AUBURN UNIVERSITY
Samuel Ginn College of Engineering

Research Report

DEVELOPMENT OF AN ALABAMA CONSTRUCTION STORMWATER QUALIFIED CREDENTIALED PROFESSIONAL TRAINING PROGRAM

Submitted to

The Alabama Department of Transportation

Prepared by

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16. Abstract

Construction stormwater management requires professionals who can interpret regulatory requirements, apply technical principles, evaluate site-specific risks, and exercise sound professional judgment throughout construction. This project addressed the need for a consistent, Alabama-specific standard of competency for Qualified Credentialed Professionals (QCPs) by developing the Alabama Construction Stormwater Professional (ACSP) Program. Program development included review of federal and peer-state credentialing programs; engagement with regulatory, transportation, academic, municipal, construction, and industry stakeholders; definition of professional competencies and eligibility requirements; and preparation of a formal Scope of Practice. The completed program separates eligibility review, exam-readiness education, examination, certification, and renewal so that course attendance alone does not constitute professional certification. Project deliverables included a one-day review course addressing Alabama Construction General Permit requirements, Construction Best Management Practices Plan development, hydrology, erosion and sediment control, stabilization, dewatering, inspections, small mines and borrow pits, and professional ethics. The project also produced a competency-based examination, controlled question banks, an examination reference booklet, applicant and examination procedures, certification records, and a two-year renewal framework. The integrated program was evaluated through stakeholder review, a soft launch, and Beta delivery involving ALDOT personnel, Alabama Department of Environmental Management representatives, and advisory participants. The project advanced the ACSP Program from initial concept to live implementation and established a common framework for evaluating professional competency within Alabama's regulatory and construction environment. Continued program value will depend on maintaining current technical and regulatory content, secure and valid examinations, consistent administration, meaningful continuing professional development, and sustained coordination among Auburn University, ALDOT, ADEM, and the regulated construction community.

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ABSTRACT

Construction stormwater management requires professionals who can interpret regulatory requirements, apply technical principles, evaluate site-specific risks, and exercise sound professional judgment throughout construction. This project addressed the need for a consistent, Alabama-specific standard of competency for Qualified Credentialed Professionals (QCPs) by developing the Alabama Construction Stormwater Professional (ACSP) Program. Program development included review of federal and peer-state credentialing programs; engagement with regulatory, transportation, academic, municipal, construction, and industry stakeholders; definition of professional competencies and eligibility requirements; and preparation of a formal Scope of Practice.

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The project advanced the ACSP Program from initial concept to live implementation and established a common framework for evaluating professional competency within Alabama's regulatory and construction environment. Continued program value will depend on maintaining current technical and regulatory content, secure and valid examinations, consistent administration, meaningful continuing professional development, and sustained coordination among Auburn University, ALDOT, ADEM, and the regulated construction community.

Table of Contents

1 Chapter 1 INTRODUCTION 6
1.1 Background 6
1.2 Problem Statement 7
1.3 Project Purpose 7
1.4 Project Objectives 8
1.5 Organization of the Report 8
2 Chapter 2 PROGRAM REVIEW AND DEVELOPMENT 9
2.1 Program Impacts 9
2.2 Review of Existing Programs 9
2.3 Alabama-Specific Program Needs 1
2.4 Program Development Criteria 1
3 Chapter 3 PROGRAM DEVELOPMENT PROCESS 2
3.1 Overall Approach 2
3.2 Peer Program Review 2
3.3 Advisory and Agency Engagement 2
3.4 Program Structure and Oversight 3
3.5 Scope of Practice Development 3
3.6 Course and Training Development 4
3.7 Initial Certification Examination Development 5
3.8 Administrative System Development 5
3.9 Soft-Launch and Beta Evaluation 6
3.10 Program Refinement 6
4 Chapter 4 FINAL ACSP PROGRAM DEVELOPMENT AND INITIAL IMPLEMENTATION 8
4.1 Final Program Framework 8
4.2 Eligibility and Application 9
4.3 Scope of Practice 9
4.4 Course and Training Program 10
4.5 Certification Examination 11
4.6 Professional Ethics 11
4.7 Administrative and Delivery System 12
4.8 Soft Launch and Beta Delivery 12
4.9 Program Refinement and Readiness 13
5 Chapter 5 IMPLEMENTATION, SUSTAINABILITY, AND RECOMMENDATIONS 14

5.1 Implementation Status 14
5.2 Program Governance and Maintenance 14
5.3 Examination Quality and Security 15
5.4 Certification Renewal and Professional Development 15
5.5 Recommendations 16
5.6 Conclusions 16
6 REFERENCES 18
7 APPENDIX A ACSP Scope of Practice 19
8 APPENDIX B ACSP Code of Ethics 20
9 APPENDIX C ACSP Application Home Page 21
10 APPENDIX D ACSP Certification Application 22
11 APPENDIX E ACSP Equations Reference Guide 23
12 APPENDIX F Future ACSP Recertification and Continuing Education Opportunities ... 24

LIST OF TABLES

Table 2-1: EPA approved qualified professional training programs. 10
Table 2-2: Peer-state training and certification programs. 11
Table 4-1: Final program framework overview. 8
Table 4-2: Program foundational practice areas. 9

Chapter 1
INTRODUCTION

1.1 BACKGROUND

Construction activities disturb soil, alter drainage patterns, and expose materials that can be transported from a site during precipitation events. When these activities are not adequately planned and managed, sediment and other construction-related pollutants can enter storm drainage systems, adjacent properties, and receiving waters. The resulting impacts can include degraded aquatic habitat, increased turbidity, loss of channel capacity, damage to public infrastructure, and regulatory noncompliance. Construction stormwater management therefore depends on both technically sound plans and consistent implementation throughout the life of a project.

In Alabama, construction stormwater discharges are regulated through the Alabama Department of Environmental Management (ADEM) National Pollutant Discharge Elimination System program. The Alabama Construction General Permit (CGP) establishes requirements for permit coverage, pollution prevention, preparation and implementation of a Construction Best Management Practices Plan (CBMPP), inspections, corrective actions, documentation, and termination of coverage. Within this framework, a Qualified Credentialed Professional (QCP) has important responsibilities for preparing or certifying plans, evaluating site conditions, providing professional oversight, and determining whether the controls implemented at a site satisfy permit requirements.

The effectiveness of this professional role depends on more than possession of a general credential. A QCP must understand Alabama-specific permit provisions, recognize how construction sequencing changes risk, apply hydrologic and erosion-control principles, select and evaluate best management practices (BMPs), document deficiencies, and communicate corrective actions to permittees and contractors. Transportation projects add complexity through linear construction, multiple drainage areas, changing phases of disturbance, roadway crossings, borrow sources, and coordination among designers, contractors, inspectors, and regulatory agencies.

Prior to this project, Alabama did not have a unified certification program developed specifically to evaluate the breadth of knowledge expected of construction stormwater QCPs. National and out-of-state programs provide useful models, but they do not necessarily reflect Alabama's CGP, the practices used by the Alabama Department of Transportation (ALDOT), ADEM expectations, or the design and implementation guidance used within the state. This project was undertaken to develop a rigorous Alabama-specific professional program that could

support a more consistent standard of competency across public and private construction sectors.

1.2 Problem Statement

The term QCP describes a role with significant technical and regulatory responsibility, yet the education, experience, credentials, and construction stormwater backgrounds of individuals serving in that role can vary substantially. An existing credential may demonstrate knowledge in a related discipline without confirming familiarity with Alabama's permit requirements or with the practical decisions necessary to develop, implement, inspect, and revise a CBMPP. Conversely, extensive field experience may provide valuable practical knowledge without demonstrating competence across hydrology, erosion mechanics, BMP design, documentation, ethics, and regulatory procedures.

This variability creates risk for project owners and permittees. Inconsistent understanding of QCP responsibilities can lead to incomplete plans, inappropriate BMP selection, insufficient construction phasing, delayed maintenance, inaccurate inspections, or inadequate response to sediment losses and other noncompliance. For ALDOT, the absence of a common understanding of the expectations and overall requirements of the CGP makes it difficult to determine whether personnel and consultants possess the knowledge needed to perform or oversee construction stormwater work consistently across projects.

A statewide program was therefore needed to define the expected professional scope, establish reasonable entry requirements, provide an opportunity to review the applicable knowledge, independently assess competence, maintain certification records, and require continued professional development. The program also needed to distinguish clearly between ACSP review course and the attainment of a professional certification. Certification was intended to be based on verified eligibility and demonstrated examination performance rather than course attendance alone.

1.3 Project Purpose

The purpose of this project was to develop an Alabama Construction Stormwater Qualified Credentialed Professional training and certification program. The resulting Alabama Construction Stormwater Professional (ACSP) Program was designed to provide an Alabama-specific pathway for evaluating professionals who perform or oversee duties associated with the QCP role. The program integrates eligibility review, an exam-readiness course, a certification examination, professional and ethical expectations, certification records, and renewal requirements.

The project emphasized the needs of ALDOT while developing a framework applicable to the broader regulated construction community. The program was informed by federal and peer-

state programs, Alabama regulatory requirements, stakeholder input, and the experience of professionals from transportation, regulatory, academic, municipal, and construction sectors. Development proceeded incrementally so that program structure, course content, examination requirements, and administrative procedures could be developed, reviewed and refined prior to regular delivery.

1.4 PROJECT OBJECTIVES

The following project objectives were established to guide the program development process:

1. Review EPA and peer-state programs to identify relevant training, certification, examination, and renewal practices.
2. Establish an advisory group with regulatory, owner, industry, municipal, and academic representation.
3. Determine the course types, program structure, and professional needs specific to Alabama construction stormwater management.
4. Define the professional scope, proficiency areas, competencies, eligibility requirements, and ethical responsibilities of an ACSP.
5. Develop the review course, technical training components, examination blueprint, question banks, and supporting reference materials.
6. Develop an administrative system for applications, registration, examination delivery, certification records, and communication.
7. Identify and prepare instructors capable of addressing regulatory, design, implementation, inspection, and ethical topics.
8. Conduct stakeholder review, soft-launch, and Beta-delivery activities to evaluate the program before regular implementation.
9. Establish certification renewal and continuing-professional-development requirements.
10. Prepare the ACSP Program for sustained course and examination offerings.

1.5 ORGANIZATION OF THE REPORT

Chapter 2 describes the regulatory context, peer-program review, and development principles that informed the ACSP Program. Chapter 3 documents the process used to develop the program, Scope of Practice, course, examination, administrative system, and staged review activities. Chapter 4 presents the final program framework and the content generated through the project, including initial implementation activities. Chapter 5 addresses continued implementation, program maintenance, performance monitoring, and recommendations for long-term sustainability.

Chapter 2
PROGRAM REVIEW AND DEVELOPMENT

2.1 PROGRAM IMPACTS

The Alabama CGP establishes a performance and documentation framework for controlling stormwater discharges associated with construction activity. Compliance requires more than installation of individual BMPs. Compliance requires knowledge and proper implementation with regards to project eligibility, receiving-water constraints, prohibited discharges, construction phasing, stabilization, pollution prevention, inspections, corrective actions, reporting, and termination of coverage. The CBMPP serves as the principal planning and implementation document connecting these obligations to the conditions and operations of a specific site.

QCP involvement occurs at several points in this process. Depending on the activity and the individual's professional qualifications, the QCP may develop or certify the CBMPP, evaluate calculations and practice selection, provide oversight during implementation, conduct or supervise evaluations, recommend modifications, and document whether the plan remains appropriate as site conditions change. Competency of a QCP requires both foundational technical knowledge and the ability to apply that knowledge in an ever-changing construction environment.

2.2 REVIEW OF EXISTING PROGRAMS

This project began with a review of federal and peer-state programs addressing construction stormwater training and certification. Beyond the review of the federal program administered by the EPA, peer programs were reviewed that were either state specific training accepted and controlled by the state’s environmental regulatory body, or state specific but developed and administered by a third-party entity such as a national training entity with state specific training, private, independent trainers, or university-based training programs. Information was compared across program purpose, target audience, course type, examination requirements, duration, cost, delivery method, continuing education, and recertification.

The review showed that peer programs vary considerably. Some emphasize inspectors or installers, while others address plan development, management, or broader erosion and sediment control competence. Course durations and delivery modes range from short online modules to multi-day classroom instruction. Some programs award a credential based primarily on course completion, while more rigorous professional certifications require a separate application, experience verification, proctored examination, and continuing-education cycle. Table 2-1 and Table 2-2. show relevant content of similar programs offered in the U.S.

Table 2-1: EPA approved qualified professional training programs.

	Training Entity	Course Types	Exam	Cost	Duration (hrs)	$/hr	PDHs	Online Option?
EPA Prog.	EPA Online	Constr. Inspection Training Progr.	80%	Free	7	$0.00	?	Only
EPA Approved Alternate Programs	Minnesota (Univ. of Minn)	Construction Installer	70%	$140	8.5	$16.47	6	Yes
		Construction Installer - Recertification	70%	$130	8.5	$15.29	5.5	Yes
		Construction Manager	70%	$225	17	$13.24	12	Yes
		Construction Manager - Recertification	70%	$130	8.5	$15.29	6	Yes
		SWPPP Design	70%	$320	17	$18.82	12	Yes
		SWPPP Design - Recertfication	70%	$165	8.5	$19.41	5.5	Yes
	Kansas (K- State Salina)	Construction Stromwater Training	70%	?	?		?	Yes
	Florida	The Florida Stormwater, Erosion, and Sedimentation Control Inspector Program	70%	$200 - $250	8 to 16	$31.25		Yes
	Alaska	Alaska Certified Erosion and Sediment Control Lead	70%	$400-500	8 to 16	$31.25-50.00	8 to 16	Yes

Table 2-2: Peer-state training and certification programs.

	Training Entity	Course Types	Exam	Cost	Duration (hrs)	$/hr	PDHs	Online Option?
	South Carolina (Clemson)	Certified Erosion Prevention and Sediment Control Inspector	?	$395	8	$49.38	Yes	Exam Only
	Georgia	Urban Lands - Erosion and Sediment Control Level IA	70%					
		Urban Lands - Erosion and Sediment Control Level IB	70%					
		Introduction to Design (Level II)	70%					
Level 1 - Fundamentals	Tennessee (UT)	Tennessee Erosion Prevention and Sediment Control Training Program for Construction Sites	75%	$250	8	$31.25	7	
Level 2 - Design			70%	$500	16	$31.25	16	
	Mississippi	None						
	Louisiana	None						
	Texas (TexA&M)	Stormwater Qualified Person		$350	8	$43.75		
	Kentucky (UK)	KY Erosion Prevention & Sediment Control (KEPSC)		$200				Online Only

2.3 ALABAMA-SPECIFIC PROGRAM NEEDS

The review of the peer program and through stakeholder discussions identified a need for content extending beyond general erosion and sediment control principles. The ACSP Program needed to address an understanding and expectations of the Alabama CGP, including eligibility, permit coverage, prohibited discharges, Notice of Intent and Notice of Termination requirements, CBMPP content, inspections, corrective actions, pollution prevention, and recordkeeping. It also needed to reflect Alabama BMP practices and the conditions under which those practices commonly succeed or fail whether through design, implementation, inspection, maintenance, or modification.

In addition to the original scope of work, ADEM coordination added two areas that were not emphasized in the initial proposal. Small mines and borrow pits were incorporated because these facilities are frequently connected to construction operations and are regulated under a separate general permit framework. Ethics was also added to address truthful certification, conflicts of interest, competence, public welfare, environmental stewardship, documentation, reporting, and response to violations. These additions broadened the program from a technical review course into a more complete professional credentialing framework.

2.4 PROGRAM DEVELOPMENT CRITERIA

The program uses a single professional certification supported by a defined Scope of Practice and Code of Ethics. Applicants would demonstrate relevant education and experience through an application process. The review course would be available as preparation and professional development but would remain independent of certification. Certification would require a proctored examination with a passing score of 70%, and certification would remain valid for two years subject to renewal requirements.

Chapter 3
PROGRAM DEVELOPMENT PROCESS

3.1 Overall Approach

The ACSP Program was developed through an iterative process that connected peer review, stakeholder input, professional-scope development, content production, administrative design, and staged delivery. The proposed plan contained 12 tasks, beginning with review of peer programs and formation of an advisory council and progressing through course and examination development, pilot delivery, regular offerings, recertification, and final reporting. Although the tasks were listed sequentially, several activities overlapped and informed one another.

The project team used successive review cycles rather than waiting until all materials were complete. Early stakeholder discussions addressed program purpose, course and exam separation, potential eligibility requirements, delivery options, fees, and renewal. Later reviews focused on the Scope of Practice, ethics, course content, exam structure, administrative workflows, and readiness for pilot and Beta delivery. This approach allowed the program to respond to program input while maintaining the general framework.

3.2 Peer Program Review

Peer programs were reviewed using publicly available program content. The comparison focused on who administered each program, the professional activity addressed, whether training and examination were separate, the duration and delivery mode, applicant prerequisites, examination format, fees, renewal requirements, and professional-development expectations.

Findings were used as assessment inputs rather than copying any particular framework or model. Features were evaluated for their relevance to Alabama's regulatory framework and the intended rigor of the ACSP credential. The review supported a review course offering and examination; a fixed passing standard, pass/fail criteria and a fixed renewal cycle. It also demonstrated that Alabama-specific content would be beneficial to supplement general construction stormwater principles.

3.3 Advisory and Agency Engagement

An advisory council was developed to provide perspectives from state and regulatory stormwater interest. ALDOT and ADEM were central participants along with members of the Alabama Stormwater Association and the Alabama Soil and Water Conservation Committee. Meetings and document reviews were used to evaluate proposed program names, rigor, eligibility, course and

examination separation, delivery locations, proctoring, fees, professional development, certification records, and governance.

Stakeholder comments were incorporated into the program as individual components developed such as the addition of small-mine and borrow-pit material and a dedicated ethics component. Advisory review also influenced the decision to maintain one certification level, the two-year renewal cycle, the distinction between course attendance and certification.

3.4 Program Structure and Oversight

Program structure was developed around a sequence of independent decisions: whether an applicant meets the eligibility standard; whether the applicant chooses to attend the review course; whether the applicant demonstrates competency on the examination; and whether a certified professional subsequently maintains the credential. Keeping these decisions separate protects the value of the certification and allows the course to serve both applicants and other professionals seeking development without implying certification.

The project team evaluated education and experience pathways during multiple stakeholder reviews. The resulting application process requires documentation of relevant preparation and direct construction stormwater experience. The program materials recognize that relevant preparation may arise through formal post-secondary education and through verified experience in activities such as design, implementation, maintenance, management, and inspection. Applications are reviewed before examination access is provided. This program specifically allows for field experience to take the place of post-secondary education as means of professional advancement.

Governance considerations included responsibility for application decisions, examination access, results notification, certification records, renewal review, ethical expectations, and future content revisions. The program was designed for administration through Auburn University Department of Civil and Environmental Engineering with continued coordination among Auburn, ADEM, ALDOT, and the advisory council as appropriate.

3.5 Scope of Practice Development

The Scope of Practice was developed to serve as the technical and professional foundation of the credential. Early versions organized expected knowledge into proficiency and competency areas addressing permitting, CGP requirements, pollution prevention, CBMPP development, BMP design, inspections, small mines and borrow pits, and ethics. Subsequent review refined the document from a topic outline into a practice-oriented description of what an ACSP should know and apply.

The final structure begins with foundational knowledge and then organizes professional activities into five practice areas: securing, maintaining, and terminating CGP coverage; CBMPP development; CBMPP implementation; CBMPP implementation verification; and negative impacts and mitigation. Within these areas, the document addresses coordination, planning, design and selection, risk evaluation, installation, maintenance, removal, inspection, reporting, professional oversight, noncompliance response, sediment-loss mitigation, and the regulatory context of enforcement.

The Scope of Practice also identifies limitations. ACSP certification does not authorize structural design reserved for licensed engineers or otherwise supersede Alabama law. Instead, it establishes a common expectation for the construction stormwater knowledge and professional judgment represented by the ACSP credential. The document was used to align application criteria, course content, examination subject matter, and renewal activities.

