

Arizona Department of Transportation Guidelines for Highways on Bureau of Land Management and U.S. Forest Service Lands 2008



Chapter Overview Presentations

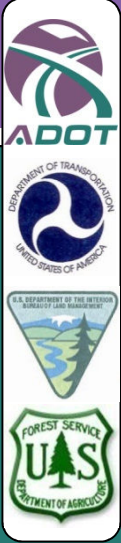
Twelve Chapter Overview presentations supplement the Guidelines document. Chapters 1-11 each have a Chapter Overview and an additional one summarizes appendices A-O.

These self-paced presentations are designed for individual use or for small group presentations where discussion can be accommodated. It is helpful to have the Guidelines document as a reference when viewing the presentations.

The Chapter Overview presentations are available on the ADOT Roadside Development Section website.

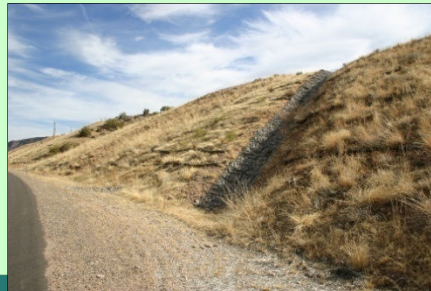
<http://www.azdot.gov/business/engineering-and-construction/roadway-engineering/roadway-design-standards-and-guidelines/guidelines-for-highways-on-bureau-of-land-management-and-us-forest-service-lands>

Navigate the Chapter Overview by scrolling through the pages.

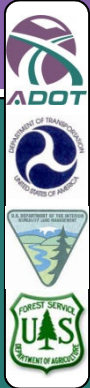


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Chapter 6: Drainage Design and Construction



Acknowledgments:



Arizona Department of Transportation

Guidelines for Highways on Bureau of Land Management and U.S. Forest Service Lands



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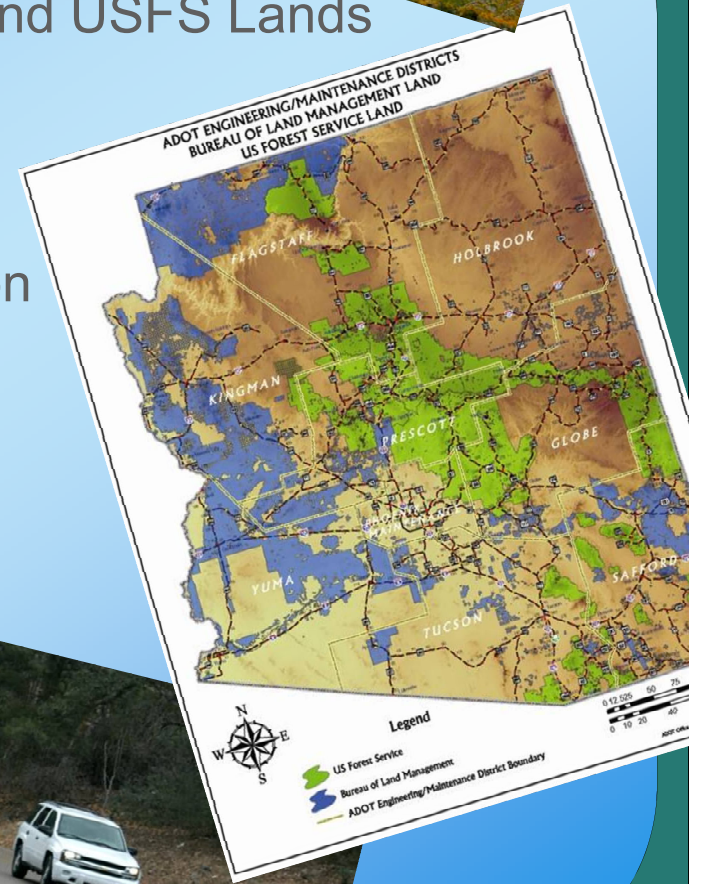
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Prepared by Wheat Scharf Associates and the Guidelines Steering Committee

Guidelines Contents



- 1 Introduction
- 2 ADOT Development Process on BLM and USFS Lands
- 3 Habitat Connectivity
- 4 Roadway Design and Construction
- 5 Major Structure Design and Construction
- 6 Drainage Design and Construction**
- 7 Landscape Restoration
- 8 Storm Water and Pollution Control
- 9 Material Sites
- 10 Construction
- 11 Maintenance Operations
- Appendices A - O



After reviewing the Chapter 6 Tutorial you should...



