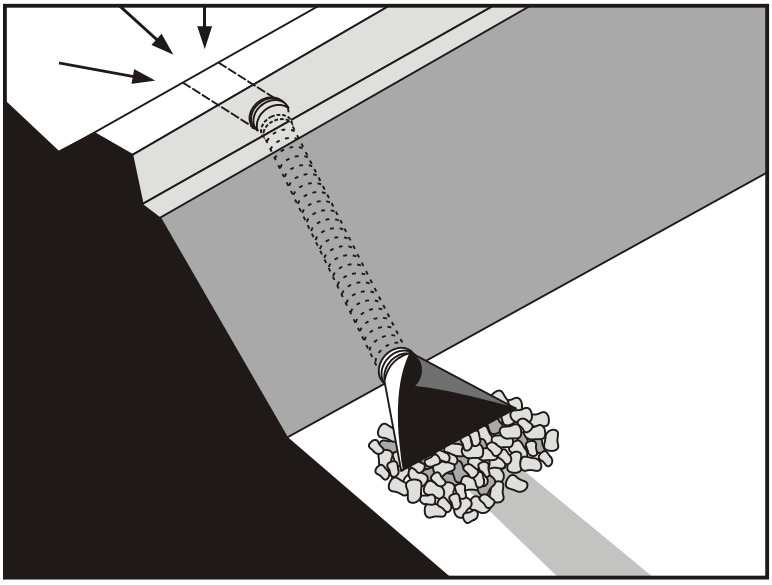
Figure SS 1-1: Ditches, Berms, Dikes and Swales

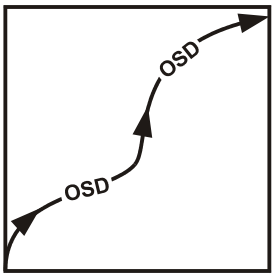


Note: Actual layout determined by design

Slope Down Drains

SS-4





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

Slope down drains are pipes, flumes or paved spillways used to protect slopes against erosion by collecting surface runoff from the roadbed, the tops of cuts, or from benches in cut or fill slopes, and conveying it down the slope to a stabilized drainage ditch or area. These devices should be used in conjunction with energy dissipation devices and other protection devices.

Appropriate Applications

Slope down drains are typically used at sites where concentrated flows must be conveyed down a slope without causing erosion. Slope down drains may consist of lined ditches or swales or, for steeper slopes, pipes or flumes.

Limitations

- The use of these devices may reduce the time of concentration (as compared to flatter, more naturalized conveyance facilities) for storm water runoff and contribute to increased peak runoff rates.
- When a slope down drain is not to be placed in a trench and backfilled, and if directed by the Engineer or specified, the down drain shall be securely anchored to the slope of the ground with an anchor assembly as directed by the Engineer or specified in the project plans.

Design Guidance

Design must be in accordance with the NDOT Drainage Manual, and NDOT Standard Plans and Specifications. Additionally, the following design guidelines should be considered:

- Slope down drains should be positioned at the lower end of the slope.
- Pipe down drains are metal pipes adaptable to any slope. They should be considered where side slopes are 4:1 (H:V) or steeper and buried when practical.

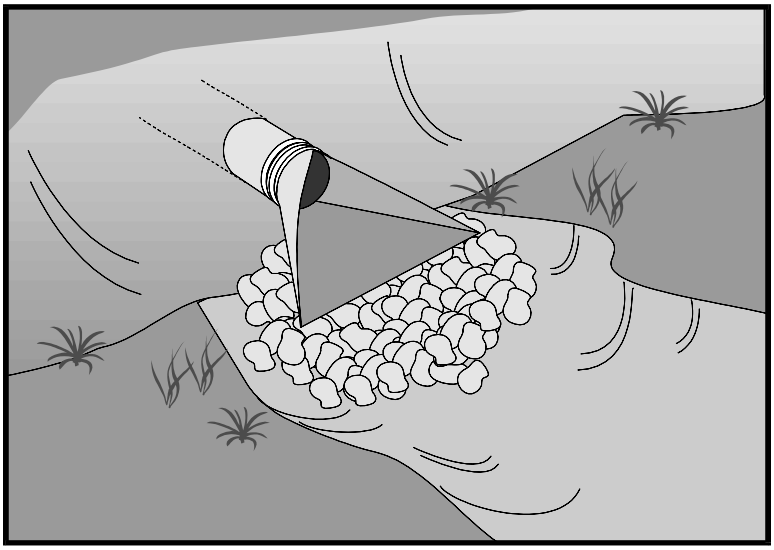
- Paved or lined spillways are recommended on side slopes flatter than 4:1 (H:V) On steeper slopes, a pipe should be used.
- Flume slope down drains are typically rectangular corrugated metal channels. They are more suitable for lower flow applications on slopes that are 2:1 (H:V) or flatter.
- Slope down drains shall be securely anchored to the slope per NDOT Standard Plans.
- Slope down drains are typically spaced laterally at 33 ft to 50 ft intervals to prevent the development of erosive flows.
- Provide for outlet protection and energy dissipation devices at the outlet of the drain, where needed.
- Severe erosion may result when overside drains fail by over topping, or pipe separation.
- Tapered inlets shall be installed in such a manner as to function properly and efficiently and shall be placed to retain the material in the dike and prevent water from percolating under or around them. The seal between the entrance of the slope down drain and the surrounding material shall be watertight.

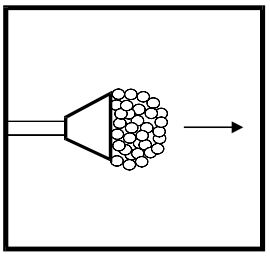
Maintenance and Inspection

- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Check for accumulated material and remove as necessary.

Flared Culvert End Sections

SS-5





BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

These are devices typically placed at inlets and outlets of pipes and channels to improve the hydraulic operation, retain the embankment near pipe conveyances and to help prevent scour and minimize erosion at these inlets and outlets.

Appropriate Applications

Flared culvert end sections should be used in the following:

- At inlets and outlets of slope drains and culverts.
- In conjunction with other protection such as rock aprons for additional scour protection and velocity dissipation.

Limitations

Limitations to consider in the use and design of flared culvert end sections include:

- Limited erosion control benefits when these structures are installed alone. The primary function of these devices is to improve the hydraulic efficiency of the drainage system.

Design Guidance

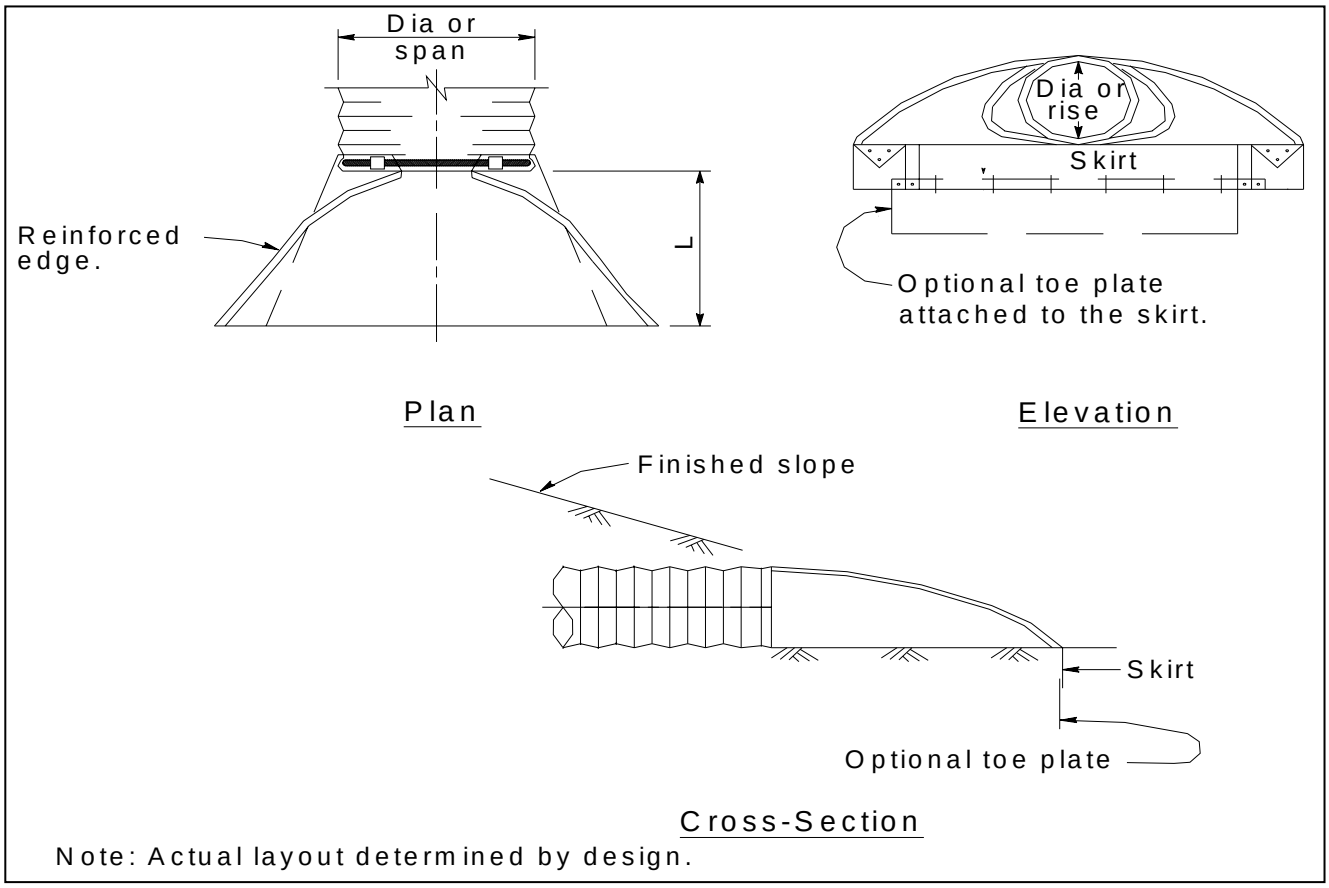
Design must be in accordance with the NDOT Drainage Manual, and NDOT Standard Plans and Specifications. Additionally, the following design guidelines should be considered:

- Use with other outlet protection/velocity dissipation devices as appropriate.

Figure SS 2-1 illustrates a typical flared culvert end section. For additional detail and dimensioning see NDOT 2001 Standard Plans, Pages R-14 & R-5.

Flared Culvert End Sections

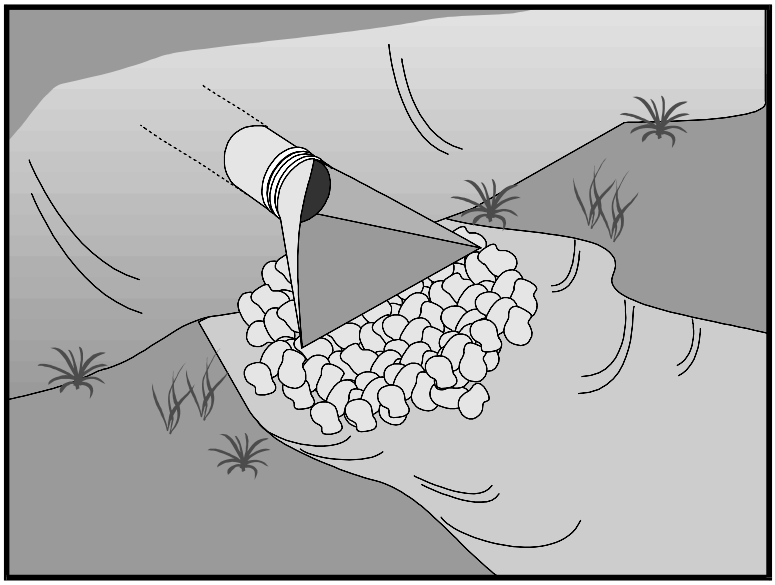
Figure SS 2-1
Flared Culvert End Section

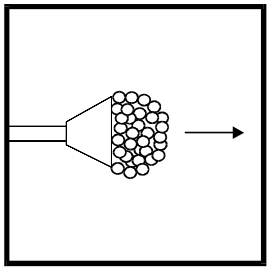


Note: Actual layout determined by design.

Outlet Protection/Velocity Dissipation Devices

SS-6





BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water

Definition and Purpose

Outlet protection is most commonly composed of a rock apron or concrete headwall and is typically used in conjunction with flared culvert end sections to prevent scour and erosion of the embankment, and reduce the outlet velocity and/or energy of exiting stormwater flows. A variety of velocity/energy dissipators exist, including:

- Grouted or non-grouted rip-rap,
- 90-degree bends or tees at pipe outlets,
- Baffle boxes, and
- Stilling basins.

Appropriate Applications

These devices are typically used at:

- The outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, where localized scouring is anticipated due to high energy flows exiting these structures.
- Outlets subject to short, intense flows of water, such as from flash floods.
- Where pipes, channels or ditches transition to unlined conveyances.

Outlet Protection/Velocity Dissipation Devices

Limitations/ Precautions

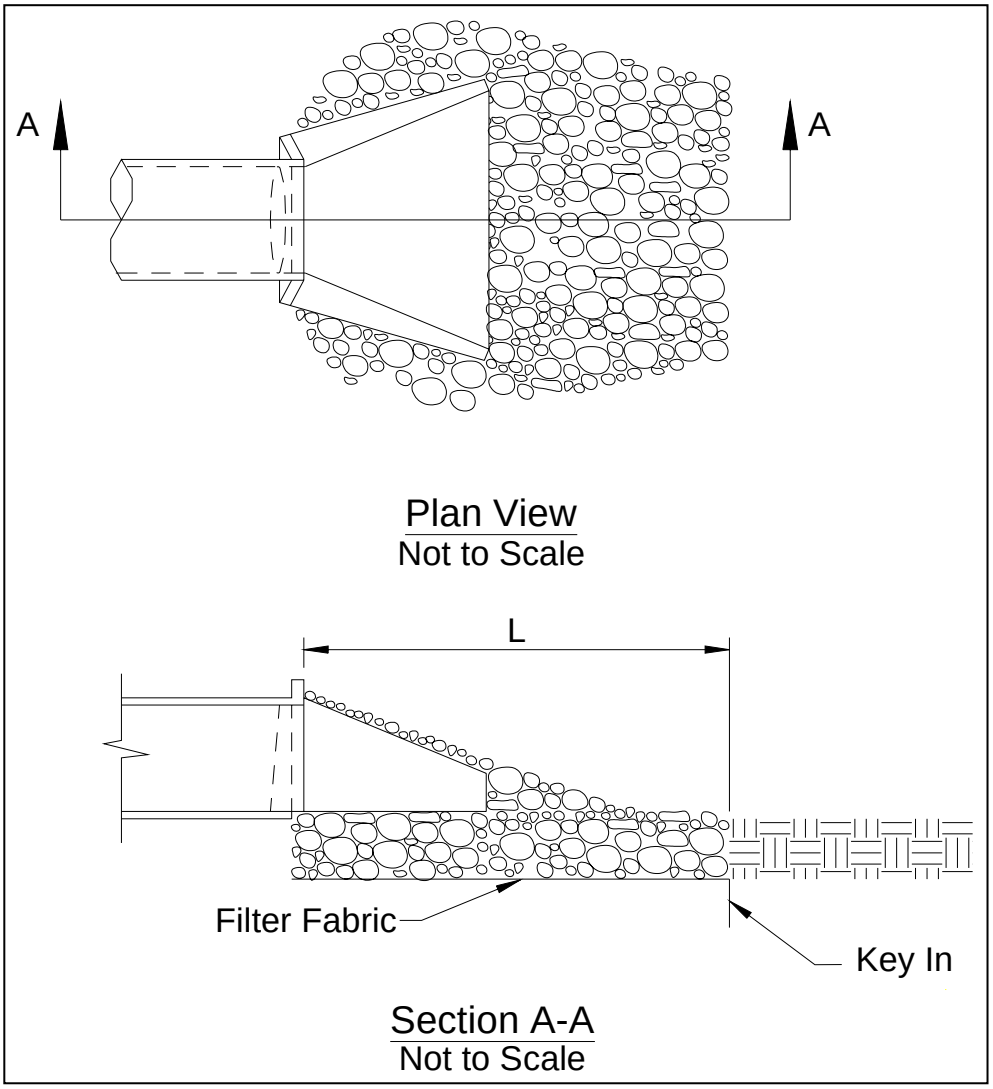
- High flows may cause riprap to wash away.
- Freeze/Thaw cycles may cause grouted riprap to break up.
- If there is not adequate drainage and water builds up behind grouted riprap, it may cause the grout to break up due to the resulting hydrostatic pressure.
- May require maintenance due to sediment/debris accumulation.
- May require additional right-of-way

Design Guidance

- There are many types of energy dissipaters; rock, which is represented in Figure SS 6-1, is one common type. However, note that this is only one example and the Hydraulics Engineer must be contacted for region-specific requirements.
- Common device for outlet protection is a structurally lined apron, lined with riprap, grouted riprap or concrete apron. Also see the Flared Culvert End Section BMP fact sheet in this appendix.
- Apron length is related to outlet flow rate and tailwater level.
- A generalized rock apron device is shown in Figure SS 6-1. For additional details and dimensions see NDOT Standard Plan R-3.1.4. Concrete headwalls shall be designed in accordance with the NDOT Standard Plans R-2.4.1 through R-2.7.2.

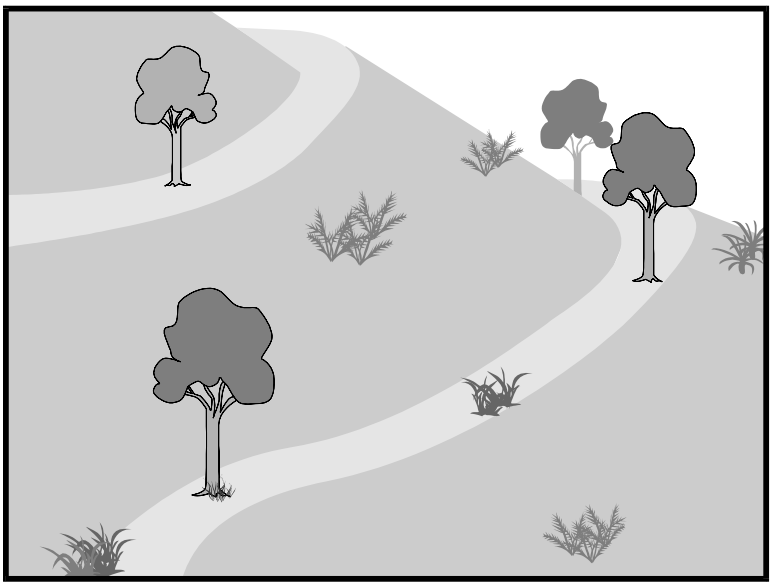
Outlet Protection/Velocity Dissipation Devices

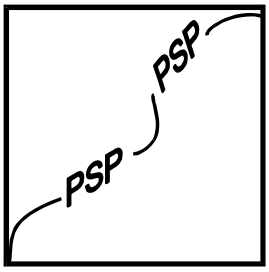
Figure SS 6-1
Outlet Protection/Velocity Dissipation Device



Vegetated Surfaces

SS-7





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

A vegetated surface is a permanent perennial vegetative cover on areas that have been disturbed by construction. The purpose of a vegetated surface is to protect the soil surface from erosion, and remove pollutants by promoting infiltration, settling, and other physical and biological removal processes. Vegetated surfaces offer several advantages to paved surfaces, including lower runoff volumes and slower runoff velocities, increased times of concentration and lower cost.