3.6 Course and Training Development

Course development began with the topics identified through the peer review, project proposal, advisory discussions, and Scope of Practice. The content was organized to progress from regulatory foundations through CBMPP development and field implementation. Initial development produced sections covering CGP requirements, pollution prevention, BMP concepts, and professional responsibilities. Later development added the more technical components of CBMPP design, erosion and sediment control calculations, site inspections, small mines and borrow pits, and ethics.

The course was designed as an exam-readiness and professional-review offering rather than a substitute for prior education and experience. It provides a structured opportunity to revisit permit requirements, understand how the program defines competency, practice technical concepts, and identify areas requiring additional study. Design models and instructional tools were developed to demonstrate underlying calculations and decision processes. These tools may also assist practitioners in their work, but they are not used as examination aids unless specifically included in the approved examination reference material.

The initial delivery format was established as 1.5 days of classroom review followed by a separate examination opportunity. Separating the events allows an eligible applicant to take the examination without attending the course and allows a course participant to defer the examination until adequately prepared. Regulatory personnel and advisory members may also audit the course to evaluate content without seeking certification.

3.7 Initial Certification Examination Development

Examination development was tied to the program's competency framework. Questions were written to evaluate both conceptual understanding and the application of technical principles. Conceptual items address permit requirements, professional responsibilities, BMP behavior, inspection, maintenance, pollution prevention, and ethics. Workout problems evaluate calculations and design-related decisions associated with runoff, time of concentration, conveyance, sediment controls, outlet protection, channels, stabilization, and related CBMPP components.

More than 300 questions had been categorized into an online Learning Management System (LMS) called Canvas that many universities and other education institutions use. Item banks are used during development to categorize the content and draw on for examination, with approximately 350 questions targeted for the complete bank. The developed examination included 60 conceptual questions and 20 workout problems. Design-based questions were weighted to reflect the additional effort and competency required. Supported question types included multiple choice, multiple answer, numerical response, true/false, and image-based questions useful for evaluating inspection and field-recognition skills.

Item banks allow each examinee to receive a different set of questions while preserving the number of questions, subject distribution, and intended difficulty. The examination was configured for a three-hour administration with a minimum passing score of 70%. Examinees receive an approved reference booklet in both printed and pdf form. Examinees may use only specified calculator models and take the examination under controlled access at an Auburn-designated location or an approved proctoring location meeting program restrictions.

A reference booklet of approximately 50 pages was developed for use during the examination. The booklet contains concepts, figures, equations, and references aligned with the types of questions included in the examination. Direct CGP-based questions were checked against the applicable permit language, and a permit reference guide was developed to document where those questions originated. This process supported technical accuracy and provided a basis for future question review when permit language changes.

3.8 Administrative System Development

Auburn Engineering Online and the project team developed an administrative model using Instructure Canvas and Canvas Catalog (sub components of the Canvas LMS). Three coordinated course environments were developed to manage payment, applications, examinations, and content distribution. Access to the examination environment is restricted to applicants who have been reviewed, approved, enrolled, and paid the applicable examination charge.

Examinees receive directives addressing the examination period, approved materials, calculators, scratch paper, passing score, certification term, and results notification. The examination is password controlled at the approved time and location. Canvas item banks support randomized forms and controlled scoring, while Catalog supports the registration and payment path. Separating administrative environments limits access to protected examination content and allows the review course to be managed independently.

The administrative design also considered certification records and public verification. The program was intended to maintain a record of certification standing and make status available for public confirmation. Renewal records, professional-development documentation, application materials, and examination results require controlled retention and access appropriate to their purpose.

3.9 Soft-Launch and Beta Evaluation

The program was introduced in stages to allow review before general release. The soft launch brought together ALDOT, ADEM, and advisory council members to review course content, application and registration processes, certification-examination options, question-bank generation, examination integrity, and certification expectations. Participants were able to comment on whether the proposed content and administration aligned with the intended QCP role.

Pre-Beta materials were then finalized, including course content, website information, examination format, reference materials, and delivery logistics. The Beta release was conducted over two days. ADEM permitting personnel audited the review course, ALDOT stormwater coordinators and staff attended the course and took the certification examination, and advisory council members audited the course and examination. The delivery included 1.5 days of classroom review and a three-hour certification examination.

The Beta process was intended to evaluate course coverage, pacing, alignment between the Scope of Practice and examination, clarity of administrative directions, performance of examination items, and participant expectations. Post-Beta review was planned to incorporate council, ADEM, and ALDOT feedback; examine assessment results; refine certification considerations; and make final adjustments before regular offerings.

3.10 Program Refinement

Refinement occurred throughout development and continued following staged delivery. Permit-related content was updated to reflect the 2026 CGP. Scope of Practice comments were incorporated following renewed council review. Small-mine and ethics content was added, examination questions were categorized into banks, reference materials were developed, and

administrative procedures were clarified. Soft-launch and Beta activities provided a final opportunity to evaluate how these components functioned together.

The refinement process treated the Scope of Practice as the controlling framework. Proposed changes were evaluated for their effect on applicant expectations, course coverage, examination content, reference materials, and certification administration. This alignment is necessary to ensure that the credential represents a coherent professional standard rather than a collection of unrelated training topics.

Chapter 4
FINAL ACSP PROGRAM DEVELOPMENT AND INITIAL IMPLEMENTATION

4.1 FINAL PROGRAM FRAMEWORK

The principal outcome of the project is an integrated professional certification program for Alabama construction stormwater practitioners. The ACSP Program consists of five connected but distinct components: eligibility review, an optional exam-readiness course, a controlled certification examination, maintenance of certification standing, and periodic renewal through continuing professional development. Together, these components create a pathway from applicant qualification to sustained professional accountability.

Table 4-1: Final program framework overview.

Program Component	Function
Application	Documents education and relevant construction stormwater experience; establishes eligibility for examination access.
Review course	Provides an optional structured review of the Scope of Practice, regulatory requirements, technical concepts, inspections, and ethics.
Certification examination	Evaluates conceptual knowledge and technical application under controlled conditions; requires a minimum score of 70%.
Certification standing	Documents individuals who have satisfied eligibility and examination requirements for the two-year certification period.
Renewal	Requires continued professional development aligned with the ACSP Scope of Practice and submission of renewal documentation.

The program is intended for appropriately qualified individuals who participate in the design, management, implementation, or verification of CBMPPs and related construction stormwater activities. It supports the duties of a QCP or a qualified person working under QCP supervision, as those roles are recognized by ADEM. Certification establishes that an eligible applicant demonstrated the knowledge evaluated by the ACSP examination; it does not replace professional licensure or other legal requirements beyond the scope of practice.

4.2 Eligibility and Application

Applicants are expected to enter the program with prior knowledge and direct experience in construction stormwater management. The application requires documentation of formal education, when applicable, and verifiable experience performing QCP-related activities. Relevant education may include environmental science, hydraulics and hydrology, geotechnical concepts, civil site work, soil science, agronomy, water resources, and other land- or water-related disciplines.

Relevant experience includes design, management, implementation, installation and maintenance, and inspection of construction stormwater controls. The application process allows program administrators to evaluate whether the combination of education and experience provides an adequate foundation for the examination. The final application materials, rather than course attendance, control an applicant's eligibility to sit for the certification examination.

4.3 Scope of Practice

The final Scope of Practice defines both the knowledge foundation and the activities associated with ACSP practice. It is organized around five practice areas that follow the regulatory and operational life cycle of a construction project. Table 4-2 summarizes these areas.

Table 4-2: Program foundational practice areas.

Practice Area	Professional Application
CGP coverage	Securing, maintaining, and terminating permit coverage; understanding eligibility, application, reporting, modification, and termination requirements.
CBMPP development	Coordinating planning; evaluating site risk; selecting and designing practices; accounting for phasing, hydrology, soils, receiving waters, and regulatory requirements.
CBMPP implementation	Evaluating risk, directing installation, verifying conformance, maintaining and replacing practices, stabilizing disturbed areas, and removing temporary controls appropriately.
Implementation verification	Conducting inspections, reporting findings, providing professional oversight, evaluating the CBMPP, and directing modifications or corrective actions.
Negative impacts and mitigation	Providing leadership, responding to noncompliance, mitigating sediment loss, documenting events, and understanding the context of enforcement actions and legal scrutiny.

Foundational knowledge supporting these practice areas includes:

- Federal, state, and local regulatory processes;
- Pollutant sources and impacts;
- Erosion mechanics; hydrology; soil properties;
- BMP functions; construction sequencing;
- Documentation; and professional ethics.

The Scope of Practice emphasizes that an ACSP must know when a matter exceeds the individual's competence or legal authority and must coordinate with an appropriately licensed professional when structural or other regulated design is required.

4.4 COURSE AND TRAINING PROGRAM

The completed review course is structured to reinforce the breadth of knowledge identified in the Scope of Practice. Content proceeds from regulatory requirements and professional responsibilities into the planning, design, implementation, and inspection of stormwater controls. The course includes Alabama CGP requirements, permitting and reporting, erosion and sediment processes, soils, runoff, CBMPP development, construction phasing, BMP selection, stabilization, conveyances, sediment controls, dewatering, inspections, small mines and borrow pits, and ethics.

The course was originally intended to be delivered as a 1.5-day classroom review. This duration required focused presentation and assumed that participants bring prior education or experience. Instruction emphasized how concepts connect to QCP decisions and how permit requirements translate into plan content and field actions. Worked examples, figures, and design models were used to review technical relationships, while field-oriented examples address BMP installation, failure modes, maintenance, documentation, and corrective action.

Post Beta test, it became apparent that the 1.5-day model was not as efficient as originally hoped. During Beta test post offering review, the decision was made to transition the course into a 1-day offering with precourse review requirements. Content such as CGP overview that is difficult to cover from a student interest standpoint has been transition to a self-taught, pre-examination registration assessment.

Participation is open to individuals seeking certification preparation and to others seeking professional development, subject to program registration conditions. Attendance does not result in ACSP certification and does not guarantee that an attendee meets application requirements. This distinction is stated throughout the program so that the course is understood as preparation rather than a credential by attendance.

4.5 CERTIFICATION EXAMINATION

The certification examination independently evaluates the knowledge expected of an ACSP. The examination combines conceptual questions with technical workout problems and draws questions from controlled Canvas item banks. Randomized selection provides different examination forms while maintaining a common blueprint. The final examination is administered over three hours and requires a score of at least 70%.

Conceptual questions evaluate regulatory requirements, professional responsibilities, BMP behavior, pollution prevention, inspection, maintenance, reporting, small-mine requirements, and ethics. Workout problems evaluate application of design and analysis concepts. The combination is important because a professional may recall permit language without being able to apply technical principles or may perform calculations without recognizing the regulatory and professional context in which the result must be used. As previously mentioned, the CGP components of the course was transitioned into a self-taught component of the certification exam. Essentially, before a person can register for an examination offering there is a prerequisite requirement to review the current CGP and then take an open content quiz on topics about the CGP requirements. This also allows for the reduction of CGP related content on the examination as attendees are expected to already have shown their understanding of the content and ability to find the prerequisite materials.

Examination integrity is supported through restricted enrollment, password-controlled access, approved proctors, specified reference materials, calculator restrictions, and controlled scratch paper. An approved reference booklet is provided for the examination. Applicants are notified of pass or fail results according to program procedures, and successful applicants receive a two-year certification standing.

4.6 PROFESSIONAL ETHICS

The ACSP ethical framework recognizes that construction stormwater decisions affect water quality, public welfare, project risk, and confidence in the regulatory system. Certified professionals are expected to act with integrity, objectivity, competence, diligence, fairness, respect, confidentiality, professionalism, and environmental stewardship. Ethical conduct is a condition of obtaining and maintaining certification.

The ethical standards address truthful representation of qualifications, practice within areas of competence, continuing professional development, accurate certification and documentation, conflicts of interest, improper gifts, confidentiality, cooperation with regulators, reporting of violations, and protection of individuals who raise legitimate concerns. They also require the professional to place water-quality protection and public welfare ahead of pressure to overlook deficiencies or misrepresent compliance.

These expectations are integrated into both course content and examination development. Treating ethics as a tested competency reinforces that the QCP role is not limited to calculations and BMP details; it also involves independent judgment, transparent communication, and accountability when site conditions or project pressures create conflict.

4.7 Administrative and Delivery System

The administrative system uses Canvas and Canvas Catalog to separate public-facing registration and payment from protected application and examination functions. Applicants move through approval and enrollment before receiving access to the examination environment. Course content is distributed through a separate environment so that training participation does not provide access to protected examination banks.

Examination directives describe the permitted reference booklet, calculator models, scratch paper, examination duration, passing score, and results process. The password-controlled examination is opened only at the approved time and location. These controls provide a practical balance between accessibility and security while allowing future delivery at Auburn-approved proctoring locations.

Certification standing is maintained for public verification, while application records and examination results remain controlled administrative records. The system also provides a basis for managing expiration dates, renewal submissions, professional-development documentation, and communications with certified individuals.

4.8 Soft Launch and Beta Delivery

The soft launch provided an integrated review of content and administration before the Beta event. ALDOT, ADEM, and council participants reviewed the proposed review-course content, application pathway, registration, examination options, question-bank approach, examination integrity, and certification expectations. The review confirmed the overall program direction and allowed remaining questions to be addressed before live delivery.

The Beta event then tested the program in the form intended for initial implementation. ALDOT stormwater coordinators and staff participated in the review course and certification examination. ADEM permitting personnel audited the course, while advisory council members audited the course and examination. The two-day event consisted of 1.5 days of instruction followed by a three-hour examination.

This staged approach provided a meaningful test of content sequence, pacing, instructions, examination delivery, and alignment among the Scope of Practice, course, and exam. It also gave the agencies and council an opportunity to evaluate the program from different perspectives: ADEM as regulator, ALDOT as an owner and employer of stormwater

professionals, council members as technical and industry representatives, and examinees as users of the complete process.

4.9 Program Refinement and Readiness

Program refinements documented during development included:

- Incorporation of 2026 CGP content,
- Expansion of small-mine and borrow-pit material,
- Addition of professional ethics,
- Revision of the Scope of Practice (pre- and post- Beta release),
- Creation of the examination reference booklet,
- Development of permit-linked question references,
- Organization of questions into Canvas item banks, and
- Clarification of application and examination instructions.

Soft-launch and Beta review provided the basis for final adjustments to content and administration.

At the conclusion of the reporting period represented by the project documentation, the foundational review, advisory, needs-assessment, outline-development, and initial program-development tasks were substantially complete. The program had progressed through soft launch and Beta delivery and had begun transition toward regular course offerings, further instructor preparation, recertification administration, and final program documentation.

Chapter 5
IMPLEMENTATION, SUSTAINABILITY, AND RECOMMENDATIONS

5.1 Implementation Status

The project advanced the ACSP Program from concept through initial live delivery. The peer review, advisory structure, program model, Scope of Practice, course content, examination banks, reference materials, administrative environments, soft launch, and Beta event were developed during the project period. These products provide the foundation for regular course and examination offerings.

Continued implementation should preserve the distinction among application, preparation, examination, certification, and renewal. Public communications will state clearly what each component represents, particularly that course participation does not result in certification. Consistent terminology across websites, Canvas environments, applications, certificates, renewal materials, and public directories will reduce confusion and protect the value of the credential.

5.2 Program Governance and Maintenance

A sustainable certification program requires responsibilities that extend beyond scheduling courses. Auburn University shall maintain application procedures, protected examination content, certification records, renewal dates, and participant communications. Technical materials require revision when ADEM permits, ALDOT specifications, statewide guidance, or accepted stormwater practices change. Ethical and eligibility matters require a consistent and documented review process.

Continued involvement by ALDOT and ADEM will help ensure that the program remains useful to owners and consistent with regulatory expectations. The advisory council can provide broader review when changes affect multiple sectors or the professional meaning of the credential. Routine administrative changes may be handled by program staff, while material changes to the Scope of Practice, eligibility, passing standard, renewal requirements, or ethical enforcement should receive formal review.

Version control is especially important for the Scope of Practice, course materials, reference booklet, examination blueprint, and permit-linked questions. Each change will identify the effective date, affected program component, reason for revision, and required follow-up. Questions based on superseded permit language shall be revised or retired before the next administration.

5.3 Examination Quality and Security

The examination shall be treated as an assessment system rather than a fixed set of questions. After each administration, program staff should review item difficulty, discrimination, omitted responses, timing, examinee comments, and patterns suggesting ambiguity or miskeying. Items shall be retained, revised, or removed through a documented technical review within the program's exam review assessment database. New questions shall be reviewed for alignment with the Scope of Practice and examination blueprint before operational use.

Security procedures shall be applied consistently across Auburn and off-site locations. Proctor qualifications, identity verification, room conditions, permitted materials, password control, collection of scratch paper, incident reporting, and response to suspected compromise shall be documented. Expanding access through approved proctoring locations is appropriate only when those locations can meet the same controls as the primary examination site. Auburn University's Engineering Online (EOL) Education program will continue to dictate facilities that meet its rigorous assessment requirements. If EOL adds or drops a facility, then ACSP program administrators will review the decision for these changes and adjust accordingly.

As the item bank grows, the program shall monitor whether randomized forms remain comparable. Subject distribution and intended difficulty shall be controlled through the blueprint rather than relying solely on random selection. Where sufficient data exist, statistical review can be used to identify forms or content areas that perform differently than intended.

5.4 Certification Renewal and Professional Development

ACSP certification is maintained on a two-year cycle. Renewal requires professional-development activity aligned with the proficiency and competency areas defined by the Scope of Practice. Documentation shall identify the provider, topic, date, duration, and relationship to ACSP practice. Renewal submissions shall be subject to audit so that the continuing-education requirement remains meaningful.

Program-sponsored training can address regulatory changes, recurring examination weaknesses, emerging BMP technologies, case studies, and professional ethics. External training should also be accepted when its content clearly supports the Scope of Practice and is documented adequately. This combination allows flexibility while preserving a direct connection between continuing education and the duties represented by the credential.

Renewal communications shall begin sufficiently before expiration and explain the certification period, required documentation, grace period, late-renewal conditions, and consequences of extended expiration. Flow automation of this communication structure including direct links to continuing education submission, time until expiration, and requirements for renewal will be handled through internal database querying as necessary. A public directory will

distinguish active, expired, and other applicable statuses without disclosing protected personal or examination information.

5.5 RECOMMENDATIONS

Based on the development and initial implementation of the ACSP Program, the following actions are recommended:

- Implementation of adjusted post Beta releases approach to ensure adequate review and maximum content coverage efficacy.
- Continue regular course and examination offerings using the established separation among application, course, and certification.
- Maintain formal coordination with ALDOT and ADEM for regulatory, owner, and implementation matters that materially affect the credential.
- Use the Scope of Practice and examination blueprint as the controlling basis for course revisions, examination content, and continuing professional development.
- Review and update permit-dependent content whenever ADEM issues or modifies applicable general permits or guidance.
- Conduct documented item analysis after each examination administration and maintain a controlled process for question revision and retirement.
- Expand regional or approved proctoring access only where examination-security requirements can be applied consistently.
- Maintain a public certification-status directory and protect application records, examination results, and other nonpublic information.
- Audit a portion of eligibility and renewal documentation to preserve confidence in the credential.
- Develop recurring professional-development offerings addressing regulatory changes, ethics, technical design, inspections, and documented areas of practitioner need.
- Periodically evaluate eligibility, renewal, and governance policies using accumulated program data and stakeholder feedback.

5.6 CONCLUSIONS

This project produced the foundation for a rigorous, Alabama-specific construction stormwater professional certification program. The project defined the knowledge and practice expected of an ACSP, developed a review course and supporting technical resources, created a controlled

competency-based examination, established an administrative delivery model, and advanced the program through stakeholder review, soft launch, and Beta delivery.

The program's principal contribution is a common framework for evaluating professional competency in the context of Alabama's regulatory requirements and construction practices. By separating eligibility, training, examination, certification, and renewal, the program avoids treating course completion as proof of competence and provides a clearer basis for owners and regulators to understand what the credential represents.

The ACSP Program should be maintained as an evolving professional system. Its continued value will depend on current permit content, valid and secure examinations, consistent administration, meaningful continuing education, transparent certification status, and sustained coordination among Auburn University, ALDOT, ADEM, and the regulated construction community. With these elements in place, the program can support more consistent QCP practice, stronger CBMPP implementation, and improved protection of Alabama's water resources.