- Have a basic understanding of the design, construction and maintenance of pipe culverts, drainage channels and ditches.
- Be able to define 'AZPDES'.
- Understand the concerns that must be addressed early in project development to protect riparian areas.
- Know the items typically included in an ADOT Drainage Report.
- Understand how Sections 404 and 401 of the Clean Water Act impact the design, construction and maintenance of highways.

And you should also...



- Be familiar with the following drainage structures and terms:
 - Crown Ditch
 - Slope Ditch
 - Embankment Curb
 - Rock Check Dam
 - Cut-to-Fill Transition
 - Spillway
 - Flared End Culvert
 - Rock Riprap
- Understand methods to use to make drainage structures more aesthetically pleasing.
- Know that an erosion control plan must be submitted to ADOT prior to beginning any earth-disturbing activities.
- Be able to access the ADOT Post-Construction BMP Manual on the ADOT website.

Chapter 6 Contents



6.1 Chapter Goals

6.2 Scoping and NEPA Processes

6.3 Design

6.4 Construction

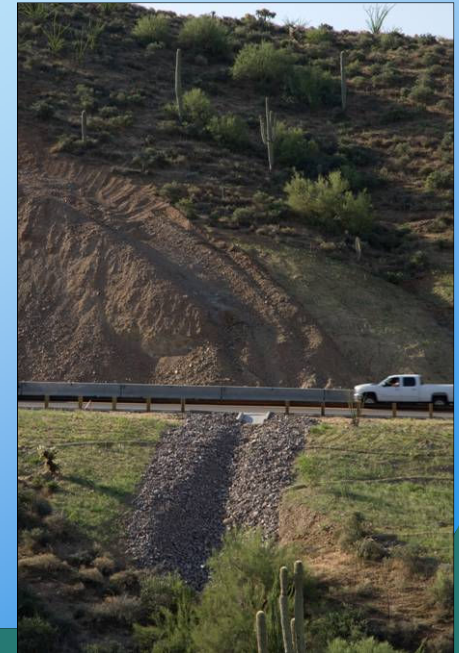
6.5 Additional Resources



6.1: Chapter Goals



- Describe opportunities and concerns for the design, construction and maintenance of new drainage facilities (pipe culverts, channels, ditches) to best integrate them into the existing landscape.
- Introduce the Arizona Pollution Discharge Elimination System (AZPDES) requirements.



Arizona Pollution Discharge Elimination System



- Erosion results in sediment loss and material transport contributing to water quality degradation.
- Employ Best Management Practices (BMPs) to comply with requirements of the National Pollution Discharge Elimination System (NPDES) and the Arizona Pollution Discharge Elimination System (AZPDES) for control of storm water quality.
 - Temporary
 - Permanent

EPA NPDES - Office of Wastewater Management

U.S. ENVIRONMENTAL PROTECTION AGENCY
National Pollutant Discharge Elimination System (NPDES)

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NPDES Alphabetical Topics Index Glossary About NPDES

NPDES Current Issues

- Final 2008 MSGP
- Final 2008 CAFO Rule
- Guide for Building an Effective Post-

ADEQ: Permits: Arizona Pollutant Discharge Elimination System (AZPDES)

ADEQ
Arizona Department of Environmental Quality

Protecting public health and the environment

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BROWSE WATER QUALITY

- Water Quality Home
- Compliance
- Data Management
- Monitoring & Assessment
- » **Permits**
- Aquifer Protection
- AZPDES
- Dredge and Fill
- Drywell
- Permits Assistance
- Reclaimed Water
- Related Statutes & Rules
- Subdivisions, Sewage Collection Systems & Onsite Systems
- Safe Drinking Water
- Wastewater Management
- Watershed Management
- Water Quality Standards

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- About ADEQ
- ADEQ Newsroom
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- Compliance
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- Laws, Rules & Policies
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- Publications & Forms
- Employment
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BROWSE BY PROGRAM

- Air Quality
- Tank Programs

PERMITS: ARIZONA POLLUTANT DISCHARGE ELIMINATION SYSTEM (AZPDES)

On Dec. 5, 2002, Arizona became one of 45 states with authorization from EPA to operate the National Pollutant Discharge Elimination System (NPDES) Permit Program (Section 402 of the Clean Water Act) on the state level.