Appropriate Applications

Nevada's General Permit for Storm Water Discharges Associated with Construction Activities requires 70% re-establishment of pre-construction vegetation. Vegetated surfaces should be established on areas of disturbed soil after construction related activities in that area are completed, and after the slope or surface has been prepared.

Vegetated surfaces should only be considered for areas that can support the selected vegetation permanently. In many parts of Nevada, dry desert conditions may prohibit the use of many types of plants. In other areas, such as Lake Tahoe, plants that are specialized for high alpine climates are needed. Consult the NDOT Landscape Architect regarding vegetated surfaces and appropriate applications. Other guidance is available from the 2002, Nevada revegetation specifications (UNR, 2002) or the TRPA recommended plant list (TRPA, 2002).

Permanent seeding and planting is appropriate in most areas that are susceptible to erosion by wind or water and have sufficient rainfall or temporary irrigation to establish and maintain the selected plant materials. Appropriate areas for vegetated surfaces include all areas of the site disturbed by construction, cut and fill areas, slopes, spoil piles, waterways, buffer strips, and stream banks.

Limitations

Limitations to consider in the use and design of vegetated surfaces include:

- If the site is highly susceptible to erosion, additional control measures may be necessary during the establishment of vegetation.
- Where site or slope-specific conditions would prevent adequate establishment and maintenance of a vegetative cover, hard surfacing may be more appropriate.

Design Guidance

The following general steps should be taken when developing a vegetation plan:

- Consider soil type and condition and if appropriate soil amendments if needed.
- Evaluate site topography, climate and season and select the appropriate native or adapted vegetation for the site.
- Develop the appropriate planting details and specifications including ongoing irrigation and maintenance requirements.
- Consider the use of geotextiles, blankets and mats, geogrids, meshes and webs. A wide variety of materials are available that are designed to be used in combination with vegetation to aid in the preliminary establishment and/or permanently strengthen the vegetated surface.

The following provide planting and maintenance guidelines:

- Refer to NDOT Standard Specifications, Section 211 Erosion Control for additional seeding requirements.
- Consult with the seed supplier, landscape architect, or other native plant specialist for more specific guidelines on planting and maintenance.
- Plant the seed using broadcast seeding, seed drilling or hydraulic application.
- Follow-up applications should be made to cover weak spots or other disturbances.
- After planting of seed, apply protective mulch, erosion control blanket, or other protective cover, to keep the seed in place and to cover and moderate the soil moisture and temperature until the seed germinates and grows.
- Schedule seeding and planting to occur when soil temperature and moisture will optimize seed germination and plant growth.

- When determined feasible, strip and stockpile topsoil (duff) and removed vegetation during construction. Use stockpiled materials in the surface preparation prior to seeding operations.
- Apply fertilizer or other soil amendments as indicated by the soils evaluation
- Vegetated surfaces should be designed to minimize flow depths and velocities, and maximize contact time between water and vegetated surfaces. This will enhance infiltration and pollutant removal opportunities

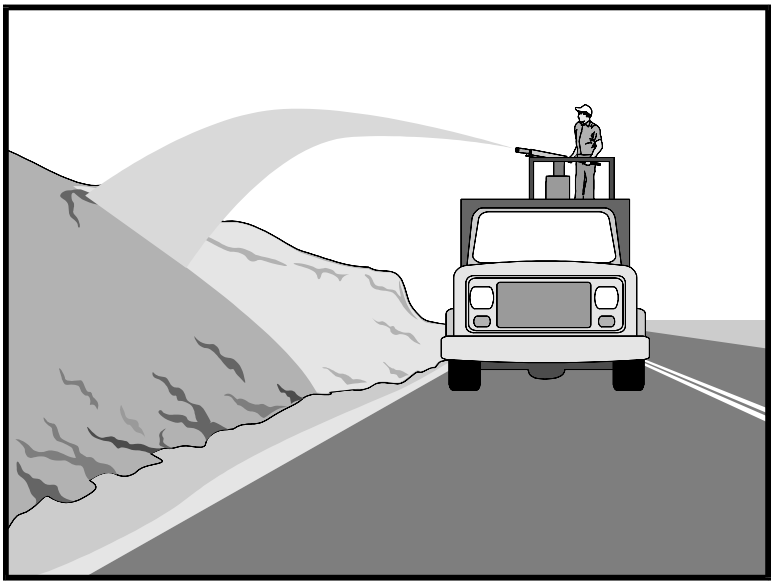
Maintenance and Inspection

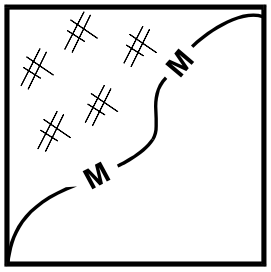
The following are maintenance and inspection considerations:

- All seeded areas should be inspected for failures and re-seeded, fertilized, and mulched as needed within the planting season.
- Most vegetation will require irrigation during the establishment period.

Mulching

SS-8





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

Mulching is the process of applying loose bulk materials to the soil surface as a permanent or temporary cover. Mulches are used to protect bare soil from wind and water erosion.

The primary function of mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff. Mulches are also generally used to compliment seeding and vegetation establishment techniques, by serving as protection for the soil before the seeds and vegetation have had a chance to grow and establish, although some mulches like rock aggregates and wood/bark chips can be used in lieu of long-term established vegetation. Mulches also prevent moisture loss, add nutrients to the soil, and help insulate the soil from extreme temperatures.

The types of mulches addressed in this section include:

- **Straw:** Field grasses indigenous to the area. Must be provided in an air-dried condition, free of noxious weeds or other materials detrimental to plant life.
- **Wood/Bark**: Manufactured from any clean, green softwood, which is cut rather than shredded or broken. For details and dimensions see NDOT Standard Specifications, Section 726.03.04 (c).
- **Rock Mulch:** Rock mulches are composed of clean, broken rock ranging in size from approximately one-half inch (pea gravel) to twelve inches or larger. (Also see Rock Slope Protection)

Appropriate Applications

Mulching is considered an erosion control (soil stabilization) alternative in the following situations:

- Straw may be used as a stand-alone temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetative cover can be established.
- Wood mulches are primarily used in areas as a temporary ground cover around trees, shrubs, and landscape plantings.
- Rock mulches are effective as long-term, non-vegetative ground covers in areas not otherwise protected from erosion due to wind and rain. These may be especially suitable in dryer areas where vegetation is more difficult to establish.

Limitations

Straw:

- There is potential for introduction of invasive weeds and unwanted plant material in sensitive areas. Certified "weed free" straw is required by NDOT Standard Specifications.
- When blowers are used to apply straw mulch, areas to be treated must be within 150 ft (45 m) of a road or other surface capable of supporting vehicular traffic. Wind and air quality considerations may also limit this application method.
- Straw can wash away with runoff or be blown by wind if not crimped into the soil or stabilized with a tackifier.

Wood:

- Erosion control effectiveness is unknown, but is considered poor. Chips are difficult to anchor on steep slopes and may wash away with runoff or be blown by high winds.

Rock:

- Rock mulches may require approval of city or local planning agencies for aesthetics.
- Rock mulches are more expensive than organic mulches and can be very labor intensive to install.

Design Guidance

Mulch Selection

There are many types of mulches, and selection of the appropriate type should be based on the type of application and site conditions. Mulches shall conform to NDOT Standard Specifications for roadside materials as in Section 726.03.04. Table SS 8-1 at the end of this section provides additional criteria that should be considered when selecting the appropriate mulch.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking should only be used where rolling is impractical.

Consider the use of geotextiles, blankets and mats, geogrids, and cellular confinement systems. A wide variety of materials are available that are designed to be used in combination with mulches to aid holding the mulch in place.

Avoid mulch over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

The construction-application procedures for mulches vary significantly depending upon the type of mulching method specified. Three (3) methods are highlighted here:

Straw Mulching:

Loose straw is the most common mulch material used in conjunction with direct seeding of soil. Mulching is generally the second part of a multi-step process that should be implemented as follows:

- Apply seed and fertilizer to the bare soil as specified in the contract documents.
- Apply loose straw immediately after seeding over the top of the seed/ fertilizer at a rate of 1,500-2000 lb/acre, either by machine or hand distribution.
- The straw must be evenly distributed on the soil surface.
- Anchor the straw in place by using a tackifier, netting, or "punch" it into the soil mechanically. Anchor to a depth of 2 in.
- Methods for holding the mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity requirements. "Punching" straw into the soil is the best way to anchor it in place:

- On small areas a spade or shovel can be used.
- On slopes with stable soils with sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife-blade roller or a straight bladed coulter, known commercially as a "crimper" or "sheepsfoot"
- On small areas and/or steepened slopes, straw can also be held in place using plastic netting.
- Where slopes are too steep to support construction equipment or areas of application too large to allow cost-effective use of nettings, straw should be held in place using NDOT approved tackifiers, which act to glue the straw together and to the soil surface.

Wood Mulching:

- Can be spread by hand or pneumatically
- The mulch should be evenly distributed across the soil surface to a depth of 2 – 3 inches.

Rock Mulching:

- May be spread by hand or construction grading equipment
- The mulch should be evenly distributed across the soil surface to a depth of 2 – 3 inches.

Mulches should be applied in conformance with NDOT Standard Specifications for erosion control described in Section 211.03.05.

Maintenance and Inspection

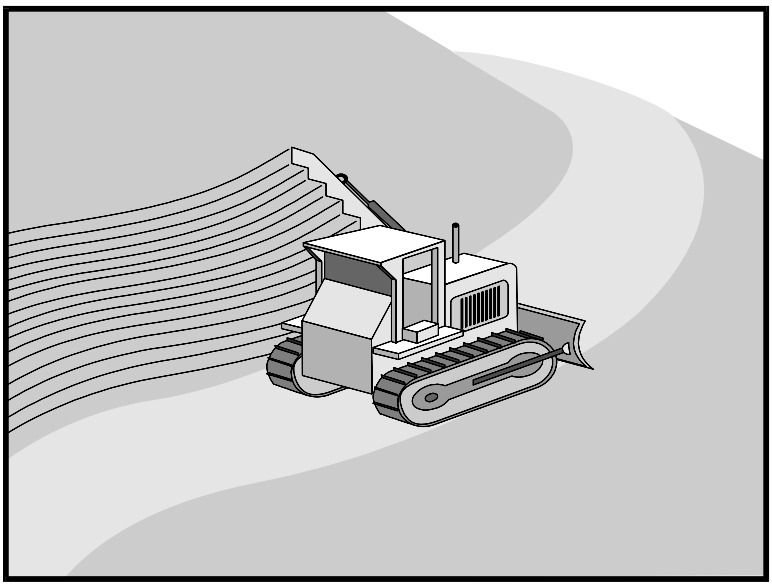
Regardless of the mulching technique selected, the key consideration in maintenance and inspection is that the mulch needs to last long enough to achieve erosion-control objectives. Mulches applied to temporarily stabilized, seeded areas, must last as long as it takes for vegetation to develop and provide permanent, erosion-resistant cover. If the mulch is applied as a stand-alone erosion control method over disturbed areas (without seed), it should last the length of time the site will remain barren or until final re-grading and revegetation. Conversely, if the mulch is utilized as part of a revegetation strategy, then a balance should be struck between the degradation of the mulch and the emergence of vegetation over time.

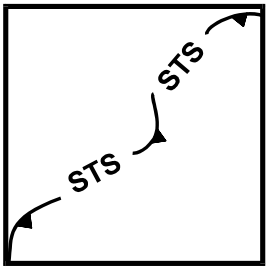
Where vegetation is the ultimate cover, maintenance and inspection should focus on the quality and diversity of vegetation establishment through the mulch. Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark, wood chips or rock, inspection and maintenance should focus on longevity and integrity of the mulch.

Table SS 8-1
Mulch Selection Considerations

Cost: ■ Material Cost ■ Preparation Cost ■ Installation Cost ■ Maintenance Cost	**Vegetation Enhancement:** ■ Native plant compatibility ■ Germination rate ■ Moisture retention ■ Temperature modification ■ Open space coverage ■ Nutrient uptake
Effectiveness: ■ Reduction of erosion ■ Reduction of flow velocity ■ Reduction of runoff	**Installation:** ■ Availability ■ Ease of installation ■ Safety
Acceptability: ■ Environmental compatibility ■ Institutional/regulatory acceptability ■ Visual impact	**Maintenance:** ■ Availability ■ Durability ■ Longevity

Slope Roughening/Terracing/Rounding SS-9





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

Roughening, terracing and rounding are techniques used for creating unevenness on bare soil through the construction of furrows, terraces, serrations, stair-steps, or track-marks on the soil surface to increase the effectiveness of temporary and permanent soil stabilization (erosion control) practices. Roughening, terracing and rounding should be used as permanent measures to prepare a slope to receive permanent vegetation.

Slope roughening or terracing reduces erosion potential by decreasing runoff velocities, reducing the length of sheet flow, trapping sediment, and increasing infiltration of water into the soil. Slope rounding is a design technique used to minimize the formation of concentrated flows.

Appropriate Applications

Slope Roughening/Terracing/Rounding should be considered for the following applications:

- Use on cut or fill slopes, prior to the application of temporary or permanent soil stabilization.
- Use where seeding, planting and mulching to stabilize exposed soils will benefit from surface roughening, such as graded areas with smooth hard surfaces.

Consider terracing as an option if the slope length needs to be shortened. Terraces must be designed with adequate drainage and stabilized outlets to discharge storm water accumulations.

Limitations

- May increase grading costs.
- These techniques are not suitable for highly erosive or non-cohesive soils.
- Roughening alone will not withstand heavy rainfall events.

Design Guidance

The site-specific characteristics of the slope must be considered when deciding what method to use for achieving a roughened soil surface. Slope steepness, mowing requirements, soil type, and whether the slope is formed by cutting or filling must be considered when choosing a method. Roughening methods include stair step grading or furrowing, which must be done across the slope and along the contour, and tracking, which must be done up and down the slope.

Roughening:

- Use stair step grading or furrows on slopes that are steeper than 3:1 (H:V) and tracking on less steep slopes. See Figure SS 9-1 for general illustrations of roughening, terracing and rounding. Additional details and dimensions may be found in NDOT Standard Plans and Specifications.
- 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, with individual vertical cuts no more than 24 in high in soft materials or no more than 3 ft high in rocky materials. Slightly slope the horizontal position of the "step" in towards the slope.
- Limit roughening with tracked machinery to soils with a sandy textural component to avoid over-compaction of the soil.

Terracing:

- Terracing may be appropriate for slopes 2:1 (H:V) or steeper. Geotechnical design issues must be considered when terracing or benching a slope. Terraces or benches should be sloped to form a valley at the toe of the upper slope.
- Lined diversion ditches and downdrains should be utilized for runoff from terraces and benches.

Rounding:

- The tops and toes of all cut slopes where the material is not solid rock should be rounded to blend with and match the adjacent existing conditions.

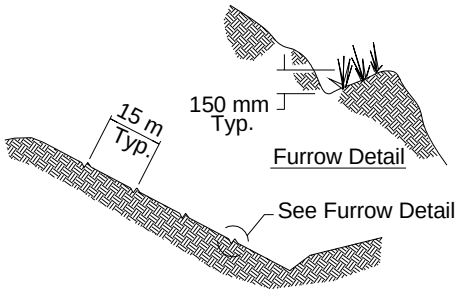
See NDOT Standard Specifications, Section 204 for additional requirements on slope rounding.

Maintenance and Inspection

Periodically check the seeded or planted slopes for rills and washes, particularly after significant storm events, greater than 0.5 in. Fill these areas slightly above the original grade, then re-seed and mulch as soon as possible. Avoid use of heavy equipment or machinery as it can damage a newly re-vegetated slope.

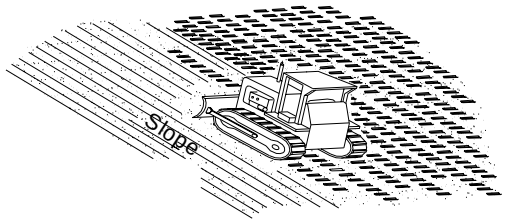
Figure SS 9-1

Slope Roughening, Terracing, Rounding, and Stepping

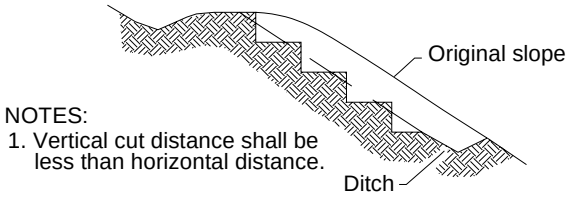


Contour Furrows
Not to Scale

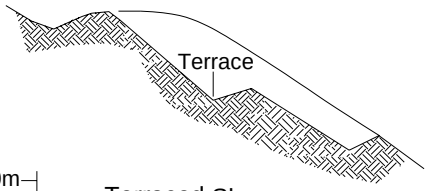
Note: Actual layout determined by design.



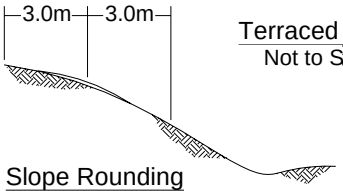
Tracking



Stepped Slope
Not to Scale



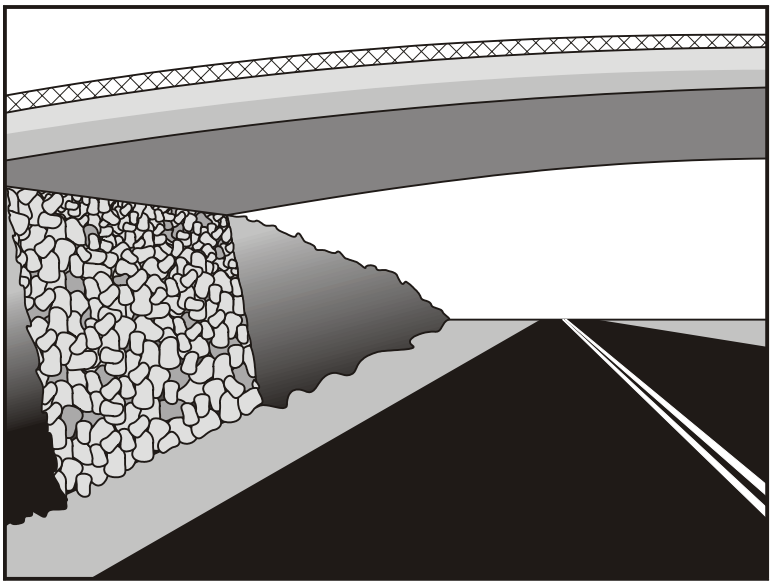
Terraced Slope
Not to Scale

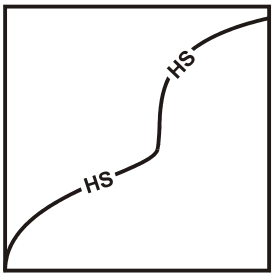


Slope Rounding
Not to Scale

Hard Surfaces

SS-10





BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water

Definition and Purpose

Hard surfaces consist of rock slope protection (RSP), grouted RSP, asphalt concrete or concrete pavement, and stabilization with asphalt millings. The effects of increased runoff from impervious areas must be considered when specifying hard surfaces for slope protection.

Appropriate Applications

Apply on disturbed soil areas where vegetation or other techniques will not provide adequate erosion protection. Hard surfaces may be suitable in areas where it is difficult or unfeasible to maintain vegetation.

Limitations

- Hard surface techniques are generally the most expensive type of slope or surface protection.
- Freeze/Thaw cycle can cause concrete (grout) to crack and break apart.
- The use of hard surfaces may be constrained by aesthetic considerations.
- If the hard surface is impervious, provisions must be made for the additional runoff.