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APPENDIX A

ACSP Scope of Practice

Alabama Construction Stormwater Professional (ACSP)

Scope of Practice

Contents

Alabama Construction Stormwater Professional (ACSP) 1
Contents 1
Foreword 2
Professional Scope of Practice 2
Foundational Knowledge 3
Technical Knowledge Areas 3
Professional Knowledge Areas 4
1.0 PRACTICE AREA - Securing, Maintaining, and Terminating CGP Coverage 4
2.0 PRACTICE AREA - CBMPP Development 5
2.1 Coordination and Planning 5
2.2 Best Management Practice Design and Selection 5
2.2.1 Managing Communication 5
2.2.2 Managing Work 6
2.2.3 Managing Water 6
2.2.4 Managing Erosion 6
2.2.5 Managing Sediment 7
3.0 PRACTICE AREA - CBMPP Implementation 7
3.1 Risk Evaluation and Abatement 7
3.2 Practice Implementation and Installation 7
3.3 Practice Maintenance 9
3.4 Practice Removal 9
4.0 PRACTICE AREA - CBMPP Implementation Verification 9
4.1 Inspection 9
4.2 Reporting 10
4.3 Professional Oversight and CBMPP Evaluation 11
5.0 PRACTICE AREA - Negative Impacts and Mitigation 11
5.1 ACSP Leadership and Involvement 11
5.2 Noncompliance Response and Reporting 11
5.3 Mitigating Sediment Loss 12
5.4 Navigating Enforcement Actions and Lawsuits 12

Foreword

Alabama is home to one of the most biodiverse aquatic ecosystems in the world. Construction activity is a significant source of sediment and pollutant loading to its rivers, streams, and wetlands. When land is cleared and graded without competent intervention, energy associated with rainfall and runoff result in accelerated soil erosion potentially causing sediment and other pollutants into Alabama's waterways — degrading habitat and impairing water quality.

The federal Clean Water Act and Alabama's construction stormwater regulations establish the framework within which this threat is managed. But regulation alone does not protect water quality — competent professionals do.

The Alabama Construction Stormwater Professional (ACSP) credential identifies individuals with the knowledge, experience, and judgment to plan, implement, and oversee effective construction stormwater management in Alabama. This document describes their scope of practice and the foundational knowledge upon which that practice depends.

Professional Scope of Practice

ACSPs support construction project planning, design, and delivery. The primary professional obligation of an ACSP is the protection of water quality throughout all phases of project delivery and land-disturbing activity with consideration given to post-construction operation and maintenance needs. ACSPs have leadership roles in pre-construction planning and design through construction and final site stabilization.

A central regulating document in this role is the Alabama Construction General Permit (CGP) ALR100000, administered by the Alabama Department of Environmental Management (ADEM), and grounded in the technical standards of the Alabama Handbook for Erosion Control, Sediment Control, and Stormwater Management on Construction Sites and Urban Areas (sometimes referred to as the Alabama Handbook or the Blue Book).

Development of a Construction Best Management Practices Plan (CBMPP), Notice of Intent (NOI) for CGP coverage, required inspection and reporting, and Notice of Termination (NOT) provide the regulatory structure within which an ACSP's water quality protection responsibilities are initiated, documented, and concluded.

The ACSP may serve a project in a design capacity (**Design ACSP**) — securing CGP coverage and developing the CBMPP; an operational capacity (**Operational ACSP**) — implementing, modifying, and terminating CGP coverage; or both. Regardless of role, the ACSP understands the full scope of permit coverage and construction stormwater management responsibilities, including CBMPP development and modification, and the supervision required for implementation, inspection, and reporting activities.

Related to the CBMPP, ACSPs have the knowledge, experience, and expertise to perform, guide, oversee, and review the work of others in the following areas:

- Development of the CBMPP utilizing a holistic and comprehensive framework and applying the current state of practice and technology for construction stormwater management;
- Implementation and modification of the CBMPP through collaboration and effective communication, and the adaptive application of prescribed and modified practices based on direct observation, field reporting, and professional judgment; and
- Verification of effective implementation through observations, inspections, reporting, and oversight to confirm water quality protection and regulatory compliance.

The professional practice of an ACSP is built upon foundational principles and knowledge and expressed through a defined set of practice areas. The foundational knowledge described below represents the technical and professional understanding that an ACSP possesses and applies. The practice areas that follow describe the specific activities and responsibilities within which that knowledge is put to work.

Foundational Knowledge

Foundational knowledge informs and reinforces professional judgment across all aspects of construction stormwater management and distinguishes the ACSP as a Qualified Credentialed Professional (QCP) as defined by the CGP. The foundational areas below make up the body of knowledge required for competent ACSP practice. This listing is not intended to be exhaustive. Knowledge of the ACSP continually evolves with advances in research, technology, and regulatory requirements.

Technical Knowledge Areas

- Alabama's Climate
    - Rainfall characteristics
        - Total depth
        - Intensity
        - Duration
        - Frequency
        - Seasonal distribution
    - Hydrology
        - Runoff estimation
    - Hydraulics
        - Drainage design
        - Slope and channel stability
- Alabama's Waters
    - Characteristics and significance
    - Water type classifications (perennial, intermittent, ephemeral)
    - State water quality standards
    - Current condition of waters
        - Impaired waters and applicable 303(d) listings and TMDLs and implications for construction stormwater management
        - Priority and non-priority watersheds per the CGP
    - Potential impacts of construction activity on Alabama's aquatic environment
    - Protected aquatic species and habitat
- Alabama's Soils
    - Soil erosion and sediment transport and deposition
        - Terms, definitions, mechanics, and impacts

        - Soil loss estimation using prediction models and equivalent tools to support CBMPP development and BMP design
        - Soil transport and delivery estimation
- Alabama's Vegetation
    - Vegetation establishment and maintenance
        - Soil amendments
        - Seed species and establishment rates
        - Cover materials (mulches, HECPs, and RECPs)
- Alabama’s Laws and Regulations
    - Purpose and scope of state construction stormwater laws and their federal origins and connections

Professional Knowledge Areas

- The role and responsibilities of the ACSP on construction projects
- The role and responsibilities of the Permittee and Operator
- Project coordination and planning, including site assessment and construction sequencing
- Application of a comprehensive approach to construction stormwater management in all stages of project planning, design, and delivery that includes managing communication, work, water, erosion, and sediment
- Construction site risk assessment and risk abatement
- Education and training of construction stormwater professionals, including QCIs, contractors, and other practitioners — requiring clear communication skills and thorough understanding of the subject matter being taught
- Professional ethics

1.0 PRACTICE AREA - Securing, Maintaining, and Terminating CGP Coverage

Construction activity that disturbs one or more acres in Alabama requires coverage under the Alabama Construction General Permit (CGP) prior to land disturbance. As QCP on a project, the ACSP is responsible for understanding and managing the full regulatory lifecycle of CGP coverage — securing coverage in a design capacity prior to land disturbance and maintaining and terminating that coverage in an operational capacity through active construction and project closeout. ACSPs know and apply the following:

- Conditions that trigger CGP coverage requirements, including acreage thresholds, common plan of development, designated sites, and permit coverage exclusions
- Communication protocols with the permittee
- Preparation and submission of an NOI to ADEM as required by the CGP for permit coverage, including required project information, receiving water identification, and operator certification
- Prohibited discharges under the CGP, including discharge types that are explicitly excluded from permit coverage and conditions under which otherwise authorized discharges become prohibited
- CGP conditions that must be maintained throughout active construction, including CBMPP implementation, inspection and reporting obligations, and permit transfer requirements
- Conditions and documentation required for NOT submittal to ADEM to end permit coverage, including final stabilization standards and site closeout requirements

- Consequences of failure to obtain, maintain, or properly terminate CGP coverage
- Identification of site-specific conditions that trigger heightened or additional regulatory obligations, including priority construction site designations and coastal zone management requirements for projects in Baldwin and Mobile counties
- Awareness of related permits and authorizations that may apply to construction projects and associated land disturbance, including the ADEM Small Mining General Permit (ALG890000) for borrow pits and small mines, and U.S. Army Corps of Engineers Section 404 permits for impacts to waters of the United States, and the circumstances under which such coverage may be required

2.0 PRACTICE AREA - CBMPP Development

The Construction Best Management Practices Plan (CBMPP) is the central planning document through which an ACSP fulfills the water quality protection and other water quality standards obligations of the CGP. ACSPs develop CBMPPs that are site-specific, comprehensive, and grounded in the current state of practice and technology. CBMPP development requires the integration of site knowledge, technical expertise, and professional judgment applied through a structured and holistic process.

2.1 Coordination and Planning

ACSPs gather and integrate the information necessary to develop an effective CBMPP through the following actions:

- Project scope of work and contract document review
- Project data gathering
    - Rainfall and climate data
    - Hydrologic and hydraulic data
    - Soils data
- Site assessment
    - Current land use, existing vegetation, and other surface covers
    - Sensitive areas, including wetlands, biological resources, cultural resources, and neighboring properties
    - Receiving water use classifications and site-specific regulatory designations that influence CBMPP requirements and permit obligations
    - Existing problematic areas and drainage challenges
    - Existing and proposed flow patterns
    - Site constraints and opportunities
- Environmental sensitivities and commitments review
- Construction sequence review and other needs for constructability

2.2 Best Management Practice Design and Selection

Using the information gathered through coordination and planning, ACSPs design and select BMPs within the following management framework:

2.2.1 Managing Communication

Managing Communication includes all efforts to convey information among project stakeholders to increase effectiveness in project planning, design, and implementation. Measures and Practices may incorporate written or verbal interaction and operational systems and behaviors to effectively convey necessary information. ACSPs design and select practices that address:

- Identification and documentation of roles and responsibilities of all parties involved in CBMPP development, implementation, and oversight
- Coordination protocols with permittees, owners, contractors, subcontractors, and regulatory agencies
- Training requirements and expectations for construction site personnel, including the ACSP's role in delivering or overseeing training for contractors, installers, and site personnel when needed
- Documentation and recordkeeping requirements

2.2.2 Managing Work

Managing Work includes all operational efforts to ensure that work proceeds in a manner that is protective of the owner's interests and environmental responsibilities. Measures and Practices incorporate prescribed operational practices and selected work methods, sequencing, and scheduling for enhanced water quality protection. ACSPs design and select practices that address:

- Construction sequencing and phasing to minimize the area and duration of disturbed soils and achieve compliance with CGP-specified disturbance limits
- Preservation of natural features, riparian buffers, and existing vegetation, including extended buffer requirements for priority construction sites
- Construction access management, including haul roads, construction exits, and watercourse crossings
- Preservation, stockpiling, and reuse of topsoil to support final stabilization and vegetation establishment
- Construction wastes, potential spills, materials storage/management, and good housekeeping practices to prevent non-sediment pollutant discharges
- Designated access, staging, and stockpile areas

2.2.3 Managing Water

Managing Water includes all efforts that address the flow of waters through the project to protect the work area and minimize the work of managing erosion and sediment. Measures and Practices address construction-related surface waters such as runoff, run-on, flow-through, and dewatering effluent. ACSPs design and select practices that address:

- Identification and management of offsite water entering the project
- Construction dewatering management, inspection, and documentation
- Stormwater conveyance design and temporary drainage systems
- Hydrologic and hydraulic analysis to support BMP selection, sizing, and placement

2.2.4 Managing Erosion

Managing Erosion includes all efforts to minimize the displacement of soil particles by splash, sheet, rill, and channel erosion to minimize negative project impacts and reduce the work of managing sediment. Measures and practices primarily include those that provide temporary and permanent ground cover, including vegetation. Practices that reduce runoff velocity and associated erosive energy are also emphasized. ACSPs design and select practices that address:

- Selection and design of soil stabilization (ground cover) practices appropriate for site conditions and construction sequence
- Temporary and permanent erosion control methods and application
- Vegetation establishment planning including species selection, soil amendments, seeding rates, and cover materials

2.2.5 Managing Sediment

Managing Sediment includes all efforts to minimize the transport and deposition of suspended soil particles displaced by erosion. Measures and Practices primarily include barriers and impoundments that cause the slowing or temporary ponding of construction site runoff. ACSPs design and select practices that address:

- Selection and design of sediment control practices appropriate for site conditions, hydrology, and receiving water sensitivity
- Perimeter control selection, design, and placement
- Large volume sediment retention practices (sediment basins and sediment traps) sizing, design, and placement
- Selection, application, storage, and management of treatment chemicals, including polymers, flocculants, and coagulants, in accordance with CGP requirements and manufacturer specifications

3.0 PRACTICE AREA - CBMPP Implementation

CBMPP implementation is the active, field-based phase of construction stormwater management in which the ACSP directs, oversees, and collaborates with contractors and site personnel to put the CBMPP into practice. Effective implementation requires continuous professional judgment, adaptive decision-making, clear communication throughout all phases of construction and commitment to protect water quality by the permittee.

3.1 Risk Evaluation and Abatement

Risk evaluation and abatement is a continuous responsibility throughout CBMPP implementation. As site conditions, construction sequencing, and weather change, ACSPs continuously reassess and respond to evolving risks, including:

- **Environmental risks** — potential impacts to receiving waters, wetlands, sensitive species, and aquatic habitat
- **Regulatory risks** — regulatory enforcement action exposure associated with permit coverage, CBMPP implementation, or implementation verification
- **Legal risks** — litigation exposure due to environmental impacts, property damages, or legal or regulatory violations
- **Contractual risks** — potential liabilities associated with scope gaps, undefined responsibilities, coordination failures, and construction claims liability
- **Social risks** — negative project stakeholder impacts associated with community and neighbor impacts, public perception, and stakeholder concerns

3.2 Practice Implementation and Installation

CBMPP implementation applies the same framework used in CBMPP development and described in 3.1. ACSPs are proficient in managing communication, work, water, erosion, and sediment through an operational lens. Where CBMPP Development selects and specifies practices, CBMPP Implementation and Installation directs, coordinates, and confirms correct practice execution in the field.

3.2.1 Managing Communication

ACSPs know and apply the following related to field communication during implementation:

- Communication of installation requirements, expectations, and standards to contractors and site personnel
- Coordination protocols with owners, contractors, subcontractors, and regulatory agencies during active construction
- Field-level training and direction of contractors, installers, and site personnel
- Documentation and recordkeeping of installation activities and communications

3.2.2 Managing Work

ACSPs know and apply the following related to operational sequencing and site management during implementation:

- Coordination of practice installation with construction sequencing and phasing to minimize the area and duration of disturbed soils
- Field verification of natural feature, buffer, and vegetation preservation
- Oversight of construction access, haul roads, and water access and stream crossings during active use
- Field management of topsoil preservation, stockpiling, and reuse
- Enforcement of waste, spill, materials management, and good housekeeping practices
- Oversight of designated access, staging, and stockpile areas

3.2.3 Managing Water

ACSPs know and apply the following related to field management of water during implementation:

- Field identification and management of offsite water entering the project
- Oversight of dewatering operations
- Installation, operation, and protection of temporary and permanent stormwater conveyances
- Field adjustments to water management practices based on observed hydrologic and hydraulic conditions, water quality protection effectiveness, and contractor work sequencing and staging

3.2.4 Managing Erosion

ACSPs know and apply the following related to field implementation of erosion control during construction:

- Installation of soil stabilization practices appropriate to current site conditions and construction sequence
- Timing and installation of temporary and permanent erosion control methods
- Field oversight of vegetation establishment activities, including application of species, amendments, and cover materials
- Field oversight of vegetation maintenance for long-term coverage and land use needs

3.2.5 Managing Sediment

ACSPs know and apply the following related to field implementation of sediment control during construction:

- Installation of sediment control practices appropriate to current site conditions, hydrology, and receiving water sensitivity
- Perimeter control installation and placement
- Sediment basin and sediment trap installation and placement
- Field application and management of treatment chemicals in accordance with CGP requirements and manufacturer specifications

3.3 Practice Maintenance

ACSPs know and apply the following related to the maintenance of CBMPP practices throughout active construction:

- Maintenance requirements and schedules for installed BMPs in accordance with the CBMPP, the Blue Book, and construction contract documents
- Recognition of practices that are failing, damaged, or no longer appropriate for current site conditions
- Coordination with the permittee, contractors and site personnel to ensure timely and effective maintenance
- Documentation of maintenance activities and conditions

3.4 Practice Removal

Temporary structural practices must be removed at the appropriate time and in the proper sequence to maintain water quality protection through final site stabilization. ACSPs know and apply the following:

- Conditions and sequencing that trigger practice removal, including site stabilization standards and construction progress
- Coordination of practice removal to ensure water quality protection is maintained through and after removal
- Site restoration requirements associated with practice removal
- Documentation of practice removal

4.0 PRACTICE AREA - CBMPP Implementation Verification

CBMPP implementation verification is the systematic process by which the ACSP confirms that stormwater management practices are in place, functioning as intended, and providing the water quality protection required by the CGP. Verification requires professional judgment, thorough documentation, and clear communication of findings to the appropriate parties.

4.1 Inspection

The CGP specifies detailed procedural and documentation requirements for inspections beyond the professional knowledge areas described here, and the ACSP is responsible for ensuring inspections are performed in accordance with those requirements, regardless of whether the ACSP personally conducts the inspection. ACSPs know and apply the following related to construction site inspection:

- Types of inspections and observations required under the CGP, including pre-construction inspections, daily observations, monthly site inspections, storm event inspections, construction dewatering inspections, and inspections triggered by site conditions
- Recognition of adverse weather conditions that are dangerous to personnel or that prohibit safe site access, and the documentation required when an inspection is delayed or postponed as a result
- The inspection process, including preparation, comprehensive site review, and documentation of findings
- What to observe during inspection, including:
    - Receiving water and discharge conditions
    - Areas of active erosion or sediment loss
    - BMP installation, condition, and performance relative to CBMPP requirements, Blue Book standards, and construction contract requirements
    - Conditions that indicate BMPs are missing, failing, damaged, or inappropriate for current site conditions
    - Changes in site conditions, construction sequencing, or drainage patterns that require CBMPP modification
- Stabilization determination, including the criteria for temporary and permanent stabilization as defined by the CGP, Blue Book, and construction contract documents
- Precipitation measurement requirements, including methods, recordkeeping obligations, and the qualifying precipitation event threshold that triggers rain event inspections
- Inspection requirements and reporting obligations that may differ for construction-associated land disturbance covered under permits other than the CGP, including ALG890000 and other applicable federal, state, and local permits and authorizations

4.2 Reporting

Inspection reporting and regulatory notification requirements are specified by the CGP. The ACSP is responsible for ensuring that reporting and notification are performed in accordance with those requirements. ACSPs know and apply the following related to inspection reporting and regulatory notification:

- Required content and documentation elements of inspection reports in accordance with CGP requirements, including site and inspection identification, weather conditions, sampling and analytical results where applicable, and photographic documentation of discharges, deficient practices, and areas of concern
- Available inspection findings and their appropriate application, including:
    - **Satisfactory** — BMPs are in place and functioning as intended
    - **Unsatisfactory** — BMPs are missing, damaged, or not functioning as intended
    - **Turbid discharge** — discharge from the site exceeds water quality standards for turbidity
    - **Sediment loss** — sediment is actively or has been discharged from the site
- How to prepare and when to submit inspection reports in accordance with CGP requirements
- When and how to notify ADEM of discharge events, permit violations, upset conditions, or other reportable conditions
- Communication of current compliance status and potential future compliance issues to the owner and/or permittee

4.3 Professional Oversight and CBMPP Evaluation

ACSPs know and apply the following related to their professional oversight role and periodic evaluation responsibilities:

- The role of the ACSP in implementation verification — maintaining professional independence, exercising judgment, and documenting findings and actions in a manner that protects water quality, supports regulatory compliance, and manages professional liability
- Communication with the permittee
- Frequency requirements for CBMPP evaluations, including more frequent evaluation requirements for priority construction sites
- Conducting a comprehensive evaluation of all installed controls relative to CBMPP requirements, site conditions, and current state of practice
- Identifying needed modifications or additions to erosion and sediment controls based on evaluation findings
- Updating the CBMPP in accordance with CGP requirements when evaluation findings indicate deficiencies
- Documentation of CBMPP evaluation findings and actions taken
- When to escalate findings — conditions that require immediate corrective action, contractor notification, owner or permittee notification, or regulatory contact
- Who to call — identifying the appropriate party to contact based on the nature and severity of findings, including permittees, contractors, owners, legal counsel, and ADEM

5.0 PRACTICE AREA - Negative Impacts and Mitigation

Despite careful planning and diligent implementation, construction sites can experience conditions that result in negative impacts to water quality. The ACSP's role in these situations is both proactive — anticipating and preventing negative impacts through leadership and oversight; and responsive — acting decisively when impacts occur to minimize harm, restore compliance, and protect all parties involved.