Under the Arizona Pollutant Discharge Elimination System (AZPDES) Permit Program, all facilities that discharge pollutants from any point source into waters of the United States (navigable waters) are required to obtain or seek coverage under an AZPDES permit. Pollutants can enter waters of the United States from a variety of pathways, including agricultural, domestic and industrial sources. For regulatory purposes these sources are generally categorized as either point source or nonpoint sources.

AZPDES Rules

ADEQ developed rules for the AZPDES program in 2001 and revised them in 2002 and 2004. The most recent revision was published in the [Arizona Administrative Code](#) on Dec. 26, 2003. View the final version of the AZPDES rules at [18 A.A.C. 9, Art 9](#), effective on Feb. 2, 2004 (page 82).

- Overview of the AZPDES Process
- Individual Permits
- General Permits
 - De Minimis
 - Concentrated Animal Feeding Operations
- Stormwater
 - Phase II
 - Construction Activities
 - Multi Sector (Industrial Activities)
 - Municipal Stormwater Program
- Pretreatment Program
- Biosolids/Sewage Sludge
- Forms and Guidance
- FAQs
- NOI Construction Database Search
- Other Programs Affecting AZPDES
- Contacts

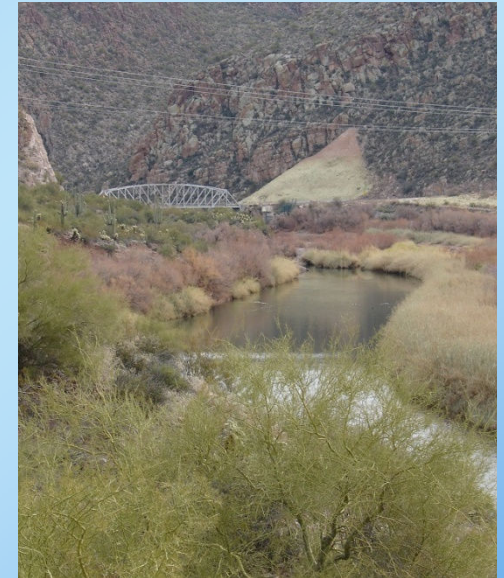
News Releases

- [06/25/07: ADEQ Director Steve Owens' Statement on U.S. Supreme Court Decision Upholding Arizona's Water Quality Permitting Program](#)

6.2 Scoping and NEPA Processes



- The following concerns must be considered early in project development:
 - Protection of riparian areas
 - Design to minimize impacts to riparian areas both within and outside the right-of-way
 - Mitigation measures, if damage to existing riparian areas is unavoidable
 - Easement acquisition
 - Maintenance (post construction) access to drainage structures



6.3 Design

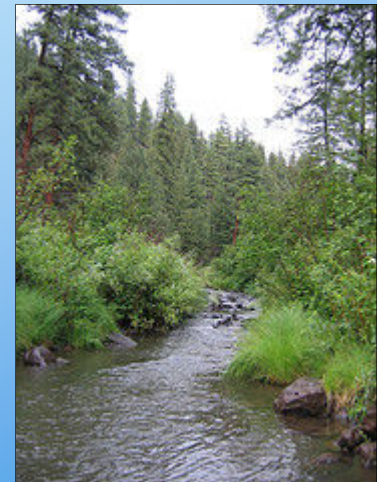


- The ADOT Drainage Report is submitted as part of Stages II and III and should include information on:
 - Floodplain jurisdictional delineation.
 - Assessment of existing and future conditions impacting watersheds, flow patterns, and flood areas.
 - Drainage map showing topographic and drainage features
 - Peak run-off rates from each drainage area.
 - Stream channel flows and streambed materials.
 - Topographic and drainage features.
 - Design criteria, procedures, methods and assumptions for analysis and design.
 - Concepts for management of storm water during and after construction.
 - Initial size and location of major drainage structures and channels that affect the roadway location.