Design Guidance

Design of hard surface slope protection must be coordinated with the Landscape Architect, Materials, Maintenance and other interested units.

Rock Slope Protection (RSP):

- RSP or riprap shall conform to NDOT Standard Specifications Section 611 and 204.
- Angular rock of specified size class is placed over fabric and/or riprap bedding to armor slopes, streambanks, etc.

- Remove loose, sharp, or extraneous material from the slope to be treated prior to placement of rock slope protection.
- Place underlayment fabric loosely over the surface so that the fabric conforms to the surface without damage. Equipment or vehicles should not be driven directly on the fabric. Fabric should be keyed in a minimum of 6" along the top of the slope.
- Excavate a footing trench along the toe of the slope and place a row of the largest rock in the specified class in the trench.
- Rock should be placed for maximum contact with the ground surface and adjacent rock.
- Use the largest rock at the toe of the slope and gradually decrease the size towards the top of the slope.

Grouted RSP:

- Angular rock of specified size class is placed over fabric and/or bedding material used to armor slopes, streambanks, etc.
- Concrete/Grout is placed into the rock interstices by gravity flow and spading and rodding, a minimum of brushing and troweling is required.

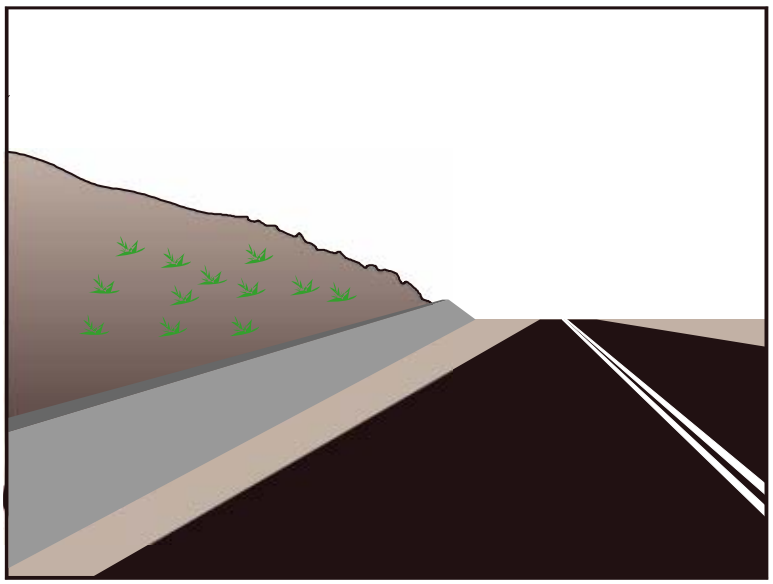
Slope Paving:

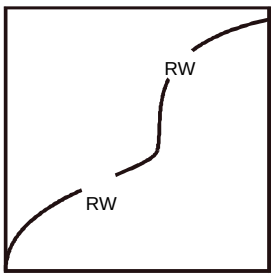
- Includes concrete, asphalt concrete, and asphalt millings.
- See NDOT Standard Plans and Specifications, Section 611 for additional requirements of Concrete Slope Paving.
- Provides erosion control and soil stabilization in areas where vegetation is difficult to establish.
- Foundation areas should be evenly graded and thoroughly compacted, with moisture sufficient to allow a firm foundation and to prevent absorption of water from the concrete or mortar. Work should be scheduled so that the work (including placing, finishing, and application of curing compound) between timber borders is started and completed in the same day.
- Asphalt millings may used to stabilize shoulders or other disturbed soil areas. They also may be especially suitable in dryer areas where vegetation is more difficult to establish.

- Asphalt millings should be spread and compacted quickly after they are generated to prevent re-hardening in the stockpile.
- Compacted grindings create an impervious surface and additional runoff should be provided for.

Retaining Walls

SS-11





BMP Objectives

- Soil Stabilization
- Sediment Control
- Tracking Control
- Wind Erosion Control
- Non-Storm Water

Definition and Purpose

In the context of this manual, retaining walls function to stabilize slope surfaces and protect against scour or erosion by reducing slope length and steepness. Retaining walls are also used to prevent mass movement of slopes; however, this is beyond the scope of this manual.

NDOT's Geotechnical Manual and The FHWA Geotechnical Engineering Circular No. 2 - Earth Retaining Systems (SA-96-038) provides more complete design guidance in the use of walls for this purpose. Select information from the Geotechnical Manual has been included below.

Retaining walls can be classified into fill wall and cut wall applications. Examples of fill walls include standard cantilever walls, modular gravity walls (gabions, bin walls, and crib walls), and Mechanically Stabilized Earth (MSE) Walls. Cut walls include soil nail walls, cantilever soldier pile walls, and ground anchored walls.

Standard Cantilever Walls

A concrete cantilever wall is constructed of cast-in-place reinforced concrete, consisting of a vertical stem and footing slab base connected to form the shape of an inverted T. After curing, the back of the wall is backfilled with free-draining, granular backfill. The backfill weight on the heel of the footing slab enables the structure to function as a gravity wall.

Timber Retaining Walls are a variation of cantilevered wall. These walls are typically 3 or 4 feet high and are constructed of vertical posts set in concrete with horizontal planking bolted to the posts.

Modular Gravity Walls

These walls use interlocking soil or rock-filled concrete, timber, or steel modules that resist earth pressures by acting as gravity walls. Examples of modular gravity walls include gabions, bin walls, masonry block, and crib walls. These wall types commonly use proprietary materials.

Gabion: Gabions are large rectangular wire mesh boxes that are filled with rock and laced together.

Masonry Block: A wall arranged in straight uniform courses of slump or split faced masonry block filled with mortar.

Mechanically Stabilized Earth (MSE) Walls

A wall constructed of reinforced cast in place or pre cast concrete panels. Mechanically stabilized earth (MSE) walls consist of tensile reinforcements in soil backfill, with facing elements that are vertical or near vertical. The reinforced mass functions as a gravity wall.

Reinforced Soil Slopes (RSS) are a variation of MSE walls and consist of tensile reinforcements in soil backfill. The reinforcement allows the slope to be constructed steeper than the normal angle of repose for the unreinforced material. Depending on the materials used, the outer face inclinations can be constructed up to 70 degrees from the horizontal. Primary reinforcing elements provide overall stability while secondary (shorter) reinforcing elements are used to provide near face support. Commonly, various types of slope facing including erosion control blankets, geogrids, gabions, or shotcrete are included to prevent near surface erosion and raveling, especially in steeper applications.

Soil Nail Walls

Soil nails are closely spaced, passive reinforcements used to strengthen existing ground. They consist of steel bars grouted into the soil connected to a temporary or permanent shotcrete facing. They are constructed in a top down manner and are used to support an excavation face. The FHWA Manual for Design and Construction Monitoring of Soil Nail Walls (FHWA-SA-96-069) is recommended for design of soil nail walls.

Cantilevered Soldier Pile and Sheet Piles Walls

These walls consist of vertical wall elements that derive lateral resistance from embedment into soil below the exposed wall face, and support the retained soil with facing elements or the piles themselves.

Appropriate Applications

Retaining walls are most appropriate for steep slopes, 1.5:1 (H:V) or greater, that cannot be re-graded to decrease the slope due to right-of-way or other constraints.

Limitations

- Structures may fail if not properly designed, installed and maintained.
- Retaining wall design should be performed by a licensed and qualified engineer.
- Vehicles and/or snow removal equipment can damage retaining walls.
- Some retaining walls or systems may be patented and therefore require legal agreements and additional associated costs.

Design Guidance

- General planning and design considerations for retaining walls are presented below. For more complete design guidance, see NDOT's Geotechnical Manual and The FHWA Geotechnical Engineering Circular No. 2 - Earth Retaining Systems (SA-96-038).
- All retaining walls must conform to NDOT Standard Plans and Specifications.
- Plans, calculations and construction specifications shall be prepared and stamped by a licensed and qualified professional engineer.
- Alignment of the wall is crucial for strength. It must be straight and plumb.
- Most effective when used in combination with vegetative or other surface stabilization on the exposed soils above the wall.
- Drainage should be provided to remove accumulated water behind the wall.

Timber Retaining Walls

- Pressure treated wood should be used to prevent decomposition
- Stagger the joints of the timber so that they don't align vertically.

Gabion Walls

- One or two layers of gabions can be used for building low walls. This is a good alternative when large rock is unavailable.
- Multiple layers, extending up to 30 feet, can be built.
- Mechanical stability of the wall is dependent on free drainage. The

presence of clay, silt and organic material behind the wall is not desirable.

Masonry Block Wall

- Masonry blocks shall be slump block or split face block of the dimensions shown on the plans and conforming to ASTM C90, Type I.
- Blocks are available in decorative colors and textures for aesthetic purposes.

Mechanically Stabilized Earth Walls

- Design Mechanically Stabilized Earth walls for a minimum service life of 75 years.
- The face of the walls shall be composed of precast reinforced concrete panels unless otherwise noted.
- Backfill shall be free from organic and otherwise deleterious materials. Do not use pea gravel.
- Soil reinforcing materials must be carefully inspected to insure they are true to size and free from defects that may impair their strength and durability.

Maintenance and Inspection

- Retaining walls require little maintenance, when properly installed.
- The walls should be inspected periodically for damage caused by subsurface drainage, material sloughing, snow removal equipment or other vehicle damage.

Biofiltration Swales and Strips

TC-1

Definition and Purpose

Biofiltration swales and biofiltration strips (bio-strips) provide pollutant removal from storm water while improving aethetics and biodiversity. Biofiltration swales and strips reduce pollutant concentration and load by slowing flows and promoting settling, biological uptake by plants and other organisms and by increasing infiltration.

Biofiltration swales are vegetated channels that receive directed flow and convey storm water. Bio-strips, also known as vegetated buffer strips, are vegetated sections of land over which storm water flows as overland sheet flow.

Pollutants are removed by sedimentation, filtration through vegetation, adsorption to soil particles, biological uptake, and infiltration through the soil. Strips and swales are most effective at removing debris and solid particles, although some dissolved constituents can also be removed.

Appropriate Applications

Vegetated strips and swales should be considered wherever site conditions and climate allow vegetation to be established and where flow velocities are not high enough to cause scour. If vegetated strips or swales cannot be sited to accept directed flows, vegetated areas provide treatment of rainfall and reduce the overall impervious surface. Suitable zones include but are not limited to: medians, parking lot surroundings, and around buildings.

Limitations

In arid locations, feasible vegetation choices can be limited by the capability of the vegetation to survive through extended dry and hot intervals. In ultra-urban environments the area required for biofiltration strips and swales may be expensive and impractical to procure.

Biofiltration Swales and Strips

Design Guidance

Swales have two design goals: 1) maximize treatment, and 2) provide adequate hydraulic function for flood routing, drainage and scour prevention. Treatment is maximized by designing the flow of water through the swale to be as shallow and long as site constraints allow. No minimum dimensions are required for treatment purposes, as this could exclude swales from consideration at some sites. Swales should also be sized as a conveyance system calculated according to NDOT procedures for peak flow routing and scour.

To maximize treatment efficiency, bio-strips should be designed to be as long (in the direction of flow) and as flat as the site will allow. No minimum lengths are required for treatment purposes and no maximum slope has been established. Bio-strips are most efficient when sheet flow is maintained at the greatest duration possible. Turbulent flow will increase the erosive force on the bio-strip. This erosive action can cause pollutant re-suspension and downstream transport. The area to be used for the strip should be free of gullies or rills that can concentrate overland flow and cause erosion or turbulence.

Guidelines for vegetation mixes appropriate for various climates and locations in Nevada are provided by UNR (UNR, 2001). Consult with the NDOT Landscape Architect for approval upon determination of appropriate vegetation mix design. The table below summarizes planning and design considerations for bio-strips and swales.

Maintenance and Inspection

Check for development of gullies and/or rills within the bio-strip that can cause ponding, flow concentration, and disrupt the overland sheet flow.

Vegetation may require mowing or harvesting to prevent overgrowth and clogging of the drainage system.

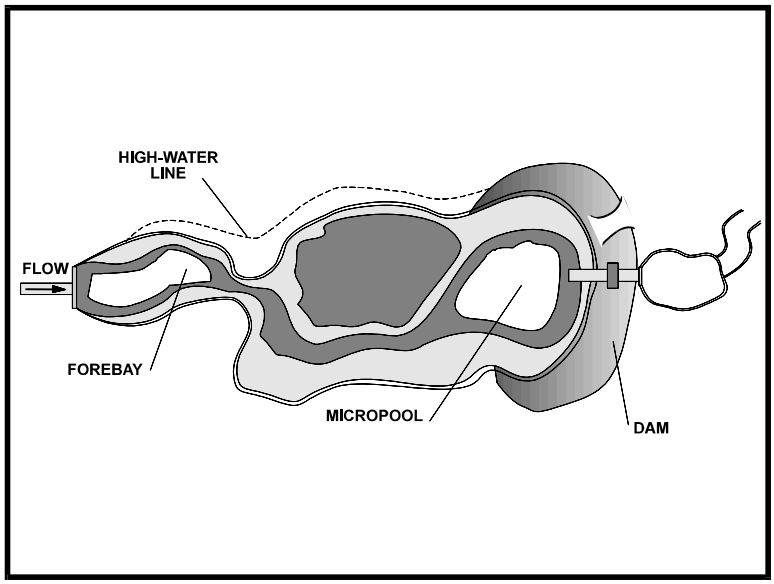
Table TC 1-1

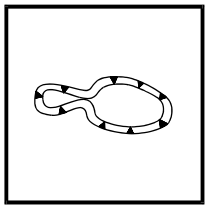
Summary of Biofiltration (Strips and Swales)

Description	Applications/Siting	Planning and Design Considerations
Swales are vegetated channels that receive and convey storm water. Strips are vegetated buffer strips over which storm water flows as sheet flow. **Treatment Mechanisms:** ▪ Filtration/Adsorption ▪ Sedimentation ▪ Infiltration **Pollutants removed:** ▪ Debris and solid particles ▪ Some dissolved constituents	▪ Site conditions and climate allow vegetation to be established ▪ Consider where flow velocities will not cause scour	▪ Swales sized as a conveyance system (per NDOT flood routing and scour procedures) ▪ Design water depth as shallow as the site will reasonably permit ▪ Strips sized as long (in direction of flow) and flat as the site will reasonably allow ▪ Strips should be free of gullies or rills ▪ Strips should be as wide as possible No minimum dimensions or slope restrictions for treatment purposes ▪ Vegetation mix appropriate for climates and location ▪ Maximum length of bio-Strip is governed by suitable flow conditions

Infiltration Basins

TC-2





BMP Objectives

- ● Sediment
- ● Oil and Grease
- ● Metals and Toxics
- ○ Nutrients
- ● Bacteria

- ● Highly Effective
- ○ Low Effectiveness

Definition and Purpose

An infiltration basin is a device designed to remove pollutants from surface discharges by capturing the runoff volume from the water quality design storm and infiltrating it prior to the next significant storm event. The primary functions of infiltration basins are to remove pollutants from storm water runoff where soil conditions are suitable, and to recharge or replenish the ground water. In addition, infiltration basins can significantly reduce total annual surface runoff volume, which can reduce streambank erosion and other adverse impacts to stream habitats from transportation facility runoff.

Infiltration basins generally are designed to capture, store and treat (infiltrate) at a volume that would retain a relatively high percentage (often greater than 80%) of all runoff, often called the Water Quality Volume (WQV). The WQV is the volume of runoff produced by the equivalent of, at a minimum, the treatment design storm event. The WQV criteria should be from permit or other regulatory data and applied to site-specific rainfall data to determine the design volume. As noted in Section 2, in Nevada, a design WQV is only specified for projects within the Lake Tahoe Basin. Criteria for other projects would be determined on a location-specific basis.

Appropriate Applications

Consider infiltration basins for use when runoff from the completed facility will discharge to significant areas of highly valuable habitat in which Federal or State listed aquatic resources have been identified, and NDOT runoff will constitute a substantial portion of the total flows to such habitat.

- Infiltration basins should be considered only when underlying soils are highly permeable and depth to groundwater is sufficient to allow

infiltration and where groundwater pollution is not an anticipated concern.

- Infiltration basins are effective when a high level of particulate and dissolved pollutant removal is required. Pollutants are removed by filtering through the soil mantle. If properly designed, very little pollution travels more than 20 in. below the basin bottom.
- Infiltration basins are usually most effective for drainage areas less than 5 ac where soil is porous, unless multiple basins are considered.
- Infiltration basins can be used in combination with detention basins for peak flow management. This type of facility is useful to provide flood control storage and significant water quality benefits by infiltrating the "first flush" (i.e., initial part of runoff where a large portion of the total pollutant load is concentrated in a relatively small portion of the total runoff volume).
- Typical highway applications include: within interchange areas; elongated basins in the median; or dedicated areas on the Right-of-Way.

Limitations

Infiltrations basins are considered Class V injection wells if they are a bored, drilled, or driven shaft, or dug hole that is deeper than its widest surface dimension, or an improved sinkhole, or a subsurface fluid distribution system. Class V injection wells are regulated under the authority of Part C of the Safe Drinking Water Act (42 U.S.C. 300h *et seq*.). The law states that the injection of storm water must not result in a violation of drinking water standards or otherwise endanger human health.

Other limitations are as follows:

- Infiltration basins can be effectively used only where the soil is porous and can infiltrate the required quantity of storm water within 1 to 7 days.
- Infiltration basins may require a minimum invert to groundwater separation to protect groundwater resources.
- Very coarse gravel soils provide low removal of dissolved pollutants that can increase risk of ground water contamination.
- Infiltration basins may not be suitable adjacent to drinking water wells, foundations, septic tanks, drain fields.

- Infiltration basins should not be installed above unstable slopes, or on fill sites or steep slope areas.
- Infiltration basins may not be appropriate where there is significant potential for hazardous chemical spills.
- Infiltration basins usually fail if they receive high sediment loads. Therefore, infiltration basins should not be used until upstream drainage area is stabilized.
- Maintenance needs of infiltration basins can be high because frequent inspection is required.
- Infiltration basins require special care during construction to maintain permeability. Heavy equipment and machinery that will cause compaction and reduce permeability should not be allowed to travel over the area.

Design Guidance

The following steps describe a rigorous methodology for determining the feasibility of infiltration BMPs. In some cases it may be appropriate to abbreviate or eliminate some of the steps; however these decisions should be made by an experienced and licensed engineer.

The major components are:

- Pre-screening
- Site Screening
- Site Investigation
- Preliminary Design

Pre-screening

Pre-screening for infiltration basins involves collecting site-specific information necessary to determine whether infiltration is an appropriate storm water treatment for the site. The steps involved in pre-screening include:

- Information Collection, and
- Preliminary determination of infiltration appropriateness.

Table TC 2-2 summarizes information that can be used to make an initial determination of the appropriateness of infiltration BMPs and lists potential sources for this information. Additional site-specific data may be required to account for local conditions.

Once the data have been collected and placed in the context of the alignment and/or location of the NDOT facility being considered for infiltration basins, the Project Engineer and Water Quality Specialist should use the data collected and follow the procedure outlined in Figure TC 2-1.

Steps for conducting preliminary screening include:

1) Determine if state or local ordinances provide limits on quality of water that can be infiltrated. Compare with NDOT runoff quality, and determine if infiltration is permissible. If not, consider detention basins or other treatment control basins.

2) Determine if local agencies, public health authorities, legal restrictions, or other concerns preclude consideration of infiltration of storm water runoff. Consult with NDOT Water Quality Specialist and representatives of appropriate authorities as needed. If infiltration into the aquifer is not acceptable to local authorities, consider detention basins.