5.1 ACSP Leadership and Involvement

ACSPs know and apply the following related to their leadership role in preventing and responding to negative impacts:

- Establishing clear expectations for water quality protection with the permittee (commitment), owners (commitment and financial), contractors, and site personnel before and during construction
- Recognizing site conditions, weather events, and construction activities that create elevated risk of negative impacts
- Taking a leadership role in directing corrective action before impacts occur or escalate
- Documenting decisions, actions, and communications related to negative impact prevention and response

5.2 Noncompliance Response and Reporting

ACSPs know and apply the following related to noncompliance response and reporting:

- Identifying conditions that constitute permit noncompliance, including unauthorized discharges, BMP failures, and inspection or reporting deficiencies
- Corrective action requirements and timelines as specified by the CGP, including time-sensitive response obligations for sediment basin failures, dewatering discharge indicators, and inspection deficiencies
- Obligations and procedures for reporting noncompliance to owners, permittee, operators, and ADEM
- Documentation requirements associated with noncompliance events

5.3 Mitigating Sediment Loss

ACSPs know and apply the following related to sediment loss mitigation:

- Immediate response actions to stop or reduce to the maximum extent practicable sediment loss from a construction site
- Determine causes of sediment loss (insufficient, inappropriate, or ill-maintained practices, chronic or catastrophic precipitation events, etc.)
- Assessment of off-site sediment impacts, including discharge to receiving waters, adjacent properties, and roadways
- Corrective BMP selection, installation, and modification to prevent recurrence
- Documentation of sediment loss events, response actions, and corrective measures

5.4 Navigating Enforcement Actions and Lawsuits

ACSPs do not provide legal advice but should understand the regulatory and legal context in which their work and documentation may be scrutinized. ACSPs know and apply the following related to enforcement and legal exposure:

- Types of enforcement actions ADEM may pursue for CGP violations, including warning letters, notices of violation, consent or administrative orders, and litigation
- ACSP and permittee roles and responsibilities when a project is subject to enforcement action
- The importance of thorough, accurate, and timely documentation in protecting the ACSP, owner, permittee, and contractor in enforcement and legal proceedings
- When to communicate with project stakeholders regarding potential legal action
- The role of the ACSP as an expert consultant or expert witness, including the professional obligations, standards of objectivity, and documentation expectations associated with providing technical expertise in support of legal or regulatory proceedings

APPENDIX B

ACSP Code of Ethics

Qualified Credentialed Professional (QCP) Code of Ethics

This Code of Ethics establishes the professional and ethical responsibilities of Qualified Credentialed Professionals (QCPs) who hold or seek to hold the Alabama Construction Stormwater Professional (ACSP) certification. In recognizing that this work directly affects water quality and the health, safety, and welfare of the public, ACSPs commit to conduct themselves with integrity, objectivity, diligence and environmental stewardship. These ethical standards promote accurate documentation, compliance with permit conditions, and protection of Alabama's water resources. Adherence to this Code is a condition for obtaining and maintaining ACSP certification with the expectation to integrate these principles into all aspects of QCP practice.

Preamble

All Alabama Construction Stormwater Professionals (ACSPs) who are certified as Qualified Credentialed Professionals (QCPs) under Alabama's current Construction General Permit (ALR100000) and/or Small Mining General Permit (ALG890000) owe a duty to the public, the environment, their clients, employers and peers. ACSPs should recognize that their work directly affects the quality of life and the health of Alabama's waters. Accordingly, they must commit to exhibiting integrity, objectivity, confidentiality, competence, professionalism, fairness, respect, diligence and environmental stewardship in all activities.

Fundamental Principles

1. **Integrity** – uphold honesty and candor, avoiding deceit and subordination of principles;
2. **Objectivity** – perform work impartially and avoid subordinating professional judgment;
3. **Confidentiality** – protect client information and proprietary data except where disclosure is required by law or necessary to prevent harm;
4. **Competence** – provide services only in areas of competence and pursue continual professional development;
5. **Professionalism** – represent the profession responsibly, courteously, and in a manner that enhances public trust;
6. **Fairness and Respect** – treat all persons with dignity and refrain from discrimination on the basis of race, gender, age, religion, national origin, disability, or other protected traits;
7. **Environmental Stewardship** – use best available science and practices to protect and enhance Alabama's surface and groundwater resources, and uphold public health, safety, and welfare;
8. **Diligence** – perform services promptly and thoroughly and supervise others appropriately.

Canons

1. Serve the public interest and protect Alabama's water resources and the environment.
2. Maintain professional integrity, objectivity, competence and a commitment to continual learning.
3. Promote transparency, truthful representation, and avoid deceptive acts.
4. Avoid conflicts of interest, bribery, or acceptance of improper gifts, and disclose any potential conflicts.
5. Respect confidentiality and proprietary information, disclosing information only when legally required or necessary to prevent harm.
6. Treat all persons fairly and respectfully, and refuse to engage in discrimination.
7. Report misconduct, environmental violations, or ethical breaches and cooperate with investigations without retaliation.

Ethical Standards

Environmental Stewardship

- Act to preserve and enhance the quality of Alabama's surface and groundwater resources.
- Prioritize the protection of water quality and the environment in all professional decisions.
- Avoid actions that undermine public confidence in environmental compliance.
- Design and implement BMPs that minimize pollutant discharges to the maximum extent practicable.
- Ensure that all discharges comply with applicable water quality standards and total maximum daily load (TMDL) requirements.

Professional Representation and Competency

- Represent qualifications, certifications, and experience truthfully.
- Perform only those services for which qualified by education, training, or experience.
- Pursue continuing education and professional development to remain current with permit requirements, BMP technologies, and evolving scientific knowledge.
- Shall not misrepresent BMP effectiveness or compliance status and shall certify documents only when they have been prepared or directly supervised by the QCP.

Compliance and Permit Requirements

- Ensure that Construction Best Management Practices Plans (CBMPPs) comply with the (ALR100000) Construction General Permit (CGP), including requirements for natural buffers, soil stabilization, pollution prevention, spill prevention, training, inspections, precipitation measurement, corrective action, documentation, and record retention.
- Ensure that Best Management Practices (BMP) plans comply with the (ALG890000) Small Mining General Permit when a borrow pit is part of the project plan, including

requirements applicability and coverage requirements, discharges into specialty designated waters, precipitation measurement, inspections, corrective action, documenting, and record retention.
- Ensure inspections are conducted at the required frequency, findings are documented accurately, and corrective actions are implemented promptly.
- Cooperate with regulators, provide accurate information, and not allow work to proceed without appropriate environmental safeguards.

Reporting, Whistle-Blower Protection, and Accountability

- Report known or suspected violations of environmental regulations or ethical standards.
- Cooperate fully and honestly with investigations conducted by ADEM or other authorities.
- Do not retaliate against individuals who report violations or raise legitimate concerns.
- Disclose any positive or negative environmental impacts of proposed activities to clients and employers.
- Acknowledge that certifications and submissions made under environmental permits are legally binding and subject to civil and criminal penalties.
- Support procedures for receiving and investigating ethical complaints and protect whistle-blowers from retaliation.
- Violations of this Code may result in disciplinary action, including suspension or revocation of QCP certification.

Plan Certification

- Only certify or sign plans and other documents that have been personally prepared or directly supervised, and for which the QCP can attest that all information is true, complete, and compliant with applicable regulations.
- Understand that certification is made under penalty of law and carries legal and ethical responsibility.
- Do not delegate certification responsibilities to unqualified individuals.
- Ensure that plans comply with applicable regulations, water quality standards, and TMDL requirements.
- Do not use the QCP designation for unapproved activities, marketing, or endorsements.

Transparency and Documentation

- Maintain complete and accurate records of inspections, evaluations, precipitation measurements, corrective actions, and plan updates as required by permit conditions.
- Submit truthful documentation and certifications under penalty of law.
- Make records available to regulatory authorities upon request.

Direct Supervision

- Ensure that QCIs and other personnel under their supervision are properly trained and competent to perform the required tasks.
- Provide adequate oversight to ensure BMPs are implemented and maintained effectively and in compliance with permit conditions.
- Do not allow work to proceed without appropriate environmental safeguards.

Conflicts of Interest

- Avoid situations in which personal, financial, or other interests conflict, or appear to conflict, with their professional obligations.
- Do not accept or offer bribes, payments, gifts, or other considerations intended to influence professional judgment or decisions.
- Disclose any potential conflicts of interest to clients, employers, or regulatory agencies and recuse themselves when conflicts cannot be resolved.

Confidentiality

- Respect the confidentiality of client information, proprietary data, and sensitive site information.
- Do not disclose such information without prior consent, except as required by law or necessary to protect public health, safety, or the environment.
- Use confidential information only for its intended purpose and shall safeguard it from unauthorized access.

Fairness and Non-Discrimination

- Treat all individuals and communities fairly and equitably.
- Do not engage in or tolerate discrimination on the basis of race, color, religion, sex, national origin, age, disability, sexual orientation, gender identity, or any other protected characteristic.
- Respect the rights of affected communities and consider social and environmental justice in decision making.

Professionalism and Diligence

- Act in a manner that demonstrates exemplary professional conduct, courtesy, and respect toward clients, regulatory officials, colleagues, and the public.
- Perform services diligently, ensuring timely and thorough completion of work, proper planning, oversight of personnel, and clear communication with stakeholders.
- Acknowledge errors, correct them promptly, and advise clients when projects will not meet permit requirements.

Ethical Commitment

By embracing this Code of Ethics, Qualified Credentialed Professionals (QCPs) commit to protect Alabama's water resources, uphold public health and safety, comply with the (ALR100000) Construction General Permit, the (ALG890000) Small Mining General Permit and other applicable regulations, and maintain the highest standards of professional conduct.

APPENDIX C

ACSP Application Home Page

Welcome to the Alabama Construction Stormwater Professional (ACSP) Program!

By registering for this program, you are taking an important step toward advancing your expertise and contributing to a cleaner, better Alabama.

The ACSP Program consists of three primary components:

1. **Certification Exam Application**
2. **Exam Readiness Course (optional)**
3. **Certification Exam**

You have already taken the first step toward becoming a certified Alabama Construction Stormwater Professional by enrolling in this application course. This application allows us to collect important information about your background, including:

- Name and contact information
- Relevant education
- Work history
- Applicable experience

Before proceeding, please review the eligibility requirements for the ACSP Certification Program. If you believe you meet these requirements, continue by completing the **ACSP Certification Exam Application. (https://auburncatalog.instructure.com/courses/3298/assignments/22085)**

Once you submit your application, it will be reviewed by program staff. You will receive a decision through the Canvas Catalog notification system via both email and course notification.

If Approved

If your application is approved, you will receive a link to register for the **Certification Exam Course** in Canvas Catalog. Registration in this course is required in order to schedule and take the exam.

- The certification exam fee is **$100 USD**
- Exam sessions are offered at **Auburn University** on scheduled dates
- You may also choose to take the exam at an approved **third-party proctoring facility**

If using a third-party proctor:

- You are responsible for scheduling your exam directly with the facility

- You must pay the **$100 exam fee** at the time of registering for the Certification Exam Course in Canvas Catalog plus any **additional proctoring fees** charged by that facility at the time of registering with them.

(Note: Proctoring fees vary by location.)

Optional: Exam Readiness Course

An optional **Exam Readiness Course** is available to help you prepare. This is a 1.5-day, in-person instructional course focused on key construction stormwater concepts specific to Alabama.

This course is open to anyone and is not required to apply for or take the certification exam.

See Canvas Course catalog (search: Alabama Construction Stormwater Professional Certification Exam Readiness Course) to register for this course.

Important Program Information

Please review the program's **Scope of Practice (https://auburncatalog.instructure.com/courses/3298/files/764755?wrap=1)** ↓ **(https://auburncatalog.instructure.com/courses/3298/files/764755/download?download_frd=1)** that outlines the expectations of a ACSP and overall program requirements.

All ACSPs are expected to uphold to a **QCP Code of Ethics (https://auburncatalog.instructure.com/courses/3298/files/764756?wrap=1)** ↓ **(https://auburncatalog.instructure.com/courses/3298/files/764756/download?download_frd=1)** as adopted by the ACSP Program. Failure to meet these ethical requirements may result in suspension or termination of ACSP certification and/or further legal action as required by Alabama or Federal law.

APPENDIX D

ACSP Certification Application

Alabama Construction Stormwater Professionals Certification Application

ⓘ This is a preview of the draft version of the quiz

Quiz Instructions

This application is intended to provide the certifiers (i.e., the Auburn University - Stormwater Research Facility personnel) and also to justify to the entities that recognize this certification (i.e., state and municipal regulators) that a person applying to be certified through the Alabama Construction Stormwater Professional Program, has the prerequisite knowledge and experience to adequately perform the duties of a qualified credentialed professional (QCP) as designated by the Alabama Department of Environmental Management in the current Alabama National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP).

The information provided in this survey will be used to determine if an applicant meets the minimum educational and experience requirements:

An associates, bachelor's, and/or post-graduate degree from an accredited college or university that has provided formal education in the concepts needed to adequately perform the tasks of a QCP. These concepts may include, but are not limited to:

- hydraulics and hydrology
- environmental science
- geotechnical concepts
- civil site works
- soil science
- agronomy
- water resources

If your application is approved, you will be eligible to sit for the Alabama Construction Stormwater Professional's Certification Examination.

Question 1 **0 pts**

Please provide the following information:

Lastname, Firstname

Company Name,

Company Title

Email Address

Phone number

Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Question 2 0 pts

Are you planning to take the Alabama Construction Stormwater Professional's Exam Readiness Course?

- ○ Yes
- ○ No

Question 3 0 pts

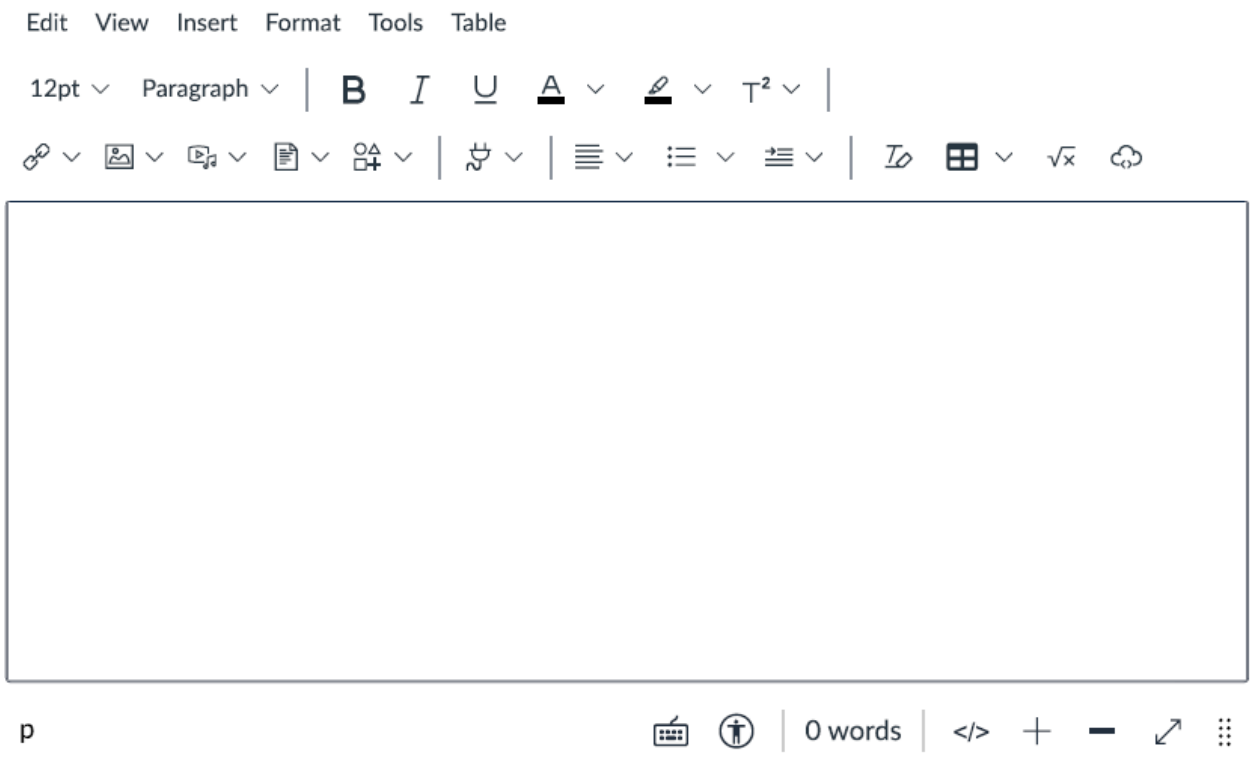
Do you have an associate's degree or higher in a field related to construction stormwater? The following are common types of degrees that would meet this requirement:

- Engineering or engineering technology related to environmental, hydraulics and hydrology, civil site, geotechnical, etc.
- Landscape architecture
- Environmental science
- Hydrology
- Soil science
- Water resources

- ○ Yes
- ○ No
- ○ Other, not listed, to be considered

Question 4 0 pts

Provide details about your degree if you do not fall into one of the previous degree types listed in the previous question. The next question will allow you to upload information about your degree to validate.



Question 5 0 pts

Please upload a copy of your transcripts that reflect your completed degree that aligns with the previous two questions.

Upload:

Choose a File

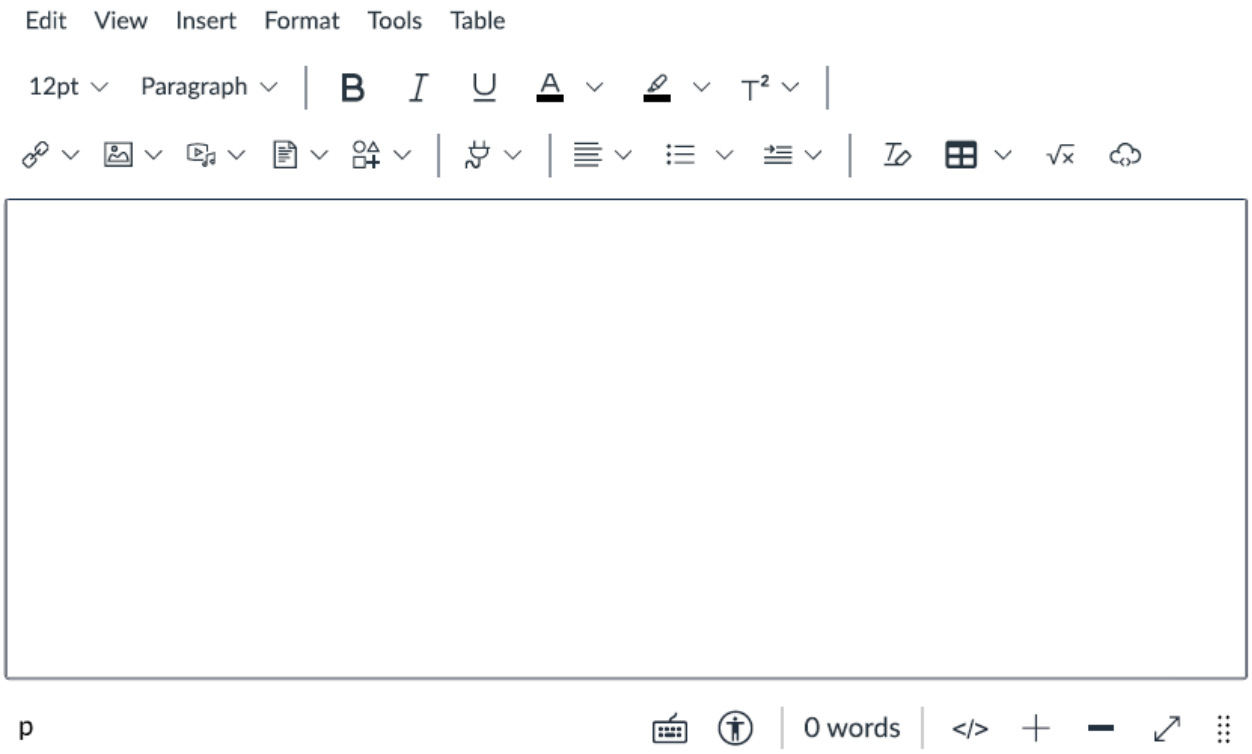
Question 6 0 pts

How many years of experience in construction stormwater, erosion, and sediment control do you have?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ More than 5
- ○ More than 10

Question 7 0 pts

Please discuss the relevant experience you have in the construction stormwater, erosion, and sediment control industry. Include content such as project type, duration, your role, locations (city or county and state is adequate) and the types of BMPs associated with the project (i.e., erosion control blankets, hydromulch, silt fence, ditch checks, sediment basins, etc.).