6.3 Design



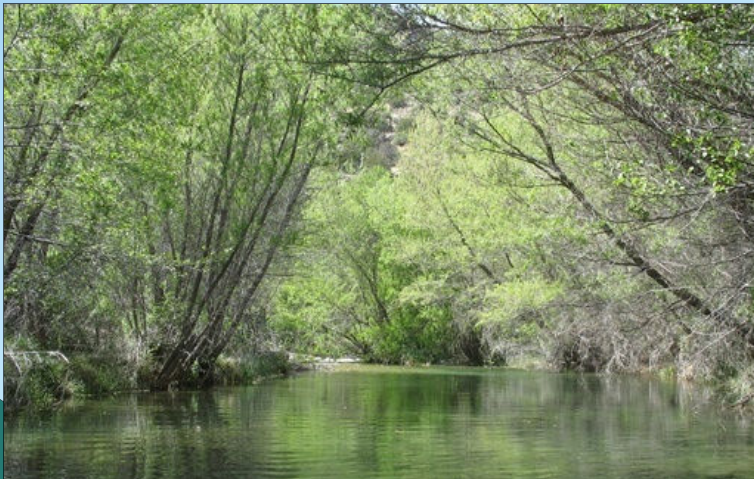
- Sections 404 and 401 of the Clean Water Act
 - Section 404 regulates the discharge of fill or dredged materials into the waters of the U.S. and establishes a program to issue permits.
 - Any proposed work in washes, rivers, streams, lakes and wetlands requires a permit from the U.S. Army Corps of Engineers.
 - Section 401 enables the State to provide certification that the draft 404 permit is in compliance with State law regarding water quality standards.



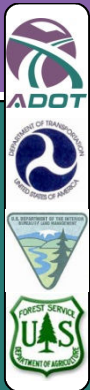
6.3 Design



- Riparian Areas in this manual include natural drainages and the habitats associated with them.
 - Inventory riparian areas during the design process.
 - Minimize change to natural stream channel dynamics.
 - Consult wildlife experts regarding species negatively impacted by drainage structure design and explore preventative measures to consider.
 - Avoid or minimize armored bank protection.
 - Minimize sediment transport into riparian areas.



6.3 Design



- Drainage Structures

- Ditches and Dikes are concentrated flow structures used to intercept and direct surface runoff into a drain or an existing drainage.



Slope Ditch



Rock Check Dams
Reduce Runoff Velocity



Crown Ditch



Erosion
Protection at
Cut-to-Fill Slope
Transition

6.3 Design



- Drainage Structures

- Overside Drains are pipes, downdrains and spillways used to protect slopes against erosion by collecting surface runoff and conveying it down the slope to stable drainage.



Embankment
Curb to
Spillway



- Culvert and Channel Inlets/Outfalls are areas of high concern for erosion; install rock riprap and flared end pipes to reduce runoff velocity and prevent scour.



6.3 Design



- Drainage Structure Aesthetics
 - The appearance of drainage structures should be considered during the design process.
 - Highly visible headwalls may be constructed utilizing formliners, concrete stain, exposed aggregate, paint or integral color concrete.
 - Riprap may be stained.
 - Channels and ditches can be more curvilinear in alignment.
 - Crown ditches should be staked in the field to minimize disturbing existing vegetation.
 - Culvert inlets and outfalls can be trimmed or formed to follow the finish grade.
 - Cut slopes can be warped to better hide slope spillways.



6.4 Construction



- All earth-moving equipment must be washed before operating on BLM/USFS Lands.
- Prior to earth-disturbing activities the contractor shall deliver his proposed erosion control plans to ADOT for approval.
- Ensure that elevations of concrete culvert forms are properly set prior to concrete installation.
- Review and adjust proposed crown ditch alignments prior to excavation.