3) Estimate the quality of runoff from the NDOT facility draining into the proposed infiltration basin using data from the NDOT storm water database and annual research summaries.

4) Compare the estimated NDOT runoff water quality with available groundwater quality data, using receiving water objectives from the NDEP, for each groundwater beneficial use. Determine if sufficient separation exists between the water table elevation and the proposed basin invert. Tabulate the results and make a preliminary determination of the appropriateness of the infiltration BMP.

If the determination is negative (infiltration not appropriate), consider detention basins. If determination is positive (infiltration potentially appropriate), proceed to site screening.

Site Screening

Using data gathered in the pre-screening process, perform an initial desktop screening of sites to narrow the number of potential sites to those that can be considered for field investigations. As needed, collect additional information, and follow these procedures:

- Perform site investigation to identify any: (a) Regulatory permit requirments, (b) Major underground utility interference, (c) Transportation improvement plan conflicts, or (d) General plan land use data for tributary area.

- Estimate soil type (consider NRCS Hydrologic Soil Groups [HSG] A, B, or C only, as shown in Table TC 2-3 from soil maps and/or U.S. Department of Agriculture (USDA) soil survey s and/or background information. In areas where septic systems are in widespread use, the County Environmental Health Department should have information on appropriate soil types for infiltration of on-site wastewaters.

- Also review other key available data: percent silt and clay, presence of a restrictive layer, permeable layers interbedded with impermeable layers, and seasonal high groundwater. Other geotechnical considerations include location in seismic impact zones, unstable areas, such as landslides and Karst terrains, and those with soil liquefaction and differential settlement potential. Generally, sites should not be constructed in fill, or on any slope greater than 15 percent.

- A general rule of thumb is to design for a minimum spacing of 10 ft between the proposed infiltration basin invert and the maximum seasonal high groundwater.

- Infiltration basins should not be sited in locations over previously identified contaminated groundwater plumes. Setback distance should be determined in coordination with the NDEP.

- Estimate the area required for infiltration as follows:

  Equation 1: $A_{est} = 12 \cdot SF \cdot WQV / k_{est} \cdot t$

  Where:

  A_{est} = estimated area of invert of basin ($ft^{2)}$
  12 = conversion factor from inches to feet
  SF = recommended safety factor of 2.0
  WQV = water quality volume calculated from permits or other requirements ($ft^{3)}$
  k_{est} = estimated infiltration rate from TC 2-3 (in/hr)
  t = recommended drawdown time of 48 hours

- The infiltration basin should be located outside any wellhead protection areas as defined in NDEP's Well Head Protection Program, 100 ft. from any private well, septic tank or drain field, and 200 ft. from a Holocene fault zone.

Site Investigation

After the desktop screening of sites has been completed, proceed with field investigations of the remaining potential sites. Both sites within and outside existing NDOT Rights-of-Way that passed the screening process should be considered.

If the parcel is outside of right-of-way, for planning to proceed, NDOT must generate a significant portion of the total runoff and make arrangements to acquire any additional property required for the facility. Otherwise, investigate opportunities for a cooperative agreement to share storm water treatment facilities with the other agency, county, or city that may be responsible for additional flow.

Assess the feasibility (extent of piping or open channels and available area) of directing runoff from the tributary area to the site. Consider potential downstream impacts from diversions and cost of diverting flow. Diversions of highway or other NDOT facility runoff directly to unimproved conveyances (creeks/streams) are prohibited. Diversions to improved conveyances (MS4s) may be permitted if it can be demonstrated that the improved conveyance has sufficient capacity to accommodate the additional flow.

The following paragraphs present the steps for infiltration basin feasibility field studies to determine if an infiltration basin may be feasible on the subject site. The screening procedure is terminated if the site does not meet the criteria for any step, and assessment of the site continues for a detention basin or other appropriate treatment control BMP. Geotechnical site investigations may be difficult to schedule, and might be conducted during the design phase.

The scope of work consists of two phases:

- Initial Investigation, and
- Detailed Investigation as follows.

Initial Investigation

The initial investigation comprises two parts: A) Initial technical field screening and determination of groundwater elevations, and B) Geotechnical investigation for soil lithology and select chemical testing, if determined to be appropriate. To streamline the initial investigation phase, Part A should performed first, followed by Part B. If the Part A criterion of sufficient clearance for the groundwater elevation below the basin invert is satisfied and the PE approves the site for further consideration. Consult the local NDEP for approval of proposed groundwater separation.

Part A: Initial Technical Field Screening and Determination of Groundwater Elevation

The depth to groundwater must be known as the first step in feasibility because a high groundwater can lead to infiltration failure and potential

contamination of the groundwater. The in-situ infiltration rate at the basin invert must also be known to ensure that infiltration of the calculated WQV is possible within 7 days to address vector concerns. Due to the extreme variability of site conditions, field investigations are required to determine the depth to groundwater and in-situ infiltration rate. A local or regional groundwater review will be performed based on the available data, including, but not necessarily limited to:

- Previously compiled databases on potential BMP sites (such as outfall inventory databases).
- Data and maps available from regional government databases, Division of Water Resources, other local agencies and internal NDOT sources.
- Local soil survey data from the NRCS and other sources.
- Soil lithology, infiltration rate and groundwater depth data from the County Health Department or other specialists that approve septic system installations in the local area.
- Information on local groundwater beneficial uses and groundwater quality issues from the NDEP; and
- Information on local groundwater-related drinking water issues from the Nevada Department of Health Services.

An initial indication of the seasonal high groundwater elevation should be determined by using a piezometer, previous studies, or other accepted geotechnical means. The piezometer should be installed to a depth of at least 20 ft. below the proposed basin invert using the direct push or other suitable method. Groundwater levels should be observed for at least 24 hours after installation. As part of this task, a geotechnical professional should conduct a site reconnaissance to evaluate the site conditions.

The geotechnical professional should make a determination on a site-by-site basis, whether the groundwater elevation determined after 24 hours can be considered to be a reasonable indication of the seasonal high water for the purposes of the evaluation of the groundwater depth criteria. If such determination cannot be made based on the available data, a longer period of water elevation monitoring should be conducted, as necessary.

If the initial seasonal high groundwater elevation indication is within 10 ft of the invert of the proposed infiltration basin, the NDEP should be consulted to approve installation of an infiltration basin. If there is not a

reliable indication that the seasonal high water is at least 10 ft below the invert of the proposed infiltration basin (i.e., if there is reason to believe the water may rise to within 10 ft of the proposed invert), a more extensive groundwater elevation investigation should be performed as described in Part C below. If the groundwater elevation at the site clearly exceeds 10 ft from the proposed basin invert and all other criteria in the initial investigation are satisfied, a detailed groundwater elevation determination should not be required.

Part B. Geotechnical Investigation for Soil Lithology and Select Chemical Testing

An initial soil investigation should be performed to adequately evaluate soil lithology and determine:

- If there are potential problems in the soil structure that would inhibit the rate or quantity of infiltration desired; or
- If there are potential adverse impacts that could result from locating the infiltration basin at the site to structures, slopes or groundwater.

A minimum of one soils log is recommended for each 5,000 ft^2 of infiltration basin area (plan view) and typically no case less than three soils logs per basin. Each soils log should extend below the ground water level. Geotechnical trenches (or at the option of the geotechnical professional, a boring may be used) should be dug using a backhoe at one or two locations within each site, depending on the site conditions.

Clearance of the site for hazardous contaminants should be done prior to drilling by the Environmental Division. Underground Service Alert (USA) clearance should also be obtained. The trenches should be at least 6 ft. long and 6 ft. deep below the proposed basin invert. The soil profiles should be carefully logged to determine variations in the subsurface profile. Of greatest importance is the presence of fine-grained materials such as silts and clays, which should be determined by direct measurement of particle size distribution. Two to four soil samples should be collected for determination of the soil particle size distribution at each site. Samples should be collected from the soil profiles at different horizons and transported to a laboratory for soil texture and chemical testing described as follows:

- Soil textures that tend to promote infiltration include sands, loamy sands, sandy loams, and loams (and possibly some of the coarser silt loams) in the NRCS classification system, or GW, GM, SP, SW and GC, SC, SM, ML (Unified Soil Classification System), subject to clay and clay/silt percentages shown and the judgment of the field

engineer or soil scientist; and

- The soil in the first 12 inches below the basin invert should be tested for organic content (OC), pH, and cation exchange capacity (CEC). Values that promote pollutant capture in the soil are: OC > 5 percent, pH in the range of 6-8, and CEC > 5 meq/100 g of soil. In general, the soil should not have more than 30 percent clay or more than 40 percent of clay and silt combined.

In addition, the trenches should be examined for other characteristics that may adversely affect infiltration. These include evidence of significant mottling (indicative of high groundwater), restrictive layer(s), and significant variation in soil types horizontally and vertically. A summary report should be prepared addressing the issues noted in this section, with recommendations on the suitability of the site for infiltration and the necessity of carrying out the next phase of the investigation. Designers should then proceed to the detailed investigation phase for the sites deemed acceptable from the initial investigation.

Detailed Investigation

If the site conditions still appear favorable for infiltration after the geotechnical review and soil investigations, a detailed field investigation should be undertaken, which includes Part A, Detailed Subsurface Soil Investigation, Part B, In-Hole Conductivity Testing, and Part C, Detailed Groundwater Elevation Determination.

Part A. Detailed Subsurface Soil Investigation

Borings should be drilled to a maximum depth of 50 ft (or refusal) for each detailed investigation location at the discretion of the geotechnical professional. Samples should be obtained at 5 ft intervals for soil characterization and laboratory testing. Bulk samples should also be collected at shallow depths to verify information collected in Parts A and B of the Initial Investigation.

Part B. In-hole Conductivity Testing

Infiltration rate tests or another method approved by the Geotechnical Engineer should be performed at the proposed basin invert. The tests should be located to measure infiltration rates in the bed of the proposed basin.

The minimum recommended acceptable infiltration rate as measured in any of the test holes is 0.5 in/hr. If any test hole shows less than the minimum value, the site may be disqualified from further consideration. If the infiltration rate at the site is significantly greater than 2.5 in/hr, the

NDEP should be consulted, and the NDEP must conclude that the groundwater quality will not be compromised, before approving the site for infiltration.

If the site is constructed in fill or partially in fill, it should be excluded from consideration unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed, rather than flocculated state, greatly impacting permeability.

The geotechnical investigation will be sufficient to develop an adequate understanding of how the storm water runoff will move in the soil (horizontally and vertically), and if there are any geological conditions that could inhibit the movement of water.

Part C. Detailed Groundwater Elevation Determination

If a detailed investigation to determine the groundwater elevation is required per the guidance and, in the opinion of the engineer, the seasonal high groundwater elevation may come within 10 ft of proposed basin invert, at least one and possibly two (per the recommendation of the geotechnical professional) piezometers should be installed. One piezometer should be installed within the proposed basin footprint and the other, if needed, should be installed near the basin but downgradient by about 30 ft. The piezometer(s) should be observed over a wet and dry season. This observation period should be extended to a second wet if the first wet season produces rainfall less than 80% of the historical average.

The minimum recommended spacing between the proposed infiltration basin invert and the seasonal high water, as measured at either of the two established monitoring wells, is 10 ft unless, in coordination with the NDEP, it can be demonstrated that the groundwater will not be adversely impacted. A geotechnical professional should oversee the detailed investigation and must also consider other potential factors that may influence the groundwater elevation, such as local or regional groundwater recharge projects, future urbanization or agriculture. The geotechnical professional shall also examine the soil borings for indications of previous high water.

A final geotechnical report, overseen by a geotechnical professional, summarizing the findings of the investigation should be prepared. The report should include all results from the initial as well as detailed investigation phases of the feasibility study.

The final site investigation step is to recalculate and verify basin area requirements using the collected field data. Use Equation 1 and the

lowest measured or anticipated infiltration rate to calculate area of basin. If an infiltration basin is feasible, proceed to Preliminary Design.

Preliminary Design

Table TC 2-1 summarizes preliminary design factors for infiltration basins. Preliminary design includes the following:

- Obtain site topography (one-foot contours, 1:500 scale). Extend topography to show where runoff leaves NDOT right-of-way, enters a drainage channel owned by others, or enters a receiving water.

- Develop a conceptual grading plan for improvements showing basin, maintenance access, basin outlet and extent of Right-of-Way requirements to accommodate the improvements. The basin invert must not have a slope greater than 3%.

- Develop unit cost-based cost estimate to construct the infiltration basin. Include allowances for hazardous/unsuitable materials, traffic management and storm drain system improvements as needed and determined by the PE.

- Develop single paragraph assessments of: nonstandard design features, impact on utilities, hydrology (WQV, peak flow, land use), Right-of-Way total area needed, current ownership, highway planting and lighting, permits, hazardous materials, environmental clearance and traffic management.

- Infiltration basins shall be located down gradient from the highway pavement to avoid infiltration to the pavement structural section and subgrade.

Infiltration basins may require energy dissipation devices to minimize scour potential.

Incorporate bypass or overflow for large events or design additional detention storage into the infiltration basin.

Land Slope: Infiltration basins can be located on slopes of up to 15 percent. Use of infiltration basins on steeper grades increases the chance of water seepage from the subgrade to lower areas of the site and reduces the amount of water that actually infiltrates.

Upon completion of the initial excavation, the side slopes of the infiltration basin, in addition to any embankments and the downstream outlets, should be stabilized to prevent siltation of the basin. When all

areas contributing runoff to the sediment basin have been stabilized, and after removal of all accumulated sediments, the excavation of the basin to finished grade should proceed. The basin inlet should be designed to help prevent erosion. Erosion should be controlled by installing outlet protection/velocity dissipation devices (See SS-6 "Outlet Protection/Velocity Dissipation Devices" BMP in this Guide).

Volume: A general maximum design goal for sizing infiltration basins is to capture the entire runoff from a treatment design storm event (water quality design storm) as discussed in Section 2. The runoff produced by this storm based upon the characteristics of the project drainage area after completion of the project should then be calculated and the resulting volume used as a maximum design target.

The basic data requirements for a design analysis are:

- The inflow peak discharge and hydrograph;
- The (allowable) infiltration rate; and
- The basin stage-storage relationship

The design process consists of establishing the inflow/storage/ outflow relationship and adjusting the storage volume and outflow characteristics until the design objectives are met. In most cases, the inflow is fixed by upstream conditions, and the outflow is fixed by the design goals. The purpose of the analysis then is to determine the appropriate basin type, storage volume and outlet configuration. In many cases for roadway drainage design, the storage volume and basin type may be fixed, and the analysis determines the size of the outlet. Infiltration basins with volumes smaller than that which can store treatment design storm event may be considered under the following circumstances:

- Sufficient Right-of-Way is not available, or cannot be feasibly obtained to accommodate the volume.
- A site-specific Maximum Extent Practicable (MEP) analysis is conducted in consultation with the NDEP staff.

Under the above circumstances, the minimum storage volume recommended is that which would capture at least 80 percent of all runoff from the project drainage area. Other water quality capture volumes which would allow capture of greater than 80 percent of all runoff up to the treatment design storm event can be considered if Right-of-Way is available or if the site specific analysis indicates a greater level of capture is justified based upon an MEP analysis.

- Basins may be lined with a 6 to 12 in. layer of filter material such as coarse sand to prevent the buildup of impervious deposits on the natural soil surface. To increase the permeability of clayey soils, a 6 in. layer of coarse organic material may be specified; but trying to increase permeability is not recommended.

- If possible, the infiltration basin sides and bottom should be stabilized. Stabilizing with vegetation or non-vegetative measures on the sides of the basin minimizes erosion and controls dust, whereas the bottom of the basin is vegetated to reduce tendency to clog with fine solids. Whenever possible, native vegetation that requires less intensive maintenance and is less likely to become a nuisance should be used. The planting design should consider access to high maintenance areas such as inlet and outlet structures. Also, a stabilized buffer strip at least 20 ft. wide should be provided around the basin to protect against erosion and sloughing.

Special Construction Considerations

- Special precautions must be taken to the work sequence, techniques, and the equipment employed to protect the natural infiltration rate. Light equipment and construction procedures that minimize compaction should be used. The basin area should be flagged off while heavy equipment is in the area.

- Storm water should not be allowed to enter the infiltration basin until all construction is completed and the contributing drainage area to the basin is adequately stabilized. If this prohibition is not feasible in particular situations, do not excavate the facility to the final grade until after all construction is complete upstream.

- If native soils are very pervious, incorporate materials into confining levee to control seepage.

Maintenance and Inspection

The primary objective of maintenance/inspection activities is to ensure that the infiltration facility continues to perform as designed and to substantially lengthen the required time interval between major rehabilitation.

- Side slopes should be maintained as needed to promote dense vegetative cover with extensive root growth that enhances infiltration through the slope surface, prevents erosion and consequent sedimentation of the basin floor, and prevents invasive weed growth.

- Dedicated access to the basin bottom should be provided for maintenance vehicles.

Table TC 2-1
Summary of Infiltration Basin Siting and Design Criteria

Recommended Siting Criteria	Preliminary Design Considerations
▪ 10 ft. separation of basin invert to seasonally high water ▪ Soil infiltration rate ≥ 0.5 inches per hour ▪ Clay content < 30%, and < 40% clay and silt combined ▪ Site should not be located in area containing fractured rock ▪ Infiltrated water is unlikely to affect the stability of downgradient structures, slopes, or embankments ▪ Runoff quality is ≥ standards for infiltration to local groundwater ▪ If pretreatment is required, only approved BMPs should be considered ▪ Consult with NDEP, water agencies, vector control authorities, and local utilities	▪ Maintenance access (road around basin and ramp to basin invert) ▪ Optional upstream diversion channel or pipe, or downstream overflow structure ▪ Flood control spillway ▪ Scour protection on inflow and spillway ▪ Size to capture the 24-hour WQV ▪ Infiltrate WQV within 7 days maximum ▪ Use ½ the measured infiltration rate to size the basin as a safety factor ▪ 10 ft. downgradient and 100 ft. upgradient from structural foundations ▪ 100 ft. from drinking water wells ▪ Provide emergency/maintenance gravity drain, if practicable ▪ Use 3:1 (H:V) side slope ratios or flatter for side slopes

Table TC 2-2

Data to be collected	Sources
Outfall Inventory: ▪ Project alignment ▪ Right-of-way ▪ Annual average daily traffic (AADT) ▪ NDOT outfall locations ▪ Other basic project maps and data	▪ Record Drawings ▪ Alternative Design Field Study ▪ Preliminary Design Field Study
▪ Tributary drainage areas and surrounding land uses	▪ Outfall inventory ▪ Record Drawings ▪ Aerial photographs ▪ Geographic Information Systems (GIS) data from NDOT and local planning agencies
Site surface hydrology data: ▪ Tributary drainage area ▪ Runoff Coefficients ▪ Drainage network ▪ Travel times	▪ U.S. Geological Survey (USGS) ▪ County Department of Water Resources (DWR)
▪ Groundwater beneficial uses and known impairments	▪ Nevada Division of Environmental Protection (NDEP)
▪ NDOT runoff quality data	▪ Monitoring studies (if available) ▪ Estimated from runoff monitoring at similar land uses
▪ Water quality volumes (WQVs) and flows (WQFs)	▪ Calculated from applicable design storms and site characteristics
Site Soil Characteristics: ▪ Indigenous soil types ▪ Soil infiltration rates	▪ Natural Resources Conservation Services (NRCS) soil maps and corresponding hydrologic soil groups (HSGs) ▪ Mapping Ecosystems along Nevada Highways, and the Development of Specifications for Vegetation Remediation (DRAFT) ▪ Estimated from any existing on-site testing in the vicinity ▪ NDOT project grading plans ▪ Record Drawings
Existing groundwater and hydrogeology: ▪ Maps of local aquifers underlying the proposed NDOT project ▪ Aquifer groundwater quality ▪ Seasonal groundwater levels ▪ Local groundwater quality concerns: ▪ Site hydrogeology ▪ Known contaminated groundwater plumes ▪ Groundwater rights data: adjudicated basins, other rights (NDEP, NHS) ▪ State Water Information Management System data for project area	▪ Monitoring well data, ▪ U.S. Geological Survey (USGS) ▪ Department of Water Resources (DWR) ▪ Local agency maps and databases ▪ NDEP ▪ Nevada Department of Health Services (NHS) ▪ Local environmental/health department (city/county) ▪ Existing boring logs: lenses, hardpan, etc.