Question 8 0 pts

Please provide any relevant documentation you feel is necessary to demonstrate your level of experience in the construction stormwater, erosion, and sediment control industry. This may include letters of reference, project monitoring/documentation managed by you, project designs you were responsible for, etc.

Upload:

Choose a File

APPENDIX E

ACSP Equations Reference Guide

ACSP Exam Reference Guide – Equations, Constants, and Conversions

1. HYDROLOGY EQUATIONS

Rational Method:

$$Q = CiA$$

Q = peak flow (cfs)
C = runoff coefficient
i = rainfall intensity (in/hr)
A = drainage area (acres)

$$C_w = (A_1C_1 + A_2C_2 + \dots A_nC_n) / (A_1 + A_2 + \dots A_n)$$

C_w = weighted/composite runoff coefficient for whole drainage area

$$V_{in} = i\Sigma ACt$$
$$V_{out} = Q_0 t$$

Q_0 = outflow rate (cfs)
C = rational method runoff coefficient
i = rainfall intensity (in/hr)
A = drainage area (acres)
t = time (s)

Storage volume required

$$V_s = maximum\, V_{in} - V_{out}$$

Runoff Volume (Simple):

$$V = (P \times A \times C)/12$$

V = volume (ft^3)
P = precipitation depth (in)

NRCS Curve Number Excess Runoff:

$$Ia = 0.2S$$

If $P \leq I_a$ then, $Q = 0$

$$Q = (P - Ia)^2 / (P - Ia + S)$$

$$S = (1000/CN) - 10$$

Q = direct runoff depth (in.)
P = precipitation depth (in.)
CN= Hydraulic Curve Number

Atlas 14 / NRCS Graphical Peak Discharge

$$q_p = q_u A Q$$

q_p = peak discharge (cfs)
q_u = unit peak discharge (cfs/ac/in.)
A = drainage area (ac.)
Q = direct runoff depth (in.)

2. EROSION / SEDIMENT

USLE/RUSLE:

$$A = R \times K \times LS \times C \times P$$

A = erosion yield (tons/acre/yr)
R = rainfall erosivity factor
K = soil erodibility factor
LS= slope length - steepness factor
C = cover-management factor
P = support practice factor

MUSLE:

$$Sediment = 95(Q \times q_p)^{0.56} \times K \times LS \times C \times P$$

Sediment = sediment yield, (tons)
Q = runoff volume (acre-ft)
q_p = peak flow (cfs)

Total Maximum Daily Load (TMDL)

$$TMDL = \Sigma WLA + \Sigma LA + \Sigma MOS$$

WLA = sum of waste load allocations (point sources) (mass/day)
LA = sum of load allocations (nonpoint sources and background) (mass/day)
MOS = margin of safety (mass/day)

3. HYDRAULICS

Continuity:

$$Q = A \times V$$

A = channel cross-sectional area (ft^2)
V = average velocity (ft/s)

Time of Concentration:

$$T_c = T_{t_1} + T_{t_2} + \ldots T_{t_m}$$

T_c = time of concentration (hr)
T_t = travel time (hr)
m = number of flow segments

$$T_t = \frac{L}{3600V}$$

T_t = travel time (hr)
L = flow length (ft)
V = average velocity (ft/s)
3600 = conversion factor from seconds to hours

Sheet flow: Manning's kinematic solution

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

T_t = travel time (hr)
n = roughness coefficient (sheet flow)
L = flow length (ft)
S = slope of hydraulic grade line (land slope, ft/ft)
P_2 = 2-year, 24-hour rainfall (in.)

Manning's Equation:

$$V = (1.49/n) \times R^{(2/3)} \times S^{(1/2)}$$

V = average velocity (ft/s)
n = roughness coefficient
R = hydraulic radius (ft)
S = slope of channel (ft/ft)

Shear Stress:

$$\tau = \gamma RS$$

γ = specific weight of water = 62.4 lb/ft^3
R = hydraulic radius (ft)
S = slope of channel (ft/ft)

4. UNIT CONVERSIONS

Length:

1 in. = 2.54 cm
1 ft = 12 in.
1 yd = 3 ft
1 m = 3.281 ft

Flow:

1 cfs = 448.8 gpm
1 cfs = 1 acre-inch/hr

Volume:

1 acre-ft = 43,560 ft^3
1 ft^3 = 7.48 gallons
1 L = 3.785 gallons

Rainfall:

1 in over 1 acre = 3,630 ft^3

Mass:

1 ton = 2,000 lb

Area:

1 acre = 43,560 sf

5. COMMON CONSTANTS

Water Unit Weight:

$\gamma = 62.4\ lb/ft^3$

Gravity:

$g = 32.2\ ft/s^2$

6. Areas and Volumes

Circle:

$A = \pi r^2$
$C = 2\pi r$

Sphere:

$V = 4\pi r^3/3 = \pi d^3/6$
$A = 4\pi r^2 = \pi d^2$

Prismoidal

$$V = \frac{D}{6}\left(A_{bot} + 4A_{mid} + A_{top}\right)$$

V = volume
A_{bot} = Area of basin bottom
A_{mid} = Area of basin at middle depth
A_{top} = Area of basin top

$$V = L_b W_b D + zD^2(L_b + W_b) + \frac{2}{3}z^2 D^3$$

L_b = Bottom length
W_b = Bottom width
D = Depth
z = horizontal component of horizontal:vertical side slope ratio of length and width sides

Runoff Coefficients for Rational Formula

Type of Drainage Area	Runoff Coefficient, *C**
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 yards 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%	0.18–0.22
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

*Higher values are usually appropriate for steeply sloped areas and longer return periods because infiltration and other losses have a proportionally smaller effect on runoff in these cases.

Source: From American Society for Civil Engineering (ASCE). *Design Manual for Storm Drainage*. 3rd ed. Reston, VA: ASCE, 1960. As found in Federal Highway Administration. National Highway Institute. *Urban Drainage Design Manual: Hydraulic Engineering Circular No. 22*. 3rd ed. FHWA-NHI-10-009. Washington, DC: U.S. Department of Transportation, September 2009, Table 3-1, p. 3-6. www.fhwa.dot.gov/engineering/hydraulics/pubs/10009/10009.pdf.

	Runoff Coefficient, C					
	Soil Group A			Soil Group B		
Slope :	< 2%	2-6%	> 6%	< 2%	2-6%	> 6%
Forest	0.08	0.11	0.14	0.10	0.14	0.18
Meadow	0.14	0.22	0.30	0.20	0.28	0.37
Pasture	0.15	0.25	0.37	0.23	0.34	0.45
Farmland	0.14	0.18	0.22	0.16	0.21	0.28
Res. 1 acre	0.22	0.26	0.29	0.24	0.28	0.34
Res. 1/2 acre	0.25	0.29	0.32	0.28	0.32	0.36
Res. 1/3 acre	0.28	0.32	0.35	0.30	0.35	0.39
Res. 1/4 acre	0.30	0.34	0.37	0.33	0.37	0.42
Res. 1/8 acre	0.33	0.37	0.40	0.35	0.39	0.44
Industrial	0.85	0.85	0.86	0.85	0.86	0.86
Commercial	0.88	0.88	0.89	0.89	0.89	0.89
Streets: ROW	0.76	0.77	0.79	0.80	0.82	0.84
Parking	0.95	0.96	0.97	0.95	0.96	0.97
Disturbed Area	0.65	0.67	0.69	0.66	0.68	0.70

Rational Method Runoff Coefficients - Part I

	Runoff Coefficient, C					
	Soil Group C			Soil Group D		
Slope :	< 2%	2-6%	> 6%	< 2%	2-6%	> 6%
Forest	0.12	0.16	0.20	0.15	0.20	0.25
Meadow	0.26	0.35	0.44	0.30	0.40	0.50
Pasture	0.30	0.42	0.52	0.37	0.50	0.62
Farmland	0.20	0.25	0.34	0.24	0.29	0.41
Res. 1 acre	0.28	0.32	0.40	0.31	0.35	0.46
Res. 1/2 acre	0.31	0.35	0.42	0.34	0.38	0.46
Res. 1/3 acre	0.33	0.38	0.45	0.36	0.40	0.50
Res. 1/4 acre	0.36	0.40	0.47	0.38	0.42	0.52
Res. 1/8 acre	0.38	0.42	0.49	0.41	0.45	0.54
Industrial	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.89	0.89	0.90	0.89	0.89	0.90
Streets: ROW	0.84	0.85	0.89	0.89	0.91	0.95
Parking	0.95	0.96	0.97	0.95	0.96	0.97
Disturbed Area	0.68	0.70	0.72	0.69	0.72	0.75

Rational Method Runoff Coefficients - Part II

Figure 2-7: Runoff Curve Numbers – continued
(d) Urban Areas [1/]

Cover Description	Average Percent Impervious Area [2/]	Runoff Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established):					
Open space (lawns, parks, golf courses, cemeteries, etc.): [3/]					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2- inch sand or gravel mulch and basin borders)		96	96	96	96
Urban district:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas:					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94

Figure 2-7: Runoff Curve Numbers – continued
(c) Arid and Semiarid Rangelands [1/]

Cover Description	Hydrologic Condition [2/]	Runoff Curve Numbers for Hydrologic Soil Group			
Cover Type		**A** [3/]	**B**	**C**	**D**
Herbaceous – mixture of grass, weeds, and low-growing brush, with brush the minor element	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen – mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper – pinyon, juniper, or both; grass understory	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub – major plants, include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

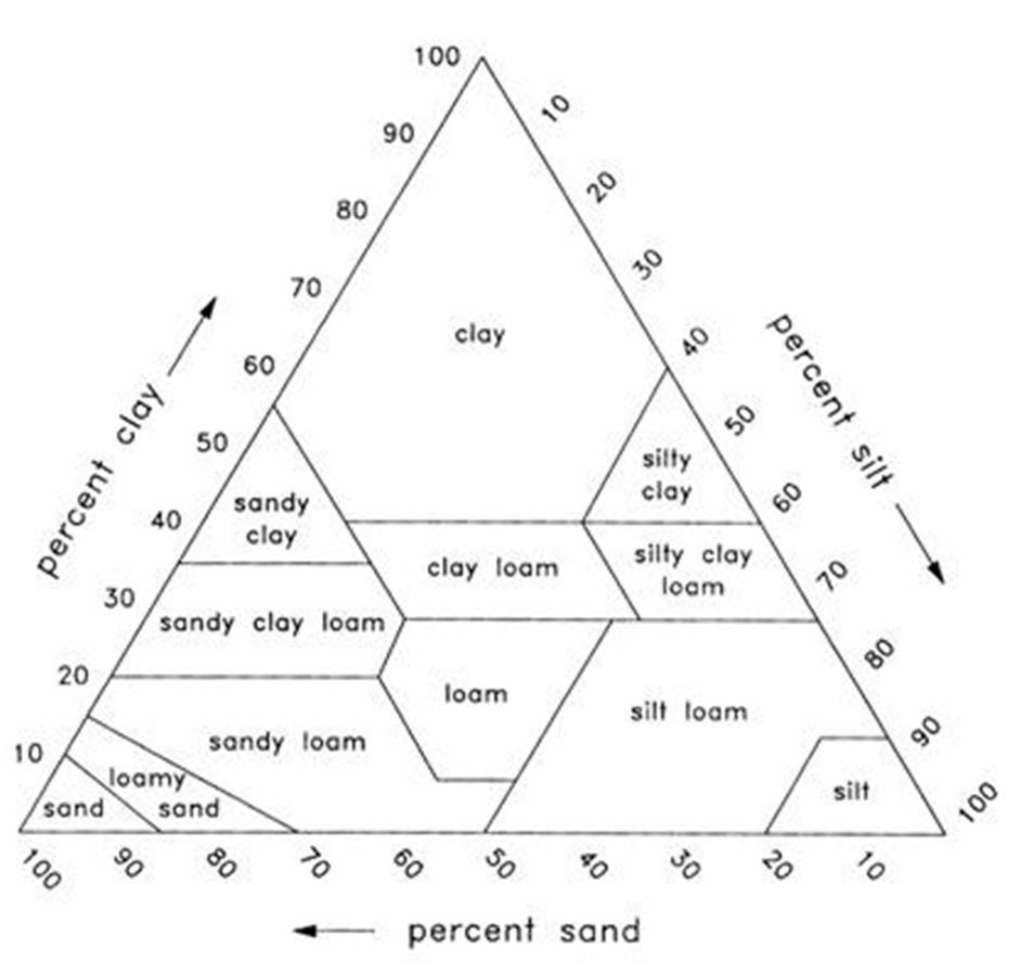
[1/] Average runoff condition and I_a=0.2S. or rangelands in humid regions, use table 2–1(b).
[2/] Poor: <30% ground cover (litter, grass, and brush overstory)
Fair: 30% to 70% ground cover
Good: >70% ground cover
[3/] Curve numbers for group A have been developed only for desert shrub.

Figure 2-7: Runoff Curve Numbers - continued
(b) Other Agricultural Lands [1/]

Cover Description	Hydrologic Condition	Runoff Curve Numbers for Hydrologic Soil Group			
Cover Type		**A**	**B**	**C**	**D**
Pasture, grassland, or range—continuous forage for grazing [2/]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay	-----	30	58	71	78
Brush—brush-forbs-grass mixture with brush the major element [3/]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4/]	48	65	73
Woods-grass combination (orchard or tree farm) [5/]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods [6/]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4/]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots	-----	59	74	82	86

[1/] Average runoff condition and Ia=0.2S
[2/] Poor: < 50% ground cover or heavily grazed with no mulch
Fair: 50% to 75% ground cover or not heavily grazed
Good: >75% ground cover and lightly or only occasionally grazed
[3/] Poor: <50% ground cover
Fair: 50 to 75% ground cover
Good: >75% ground cover
[4/] Actual curve number is less than 30; use CN = 30 for runoff computations
[5/] CNs shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture
[6/] Poor: Forest litter, small trees, and brush have been destroyed by heavy grazing or regular burning
Fair: Woods are grazed but not burned, and some forest litter covers the soil
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

HSG	Soil Textures
A	sand, loamy sand, or sandy loam
B	silt, silt loam, or loam
C	sandy clay loam
D	clay loam, silty clay loam, sandy clay, silty clay, or clay



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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.456** (0.374-0.555)	**0.520** (0.426-0.633)	**0.623** (0.508-0.760)	**0.706** (0.573-0.865)	**0.819** (0.641-1.03)	**0.905** (0.691-1.15)	**0.988** (0.729-1.28)	**1.07** (0.757-1.42)	**1.18** (0.801-1.60)	**1.26** (0.834-1.74)
10-min	**0.668** (0.548-0.813)	**0.761** (0.624-0.927)	**0.912** (0.745-1.11)	**1.03** (0.840-1.27)	**1.20** (0.938-1.50)	**1.32** (1.01-1.68)	**1.45** (1.07-1.88)	**1.57** (1.11-2.08)	**1.73** (1.17-2.35)	**1.84** (1.22-2.55)
15-min	**0.815** (0.668-0.992)	**0.928** (0.761-1.13)	**1.11** (0.908-1.36)	**1.26** (1.02-1.55)	**1.46** (1.14-1.83)	**1.62** (1.24-2.05)	**1.76** (1.30-2.29)	**1.91** (1.35-2.54)	**2.11** (1.43-2.86)	**2.25** (1.49-3.11)
30-min	**1.18** (0.965-1.43)	**1.35** (1.10-1.64)	**1.62** (1.32-1.98)	**1.84** (1.50-2.26)	**2.14** (1.67-2.68)	**2.37** (1.81-3.00)	**2.58** (1.90-3.35)	**2.80** (1.98-3.71)	**3.08** (2.09-4.18)	**3.28** (2.17-4.53)
60-min	**1.55** (1.27-1.88)	**1.76** (1.45-2.15)	**2.12** (1.73-2.59)	**2.42** (1.97-2.97)	**2.84** (2.23-3.58)	**3.17** (2.43-4.04)	**3.50** (2.59-4.56)	**3.84** (2.72-5.12)	**4.30** (2.93-5.87)	**4.66** (3.08-6.43)
2-hr	**1.92** (1.59-2.32)	**2.18** (1.80-2.64)	**2.62** (2.16-3.18)	**3.00** (2.45-3.65)	**3.54** (2.80-4.44)	**3.97** (3.07-5.04)	**4.42** (3.30-5.73)	**4.89** (3.49-6.48)	**5.53** (3.79-7.51)	**6.03** (4.02-8.28)
3-hr	**2.16** (1.79-2.60)	**2.44** (2.03-2.94)	**2.94** (2.43-3.55)	**3.38** (2.78-4.10)	**4.03** (3.22-5.06)	**4.56** (3.55-5.79)	**5.13** (3.85-6.64)	**5.72** (4.11-7.58)	**6.56** (4.52-8.90)	**7.23** (4.84-9.89)
6-hr	**2.60** (2.17-3.10)	**2.96** (2.48-3.54)	**3.62** (3.01-4.33)	**4.20** (3.48-5.05)	**5.08** (4.09-6.35)	**5.81** (4.56-7.33)	**6.59** (4.98-8.48)	**7.42** (5.37-9.79)	**8.61** (5.98-11.6)	**9.56** (6.44-13.0)
12-hr	**3.09** (2.60-3.66)	**3.59** (3.02-4.25)	**4.46** (3.74-5.30)	**5.24** (4.37-6.25)	**6.39** (5.18-7.93)	**7.35** (5.80-9.20)	**8.36** (6.36-10.7)	**9.44** (6.87-12.4)	**11.0** (7.66-14.7)	**12.2** (8.25-16.4)
24-hr	**3.65** (3.10-4.29)	**4.25** (3.61-5.00)	**5.32** (4.50-6.27)	**6.27** (5.27-7.42)	**7.69** (6.28-9.47)	**8.86** (7.05-11.0)	**10.1** (7.75-12.8)	**11.5** (8.40-14.9)	**13.3** (9.38-17.8)	**14.8** (10.1-19.9)
2-day	**4.29** (3.68-5.01)	**4.93** (4.22-5.76)	**6.08** (5.19-7.12)	**7.15** (6.06-8.40)	**8.78** (7.26-10.8)	**10.2** (8.16-12.6)	**11.7** (9.02-14.8)	**13.3** (9.83-17.2)	**15.6** (11.1-20.7)	**17.5** (12.0-23.3)
3-day	**4.72** (4.06-5.48)	**5.38** (4.63-6.26)	**6.62** (5.66-7.71)	**7.76** (6.61-9.08)	**9.54** (7.93-11.7)	**11.1** (8.93-13.7)	**12.7** (9.88-16.0)	**14.5** (10.8-18.7)	**17.1** (12.2-22.6)	**19.2** (13.3-25.5)
4-day	**5.06** (4.36-5.85)	**5.76** (4.97-6.68)	**7.07** (6.07-8.21)	**8.29** (7.08-9.66)	**10.2** (8.49-12.4)	**11.8** (9.56-14.5)	**13.6** (10.6-17.1)	**15.5** (11.6-20.0)	**18.3** (13.1-24.1)	**20.6** (14.2-27.2)
7-day	**5.88** (5.11-6.77)	**6.70** (5.81-7.71)	**8.18** (7.08-9.45)	**9.57** (8.22-11.1)	**11.7** (9.80-14.2)	**13.5** (11.0-16.5)	**15.4** (12.1-19.3)	**17.6** (13.2-22.5)	**20.6** (14.8-27.0)	**23.1** (16.1-30.5)
10-day	**6.61** (5.77-7.58)	**7.50** (6.54-8.61)	**9.11** (7.91-10.5)	**10.6** (9.13-12.2)	**12.8** (10.8-15.4)	**14.7** (12.0-17.9)	**16.8** (13.2-20.8)	**19.0** (14.3-24.1)	**22.1** (15.9-28.8)	**24.7** (17.2-32.4)
20-day	**8.77** (7.71-9.97)	**9.81** (8.62-11.2)	**11.6** (10.2-13.3)	**13.2** (11.5-15.2)	**15.6** (13.2-18.5)	**17.6** (14.4-21.1)	**19.6** (15.5-24.1)	**21.8** (16.5-27.5)	**24.9** (18.0-32.1)	**27.4** (19.2-35.7)
30-day	**10.6** (9.38-12.0)	**11.8** (10.4-13.4)	**13.8** (12.1-15.7)	**15.5** (13.6-17.7)	**18.0** (15.2-21.2)	**20.0** (16.4-23.8)	**22.0** (17.4-26.8)	**24.1** (18.3-30.1)	**27.0** (19.6-34.6)	**29.3** (20.7-38.1)
45-day	**13.0** (11.6-14.7)	**14.4** (12.8-16.2)	**16.7** (14.8-18.9)	**18.6** (16.3-21.1)	**21.2** (17.9-24.7)	**23.2** (19.2-27.4)	**25.2** (20.1-30.5)	**27.3** (20.7-33.8)	**30.0** (21.8-38.2)	**32.1** (22.7-41.4)
60-day	**15.1** (13.4-16.9)	**16.7** (14.9-18.8)	**19.3** (17.1-21.7)	**21.4** (18.8-24.2)	**24.1** (20.5-27.9)	**26.2** (21.7-30.8)	**28.3** (22.5-33.9)	**30.3** (23.0-37.3)	**32.8** (23.9-41.5)	**34.7** (24.6-44.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