6.4 Construction



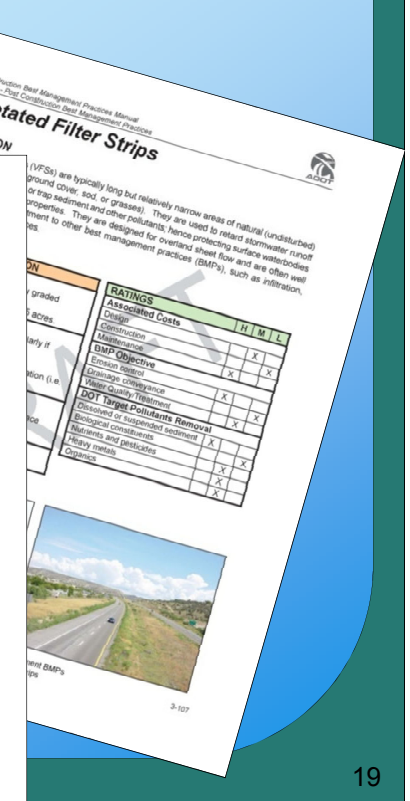
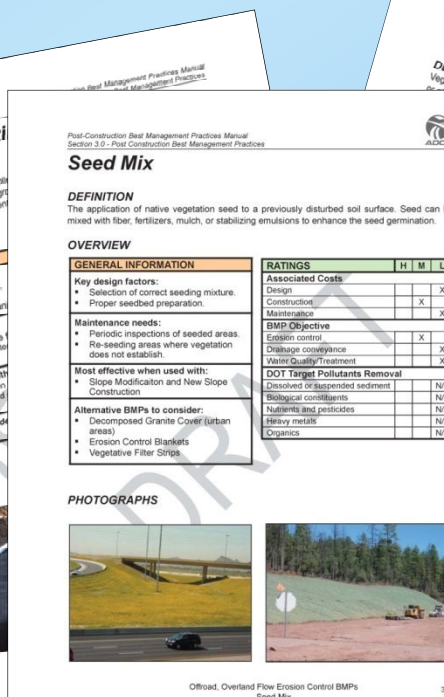
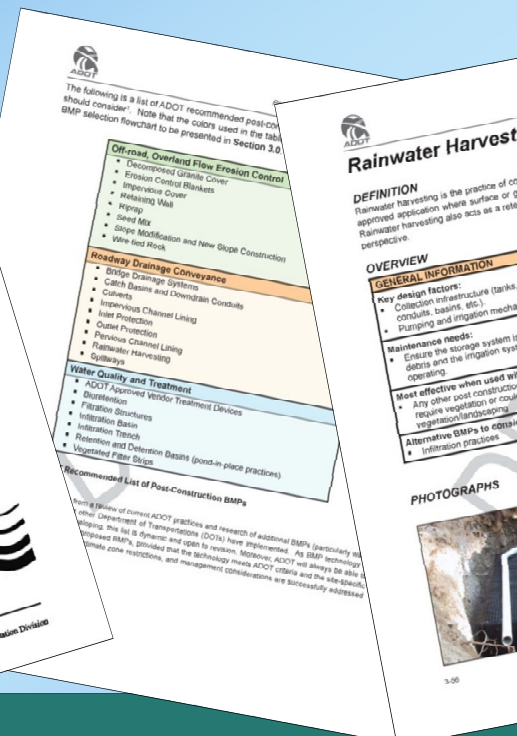
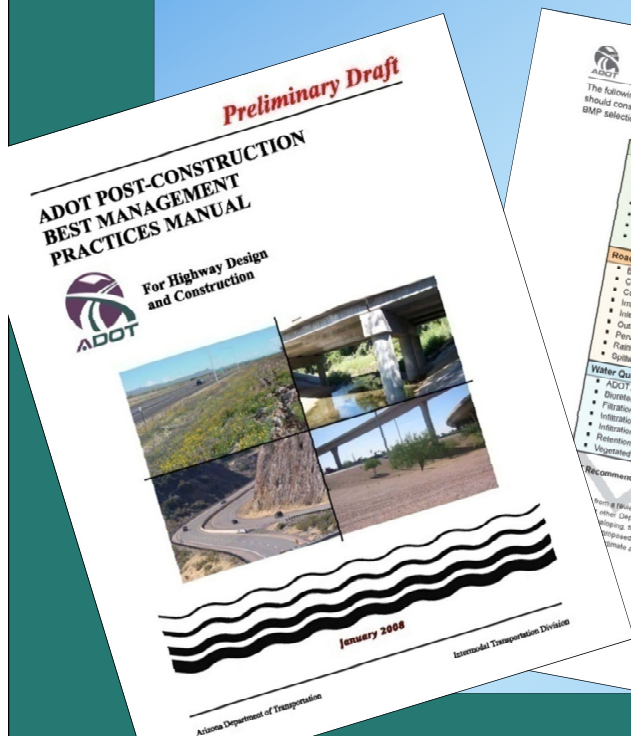
- Minimize potential for erosion of disturbed soil into natural drainages with respect to contractor staging areas adjacent to drainages.
- Remove temporary access and restore disturbed areas promptly.