Table TC 2-3

Typical Infiltration Rates for NRCS Type and HSG Classification		
		Infiltration Rate
NRCS Soil Type	HSG Classification	in/hr
Sand	A	(8.0)
Loamy sand	A	(2.0)
Sandy loam	B	(1.0)
Loam	B	(0.5)*
Silt loam	C	(0.25)
Sandy clay loam	C	(0.15)
Clay loam & silty clay loam	D	(<0.09)
Clays	D	(<0.05)

* Minimum rate for infiltration basins. Silt loams may also be acceptable (HSG C) if geotechnical investigations demonstrate adequate infiltration rates.

Figure TC 2-1
Pre-screening for the Infiltration Basins

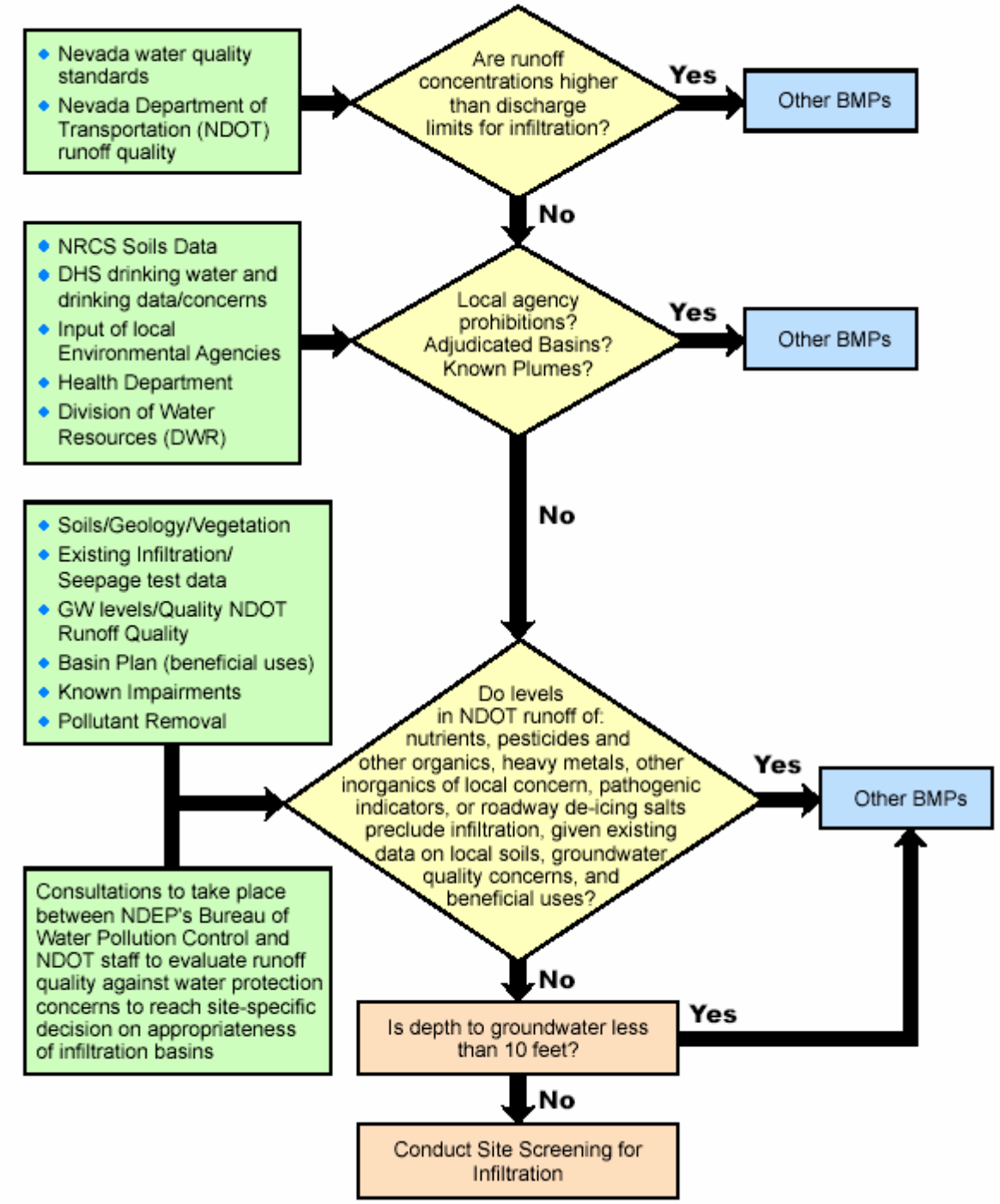
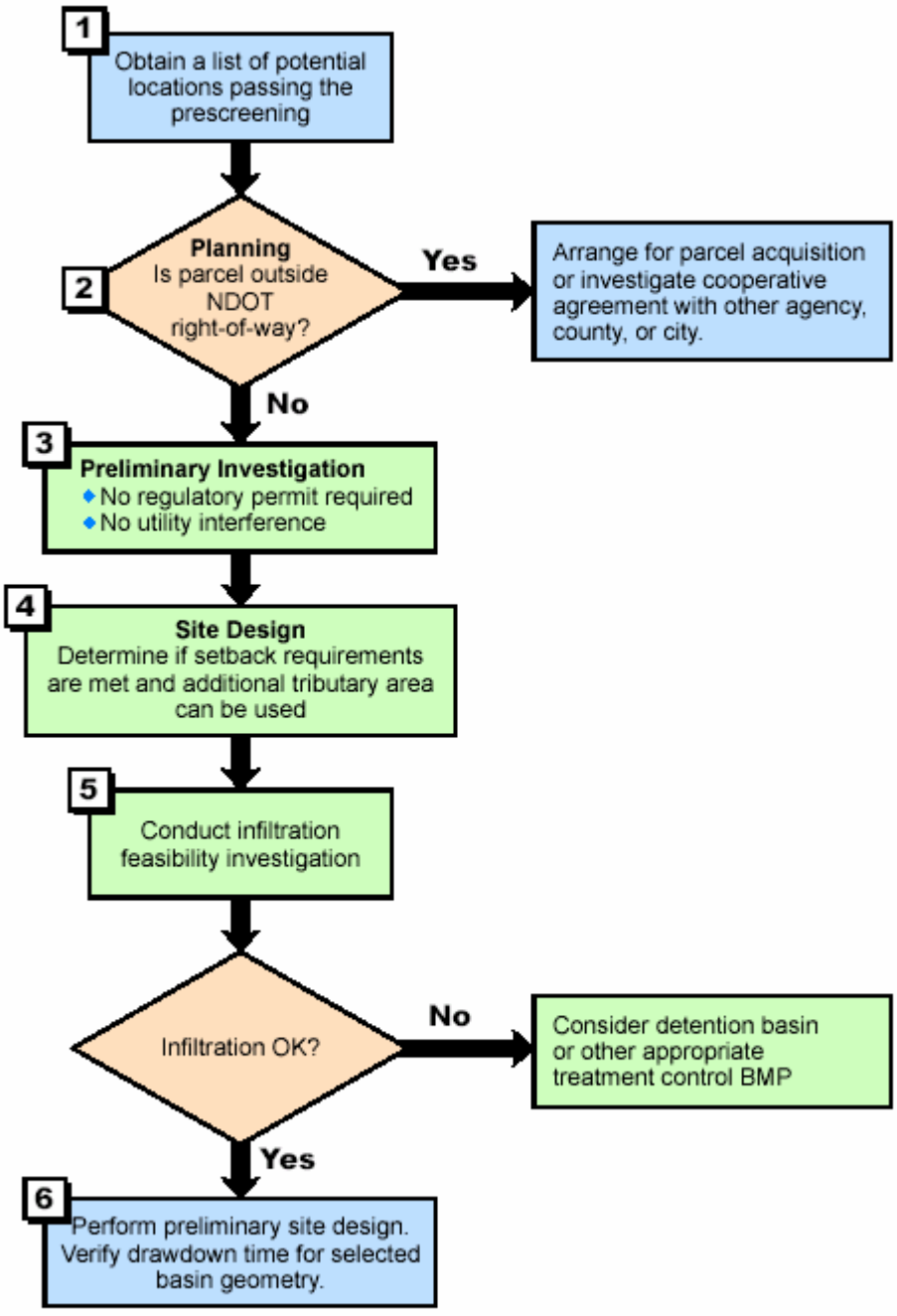
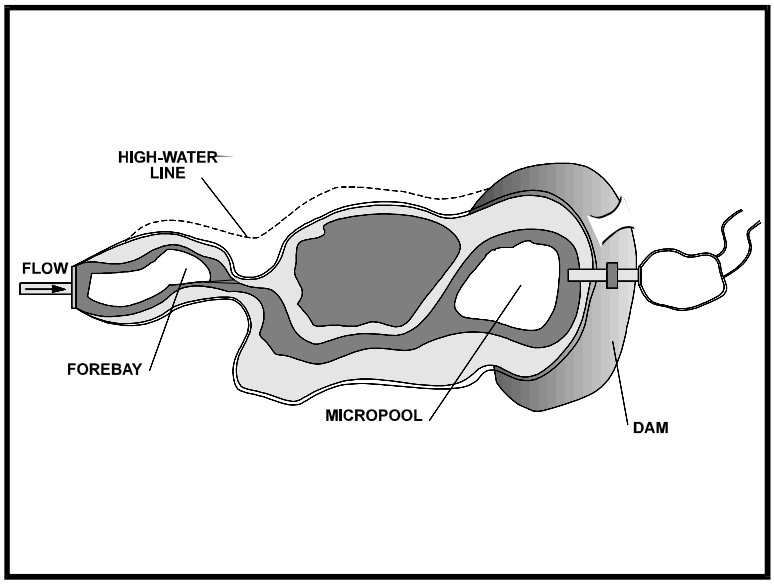


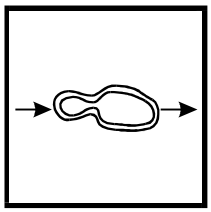
Figure TC 2-2
BMP Siting Procedure for Infiltration Basins



Detention Basins

TC-3





BMP Objectives

- ● Sediment
- ○ Oil and Grease
- ○ Metals and Toxics
- ○ Nutrients
- ○ Bacteria

- ● Highly Effective
- ○ Low Effectiveness

Definition and Purpose

A detention basin is a permanent device formed by excavating and/or constructing an embankment so that runoff from the water quality design storm is temporarily detained under quiescent conditions, allowing sediment and particulates to settle out before the runoff is discharged.

Appropriate Applications

Consider detention basins for use when runoff from the completed facility will discharge to significant areas of highly valuable habitat in which Federal or State listed aquatic resources have been identified, and NDOT runoff will constitute a substantial portion of the total flows to such habitat. More specifically, detention basins may be appropriate in the following situations:

- Detention basins are used upstream of receiving waters to remove sediment or other pollutants from storm water runoff from highways, roads, parking lots and rest areas, and maintenance areas.
- Detention basins can be used where less permeable soils and/or restrictive subsurface conditions prevent the use of infiltration basins for pollutant removal.
- Detention basins can be designed and constructed in conjunction with flood control basins to reduce peak storm water flow rates for drainage areas where the hydraulic capacity of receiving waters is limited (e.g., 2, 5, 10, 100-yr storms).
- Usual highway placement locations are cloverleaves and dedicated areas in the Right-of-Way.

Limitations

- The quality of the runoff and the intent of the basin should be considered. If the basin is being considered for highly soluble pollutant removal such as nutrients, then an infiltration basin is preferred.
- Detention basins require a large surface area (0.5 to 3% of the contributing drainage area) to permit settling of sediment. Space may be limited for a particular site.
- Detention basins are not typically practical for small drainage areas because the necessary outflow control requires small outlets that clog rapidly.
- If upstream erosion is not properly controlled, detention basins can be maintenance intensive with respect to sediment removal, nuisance odors, and insects (i.e., mosquitoes), etc.
- Detention basins require a differential elevation between inlets and outlets and thus, may be limited by terrain.

Design Guidance

- Access: A permanent area should be provided around the perimeter of the impoundment to allow maintenance. Provisions should also be made for emptying the basin as necessary for maintenance procedures.
- Volume: A general maximum design goal for sizing detention basins is to capture the entire runoff from a treatment design storm event, as discussed in Section 2. The runoff produced by this storm based upon the characteristics of the project drainage area after completion of the project should then be calculated and the resulting volume used as a maximum design target. In cases where traction sand is to be removed and stored in these basins (i.e. no sand traps exist), the volume also should include provisions for sand storage. See TC – 4, Sand Traps for guidance on calculating sand storage requirements.

The basic data requirements for a design analysis are:

- The inflow peak discharge and hydrograph,
- The (allowable) outflow peak discharge,
- The basin stage-storage relationship, and
- The outlet stage-discharge relationship.

The design process consists of establishing the inflow/storage/outflow relationship and adjusting the storage volume and outflow characteristics until the design objectives are met. In most cases, the inflow is fixed by upstream conditions, and the outflow is fixed by the design goals. The purpose of the analysis then is to determine the appropriate basin type, storage volume and outlet configuration. In many cases for roadway drainage design, the storage volume and basin type may be fixed, and the analysis determines the size of the outlet. Figure TC 3-1 is a graphical representation of the storage volume required for on-line detention, off-line detention, and infiltration basins.

The inflow peak discharge and hydrograph are obtained through hydrologic analysis of the upstream watershed. Hydrologic analysis is discussed in detail the FHWA publication "Practical Highway Hydrology", Highway Drainage Series #2, and Hydraulic Engineering Circular #22 (HEC22). The peak discharge is obtained by developing a rainfall-runoff relationship and applying a design storm to determine a peak flow rate. The Rational Method is one very common and well-documented method of determining peak discharge rates. Peak discharges also can be obtained by statistical analysis of past flows, unit hydrograph analysis, regional relationships or other methods. Hydrographs can be obtained from unit hydrograph analysis, synthetic hydrograph methods or the use of physically based computer models such as the United States Soil Conservation Service TR-20 program, subsystem HYDRA in HYDRAIN, or the U.S. Army Corps of Engineers HEC-1 program.

The outflow peak discharge usually is determined by the design objectives. It may be desired to maintain outflow discharge at existing levels, at the capacity of an existing or proposed downstream structure, or at another discharge determined by local conditions. There may be a range of acceptable outflow discharges depending on the magnitude of the inflow discharge.

The basin stage-storage relationship is determined from the topography of the storage basin. The relationship is represented by a table of ponding depth versus total ponding volume. For design of storage basins, determination of basin topography may be a trial-and-error procedure. A preliminary estimate of the total volume required can be made using the procedure described below.

The outlet stage-discharge relationship is determined from the hydraulic characteristics of the outlet. The relationship is represented by a table of ponding depth in feet versus total outflow discharge in cubic feet per second. Determination of the outlet configuration may be a trial-and-error

process. If the outfall type and dimensions are known, it can be a simple matter of a direct hydraulic analysis to determine an outlet stage-discharge relationship (performance curve).

Storage Indication Method (On-Line Basins):

The Storage Indication Method is used for routing of flow through on-line detention basins. This method is based upon the equation:

$$I - O = \frac{\Delta S}{\Delta t} \qquad \text{(Eq. 1)}$$

where:

I = inflow rate, in ft^3/s,

O = outflow rate, in ft^3/s,

S = the change in the storage volume, in ft^3,

Δt = elapsed time, in seconds.

Equation 1 states that inflow minus outflow is equal to the change in storage. The equation can be rearranged for a finite time period as:

$$\frac{(I_1 + I_2)}{2} + \left(\frac{S_1}{\Delta t} - \frac{O_1}{2}\right) = \left(\frac{S_2}{\Delta t} + \frac{O_2}{2}\right) \qquad \text{(Eq. 2)}$$

where:

I_1 = inflow rate at the start of the time period, in ft^3/s,

I_2 = inflow rate at the end of the time period, in ft^3/s,

O_1 = outflow rate at the start of the time period, in ft^3/s,

O_2 = outflow rate at the end of the time period, in ft^3/s,

S_1 = storage volume at the start of the time period, in ft^3,

S_2 = storage volume at the end of the time period, in ft^3,

Δt = duration of the time period, in seconds.

This equation, in conjunction with an inflow hydrograph and the relationship between storage and outflow, can be used to route flows through a detention basin.

The Storage Indication Method is described in detail in many hydrologic texts. The application of the method in the design of on-line detention basins for which the outflow discharge is known is described below. It is assumed that an inflow hydrograph is available prior to beginning the procedure.

Step 1: A preliminary estimate of the storage volume can be made by superimposing an assumed outflow hydrograph on the inflow hydrograph as shown in Figure TC 3-1 and estimating the volume represented by the difference between the two up to the time that inflow equals outflow. This volume is shown labeled as "storage" on Figure TC 3-1. The outflow hydrograph is assumed to begin at the same time as the inflow hydrograph, and peak at a point on the falling limb of the inflow hydrograph.

If the inflow and outflow hydrographs are triangular as shown in Figure TC 3-1, the preliminary volume estimate can be represented by:

$$V_s = V_i \left[1 - \left(\frac{O_p}{I_p} \right) \right] \qquad \text{(Eq. 3)}$$

where:

V_S = estimate of required storage volume, in ft^3,

V_i = total inflow volume, in ft^3,

O_p = peak outflow rate, in ft^3/s,

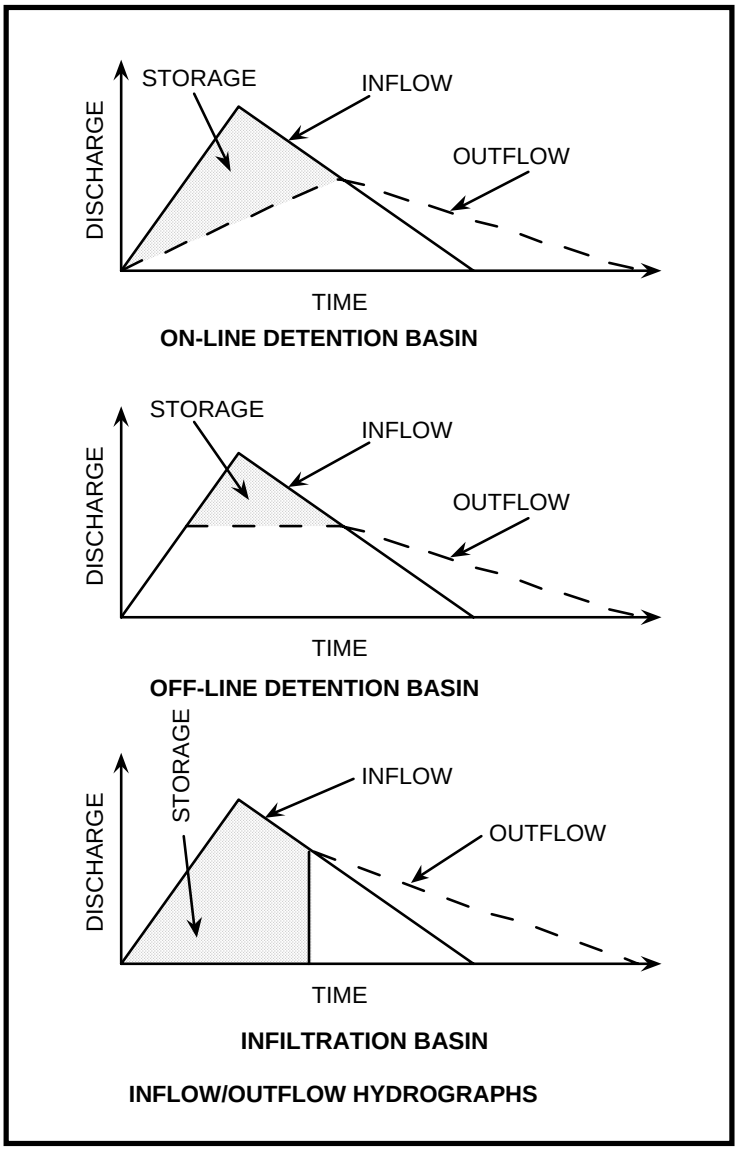
I_p = peak inflow rate, in ft^3/s.