Point Precipitation Frequency Estimates (in.): Montgomery, AL
Lat.: 32.3495°, Long.: -86.2949°, Elev.: 240 ft

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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.437 (0.375-0.514)	0.502 (0.431-0.591)	0.607 (0.520-0.716)	0.692 (0.590-0.819)	0.807 (0.666-0.971)	0.893 (0.723-1.09)	0.978 (0.769-1.21)	1.06 (0.805-1.34)	1.17 (0.857-1.50)	1.25 (0.897-1.63)
10-min	0.639 (0.549-0.752)	0.735 (0.631-0.865)	0.889 (0.761-1.05)	1.01 (0.864-1.20)	1.18 (0.975-1.42)	1.31 (1.06-1.59)	1.43 (1.12-1.77)	1.55 (1.18-1.96)	1.71 (1.26-2.20)	1.83 (1.31-2.39)
15-min	0.780 (0.670-0.917)	0.896 (0.770-1.06)	1.08 (0.928-1.28)	1.24 (1.05-1.46)	1.44 (1.19-1.73)	1.60 (1.29-1.94)	1.75 (1.37-2.16)	1.90 (1.44-2.39)	2.09 (1.53-2.68)	2.23 (1.60-2.91)
30-min	1.12 (0.963-1.32)	1.29 (1.11-1.52)	1.57 (1.34-1.85)	1.79 (1.52-2.12)	2.09 (1.72-2.51)	2.31 (1.87-2.81)	2.53 (1.99-3.12)	2.74 (2.08-3.46)	3.02 (2.21-3.88)	3.22 (2.31-4.20)
60-min	1.49 (1.28-1.75)	1.70 (1.46-2.00)	2.05 (1.75-2.41)	2.33 (1.99-2.76)	2.72 (2.25-3.28)	3.02 (2.45-3.68)	3.32 (2.61-4.11)	3.61 (2.74-4.56)	4.00 (2.94-5.16)	4.30 (3.09-5.61)
2-hr	1.86 (1.60-2.17)	2.11 (1.82-2.47)	2.53 (2.18-2.96)	2.87 (2.46-3.38)	3.35 (2.79-4.02)	3.73 (3.04-4.52)	4.10 (3.25-5.06)	4.48 (3.43-5.63)	4.99 (3.69-6.40)	5.38 (3.89-6.98)
3-hr	2.10 (1.82-2.45)	2.38 (2.06-2.77)	2.84 (2.45-3.31)	3.23 (2.77-3.77)	3.77 (3.16-4.52)	4.20 (3.44-5.08)	4.64 (3.70-5.70)	5.09 (3.91-6.38)	5.70 (4.24-7.29)	6.17 (4.49-7.97)
6-hr	2.56 (2.23-2.95)	2.90 (2.52-3.35)	3.47 (3.02-4.02)	3.96 (3.42-4.60)	4.66 (3.92-5.54)	5.21 (4.30-6.25)	5.77 (4.63-7.05)	6.36 (4.92-7.92)	7.16 (5.36-9.09)	7.78 (5.69-9.97)
12-hr	3.05 (2.67-3.49)	3.50 (3.07-4.02)	4.26 (3.72-4.89)	4.90 (4.26-5.64)	5.79 (4.90-6.83)	6.49 (5.39-7.74)	7.21 (5.81-8.74)	7.94 (6.18-9.81)	8.93 (6.73-11.3)	9.69 (7.14-12.4)
24-hr	3.60 (3.18-4.10)	4.16 (3.67-4.74)	5.09 (4.47-5.81)	5.87 (5.13-6.72)	6.96 (5.93-8.16)	7.82 (6.53-9.25)	8.69 (7.05-10.5)	9.58 (7.51-11.8)	10.8 (8.18-13.5)	11.7 (8.68-14.8)
2-day	4.24 (3.76-4.79)	4.86 (4.31-5.50)	5.90 (5.22-6.69)	6.80 (5.98-7.72)	8.05 (6.90-9.38)	9.05 (7.61-10.6)	10.1 (8.23-12.1)	11.1 (8.79-13.6)	12.6 (9.61-15.6)	13.7 (10.2-17.2)
3-day	4.65 (4.14-5.23)	5.32 (4.73-5.99)	6.45 (5.72-7.28)	7.42 (6.55-8.40)	8.80 (7.58-10.2)	9.90 (8.36-11.6)	11.0 (9.06-13.2)	12.2 (9.70-14.9)	13.8 (10.6-17.2)	15.1 (11.3-18.9)
4-day	4.98 (4.44-5.59)	5.69 (5.08-6.39)	6.90 (6.13-7.76)	7.94 (7.02-8.95)	9.42 (8.14-10.9)	10.6 (8.99-12.4)	11.9 (9.76-14.1)	13.2 (10.5-16.0)	14.9 (11.5-18.5)	16.3 (12.3-20.4)
7-day	5.83 (5.23-6.50)	6.62 (5.93-7.39)	7.99 (7.13-8.93)	9.18 (8.16-10.3)	10.9 (9.49-12.6)	12.3 (10.5-14.3)	13.8 (11.4-16.3)	15.3 (12.3-18.5)	17.5 (13.6-21.6)	19.2 (14.5-23.8)
10-day	6.58 (5.91-7.31)	7.44 (6.68-8.26)	8.91 (7.98-9.92)	10.2 (9.10-11.4)	12.1 (10.6-13.9)	13.6 (11.7-15.8)	15.2 (12.7-18.0)	16.9 (13.6-20.4)	19.3 (15.0-23.7)	21.2 (16.1-26.2)
20-day	8.74 (7.91-9.64)	9.78 (8.83-10.8)	11.5 (10.4-12.7)	13.0 (11.7-14.4)	15.2 (13.3-17.3)	16.9 (14.5-19.4)	18.7 (15.6-21.8)	20.5 (16.6-24.5)	23.1 (18.1-28.1)	25.1 (19.2-30.8)
30-day	10.6 (9.64-11.7)	11.8 (10.7-13.0)	13.8 (12.5-15.2)	15.5 (13.9-17.1)	17.8 (15.6-20.1)	19.6 (16.9-22.3)	21.4 (18.0-24.9)	23.3 (18.9-27.6)	25.8 (20.3-31.2)	27.8 (21.4-34.0)
45-day	13.1 (11.9-14.3)	14.5 (13.2-15.9)	16.8 (15.3-18.4)	18.7 (16.9-20.5)	21.2 (18.6-23.7)	23.1 (20.0-26.2)	25.0 (21.0-28.8)	26.9 (21.8-31.6)	29.3 (23.1-35.1)	31.0 (24.0-37.8)
60-day	15.2 (13.9-16.6)	16.9 (15.4-18.4)	19.5 (17.7-21.3)	21.6 (19.6-23.6)	24.3 (21.4-27.0)	26.3 (22.7-29.6)	28.2 (23.7-32.3)	30.0 (24.4-35.1)	32.3 (25.5-38.5)	33.9 (26.2-41.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Auburn, AL
Lat.: 32.5909°, Long.: -85.4819°, Elev.: 640 ft