6.5 Additional Resources



- ADOT Roadway Engineering Group: Drainage Design Section
<http://www.azdot.gov/business/engineering-and-construction/roadway-engineering/drainage-design>
- ADOT Post-Construction BMP Manual
[http://www.azdot.gov/docs/planning/post-construction-best-management-practices-\(bmp\)-manual.pdf?sfvrsn=0](http://www.azdot.gov/docs/planning/post-construction-best-management-practices-(bmp)-manual.pdf?sfvrsn=0)



Highlights



- Read Chapter 6.....
 - To understand how pipe culverts, drainage channels and ditches can be best integrated into the existing landscape to facilitate drainage.
 - To learn how to minimize impacts to riparian areas.
 - For an overview of types of drainage ditches and dikes; overside drains; and culvert and channel inlet/outfall erosion protection methods.



Knowledge Check: Do you.....



- ✓ Have a basic understanding of the design, construction and maintenance of pipe culverts, drainage channels and ditches?
- ✓ Know what 'AZPDES' means?
- ✓ Understand the concerns that must be addressed early in project development to protect riparian areas?
- ✓ Know the items typically included in an ADOT Drainage Report?
- ✓ Understand how Sections 404 and 401 of the Clean Water Act impact the design, construction and maintenance of highways?

And do you.....

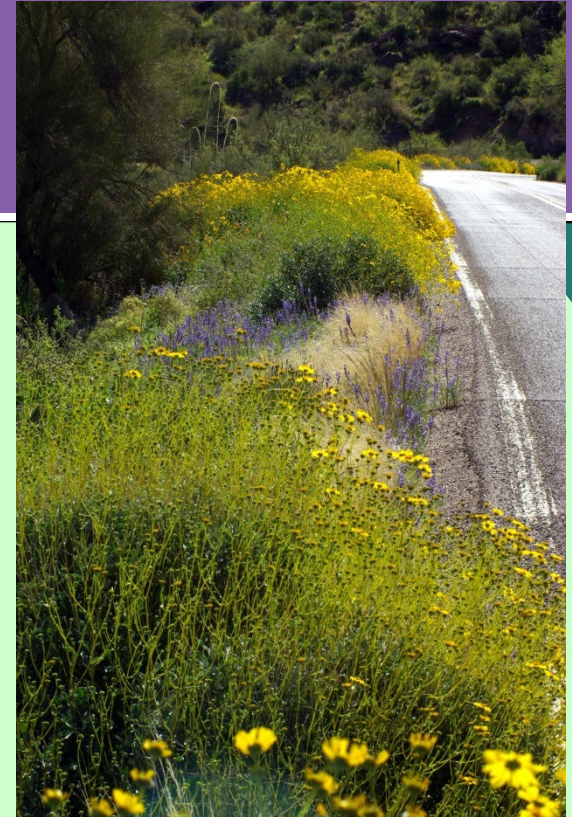


- ✓ Know the following drainage structures and terms:
 - ✓ Crown Ditch
 - ✓ Slope Ditch
 - ✓ Embankment Curb
 - ✓ Rock Check Dam
 - ✓ Cut-to-Fill Transition
 - ✓ Spillway
 - ✓ Flared End Culvert
 - ✓ Rock Riprap
- ✓ Understand which methods to use to make drainage structures more aesthetically pleasing?
- ✓ Know that an erosion control plan must be submitted to ADOT prior to beginning any earth-disturbing activities?
- ✓ Know how to access the ADOT Post-Construction BMP Manual on the ADOT website?

Guidelines Appendices



- Acronyms and Abbreviations
- Glossary of Terms
- ADOT-FHWA-USFS MOU
- ADOT-FHWA-BLM MOU
- Slope Design Details
- Easement Development
- Section 106 Process on Forest Service Lands
- Typical Blasting Plan Content
- Comparison of Permit Processes for Material Sites
- Signing
- Project Reference Fact Sheet
- Native Plant Salvage & Replanting Evaluation Guidelines
- References and Photography Credits
- Additional Photos (online appendix)
- Document Revision History



Document Availability



Purchase from:
ADOT Engineering Records Section
1655 W. Jackson Room 175
Mail Drop 112F
Phoenix, Arizona 85007-3217
Telephone: 602-712-8216 or 712-7498
Fax: 602-712-3235

For availability and cost:
[http://www.azdot.gov/business/Contracts
andSpecifications](http://www.azdot.gov/business/ContractsandSpecifications)

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