Step 2: Prepare a preliminary detention basin configuration based upon the preliminary volume estimate. Develop a stage-storage relationship for the assumed basin configuration.

Step 3: Choose an initial outflow configuration based on engineering judgment and develop a stage-outflow relationship. The stage-outflow relationship can be estimated using mathematical equations for orifice or weir flow, or approximated from Federal Highway Administration (FHWA) nomographs for culvert design (FHWA Hydraulic Design Series #5).

Step 4: The common parameter in the stage-storage (step 2) and stage-outflow relationships (step 3) is stage. Therefore, merge the two relationships to construct a storage-outflow relationship.

Figure TC 3-1



Note: For water quality purposes and to capture the "first-flush", an off-line detention basin would be configured to have and inflow-outflow hydrograph similar to one for an infiltration basin.

Step 5: Select a routing time interval (Δt). For the initial estimate and for convenience, this value may be one tenth of the rise time of the inflow hydrograph. The inflow hydrograph will be "discretized" using this time increment.

Step 6: Using the storage-outflow relationship and the chosen time interval, establish a relationship between outflow (O) and the quantity

[(S/Δt) + (O/2)] in Equation 2. Prepare a working table and working curve of this relationship. It may be convenient to plot the working curve on logarithmic graph paper due to the wide range of values that generally must be represented.

An "equal-values" line refers to the locus of points on the working curve where [(S/Δt) + (O/2)] equals the outflow (O). Check the working curve to ensure that it does not exceed the "equal-values" line at any point on the curve. If it does exceed the "equal-values" line, the routing time interval Δt, is too large. Reduce the routing time and repeat Steps 5 and 6. A small routing time is not a particular problem if computer calculations are to be made. The interest in having a larger time step (up to about one-tenth of the time to rise on the inflow hydrograph) is to minimize manual calculations.

Step 7: Perform the routing by computing outflow for each time step from Equation 2 and the relationship between outflow and [(S/Δt) + (O/2)]. A routing tabulation is useful to track the routing computations. For convenience, the routing table should have columns for:

- The time steps;
- The inflow hydrograph;
- The quantity [(S/Δt) - (O/2)];
- The quantity [(S/Δt) + (O/2)]; and
- Outflow.

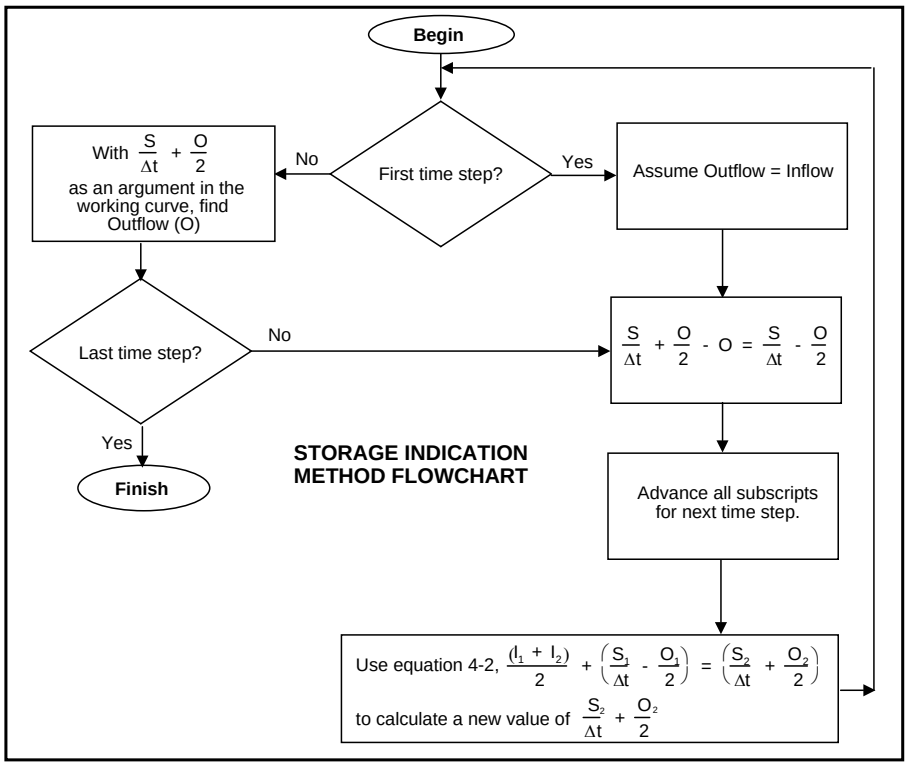
Reservoir stage and storage volume could be included in the table, but they are not necessary to the routing computations.

The routing procedure is as follows: (Subscript 1 represents a value for the previous time step and subscript 2 represents a value for the current time step.)

Steps 1 through 7 are graphically illustrated by the flowchart shown as Figure TC 3-2.

Step 8: As the final step, a graphical representation of the inflow and outflow hydrographs should be prepared.

Figure TC 3-2



- Detention Time: Detention basins require longer detention times to provide the opportunity for sediment particles in the runoff to settle out of the water column. Detention facility studies indicate that effective detention basins should be designed for a detention time of 24 hours for average conditions rather than full-basin conditions. The maximum design goal is to achieve a 48-hour drawdown for a full basin. Detention times longer than 48 hours should not be considered to minimize the potential for mosquito breeding.

The design analysis must then be scheduled to determine if the facility takes at least 24 hours to drain when half full. For basins sized to capture the treatment design storm event, an outlet sized to draw down the basin in 48 hours will very likely result in detention times of less than 24 hours for the half full condition and smaller storms. For such conditions, a two-step outlet should be designed.

It is recommended that the lower outlet be sized to drain the water quality volume in 40 hours. The second outlet is placed at the mid-water elevation and is sized in combination with the lower orifice to drain the entire facility in 48 hours. Another approach is to install the outlet about 12 in. above the bottom of the pond (essentially enlarging the micropool

area). This lower area will normally dry up between storms and will capture much of the volume of small storms, improving pollutant removal.

Detention basins shall have three discharge stages. They are:

- The Water Quality Volume,
- The primary flood control outlet, and
- A secondary outlet to limit the risk of overtopping the device.
- Basin Geometry: The configuration of the basin, as well as the location of the associated facilities (inlet, outlet structures, baffles, etc.), will significantly impact the desired function of the basin. In order to enhance pollutant removal, the hydraulic flow length of the basin should be maximized. Typically the length to width ratio of the basin should be on the order of 3:1 or greater. Typical pond depths range from 4 to 6 ft. Figure TC 3-3 is an idealized detention basin layout.
- Basin Side Slopes: Embankment slopes should be stable and gentle enough to limit rill erosion and facilitate maintenance access and needs. Although limited by the stability of the soil, typically, basin slopes should be 1:4 (V:H) or flatter. Steeper slopes may require that the facility be fenced for safety. Embankment slopes should be compacted and stabilization of slopes provided to assist in preventing erosion.
- Basin sizes, volumes and berm/dam heights must be in conformance with Dam Safety requirements.
- Inlets: Inlet structures should be designed to dissipate flow energy at the inlet point to limit erosion and promote particle sedimentation. They should be located as far as possible from the outlet structure to maximize the hydraulic flow length. A forebay, designed upstream of the basin, can be provided to remove large particles.
- Invert Depth to Groundwater: Detention devices should have an impermeable liner at locations where the invert to seasonally high (wet weather) groundwater separation is less than 5 ft. This will reduce maintenance access problems and minimize establishment of wetland plant species.
- Aesthetics: The aesthetics of the site are also a consideration. Vegetation should be selected carefully to enhance the appearance of the basins. If a detention pond is designed to empty completely

following a rainfall event, appropriate ground cover should be provided.

- Maintenance Considerations: Maintenance procedures should also be considered during the planning stages. Basins should be located such that safe and easy access for maintenance is provided. Debris in empty basins may be unsightly and require more frequent maintenance. In some areas, mosquitoes and other insects may require additional maintenance.

Safety: Safety is a major consideration when planning detention basins. Basins should be located where failure would not cause loss of life or property damage. Basins that maintain either temporary or permanent pools of water should be fenced to limit public access.

Basin Outlet Guidance

Discharge should be directed through a water quality outlet. An example is shown in Figure TC 3-4. A rock pile or rock-filled gabion can serve as alternatives to the debris screen although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.

Proper hydraulic design of the outlet is critical to achieving good performance of the detention basin. The water quality outlet should be designed to empty the device within 2 to 7 days (also referred to as "drawdown time"). (The 2-day limit is specified to provide adequate settling time; the 7-day limit is specified to mitigate vector control concerns.)

The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. A V-notch weir can also be used, but is not recommended. A V-notch weir will not clog, but it is difficult to maintain small release rates at low heads. The perforated riser, if properly designed and gravel packed, gives much better control and is recommended over the V-notch weir. Design guidance for single orifice and perforated riser outlets follow:

Flow Control Using a Single Orifice At The Bottom Of The Basin:

The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H-Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H-Ho)^{0.5}}{CT} \quad \text{(Eq. 4)}$$

Where:
- a = area of orifice (ft²)
- A = surface area of the basin at mid elevation (ft²)
- C = orifice coefficient
- T = drawdown time of full basin (hrs)
- G = gravity (32.2 ft/s²)
- H = elevation when the basin is full (ft)
- Ho = final elevation when basin is empty (ft)

For a riser orifice having multiple openings (see Figure TC 3-3), use:

$$a_t = \frac{2A(h_{\max})}{CT(2g[h_{\max} - h_{centroid\ of\ orifices}])^{0.5}} \quad \text{(Eq. 5)}$$

With terms as shown in this section except:
- a_t = total area of orifices;
- hmax = maximum height from lowest orifice to the maximum water surface (ft);
- $h_{centroid\ of\ orifices}$ = height from the lowest orifice to the centroid of the orifice configuration (ft).

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally.

If the WQV was determined using an assumed drawdown time, then use the same value for drawdown time (T) in equations 4 and 6. Because detention basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Assuming an average release rate at one half the basin depth (a common approach in several design manuals) may lead to considerable error if the basin has a significant variation of surface area with depth. If this is true, consult HEC-22, Chapter 10, for the design of detention facilities.

Care must be taken in the selection of "C"; 0.60 is most often recommended and used. However, based on actual tests, GKY (1989),

"Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

Drilling the orifice into an outlet structure that is made of concrete can result in considerable impact on the coefficient, as does the beveling of the edge.

Three alternative outlet structures that use single orifice outlets are suggested. The concrete block structure is appropriate for large basins. The riser pipe is suggested for small to large basins to prevent orifice clogging. Hole size and placement are not critical in this case because the orifice will control the discharge rate. Placing the outlet control in the berm or in a manhole located downstream of the facility is most suitable for small basins as long as other outlets/spillways are provided for storms larger than the water quality design storm. For small facilities, place the control orifice in the outlet manhole downstream of the filter, or use a "T-pipe" to submerge the orifice. Variations of this alternative may include gates, valves, or weirs.

Flow Control Using the Perforated Riser

For outlet control using the perforated riser as the outlet control, as shown on Figure TC 3-4, use the following design guidance. This design incorporates flow control for the small storms in the perforated riser, and also provides an overflow outlet for large storms. If properly designed, the facility can be used for both water quality and drainage control by: (1) sizing the perforated riser as indicated for water quality control; (2) sizing the outlet pipe to control peak outflow rate from the 2-year storm; and (3) using an overflow spillway in the basin to control the discharge from larger storms up to the 100-year storm.

To prevent clogging of the bottom orifices of the riser pipe, wrap the bottom three rows of orifices with silt fence fabric and a cone of 1 to 3 in. clean drain-rock.

Public health and vector control authorities should be consulted to verify the acceptability of detention basins and to establish the maximum drawdown time allowed in order to avoid mosquito problems.

The inlet structure of the basin should be designed to divert the peak hydraulic flow (calculated according to NDOT procedures for flood

routing and scour) when the basin is full. Alternatively, an overflow structure sized according to these criteria can be provided in one of the downstream walls or berms. A third alternative is to include a flood control outlet in the top of the water quality outlet. In this case, an additional outlet (riser or spillway) should be supplied to prevent overtopping of the walls or berms. Entering flows should be distributed uniformly at low velocity to prevent re-suspension of settled materials and to encourage quiescent conditions.

The site must have sufficient area for a perimeter maintenance road and safe access to and from the site from local roads. Basin side slopes must be shallow enough to permit tracked vehicles to access the basin invert for maintenance. Alternatively, an access ramp should be provided. Planning and design considerations for detention basins are summarized in Table TC 3-1.

Special Construction Considerations

During construction of detention basins it is important to keep the following in mind:

- Sediment should be removed from temporary basins that are to be used for permanent detention basins.
- Temporary BMPs including sediment basins and traps, diversion channels and dikes, should be maintained until permanent BMPs are complete and operable.
- The fill material used in embankments should be compacted to at least 95% of the maximum density obtained form compaction tests performed by the Modified Proctor method of ASTM D698.
- Seepage through embankments may cause embankment failure. Consideration must be given to permeability of embankments.

Maintenance and Inspection

- Accumulated sediment should be removed per the scheduled maintenance cycle and as needed to maintain basin function
- Vegetation should be maintained as needed including periodic removal of aquatic plants that may potentially impact nutrients in the water.
- Vector controls should be implemented as needed. Varying water depths every few days may help control some vectors.

Table TC 3-1
Summary Of Detention Basin Siting And Design Criteria

Description	Applications/Siting	Planning and Design Considerations
▪ Impoundments where the WQV is temporarily detained ▪ Treatment Mechanisms: ▪ Sedimentation ▪ Infiltration (if basin unlined) ▪ Pollutants removed: ▪ Sediment and particulates ▪ Litter ▪ Sorbed pollutants (heavy metals, oil and grease [O&G])	▪ Sufficient head to prevent objectionable backwater condition in the storm drain system ▪ Seasonally high groundwater below basin invert ▪ Consult public health and vector control authorities ▪ Minimum orifice size of 0.5 in.	▪ Size to capture the water quality volume according to Appendix C ▪ Flow-path-to-width ratio of at least 2:1 recommended ▪ Maximum water level should not cause groundwater to occur under the roadway within 0.7 ft. of the roadway subgrade ▪ Basin invert ≥ 5 ft. above seasonally high groundwater or else a impermeable liner is recommended ▪ Maintenance access (road around basin and ramp to basin invert) ▪ Upstream diversion channel or pipe, downstream overflow structure or flood control outlet ▪ Discharge through a water quality outlet with debris screen (or equivalent) ▪ Outlet design to empty basin within 1 to 7 days (consistent with basin sizing method, as appropriate) ▪ Flows should enter at low velocity. Use scour protection on inflow, outfall and spillway if necessary. ▪ Use 3:1 side slope ratios or flatter for earthen berms

Figure TC 3-3
Example Schematic of a Detention Basin (Not a Standard Plan)