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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.24** (4.50-6.17)	**6.02** (5.17-7.09)	**7.28** (6.24-8.59)	**8.30** (7.08-9.83)	**9.68** (7.99-11.7)	**10.7** (8.68-13.0)	**11.7** (9.23-14.5)	**12.7** (9.66-16.1)	**14.0** (10.3-18.0)	**15.0** (10.8-19.5)
10-min	**3.83** (3.29-4.51)	**4.41** (3.79-5.19)	**5.33** (4.57-6.29)	**6.08** (5.18-7.19)	**7.09** (5.85-8.53)	**7.85** (6.35-9.54)	**8.59** (6.75-10.6)	**9.32** (7.07-11.8)	**10.3** (7.53-13.2)	**11.0** (7.88-14.3)
15-min	**3.12** (2.68-3.67)	**3.58** (3.08-4.22)	**4.34** (3.71-5.11)	**4.94** (4.21-5.85)	**5.76** (4.76-6.94)	**6.38** (5.16-7.76)	**6.98** (5.49-8.64)	**7.58** (5.75-9.56)	**8.35** (6.12-10.7)	**8.92** (6.41-11.6)
30-min	**2.24** (1.93-2.64)	**2.58** (2.22-3.04)	**3.13** (2.68-3.70)	**3.58** (3.05-4.23)	**4.17** (3.44-5.02)	**4.62** (3.74-5.62)	**5.05** (3.97-6.25)	**5.48** (4.16-6.91)	**6.03** (4.42-7.76)	**6.44** (4.62-8.40)
60-min	**1.49** (1.28-1.75)	**1.70** (1.46-2.00)	**2.05** (1.75-2.41)	**2.33** (1.99-2.76)	**2.72** (2.25-3.28)	**3.02** (2.45-3.68)	**3.32** (2.61-4.11)	**3.61** (2.74-4.56)	**4.00** (2.94-5.16)	**4.30** (3.09-5.61)
2-hr	**0.928** (0.802-1.08)	**1.06** (0.911-1.23)	**1.26** (1.09-1.48)	**1.44** (1.23-1.69)	**1.68** (1.40-2.01)	**1.86** (1.52-2.26)	**2.05** (1.63-2.53)	**2.24** (1.72-2.82)	**2.50** (1.85-3.20)	**2.69** (1.95-3.49)
3-hr	**0.700** (0.607-0.815)	**0.792** (0.686-0.922)	**0.945** (0.816-1.10)	**1.07** (0.923-1.26)	**1.26** (1.05-1.50)	**1.40** (1.15-1.69)	**1.54** (1.23-1.90)	**1.70** (1.30-2.12)	**1.90** (1.41-2.43)	**2.06** (1.49-2.66)
6-hr	**0.426** (0.372-0.492)	**0.484** (0.421-0.559)	**0.579** (0.503-0.671)	**0.661** (0.571-0.768)	**0.777** (0.654-0.925)	**0.869** (0.717-1.04)	**0.963** (0.772-1.18)	**1.06** (0.822-1.32)	**1.19** (0.894-1.52)	**1.30** (0.949-1.66)
12-hr	**0.252** (0.221-0.289)	**0.290** (0.254-0.333)	**0.353** (0.308-0.406)	**0.406** (0.353-0.468)	**0.480** (0.406-0.567)	**0.538** (0.447-0.642)	**0.598** (0.482-0.725)	**0.659** (0.513-0.814)	**0.741** (0.558-0.934)	**0.804** (0.592-1.02)
24-hr	**0.150** (0.132-0.170)	**0.173** (0.152-0.197)	**0.212** (0.186-0.242)	**0.244** (0.213-0.280)	**0.290** (0.246-0.340)	**0.325** (0.271-0.385)	**0.362** (0.293-0.435)	**0.399** (0.312-0.489)	**0.449** (0.340-0.562)	**0.487** (0.361-0.616)
2-day	**0.088** (0.078-0.099)	**0.101** (0.089-0.114)	**0.123** (0.108-0.139)	**0.141** (0.124-0.160)	**0.167** (0.143-0.195)	**0.188** (0.158-0.221)	**0.209** (0.171-0.251)	**0.231** (0.183-0.282)	**0.261** (0.200-0.325)	**0.285** (0.213-0.358)
3-day	**0.064** (0.057-0.072)	**0.073** (0.065-0.083)	**0.089** (0.079-0.101)	**0.103** (0.090-0.116)	**0.122** (0.105-0.141)	**0.137** (0.116-0.161)	**0.153** (0.125-0.182)	**0.169** (0.134-0.206)	**0.192** (0.147-0.238)	**0.209** (0.157-0.262)
4-day	**0.051** (0.046-0.058)	**0.059** (0.052-0.066)	**0.071** (0.063-0.080)	**0.082** (0.073-0.093)	**0.098** (0.084-0.113)	**0.110** (0.093-0.129)	**0.123** (0.101-0.146)	**0.136** (0.109-0.166)	**0.155** (0.119-0.192)	**0.169** (0.127-0.212)
7-day	**0.034** (0.031-0.038)	**0.039** (0.035-0.043)	**0.047** (0.042-0.053)	**0.054** (0.048-0.061)	**0.064** (0.056-0.074)	**0.073** (0.062-0.085)	**0.082** (0.068-0.097)	**0.091** (0.073-0.110)	**0.104** (0.080-0.128)	**0.114** (0.086-0.141)
10-day	**0.027** (0.024-0.030)	**0.030** (0.027-0.034)	**0.037** (0.033-0.041)	**0.042** (0.037-0.047)	**0.050** (0.043-0.057)	**0.056** (0.048-0.065)	**0.063** (0.052-0.074)	**0.070** (0.056-0.084)	**0.080** (0.062-0.098)	**0.088** (0.067-0.109)
20-day	**0.018** (0.016-0.020)	**0.020** (0.018-0.022)	**0.023** (0.021-0.026)	**0.027** (0.024-0.030)	**0.031** (0.027-0.035)	**0.035** (0.030-0.040)	**0.038** (0.032-0.045)	**0.042** (0.034-0.051)	**0.048** (0.037-0.058)	**0.052** (0.040-0.064)
30-day	**0.014** (0.013-0.016)	**0.016** (0.014-0.018)	**0.019** (0.017-0.021)	**0.021** (0.019-0.023)	**0.024** (0.021-0.027)	**0.027** (0.023-0.030)	**0.029** (0.024-0.034)	**0.032** (0.026-0.038)	**0.035** (0.028-0.043)	**0.038** (0.029-0.047)
45-day	**0.012** (0.011-0.013)	**0.013** (0.012-0.014)	**0.015** (0.014-0.017)	**0.017** (0.015-0.019)	**0.019** (0.017-0.021)	**0.021** (0.018-0.024)	**0.023** (0.019-0.026)	**0.024** (0.020-0.029)	**0.027** (0.021-0.032)	**0.028** (0.022-0.035)
60-day	**0.010** (0.009-0.011)	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.014** (0.013-0.016)	**0.016** (0.014-0.018)	**0.018** (0.015-0.020)	**0.019** (0.016-0.022)	**0.020** (0.016-0.024)	**0.022** (0.017-0.026)	**0.023** (0.018-0.028)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Auburn, AL
Lat.: 32.5909°, Long.: -85.4819°, Elev.: 640 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.618** (0.506-0.753)	**0.702** (0.574-0.856)	**0.842** (0.686-1.03)	**0.959** (0.777-1.18)	**1.12** (0.879-1.41)	**1.25** (0.956-1.59)	**1.38** (1.02-1.79)	**1.51** (1.07-2.00)	**1.69** (1.15-2.29)	**1.82** (1.21-2.50)
10-min	**0.905** (0.741-1.10)	**1.03** (0.841-1.25)	**1.23** (1.00-1.50)	**1.40** (1.14-1.72)	**1.64** (1.29-2.06)	**1.83** (1.40-2.32)	**2.02** (1.49-2.62)	**2.21** (1.57-2.93)	**2.47** (1.68-3.35)	**2.67** (1.77-3.67)
15-min	**1.10** (0.904-1.34)	**1.25** (1.03-1.53)	**1.50** (1.22-1.84)	**1.71** (1.39-2.10)	**2.00** (1.57-2.52)	**2.23** (1.71-2.84)	**2.46** (1.82-3.19)	**2.70** (1.91-3.57)	**3.01** (2.05-4.08)	**3.26** (2.16-4.47)
30-min	**1.57** (1.29-1.92)	**1.80** (1.47-2.19)	**2.17** (1.77-2.65)	**2.48** (2.01-3.04)	**2.92** (2.28-3.66)	**3.25** (2.49-4.13)	**3.59** (2.65-4.65)	**3.93** (2.79-5.21)	**4.39** (2.99-5.95)	**4.74** (3.15-6.51)
60-min	**2.09** (1.71-2.55)	**2.39** (1.95-2.91)	**2.88** (2.35-3.52)	**3.30** (2.68-4.05)	**3.91** (3.07-4.93)	**4.39** (3.37-5.60)	**4.89** (3.62-6.36)	**5.41** (3.84-7.19)	**6.13** (4.18-8.32)	**6.68** (4.43-9.18)
2-hr	**2.62** (2.16-3.16)	**2.97** (2.45-3.59)	**3.59** (2.94-4.35)	**4.12** (3.37-5.01)	**4.90** (3.89-6.15)	**5.54** (4.28-7.02)	**6.20** (4.62-8.01)	**6.89** (4.93-9.11)	**7.86** (5.40-10.6)	**8.62** (5.76-11.8)
3-hr	**2.97** (2.46-3.57)	**3.37** (2.79-4.05)	**4.08** (3.36-4.91)	**4.71** (3.86-5.70)	**5.64** (4.50-7.08)	**6.42** (4.99-8.13)	**7.24** (5.44-9.35)	**8.13** (5.84-10.7)	**9.37** (6.47-12.6)	**10.4** (6.95-14.1)
6-hr	**3.58** (2.99-4.27)	**4.10** (3.42-4.89)	**5.04** (4.18-6.02)	**5.89** (4.86-7.07)	**7.19** (5.79-8.99)	**8.28** (6.49-10.4)	**9.46** (7.16-12.2)	**10.7** (7.78-14.1)	**12.6** (8.74-16.9)	**14.0** (9.46-18.9)
12-hr	**4.20** (3.53-4.97)	**4.90** (4.11-5.79)	**6.15** (5.15-7.30)	**7.31** (6.08-8.70)	**9.08** (7.38-11.3)	**10.6** (8.36-13.2)	**12.2** (9.29-15.6)	**13.9** (10.2-18.2)	**16.4** (11.5-22.0)	**18.5** (12.6-24.8)
24-hr	**4.89** (4.14-5.74)	**5.73** (4.85-6.73)	**7.28** (6.14-8.56)	**8.72** (7.31-10.3)	**10.9** (8.98-13.6)	**12.8** (10.2-16.0)	**14.9** (11.5-19.0)	**17.2** (12.6-22.3)	**20.4** (14.4-27.1)	**23.1** (15.8-30.8)
2-day	**5.70** (4.86-6.62)	**6.62** (5.64-7.70)	**8.34** (7.08-9.73)	**9.98** (8.43-11.7)	**12.6** (10.4-15.5)	**14.8** (11.9-18.3)	**17.2** (13.3-21.8)	**19.9** (14.8-25.8)	**23.8** (17.0-31.5)	**27.1** (18.6-35.8)
3-day	**6.21** (5.32-7.18)	**7.20** (6.16-8.34)	**9.06** (7.73-10.5)	**10.8** (9.17-12.6)	**13.6** (11.3-16.6)	**15.9** (12.9-19.6)	**18.5** (14.4-23.3)	**21.4** (15.9-27.5)	**25.5** (18.2-33.5)	**28.9** (20.0-38.1)
4-day	**6.64** (5.70-7.65)	**7.67** (6.59-8.85)	**9.60** (8.21-11.1)	**11.4** (9.71-13.2)	**14.2** (11.9-17.4)	**16.7** (13.5-20.5)	**19.3** (15.1-24.2)	**22.2** (16.6-28.5)	**26.5** (18.9-34.7)	**29.9** (20.7-39.3)
7-day	**7.77** (6.72-8.89)	**8.82** (7.62-10.1)	**10.8** (9.27-12.4)	**12.6** (10.8-14.5)	**15.4** (12.9-18.7)	**17.9** (14.6-21.8)	**20.6** (16.1-25.6)	**23.5** (17.7-30.0)	**27.8** (20.0-36.2)	**31.3** (21.8-40.9)
10-day	**8.74** (7.59-9.96)	**9.82** (8.52-11.2)	**11.8** (10.2-13.5)	**13.7** (11.7-15.7)	**16.5** (13.9-19.8)	**19.0** (15.5-23.0)	**21.7** (17.0-26.8)	**24.6** (18.5-31.1)	**28.8** (20.8-37.3)	**32.2** (22.5-42.0)
20-day	**11.4** (10.0-12.9)	**12.8** (11.2-14.5)	**15.2** (13.2-17.2)	**17.3** (15.0-19.7)	**20.4** (17.2-24.1)	**23.0** (18.8-27.4)	**25.6** (20.3-31.3)	**28.5** (21.5-35.6)	**32.5** (23.6-41.6)	**35.7** (25.1-46.2)
30-day	**13.8** (12.1-15.5)	**15.5** (13.6-17.4)	**18.3** (16.0-20.6)	**20.7** (18.0-23.4)	**24.0** (20.2-28.0)	**26.7** (21.9-31.6)	**29.4** (23.3-35.6)	**32.3** (24.4-40.0)	**36.1** (26.3-45.9)	**39.1** (27.6-50.4)
45-day	**16.9** (15.0-18.9)	**19.0** (16.8-21.3)	**22.3** (19.6-25.1)	**25.1** (21.9-28.3)	**28.8** (24.3-33.3)	**31.7** (26.1-37.1)	**34.5** (27.4-41.4)	**37.4** (28.4-46.0)	**41.1** (29.9-51.9)	**43.9** (31.1-56.4)
60-day	**19.7** (17.5-22.0)	**22.1** (19.6-24.7)	**25.9** (22.8-28.9)	**28.9** (25.4-32.5)	**33.0** (27.8-37.9)	**36.0** (29.7-42.0)	**39.0** (31.0-46.5)	**41.9** (31.8-51.2)	**45.6** (33.2-57.2)	**48.2** (34.3-61.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Mobile, AL
Lat.: 30.6541°, Long.: -88.1296°, Elev.: 40 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**7.42** (6.07-9.04)	**8.42** (6.89-10.3)	**10.1** (8.23-12.3)	**11.5** (9.32-14.1)	**13.5** (10.5-16.9)	**15.0** (11.5-19.1)	**16.5** (12.2-21.4)	**18.1** (12.8-24.0)	**20.2** (13.8-27.4)	**21.9** (14.5-30.0)
10-min	**5.43** (4.45-6.61)	**6.17** (5.05-7.52)	**7.39** (6.03-9.03)	**8.42** (6.83-10.3)	**9.86** (7.72-12.4)	**11.0** (8.40-14.0)	**12.1** (8.95-15.7)	**13.3** (9.40-17.6)	**14.8** (10.1-20.1)	**16.0** (10.6-22.0)
15-min	**4.42** (3.62-5.38)	**5.02** (4.10-6.11)	**6.01** (4.90-7.34)	**6.85** (5.55-8.39)	**8.01** (6.28-10.1)	**8.92** (6.83-11.3)	**9.84** (7.28-12.8)	**10.8** (7.64-14.3)	**12.1** (8.21-16.3)	**13.0** (8.64-17.9)
30-min	**3.14** (2.57-3.83)	**3.60** (2.94-4.39)	**4.34** (3.54-5.31)	**4.97** (4.03-6.09)	**5.83** (4.57-7.33)	**6.50** (4.98-8.26)	**7.18** (5.31-9.30)	**7.87** (5.57-10.4)	**8.79** (5.98-11.9)	**9.49** (6.29-13.0)
60-min	**2.09** (1.71-2.55)	**2.39** (1.95-2.91)	**2.88** (2.35-3.52)	**3.30** (2.68-4.05)	**3.91** (3.07-4.93)	**4.39** (3.37-5.60)	**4.89** (3.62-6.36)	**5.41** (3.84-7.19)	**6.13** (4.18-8.32)	**6.68** (4.43-9.18)
2-hr	**1.31** (1.08-1.58)	**1.49** (1.22-1.80)	**1.79** (1.47-2.17)	**2.06** (1.68-2.51)	**2.45** (1.94-3.08)	**2.77** (2.14-3.51)	**3.10** (2.31-4.00)	**3.45** (2.46-4.56)	**3.93** (2.70-5.31)	**4.31** (2.88-5.88)
3-hr	**0.988** (0.818-1.19)	**1.12** (0.928-1.35)	**1.36** (1.12-1.64)	**1.57** (1.28-1.90)	**1.88** (1.50-2.36)	**2.14** (1.66-2.71)	**2.41** (1.81-3.11)	**2.71** (1.95-3.57)	**3.12** (2.16-4.21)	**3.45** (2.31-4.69)
6-hr	**0.598** (0.498-0.713)	**0.684** (0.570-0.816)	**0.840** (0.698-1.00)	**0.983** (0.812-1.18)	**1.20** (0.967-1.50)	**1.38** (1.08-1.74)	**1.58** (1.20-2.03)	**1.79** (1.30-2.36)	**2.10** (1.46-2.82)	**2.34** (1.58-3.16)
12-hr	**0.348** (0.293-0.412)	**0.406** (0.341-0.480)	**0.510** (0.427-0.605)	**0.606** (0.504-0.722)	**0.753** (0.612-0.937)	**0.877** (0.693-1.10)	**1.01** (0.770-1.29)	**1.16** (0.844-1.51)	**1.36** (0.957-1.82)	**1.53** (1.04-2.06)
24-hr	**0.203** (0.172-0.239)	**0.238** (0.202-0.280)	**0.303** (0.255-0.356)	**0.363** (0.304-0.429)	**0.456** (0.374-0.564)	**0.535** (0.426-0.667)	**0.621** (0.477-0.790)	**0.715** (0.526-0.929)	**0.851** (0.601-1.13)	**0.961** (0.657-1.28)
2-day	**0.118** (0.101-0.137)	**0.137** (0.117-0.160)	**0.173** (0.147-0.202)	**0.207** (0.175-0.243)	**0.261** (0.216-0.322)	**0.307** (0.247-0.381)	**0.358** (0.278-0.453)	**0.415** (0.307-0.536)	**0.496** (0.353-0.655)	**0.563** (0.387-0.746)
3-day	**0.086** (0.073-0.099)	**0.100** (0.085-0.115)	**0.125** (0.107-0.145)	**0.150** (0.127-0.174)	**0.188** (0.156-0.230)	**0.221** (0.178-0.272)	**0.257** (0.200-0.323)	**0.296** (0.221-0.381)	**0.354** (0.253-0.465)	**0.401** (0.277-0.529)
4-day	**0.069** (0.059-0.079)	**0.079** (0.068-0.092)	**0.099** (0.085-0.115)	**0.118** (0.101-0.138)	**0.148** (0.123-0.180)	**0.173** (0.140-0.213)	**0.201** (0.156-0.252)	**0.231** (0.172-0.296)	**0.275** (0.197-0.361)	**0.311** (0.215-0.409)
7-day	**0.046** (0.039-0.052)	**0.052** (0.045-0.060)	**0.064** (0.055-0.073)	**0.074** (0.064-0.086)	**0.091** (0.077-0.111)	**0.106** (0.086-0.129)	**0.122** (0.096-0.152)	**0.140** (0.105-0.178)	**0.165** (0.119-0.215)	**0.186** (0.129-0.243)
10-day	**0.036** (0.031-0.041)	**0.040** (0.035-0.046)	**0.049** (0.042-0.056)	**0.056** (0.048-0.065)	**0.068** (0.057-0.082)	**0.079** (0.064-0.095)	**0.090** (0.070-0.111)	**0.102** (0.077-0.129)	**0.119** (0.086-0.155)	**0.134** (0.093-0.174)
20-day	**0.023** (0.020-0.026)	**0.026** (0.023-0.030)	**0.031** (0.027-0.035)	**0.036** (0.031-0.041)	**0.042** (0.035-0.050)	**0.047** (0.039-0.057)	**0.053** (0.042-0.065)	**0.059** (0.044-0.074)	**0.067** (0.049-0.086)	**0.074** (0.052-0.096)
30-day	**0.019** (0.016-0.021)	**0.021** (0.018-0.024)	**0.025** (0.022-0.028)	**0.028** (0.024-0.032)	**0.033** (0.028-0.038)	**0.037** (0.030-0.043)	**0.040** (0.032-0.049)	**0.044** (0.033-0.055)	**0.050** (0.036-0.063)	**0.054** (0.038-0.070)
45-day	**0.015** (0.013-0.017)	**0.017** (0.015-0.019)	**0.020** (0.018-0.023)	**0.023** (0.020-0.026)	**0.026** (0.022-0.030)	**0.029** (0.024-0.034)	**0.031** (0.025-0.038)	**0.034** (0.026-0.042)	**0.038** (0.027-0.048)	**0.040** (0.028-0.052)
60-day	**0.013** (0.012-0.015)	**0.015** (0.013-0.017)	**0.017** (0.015-0.020)	**0.020** (0.017-0.022)	**0.022** (0.019-0.026)	**0.025** (0.020-0.029)	**0.027** (0.021-0.032)	**0.029** (0.022-0.035)	**0.031** (0.023-0.039)	**0.033** (0.023-0.042)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Mobile, AL
Lat.: 30.6541°, Long.: -88.1296°, Elev.: 40 ft

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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.529** (0.424-0.664)	**0.600** (0.480-0.754)	**0.714** (0.570-0.900)	**0.807** (0.640-1.02)	**0.931** (0.715-1.21)	**1.02** (0.771-1.36)	**1.12** (0.814-1.52)	**1.21** (0.847-1.70)	**1.33** (0.896-1.92)	**1.41** (0.934-2.09)
10-min	**0.774** (0.621-0.972)	**0.878** (0.703-1.10)	**1.04** (0.834-1.32)	**1.18** (0.938-1.50)	**1.36** (1.05-1.78)	**1.50** (1.13-1.99)	**1.64** (1.19-2.23)	**1.77** (1.24-2.48)	**1.94** (1.31-2.81)	**2.07** (1.37-3.06)
15-min	**0.944** (0.757-1.19)	**1.07** (0.858-1.35)	**1.28** (1.02-1.61)	**1.44** (1.14-1.82)	**1.66** (1.28-2.17)	**1.83** (1.38-2.43)	**2.00** (1.45-2.72)	**2.16** (1.51-3.03)	**2.37** (1.60-3.43)	**2.52** (1.67-3.73)
30-min	**1.32** (1.06-1.66)	**1.51** (1.21-1.89)	**1.81** (1.44-2.28)	**2.05** (1.63-2.60)	**2.38** (1.82-3.10)	**2.62** (1.97-3.47)	**2.86** (2.08-3.89)	**3.10** (2.17-4.34)	**3.40** (2.29-4.92)	**3.62** (2.39-5.35)
60-min	**1.72** (1.38-2.17)	**1.96** (1.57-2.46)	**2.35** (1.88-2.96)	**2.69** (2.14-3.40)	**3.17** (2.44-4.16)	**3.55** (2.68-4.73)	**3.94** (2.88-5.39)	**4.34** (3.05-6.13)	**4.89** (3.32-7.12)	**5.32** (3.51-7.87)
2-hr	**2.13** (1.72-2.66)	**2.41** (1.94-3.01)	**2.90** (2.33-3.63)	**3.33** (2.66-4.19)	**3.96** (3.08-5.19)	**4.47** (3.40-5.95)	**5.01** (3.69-6.85)	**5.59** (3.96-7.86)	**6.39** (4.36-9.26)	**7.02** (4.67-10.3)
3-hr	**2.40** (1.94-2.98)	**2.71** (2.19-3.37)	**3.27** (2.63-4.07)	**3.78** (3.03-4.74)	**4.56** (3.58-5.99)	**5.22** (3.99-6.94)	**5.92** (4.39-8.10)	**6.69** (4.77-9.42)	**7.78** (5.35-11.3)	**8.67** (5.78-12.7)
6-hr	**2.86** (2.32-3.53)	**3.26** (2.65-4.03)	**4.01** (3.24-4.96)	**4.71** (3.79-5.86)	**5.81** (4.60-7.63)	**6.75** (5.20-8.97)	**7.78** (5.81-10.6)	**8.91** (6.40-12.5)	**10.5** (7.30-15.2)	**11.9** (7.98-17.3)
12-hr	**3.33** (2.72-4.08)	**3.88** (3.16-4.76)	**4.89** (3.97-6.01)	**5.83** (4.72-7.21)	**7.30** (5.81-9.54)	**8.56** (6.64-11.3)	**9.93** (7.46-13.5)	**11.4** (8.26-16.0)	**13.6** (9.48-19.5)	**15.4** (10.4-22.2)
24-hr	**3.88** (3.18-4.72)	**4.52** (3.70-5.50)	**5.72** (4.67-6.98)	**6.85** (5.57-8.41)	**8.63** (6.92-11.2)	**10.2** (7.93-13.4)	**11.9** (8.96-16.0)	**13.7** (9.98-19.0)	**16.4** (11.5-23.4)	**18.6** (12.7-26.7)
2-day	**4.51** (3.72-5.45)	**5.15** (4.24-6.23)	**6.40** (5.25-7.76)	**7.61** (6.22-9.28)	**9.57** (7.74-12.4)	**11.3** (8.88-14.8)	**13.2** (10.1-17.7)	**15.4** (11.3-21.2)	**18.5** (13.1-26.2)	**21.1** (14.4-30.0)
3-day	**4.87** (4.03-5.86)	**5.55** (4.59-6.69)	**6.87** (5.66-8.30)	**8.16** (6.69-9.90)	**10.2** (8.28-13.2)	**12.0** (9.49-15.7)	**14.0** (10.7-18.8)	**16.3** (12.0-22.4)	**19.5** (13.9-27.6)	**22.3** (15.3-31.6)
4-day	**5.18** (4.29-6.21)	**5.88** (4.87-7.06)	**7.24** (5.98-8.72)	**8.56** (7.04-10.4)	**10.7** (8.67-13.7)	**12.5** (9.90-16.3)	**14.6** (11.2-19.4)	**16.9** (12.4-23.1)	**20.2** (14.4-28.4)	**22.9** (15.8-32.5)
7-day	**6.03** (5.02-7.19)	**6.73** (5.60-8.04)	**8.09** (6.71-9.69)	**9.42** (7.77-11.3)	**11.5** (9.41-14.7)	**13.4** (10.6-17.3)	**15.5** (11.9-20.5)	**17.8** (13.2-24.2)	**21.1** (15.1-29.6)	**23.9** (16.6-33.7)
10-day	**6.77** (5.66-8.05)	**7.50** (6.26-8.92)	**8.89** (7.39-10.6)	**10.2** (8.47-12.3)	**12.4** (10.1-15.7)	**14.2** (11.3-18.2)	**16.3** (12.6-21.4)	**18.6** (13.8-25.2)	**21.9** (15.7-30.6)	**24.7** (17.2-34.6)
20-day	**8.88** (7.45-10.5)	**9.83** (8.24-11.6)	**11.5** (9.63-13.7)	**13.1** (10.9-15.6)	**15.4** (12.5-19.2)	**17.3** (13.8-21.9)	**19.4** (15.0-25.2)	**21.7** (16.1-29.0)	**24.8** (17.9-34.2)	**27.4** (19.2-38.2)
30-day	**10.8** (9.07-12.7)	**12.0** (10.1-14.1)	**13.9** (11.7-16.5)	**15.7** (13.1-18.6)	**18.2** (14.8-22.4)	**20.2** (16.1-25.2)	**22.3** (17.2-28.6)	**24.4** (18.2-32.4)	**27.5** (19.8-37.5)	**29.8** (21.0-41.4)
45-day	**13.4** (11.3-15.7)	**14.8** (12.5-17.4)	**17.2** (14.5-20.2)	**19.1** (16.0-22.6)	**21.8** (17.7-26.6)	**23.9** (19.0-29.6)	**25.9** (20.1-33.0)	**28.0** (20.9-36.8)	**30.7** (22.2-41.6)	**32.8** (23.1-45.3)
60-day	**15.8** (13.3-18.4)	**17.4** (14.7-20.4)	**20.1** (16.9-23.5)	**22.2** (18.6-26.1)	**25.0** (20.3-30.2)	**27.0** (21.6-33.3)	**29.0** (22.5-36.7)	**31.0** (23.1-40.4)	**33.4** (24.1-45.0)	**35.1** (24.9-48.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Dothan, AL
Lat.: 31.2101°, Long.: -85.3611°, Elev.: 278 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**6.35** (5.09-7.97)	**7.20** (5.76-9.05)	**8.57** (6.84-10.8)	**9.68** (7.68-12.3)	**11.2** (8.58-14.6)	**12.3** (9.25-16.3)	**13.4** (9.77-18.3)	**14.5** (10.2-20.4)	**15.9** (10.8-23.1)	**17.0** (11.2-25.1)
10-min	**4.64** (3.73-5.83)	**5.27** (4.22-6.62)	**6.27** (5.00-7.90)	**7.09** (5.63-8.97)	**8.18** (6.28-10.7)	**9.01** (6.77-11.9)	**9.82** (7.15-13.4)	**10.6** (7.44-14.9)	**11.7** (7.88-16.9)	**12.4** (8.20-18.4)
15-min	**3.78** (3.03-4.74)	**4.28** (3.43-5.38)	**5.10** (4.07-6.42)	**5.76** (4.58-7.30)	**6.65** (5.10-8.67)	**7.32** (5.51-9.71)	**7.98** (5.81-10.9)	**8.64** (6.05-12.1)	**9.48** (6.40-13.7)	**10.1** (6.67-14.9)
30-min	**2.64** (2.12-3.31)	**3.01** (2.41-3.79)	**3.61** (2.88-4.55)	**4.10** (3.26-5.19)	**4.75** (3.64-6.19)	**5.24** (3.94-6.94)	**5.72** (4.16-7.78)	**6.19** (4.33-8.68)	**6.80** (4.59-9.83)	**7.24** (4.78-10.7)
60-min	**1.72** (1.38-2.17)	**1.96** (1.57-2.46)	**2.35** (1.88-2.96)	**2.69** (2.14-3.40)	**3.17** (2.44-4.16)	**3.55** (2.68-4.73)	**3.94** (2.88-5.39)	**4.34** (3.05-6.13)	**4.89** (3.32-7.12)	**5.32** (3.51-7.87)
2-hr	**1.06** (0.858-1.33)	**1.21** (0.971-1.50)	**1.45** (1.16-1.81)	**1.66** (1.33-2.09)	**1.98** (1.54-2.59)	**2.24** (1.70-2.97)	**2.51** (1.84-3.42)	**2.79** (1.98-3.93)	**3.19** (2.18-4.63)	**3.51** (2.33-5.16)
3-hr	**0.798** (0.645-0.991)	**0.901** (0.727-1.12)	**1.09** (0.875-1.36)	**1.26** (1.01-1.58)	**1.52** (1.19-2.00)	**1.74** (1.33-2.31)	**1.97** (1.46-2.70)	**2.23** (1.59-3.14)	**2.59** (1.78-3.76)	**2.89** (1.92-4.22)
6-hr	**0.477** (0.387-0.588)	**0.544** (0.441-0.672)	**0.669** (0.541-0.828)	**0.786** (0.633-0.979)	**0.969** (0.767-1.27)	**1.13** (0.868-1.50)	**1.30** (0.969-1.77)	**1.49** (1.07-2.09)	**1.76** (1.22-2.54)	**1.98** (1.33-2.88)
12-hr	**0.276** (0.225-0.338)	**0.321** (0.262-0.394)	**0.405** (0.329-0.498)	**0.484** (0.391-0.598)	**0.605** (0.482-0.791)	**0.710** (0.550-0.938)	**0.824** (0.618-1.12)	**0.949** (0.685-1.32)	**1.13** (0.786-1.62)	**1.28** (0.862-1.84)
24-hr	**0.161** (0.132-0.196)	**0.188** (0.154-0.229)	**0.238** (0.194-0.290)	**0.285** (0.232-0.350)	**0.359** (0.288-0.467)	**0.423** (0.330-0.556)	**0.493** (0.373-0.665)	**0.571** (0.415-0.792)	**0.683** (0.479-0.974)	**0.774** (0.527-1.11)
2-day	**0.093** (0.077-0.113)	**0.107** (0.088-0.129)	**0.133** (0.109-0.161)	**0.158** (0.129-0.193)	**0.199** (0.161-0.258)	**0.235** (0.185-0.308)	**0.275** (0.209-0.369)	**0.319** (0.234-0.441)	**0.384** (0.272-0.546)	**0.439** (0.300-0.625)
3-day	**0.067** (0.056-0.081)	**0.077** (0.063-0.092)	**0.095** (0.078-0.115)	**0.113** (0.092-0.137)	**0.141** (0.115-0.183)	**0.166** (0.131-0.217)	**0.194** (0.148-0.260)	**0.226** (0.166-0.310)	**0.271** (0.192-0.383)	**0.309** (0.212-0.439)
4-day	**0.053** (0.044-0.064)	**0.061** (0.050-0.073)	**0.075** (0.062-0.090)	**0.089** (0.073-0.107)	**0.111** (0.090-0.142)	**0.130** (0.103-0.169)	**0.151** (0.116-0.202)	**0.175** (0.129-0.240)	**0.210** (0.149-0.296)	**0.238** (0.164-0.338)
7-day	**0.035** (0.029-0.042)	**0.040** (0.033-0.047)	**0.048** (0.039-0.057)	**0.056** (0.046-0.067)	**0.068** (0.055-0.087)	**0.079** (0.063-0.102)	**0.092** (0.070-0.121)	**0.105** (0.078-0.143)	**0.125** (0.089-0.176)	**0.142** (0.098-0.200)
10-day	**0.028** (0.023-0.033)	**0.031** (0.026-0.037)	**0.037** (0.030-0.044)	**0.042** (0.035-0.051)	**0.051** (0.042-0.065)	**0.059** (0.047-0.076)	**0.067** (0.052-0.089)	**0.077** (0.057-0.104)	**0.091** (0.065-0.127)	**0.102** (0.071-0.144)
20-day	**0.018** (0.015-0.021)	**0.020** (0.017-0.024)	**0.024** (0.020-0.028)	**0.027** (0.022-0.032)	**0.032** (0.026-0.039)	**0.036** (0.028-0.045)	**0.040** (0.031-0.052)	**0.045** (0.033-0.060)	**0.051** (0.037-0.071)	**0.057** (0.040-0.079)
30-day	**0.014** (0.012-0.017)	**0.016** (0.013-0.019)	**0.019** (0.016-0.022)	**0.021** (0.018-0.025)	**0.025** (0.020-0.031)	**0.028** (0.022-0.035)	**0.030** (0.023-0.039)	**0.033** (0.025-0.044)	**0.038** (0.027-0.052)	**0.041** (0.029-0.057)
45-day	**0.012** (0.010-0.014)	**0.013** (0.011-0.016)	**0.015** (0.013-0.018)	**0.017** (0.014-0.020)	**0.020** (0.016-0.024)	**0.022** (0.017-0.027)	**0.023** (0.018-0.030)	**0.025** (0.019-0.034)	**0.028** (0.020-0.038)	**0.030** (0.021-0.041)
60-day	**0.010** (0.009-0.012)	**0.012** (0.010-0.014)	**0.013** (0.011-0.016)	**0.015** (0.012-0.018)	**0.017** (0.014-0.020)	**0.018** (0.014-0.023)	**0.020** (0.015-0.025)	**0.021** (0.016-0.028)	**0.023** (0.016-0.031)	**0.024** (0.017-0.033)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Dothan, AL
Lat.: 31.2101°, Long.: -85.3611°, Elev.: 278 ft