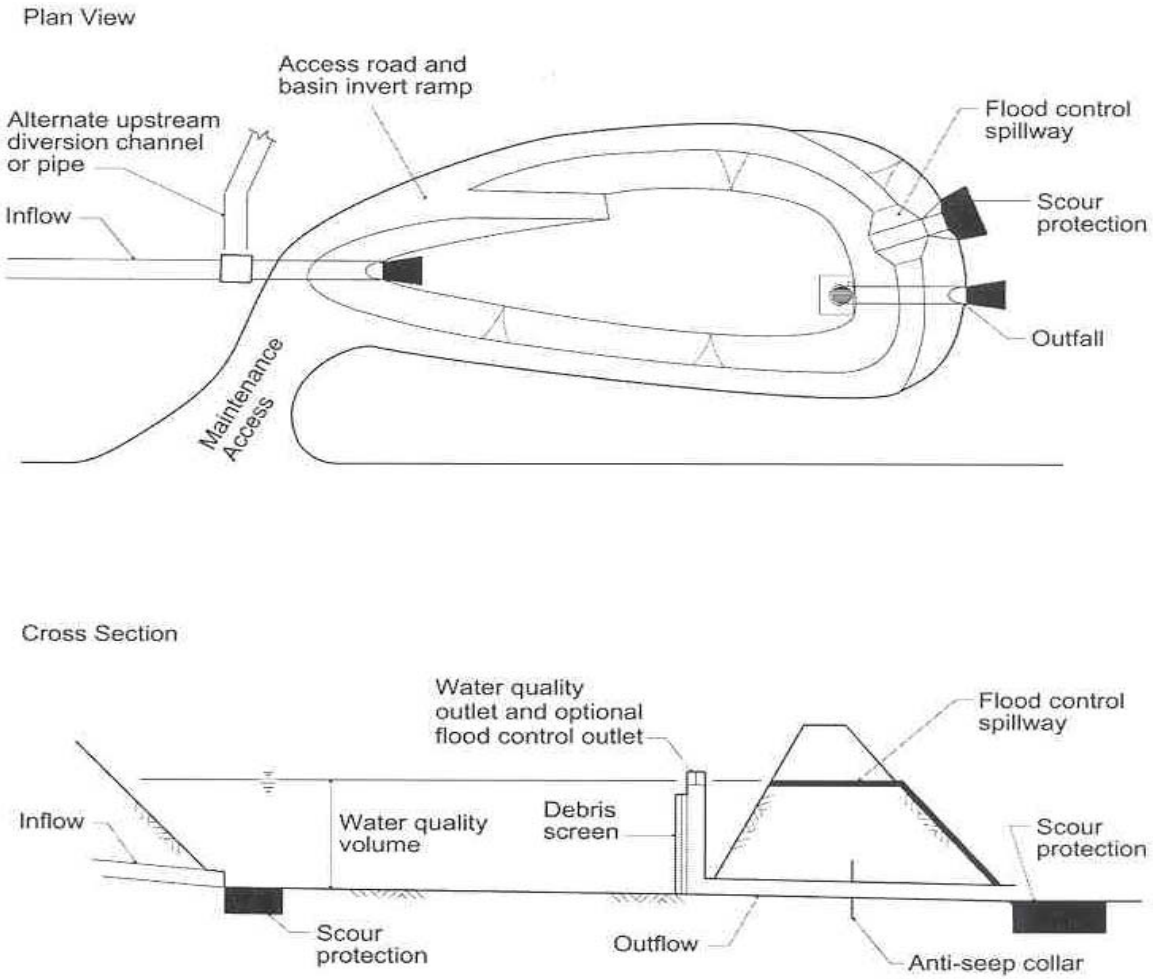
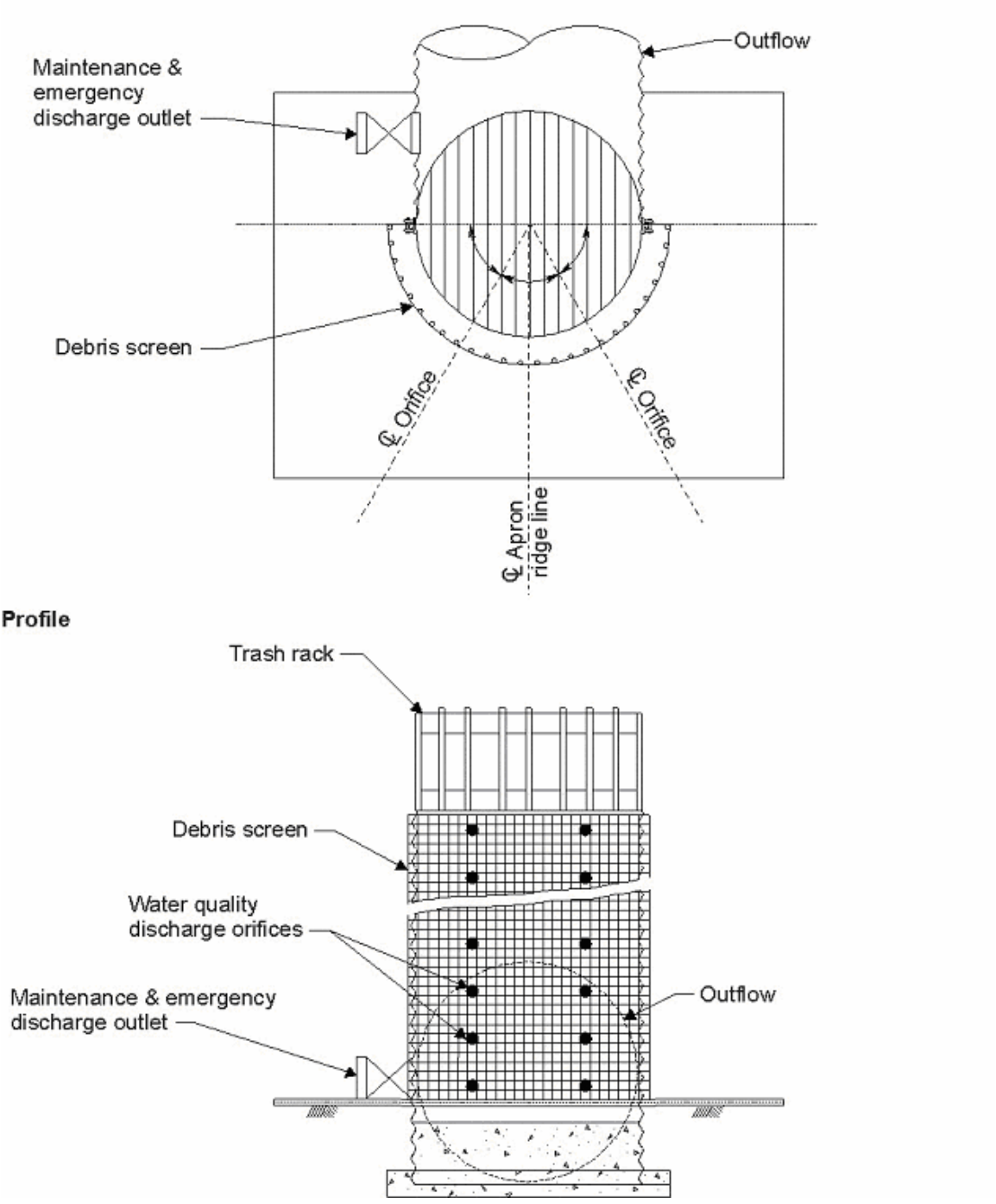
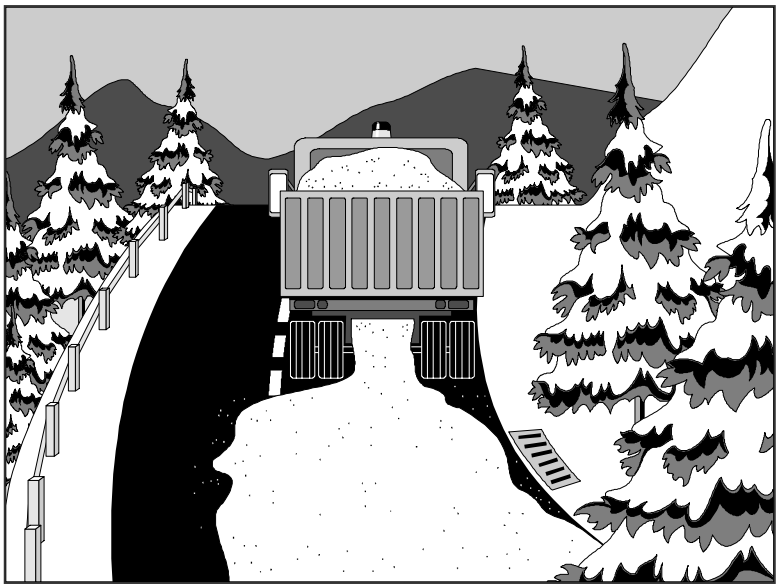


Figure TC 3-4
Example Schematic of Water Quality Outlet Structure (Not a Standard Plan)



Traction Sand Traps

TC-4



BMP Objectives

- ● Sediment
- ○ Oil and Grease
- ○ Metals and Toxics
- ○ Nutrients
- ○ Bacteria

- ● Highly Effective
- ○ Low Effectiveness

Definition and Purpose

A traction sand trap is a device that allows traction sand to settle out of highway storm water runoff. It must provide sufficient storage volume to retain the settled sand until the traction sand trap is cleaned. A traction sand trap is a permanent control measure that may be a stand-alone device, or may be incorporated as part of another storm water facility such as a detention basin.

NDOT routinely applies sand on snowy or icy roadways, primarily in mountainous areas, to provide additional traction for vehicles. The main purpose of sand traps is to recapture this sand from storm water runoff, thereby reducing traction sand discharges to receiving waters and habitats. Traction sand traps are not efficient at removing fine sediments (silts, clays) or other pollutants and should not be considered for this purpose.

Typically, a traction sand trap device is a drainage inlet that has been modified to capture and retain traction sand. Typical modifications include increasing the depth of the inlet so that there is a settling/storage area below the invert of the outlet pipe, linking multiple inlets for increased storage volume, and adding weep holes to allow the storage volume to drain.

Appropriate Applications

Traction sand traps should be considered at sites where sand or other traction-enhancing substances are commonly applied to the roadway. If sand is used only rarely (less than once or twice a year), traction sand traps may not need to be considered for installation.

Traction sand traps are used predominantly in areas that experience winter storm conditions and/or freezing temperatures. Roads with

elevated traffic are typically treated with a larger volume of traction sand and therefore require sand traps with larger sand storm volumes.

Due to the cost benefit differences, traction sand traps should be considered only where detention basins are not feasible, or where contributing drainage area is less than 1 acre. The NDEP should be consulted to determine whether open bottomed traction sand traps are classified as a regulated Class V underground injection well.

Limitations

Traction sand trap devices:

- Have a tributary area limited to that of a single inlet location.
- Provide relatively little traction sand storage volume.
- May result in traction sand discharges during high flow conditions as a result of limited volume, turbulent conditions, or insufficient settling time.
- Are difficult to design for specific removal efficiencies.
- Require the use of a vacuum truck for cleaning.

Design Guidance

Traction sand traps should have sufficient volume to store the settled sand through the winter (or some other period of time chosen by NDOT) with enough depth over the stored sand to prevent scouring and resuspension and to promote relatively calm pool conditions for settling. The volume required to store traction sand is calculated by starting with the estimated amount of traction sand spread in a given area and applying reduction factors to account for sand that has been recovered by other means or that cannot be captured. The equation for calculating the volume of traction sand storage is:

$V = (S \times R \times L \times E)/F$

Where:

V = The total volume of traction sand that must be stored (ft^3).

S = The estimated volume of sand applied (ft^3/yr).

R = A reduction factor to account for sand recovered by roadway sweeping.

L = A factor to account for other miscellaneous losses/accumulations.

E = An estimated recovery efficiency.

F = The number of times the trap will be cleaned (times/yr.) (See below)

Guidelines for defining the variables in this equation are as follows:

S: Typical sand application rates range from 1,650 ft^3/lane/mi/yr for areas with average application rates to 3,325 ft^3/lane/mi/yr for areas with high application rates. To estimate the total volume of traction sand applied, select an appropriate application rate from the range listed above, and multiply it by the total number of lanes (e.g., one lane in each direction equals two lanes) and the length of highway tributary to the sand trap. Because some areas track sand usage by post mile, a more accurate estimate may be obtained by consulting with District Maintenance staff. In any event, consider the following guidelines when estimating the volume of sand that is spread annually in the tributary area:

Exposure: Roadways on north facing slopes generally require more traction sand than similar south facing slopes. The surrounding vegetation may also significantly affect exposure and traction sand application.

Roadway grade: steeper grades generally receive more traction sand.

Other climatic and geographic factors, such as elevation, will affect the traction sand application rate for a specific area.

Other sources of similar material: Adjacent cut slopes and other non-paved tributary areas may contribute similar-sized sediment or other debris that will be retained in the trap.

R: This is a reduction factor to account for traction sand that is recovered through roadway sweeping. Estimate a value between 1.0 (no roadway sweeping) and 0.6 (aggressive winter roadway sweeping) based on interviews with District maintenance staff. If actual sweeping records are available, these may provide a more accurate estimate.

L: This is a factor to account for traction sand that has been carried into or out of the tributary area by miscellaneous means such as wind (smaller particles), sand thrown out of the tributary area by snow clearing equipment, and sand splashed or carried by vehicles. Estimate an appropriate value in the range of 0.8 (high losses from known sources such as snow blowers) to 1.2 (high accumulation from known sources).

Use a factor of 1.0 for no miscellaneous losses/accumulations.

E: This reduction factor is provided to account for traction sand that passes through the sand trap without settling out. Because of particle size limitations, settling inefficiencies, and other factors, it may not be realistic or practicable to recover all of the traction sand that reaches the sand trap. Until empirical information is obtained from pilot studies, a value of 1.0 should be used for this factor.

F: This is the number of times the sand trap will be cleaned each season. Usually, the value for F is 1 as most basins are cleaned once per year, usually in the summer. If obtaining the required storage volume is difficult, it may be possible to implement mid-season cleaning (F greater than 1), but District Maintenance staff should be consulted to make sure this is practicable. Mid-season cleaning requirements will also likely affect trap design, as maintenance equipment will have to access the trap under wet or snowy conditions.

An example sand storage volume calculation is presented in Appendix C of this manual.

After calculating the sand storage volume, it is necessary to determine the settling volume. This is dependent on the water quality flow (WQF) and the targeted particle size for removal.

For drainage areas less than 200 acres, the Rational Method may be used to determine the peak water quality flow rate (WQF):

$Q = CiA$ (ft^3/s)

Where: Q = peak flow rate (ft^3/s)

C = runoff (rational) coefficient

i = intensity of precipitation (in/hr)

A = drainage area (Acres)

A targeted particle size to be removed must be selected, then it's settling velocity is calculated using Stokes' Equation. Stokes' Equation for Reynold's numbers higher than 2 is:

$V_s = [(3.33)(g)(D)(\rho-\rho_w)/\ \rho_w]^{0.5}$

Where:

V_s = particle settling velocity

g = gravity constant (32.2 ft/s^2)

D = diameter of particle (ft)

ρ = density of particle (lbm/ft^3)

ρ_w = density of water (62.4 lbm/ft^3)

To calculate the time required for a particle to settle a given distance use:

$D \times V = T_d$

Where:

D = Required Settling Distance

= The particle settling velocity as calculated from Stoke's Equation

T_d = Required Detention Time to the target particle size

Now calculate the settling volume by multiplying the WQF by the detention time.

A example calculation for determining a sand trap settling volume is provided in Appendix C

Modifications for Traction Sand Inlet Trap Design.

Typical modifications from a standard inlet include increasing the depth of the inlet so that there is a settling/storage area below the invert of the outlet pipe, linking multiple inlets at one location for increased sand storage volume, and adding weep holes to the bottom to allow the storage area to drain. The primary design considerations for modifying a standard inlet into a traction sand trap device are sand storage volume, inlet depth, inlet drainage, and maintenance access.

Inlet Depth: Once the required storage volume has been determined, divide the required volume by the inlet cross sectional area (plan view) to calculate the required depth of the inlet's traction sand storage area. The storage area should start at least 1 ft. below the invert of the inlet's outlet pipe and extend no more than 10 ft. below the inlet grate (or road surface). If the inlet is any deeper than that, a vacuum truck will have difficulty removing the traction sand from the bottom of the basin. Additionally, the bottom of the inlet should be at least 6 ft. above the ground water

table. If the required storage volume cannot be met under these criteria, consider using double inlets or non-standard inlets, adding more inlets, using a different treatment control, or supplementing the traction sand inlets with additional down-stream controls.

Inlet Drainage: Because the bottom of a traction sand inlet is below the inlet's outlet pipe, additional drainage holes must be provided to prevent standing water and associated vector problems (e.g., mosquito breeding). The design infiltration rate should be limited to 50 percent of that indicated in the soils report. This would provide a factor of safety and allow for accumulation of fines that, over time, will reduce the infiltration rate. If the surrounding soils do not provide sufficient permeability to draw down the inlet within 7 days, it may be necessary to select a different treatment control. Any traction sand inlet with drainage holes must be designed to prevent damage to the adjacent roadway subgrade. Typical mitigation measures include locating inlets only on the down-gradient side of the roadway, locating the top inlet drainage hole below the roadway subgrade, and providing additional drainage pathways (such as a leach line) to guide water away from the subgrade. Locating traction sand inlets on the high side of a super elevated section should be avoided.

Traction sand traps require a small hydraulic head for gravity flow operation. The inlet and outlet devices should be arranged or baffled to minimize short-circuiting of the flow through the device. Preliminary design factors for traction sand traps are summarized in Table TC 4-1.

Maintenance

Maintenance Access: Vacuum trucks are typically used to remove accumulated traction sand from the inlets. Providing a pullout area for the vacuum truck not only provides an additional measure of safety for the cleaning crew, but may also save time and money by avoiding lane closures. At a minimum, the pullout area should be about 40 ft. long and about 10 ft. wide and be located so the inlet is near the front of the truck. (Also see "Inlet Depth," above.) Consult with District Maintenance staff to see if inlet location markers are required.

Table TC 4-1
Summary of Traction Sand Trap Siting and Design Criteria

Description	Applications/Siting	Planning and Design Considerations
▪ Sedimentation devices that temporarily detain runoff and allow traction sand to settle out. May be basins, tanks, or vaults. ▪ Treatment Mechanisms: ▪ Sedimentation ▪ Pollutants removed: ▪ Sand or other traction-enhancing substances	▪ Sites where sand or other traction-enhancing substances are commonly applied to the roadway ▪ Not considered where sand is used only rarely (less than once or twice a year) ▪ Where detention basins are not feasible ▪ Consult District/Regional NPDES Storm Water Quality Specialist to ensure device not classified as a regulated underground injection well ▪ Locate device so water is not introduced above the roadway subgrade in case of blockage	▪ Design for anticipated sand recovery ▪ Divert peak hydraulic flow ▪ Sufficient volume to store the settled sand through the winter and avoid scour ▪ Sufficient hydraulic head for gravity flow ▪ Inlet and outlet arrangement to minimize short-circuiting of the flow ▪ Weep holes to allow proper drainage ▪ Invert 3 to 6 ft. above groundwater ▪ Maintenance space and/or access ramps for large equipment

Gross Solids Removal Devices (GSRDs)

TC-5

Definition and Purpose

Gross Solids Removal Devices (GSRDs) are intended for use in highly urban settings and are to be used to remove litter and solids from storm water runoff. Gross Solids Removal Devices include physical/mechanical methods of removing litter and solids 0.25 inch nominal and larger from storm water runoff using various screening technologies.

Appropriate Applications

GSRDs should be considered for areas where receiving water bodies are on the 303(d) impaired water body list for trash, or where trash, litter, or other debris has been identified as a major receiving water concern.

GSRDs are still being investigated for functioning under different loading and flow patterns in order to refine design and determine effectiveness. Some health and safety aspects are being evaluated too. Effective operation of device is dependent on appropriate maintenance. Two types of GSRDs that have been installed and function effectively include:

1. Linear Radial GSRD, and
2. Inclined Screen GSRD.

- The Linear Radial Device (Figure TC 5-1) utilizes modular well casings with 0.25-inch nominal louvers to remove litter. The louvered well casings are contained in a concrete vault. Flows pass radially through the louvers trapping litter and solids in the casing and passing flows into the vault for discharge via an outlet pipe. The bottom of the casing is smooth to allow trapped litter to move to the downstream end of the well casing. The device requires very little head to operate and has

been pilot tested for 1% slope. Flatter slopes may work but have not been tested. The Linear Radial Device is designed to work in-line with the existing storm drain system or could be placed in an off-line configuration. In-line configuration incorporates overflow/bypass if the unit becomes plugged. As shown in Figure TC 5-1, the first foot and a half of the linear well casing is non-louvered with an open top to allow for influent bypass should the device become clogged with litter. The circular louvered sections have access doors that can be easily opened to facilitate cleaning with a vacuum truck or other equipment if necessary. The device is covered with a load-bearing grating appropriate to the location.

- In the Inclined Screen Device, the flow overtops a weir and falls through an inclined bar rack (wedge-wire screen) with a 0.125-inch nominal maximum spacing between the bars, located after the influent trough. After passing through the rack, the flow exits the device via the discharge pipe. A distribution trough is provided to allow influent to be distributed along the length of the Inclined Screen. The litter captured by the bar rack is pushed down toward the litter storage area by the storm water runoff. Parabolic wedge-wire screen inclined at 60 degrees and 3 ft high was tested in pilot studies and worked effectively. Other configurations with different inclinations and heights of the screen may work but have not been pilot tested. In order to minimize the footprint of the device, a 90-degree elbow configuration of the screen (Figure TC 5-2) was used in the pilot study. Other configurations of the screen can be used on a site-specific basis. The gross solids storage area is sloped and is provided with a drain to prevent standing water. As shown in Figure TC 5-3, an opening above the litter storage area is provided to allow for overflow/bypass if the device becomes plugged. The device should be designed for litter and debris storage for a period of one year. The device is covered with a load-bearing grating appropriate to the location.

The Linear Radial Device requires very little head to operate and is well suited for narrow and relatively flat rights-of-way with limited space. The Inclined Screen requires about 5 ft. of head and is well suited for fill sections of the highways.

Design Guidance

The two most important factors affecting the design of these devices are: (1) the need to be sized to accommodate both gross pollutants storage for a given maintenance period (typically one year), and (2) the hydraulic capacity of the drainage system in which it is to be installed. Litter and debris accumulation data need to be available to properly size the devices for the given drainage area. If regional debris accumulation data are not

available, then 10 ft^3/ac/yr may be used. These devices can be designed both in-line and off-line. In-line configuration incorporates overflow/bypass if the unit becomes plugged. A summary of preliminary design factors is presented in Table TC 5-1.

Maintenance and Inspection

GSRDs require sufficient space and/or access ramps for maintenance and inspection including the use of vactor trucks or other large equipment to remove accumulated trash.

Table TC 5-1
Summary of Gross Solids Removal Devices
(Linear Radial and Inclined Screen)

Description	Applications/Siting	Planning and Design Considerations
Treatment Mechanisms: ▪ Filtration through screens Pollutants removed: ▪ Litter and solid particles greater than 0.25 in. nominal	▪ Site conditions must have adequate space for device and maintenance activities. ▪ Sites that drain to litter sensitive receiving waters on 303(d) list for trash or areas where TMDLs require trash removal. ▪ The Linear Radial Device requires little head to operate and is well suited for flat sections of highway. ▪ The Inclined Screen requires 5 ft. of head and it is well suited for fill sections.	▪ Regional litter accumulation data is desirable; otherwise use 10 ft^3/acre/year. ▪ Devices must be sized for peak design flow while carrying design gross solids load. ▪ The Linear Radial Device well casing is available up to 36 in. diameter. ▪ Devices can be placed in-line incorporating bypass/overflow or it may be placed offline.

Gross Solids Removal Devices (GSRDs)

Figure TC 5-1
Example Schematic of Linear Radial Device (Not a Standard Plan)

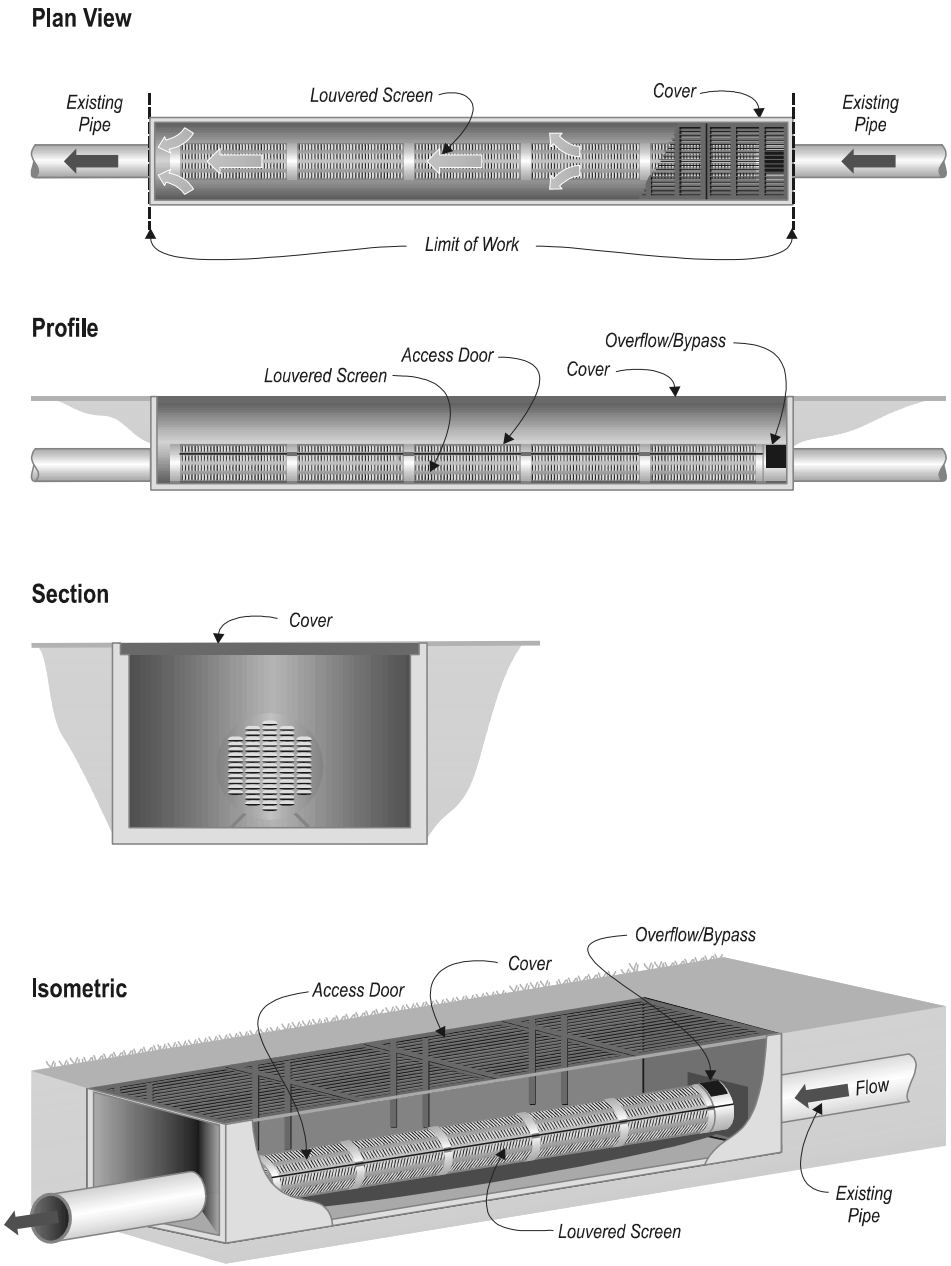


Figure TC 5-2
Example Schematic of Inclined Screen (Not a Standard Plan)

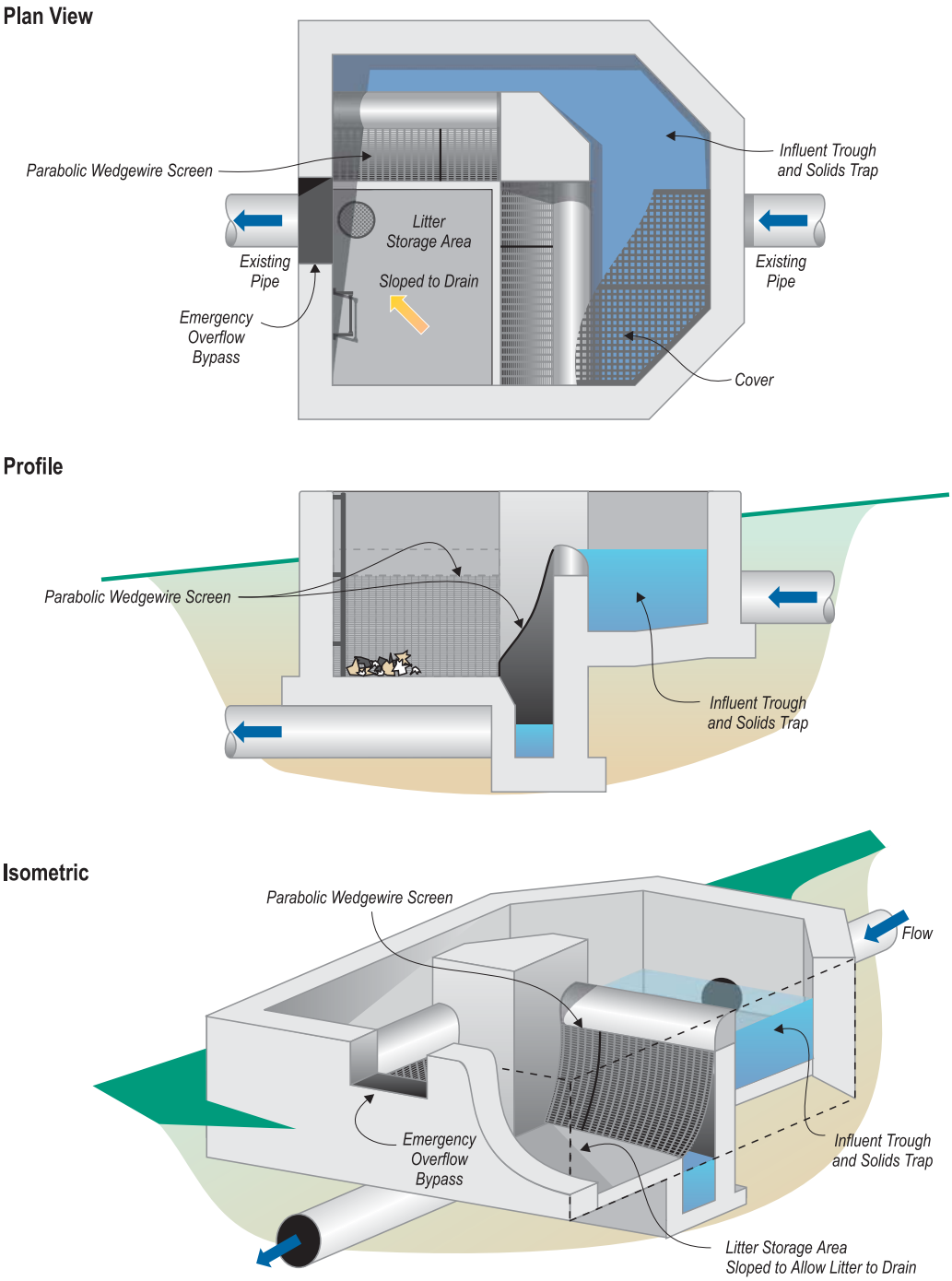


Figure TC 5-3
Inclined Screen

Appendix C
Treatment Control BMP Design Examples

This appendix illustrates general design approaches to sizing the more common treatment control BMPs discussed in this Planning and Design Guide. Example calculations are provided for the following design parameters:

- Water Quality Volume and Flow (WQV and WQF),
- Sand Storage Volume,
- Infiltration Basin Surface Area,
- Sand Trap Settling Volume.

These examples represent one possible design approach for these BMPs and are intended for illustrative purposes only. Actual designs will include many additional site specific considerations including critical issues such as flood protection and roadway drainage that are not covered in this section. See the NDOT Drainage Manual for drainage and flood control design guidance.

1.1 General Problem Statement

Consider a ¼ mile section of NDOT roadway in the Lake Tahoe Basin. The paved width of the road is 30 ft. and curb and gutter has been installed at the edge of pavement on both sides.

Size either a detention basin, an infiltration basin or sand traps to address the water quality needs of this roadway section.

1.2 Design Approach

Table C-1 illustrates the main design parameters that must be determined to size the various BMPs.

Table C-1
General Design Outline

Treatment Control BMP	Design Parameters
Detention and Infiltration Basins	1. Water Quality Volume 2. Sand Storage Volume 3. Surface Area (infiltration basin only)
Sand Trap	1. Peak Water Quality Flow 2. Sand Storage Volume 3. Settling Volume

After calculating the items listed in Table C-1, site-specific design considerations and constraints must be applied as discussed in Sections 2, 3 and 4 and in Appendix B.

1.3 Detention and Infiltration Basins

Calculate the Water Quality Volume (WQV):
In the Lake Tahoe Basin, the WQV can be calculated by distributing the 1-inch rainfall depth from the given design storm over the drainage area and then applying the appropriate runoff coefficient (0.95 for paved surfaces).

WQV = (1 in)(1 ft/12 in)(0.91 acres)(43,560 ft^2/acre)(0.95) = 3,138 ft^3 (See Section 2)

Next, determine the required sand storage volume using the following equation and methodology:

Sand Volume V = (S x R x L x E)/F (See TC-4, "Traction Sand Traps")

Where:

V = the total volume of traction sand that must be stored (ft^3).

S = the estimated volume of sand applied (ft^3/lane-mile/yr).

R = a reduction factor to account for sand recovered by roadway sweeping.

L = a factor to account for other miscellaneous losses/accumulations.

E = an estimated recovery efficiency.

F = the number of times the trap will be cleaned (times/yr).

For more detailed description of sand volume variables, see *Appendix B*, *TC 4 - Traction Sand Traps*

For the purposes of this example assume high sand application rates, aggressive winter sweeping, no miscellaneous additions or losses, and once-a-year maintenance.

Therefore:

V = [(3,325ft^3/lane-mile/yr)(0.25 miles)(2 lanes)(0.6)(1)(1)]/(1) = 997.5 ft^3/yr

Using the WQV and the sand storage volume, a detention basin or infiltration basin for this roadway section would require a working volume of:

Total Volume = 3,138 ft^3 + 997.5 ft^3 = 4,135.5 ft^3

The detention basin can now be fit into the available space and design details can be developed using the additional guidelines in Appendix B.

Infiltration Basins
For infiltration basins the required surface area must be calculated based on the required WQV and the infiltration rates of the site soils.

A_{est} = WQV×SF×12 / k_{est}×t (See TC-2, "Infiltration Basins")

Where:

A_{est} = estimated surface area of basin invert, ft^2

12 = conversion factor from inch to feet

SF = safety factor of 2.0

WQV = water quality volume calculated from the design storm (ft^3)

k_{est} = estimated infiltration rate (in/hr).

Assume sandy loam soils (NRCS HSG "B" classification) exist at the proposed basin location then from Table TC 2-3 find the estimated infiltration rate of 1 in/hr.

t = drawdown time, use 72 hours

Therefore:

A_{est} = {[(12in/ft)(2.0)(3,138 ft^3)]/[(1.0in/hr)(72hr)]} = 1,046 ft^2.

Using the WQV and the required surface area, the infiltration basin must have a minimum working depth of:

Depth = (WQV + Sand Storage Volume)/ A_{est} = (3,138 ft^3 + 997.5)/1,046 ft^2 = 4 ft.

The final shape of the basin will depend on site-specific characteristics of the basins location such as available right-of way, slopes, soil conditions etc.

1.4 Sand Traps

Sand traps are flow-through devices that function to slow runoff enough to allow heavier materials to settle and be trapped. These devices are placed along the edges of the roadway and serve shorter sections than the basins discussed above. For this example assume a 100 ft section of the road drains to a single sand trap.

For drainage areas less than 200 acres, the Rational Method may be used to size sand traps. Use the Rational Method equation to determine the peak water quality flow rate (WQF):

Q = CiA (ft^3/s)

Where: Q = peak flow rate (ft^3/s)

C = runoff (rational) coefficient

i = intensity of precipitation (in/hr)

A = drainage area (Acres)

Runoff Coefficient:

Determine the appropriate runoff coefficient "C" value based upon the drainage area characteristics. For paved surfaces, an applicable value is equal to 0.95 (See Table 5-2).

Intensity:

In the Tahoe Basin, the intensity is determined from the TRPA 20 year, 1 hour design storm. Using published Intensity/Duration/Frequency relationships, the intensity has been determined to be approximately 1 inch per hour.

Area:

(100 ft)(30 ft)(1 ac/43,560 ft) = 0.07 Acres

Using these values:

$Q = (0.95)(1\ in/hr)(0.07\ acres) = 0.0665\ (ft^3/s)$

A targeted particle size to be removed must be selected then its settling velocity is calculated. The TRPA recommends a 20-micron particle size for the targeted particle to be removed by the sand traps. The settling velocity for such a particle is calculated using Stokes' Equation. Stokes' Equation for Reynolds numbers higher than 2 is:

$V_s = [(3.33)(g)(D)(\rho-\rho_w)/\ \rho_w]^{0.5}$

Where:

V_s = particle settling velocity

g = gravity constant (32.2 ft/s^2)

D = diameter of particle (20 microns = 6.56 X 10^{-5} ft)

ρ = density of particle (165 lbm/ft^3)

ρ_w = density of water (62.4 lbm/ft^3)

Therefore:

$V_s = [(3.33)\ (32.2\ ft/s^2)\ (6.56 \times 10^{-5}\ ft)\ (165\ lbm/ft^3 - 62.4\ lbm/ft^3)\ /\ (62.4\ lbm/ft^3)]^{0.5}$

$V_s = 0.091\ ft/s$

Next, the maximum depth of flow in the pipe exiting the sand trap must be found. This is accomplished by using the previously calculated peak WQF, the pipe's

physical characteristics, and the pipe slope. This determination involves hydraulic calculations that are beyond the scope of this manual but can be found in any hydraulic design manual. For the scope of this example, assume that the maximum depth of flow has been calculated to be 4 inches.

In order for the particle to be trapped it must settle to below the invert elevation of the exiting pipe. To help ensure that the particles will be trapped and not re-suspended and washed out by more turbulent flows, additional separation between the settled particles and the pipe invert should be added. It is recommended that a 1-foot separation from the invert of the exiting pipe to the top of the sand storage area be incorporated for this purpose. To calculate the time required for a particle to settle a given distance use:

Required Settling Distance X Particle Settling Velocity = Settling Time (Detention Time)

For the 20-micron particle considered above this would take:

(12 in + 4 in)(1 ft/ 12 in)/(0.091 ft/s) = 14.6 seconds

This means that the sand trap must have a detention time of approximately 15 seconds to settle the particle of concern. Several standard shape and size sand traps are available. For this example, assume a 3 ft wide by 4 ft long box will be used. The retention time for such a box is:

(3 ft X 4 ft X 1 ft)/(0.0665 ft^3/s) = 180 seconds or about 3 minutes. Therefore a 1-foot deep settling zone should easily trap the 20-micron particle.

Next, calculate the required sand storage volume as above but for the shorter roadway section.

V = [(3,325ft^3/lane/mile)(100ft)(1 mile/5,280 ft)(2 lanes)(0.6)(1)(1)]/(1) = 75.5 ft^3

For the 3 X 4 box, the sand storage depth is:

75.5 ft^3/12 ft^2 = 6.3 ft.

Now adding the settling zone depth and the sand storage depth, the sand trap should be:

1 ft + 6.3 ft = 7.3 ft deep, below the invert of the exiting pipe.

APPENDIX D
Storm Water Documents and Web Sites

Clark County Regulations, Criteria and Design Manual for the Control of Drainage - http://www.co.clark.nv.us/Comprehensive_planning/Advanced/MajorProjects/Title28/Title28_27.htm

Clark County Air Quality Regulations - http://www.co.clark.nv.us/air_quality/Regs.htm

Clark County Dust Control Handbook - http://www.co.clark.nv.us/Air_Quality/AppendixG/Section_94_Handbook.pdf

Federal Highway Administration - BMP Manual for Ultra Urban Settings - http://www.fhwa.dot.gov/environment/ultraurb/index.htm

Federal Highway Administration - Air Quality Planning Guidance - http://www.fhwa.dot.gov/environment/aqplan/aqintro.htm

International Erosion Control Association - http://www.ieca.org/

City of Las Vegas Stormwater Quality Management Committee - http://www.lvstormwater.com/

Nevada Division of Environmental Protection - http://ndep.nv.gov/

National Weather Service: Updated Precipitation Frequency Estimates for the Semiarid Southwest - http://www.nws.noaa.gov/oh/hdsc/

National Weather Service: Updated Precipitation Frequency Estimates for the Semiarid Southwest - http://www.nws.noaa.gov/oh/hdsc/

Truckee Meadows Construction Site Best Management Practices (BMP) Handbook - http://www.cityofreno.com/pub_works/stormwater/pdfs/TruckeeMeadowsBMP_rev01.pdf

UNR, 2002, Tueller, P. Dr., Post, D., Noonan, E., *Mapping Ecosystems along Nevada Highways and the Development of Specifications for Vegetation Remediation*. (Draft 07/11/02).

Urban Runoff Quality Management, 1998, *ASCE Manual and Report on Engineering Practice NO. 87/WEF Manual of Practice,* No. 23.

U.S. Department of Transportation, 1996, *Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22 – HEC22.*

U.S. Department of Transportation, 1996, Federal Highway Administration, *Retention, Detention and Overland Flow for Pollutant Removal from Highway Stormwater Runoff. Volume 2 - Design Guidelines*. Publication No. FHWA-SA-96-096.

USEPA, January 2001, Best Non-point Source Documents - http://www.epa.gov/owow/nps/bestnpsdocs.html

Washoe County Air Quality Regulations - http://www.co.washoe.nv.us/health/air/Regulations/Regulations_main.htm

Washoe County Application for Dust Control Plan - http://www.co.washoe.nv.us/health/air/Applications/Dust%20Control%20Plan.pdf

Washoe County Hydrologic Criteria and Drainage Design Manual, 2003 (Draft).

Western U.S. Precipitation Frequency Maps – http://www.wrcc.dri.edu/pcpnfreq.html