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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.489** (0.403-0.599)	**0.559** (0.460-0.685)	**0.671** (0.549-0.824)	**0.760** (0.619-0.940)	**0.879** (0.688-1.12)	**0.968** (0.740-1.26)	**1.05** (0.777-1.41)	**1.14** (0.803-1.57)	**1.24** (0.844-1.78)	**1.32** (0.874-1.94)
10-min	**0.717** (0.590-0.877)	**0.819** (0.673-1.00)	**0.982** (0.805-1.21)	**1.11** (0.907-1.38)	**1.29** (1.01-1.64)	**1.42** (1.08-1.84)	**1.54** (1.14-2.06)	**1.67** (1.18-2.30)	**1.82** (1.24-2.61)	**1.94** (1.28-2.84)
15-min	**0.874** (0.720-1.07)	**0.999** (0.821-1.22)	**1.20** (0.981-1.47)	**1.36** (1.11-1.68)	**1.57** (1.23-2.00)	**1.73** (1.32-2.24)	**1.88** (1.39-2.52)	**2.03** (1.43-2.81)	**2.22** (1.51-3.18)	**2.36** (1.56-3.46)
30-min	**1.32** (1.09-1.62)	**1.49** (1.23-1.83)	**1.78** (1.45-2.18)	**2.01** (1.64-2.48)	**2.34** (1.84-3.00)	**2.59** (1.99-3.38)	**2.85** (2.11-3.83)	**3.12** (2.20-4.33)	**3.47** (2.36-4.99)	**3.74** (2.47-5.48)
60-min	**1.74** (1.43-2.13)	**1.96** (1.61-2.40)	**2.34** (1.92-2.88)	**2.68** (2.18-3.31)	**3.16** (2.50-4.08)	**3.56** (2.74-4.67)	**3.97** (2.94-5.37)	**4.41** (3.13-6.15)	**5.01** (3.41-7.23)	**5.49** (3.63-8.04)
2-hr	**2.15** (1.78-2.62)	**2.43** (2.01-2.96)	**2.91** (2.40-3.56)	**3.35** (2.74-4.11)	**3.99** (3.18-5.14)	**4.52** (3.51-5.92)	**5.09** (3.80-6.86)	**5.70** (4.07-7.92)	**6.55** (4.49-9.41)	**7.24** (4.81-10.5)
3-hr	**2.39** (1.98-2.89)	**2.70** (2.24-3.28)	**3.28** (2.71-3.99)	**3.80** (3.12-4.65)	**4.60** (3.68-5.92)	**5.27** (4.11-6.89)	**6.00** (4.50-8.07)	**6.78** (4.87-9.43)	**7.90** (5.45-11.3)	**8.82** (5.88-12.8)
6-hr	**2.84** (2.37-3.42)	**3.24** (2.70-3.90)	**3.99** (3.32-4.82)	**4.71** (3.89-5.72)	**5.84** (4.73-7.54)	**6.82** (5.36-8.91)	**7.90** (5.98-10.6)	**9.09** (6.59-12.6)	**10.8** (7.52-15.5)	**12.2** (8.22-17.6)
12-hr	**3.39** (2.85-4.06)	**3.89** (3.26-4.66)	**4.86** (4.06-5.84)	**5.82** (4.84-7.03)	**7.37** (6.03-9.53)	**8.75** (6.93-11.4)	**10.3** (7.85-13.8)	**12.0** (8.76-16.6)	**14.5** (10.2-20.6)	**16.6** (11.2-23.7)
24-hr	**4.00** (3.38-4.75)	**4.62** (3.90-5.49)	**5.84** (4.91-6.97)	**7.07** (5.91-8.48)	**9.07** (7.48-11.7)	**10.9** (8.67-14.1)	**12.9** (9.89-17.2)	**15.1** (11.1-20.8)	**18.4** (13.0-26.1)	**21.2** (14.4-30.1)
2-day	**4.65** (3.95-5.49)	**5.37** (4.56-6.35)	**6.81** (5.76-8.08)	**8.26** (6.95-9.85)	**10.6** (8.83-13.6)	**12.8** (10.2-16.5)	**15.1** (11.7-20.1)	**17.8** (13.2-24.4)	**21.8** (15.5-30.6)	**25.0** (17.2-35.4)
3-day	**5.12** (4.36-6.02)	**5.84** (4.97-6.87)	**7.30** (6.20-8.62)	**8.80** (7.42-10.4)	**11.3** (9.39-14.4)	**13.5** (10.9-17.4)	**16.0** (12.4-21.2)	**18.8** (14.0-25.6)	**23.0** (16.4-32.3)	**26.5** (18.2-37.3)
4-day	**5.50** (4.70-6.45)	**6.21** (5.30-7.29)	**7.68** (6.54-9.05)	**9.19** (7.77-10.9)	**11.7** (9.77-14.9)	**13.9** (11.3-17.9)	**16.5** (12.9-21.8)	**19.4** (14.5-26.3)	**23.6** (16.9-33.1)	**27.2** (18.8-38.2)
7-day	**6.40** (5.49-7.46)	**7.17** (6.15-8.37)	**8.72** (7.46-10.2)	**10.3** (8.74-12.1)	**12.8** (10.7-16.2)	**15.1** (12.3-19.2)	**17.7** (13.8-23.1)	**20.5** (15.4-27.7)	**24.7** (17.8-34.4)	**28.3** (19.6-39.5)
10-day	**7.18** (6.18-8.34)	**8.04** (6.91-9.35)	**9.69** (8.30-11.3)	**11.3** (9.62-13.3)	**13.9** (11.6-17.3)	**16.1** (13.1-20.4)	**18.6** (14.6-24.2)	**21.4** (16.1-28.7)	**25.5** (18.4-35.2)	**28.8** (20.1-40.1)
20-day	**9.47** (8.21-10.9)	**10.6** (9.14-12.2)	**12.5** (10.8-14.5)	**14.3** (12.2-16.6)	**16.9** (14.1-20.6)	**19.1** (15.5-23.7)	**21.4** (16.8-27.3)	**23.9** (18.0-31.6)	**27.4** (19.8-37.4)	**30.3** (21.2-41.9)
30-day	**11.5** (9.96-13.2)	**12.8** (11.1-14.7)	**14.9** (12.9-17.3)	**16.8** (14.5-19.5)	**19.5** (16.3-23.6)	**21.7** (17.7-26.7)	**23.9** (18.8-30.3)	**26.3** (19.8-34.3)	**29.4** (21.3-39.8)	**31.9** (22.5-44.0)
45-day	**14.0** (12.2-16.1)	**15.6** (13.6-17.9)	**18.2** (15.8-20.9)	**20.3** (17.5-23.4)	**23.1** (19.3-27.6)	**25.3** (20.6-30.8)	**27.5** (21.6-34.4)	**29.6** (22.3-38.4)	**32.5** (23.5-43.6)	**34.6** (24.5-47.4)
60-day	**16.3** (14.2-18.6)	**18.1** (15.8-20.7)	**21.0** (18.2-24.0)	**23.3** (20.1-26.8)	**26.3** (21.9-31.2)	**28.6** (23.3-34.5)	**30.7** (24.2-38.3)	**32.8** (24.8-42.3)	**35.4** (25.7-47.3)	**37.3** (26.4-51.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Greenville, AL
Lat.: 31.7255°, Long.: -86.6575°, Elev.: 366 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.87** (4.84-7.19)	**6.71** (5.52-8.22)	**8.05** (6.59-9.89)	**9.12** (7.43-11.3)	**10.5** (8.26-13.4)	**11.6** (8.88-15.1)	**12.6** (9.32-16.9)	**13.7** (9.64-18.9)	**14.9** (10.1-21.4)	**15.9** (10.5-23.3)
10-min	**4.30** (3.54-5.26)	**4.91** (4.04-6.02)	**5.89** (4.83-7.24)	**6.68** (5.44-8.26)	**7.73** (6.05-9.84)	**8.51** (6.50-11.0)	**9.26** (6.83-12.4)	**10.0** (7.06-13.8)	**10.9** (7.41-15.7)	**11.6** (7.68-17.0)
15-min	**3.50** (2.88-4.28)	**4.00** (3.28-4.90)	**4.79** (3.92-5.89)	**5.43** (4.42-6.71)	**6.28** (4.92-8.00)	**6.92** (5.29-8.98)	**7.53** (5.55-10.1)	**8.13** (5.74-11.2)	**8.90** (6.03-12.7)	**9.45** (6.24-13.8)
30-min	**2.65** (2.18-3.24)	**2.99** (2.46-3.66)	**3.55** (2.91-4.36)	**4.02** (3.27-4.97)	**4.67** (3.68-5.99)	**5.19** (3.98-6.77)	**5.70** (4.22-7.67)	**6.23** (4.41-8.66)	**6.94** (4.71-9.97)	**7.48** (4.94-11.0)
60-min	**1.74** (1.43-2.13)	**1.96** (1.61-2.40)	**2.34** (1.92-2.88)	**2.68** (2.18-3.31)	**3.16** (2.50-4.08)	**3.56** (2.74-4.67)	**3.97** (2.94-5.37)	**4.41** (3.13-6.15)	**5.01** (3.41-7.23)	**5.49** (3.63-8.04)
2-hr	**1.08** (0.891-1.31)	**1.22** (1.00-1.48)	**1.46** (1.20-1.78)	**1.67** (1.37-2.06)	**2.00** (1.59-2.57)	**2.26** (1.75-2.96)	**2.54** (1.90-3.43)	**2.85** (2.04-3.96)	**3.28** (2.25-4.71)	**3.62** (2.41-5.27)
3-hr	**0.794** (0.660-0.962)	**0.900** (0.746-1.09)	**1.09** (0.901-1.33)	**1.26** (1.04-1.55)	**1.53** (1.23-1.97)	**1.75** (1.37-2.29)	**2.00** (1.50-2.69)	**2.26** (1.62-3.14)	**2.63** (1.81-3.78)	**2.94** (1.96-4.26)
6-hr	**0.474** (0.395-0.570)	**0.540** (0.451-0.651)	**0.666** (0.553-0.805)	**0.786** (0.649-0.955)	**0.974** (0.789-1.26)	**1.14** (0.895-1.49)	**1.32** (0.998-1.77)	**1.52** (1.10-2.10)	**1.81** (1.26-2.58)	**2.04** (1.37-2.94)
12-hr	**0.281** (0.236-0.336)	**0.322** (0.270-0.386)	**0.403** (0.337-0.484)	**0.483** (0.401-0.583)	**0.611** (0.500-0.790)	**0.725** (0.575-0.947)	**0.852** (0.651-1.14)	**0.994** (0.726-1.38)	**1.20** (0.842-1.71)	**1.38** (0.930-1.97)
24-hr	**0.166** (0.140-0.198)	**0.192** (0.162-0.228)	**0.243** (0.204-0.290)	**0.294** (0.246-0.353)	**0.377** (0.311-0.487)	**0.452** (0.361-0.588)	**0.535** (0.411-0.715)	**0.629** (0.463-0.866)	**0.767** (0.541-1.09)	**0.882** (0.600-1.25)
2-day	**0.096** (0.082-0.114)	**0.111** (0.094-0.132)	**0.141** (0.120-0.168)	**0.172** (0.144-0.205)	**0.221** (0.183-0.283)	**0.265** (0.213-0.343)	**0.315** (0.244-0.418)	**0.371** (0.274-0.507)	**0.453** (0.321-0.638)	**0.521** (0.357-0.737)
3-day	**0.071** (0.060-0.083)	**0.081** (0.069-0.095)	**0.101** (0.086-0.119)	**0.122** (0.103-0.145)	**0.156** (0.130-0.199)	**0.187** (0.151-0.241)	**0.222** (0.172-0.293)	**0.261** (0.194-0.356)	**0.319** (0.227-0.448)	**0.367** (0.253-0.517)
4-day	**0.057** (0.048-0.067)	**0.064** (0.055-0.075)	**0.080** (0.068-0.094)	**0.095** (0.080-0.113)	**0.121** (0.101-0.154)	**0.145** (0.117-0.186)	**0.171** (0.133-0.226)	**0.201** (0.150-0.274)	**0.246** (0.176-0.344)	**0.283** (0.195-0.397)
7-day	**0.038** (0.032-0.044)	**0.042** (0.036-0.049)	**0.051** (0.044-0.060)	**0.061** (0.052-0.072)	**0.076** (0.063-0.096)	**0.089** (0.072-0.114)	**0.105** (0.082-0.137)	**0.122** (0.091-0.164)	**0.147** (0.105-0.204)	**0.168** (0.116-0.234)
10-day	**0.029** (0.025-0.034)	**0.033** (0.028-0.038)	**0.040** (0.034-0.047)	**0.047** (0.040-0.055)	**0.057** (0.048-0.072)	**0.067** (0.054-0.084)	**0.077** (0.060-0.100)	**0.089** (0.066-0.119)	**0.106** (0.076-0.146)	**0.120** (0.083-0.167)
20-day	**0.019** (0.017-0.022)	**0.022** (0.019-0.025)	**0.026** (0.022-0.030)	**0.029** (0.025-0.034)	**0.035** (0.029-0.042)	**0.039** (0.032-0.049)	**0.044** (0.034-0.056)	**0.049** (0.037-0.065)	**0.057** (0.041-0.077)	**0.063** (0.044-0.087)
30-day	**0.015** (0.013-0.018)	**0.017** (0.015-0.020)	**0.020** (0.017-0.023)	**0.023** (0.020-0.027)	**0.027** (0.022-0.032)	**0.030** (0.024-0.037)	**0.033** (0.026-0.042)	**0.036** (0.027-0.047)	**0.040** (0.029-0.055)	**0.044** (0.031-0.061)
45-day	**0.012** (0.011-0.014)	**0.014** (0.012-0.016)	**0.016** (0.014-0.019)	**0.018** (0.016-0.021)	**0.021** (0.017-0.025)	**0.023** (0.019-0.028)	**0.025** (0.020-0.031)	**0.027** (0.020-0.035)	**0.030** (0.021-0.040)	**0.032** (0.022-0.043)
60-day	**0.011** (0.009-0.012)	**0.012** (0.010-0.014)	**0.014** (0.012-0.016)	**0.016** (0.013-0.018)	**0.018** (0.015-0.021)	**0.019** (0.016-0.023)	**0.021** (0.016-0.026)	**0.022** (0.017-0.029)	**0.024** (0.017-0.032)	**0.025** (0.018-0.035)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Greenville, AL
Lat.: 31.7255°, Long.: -86.6575°, Elev.: 366 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.423** (0.366-0.495)	**0.491** (0.424-0.574)	**0.598** (0.514-0.701)	**0.684** (0.584-0.806)	**0.798** (0.653-0.964)	**0.882** (0.704-1.08)	**0.964** (0.739-1.22)	**1.04** (0.763-1.35)	**1.15** (0.800-1.53)	**1.22** (0.829-1.66)
10-min	**0.620** (0.536-0.725)	**0.719** (0.621-0.841)	**0.875** (0.753-1.03)	**1.00** (0.856-1.18)	**1.17** (0.955-1.41)	**1.29** (1.03-1.59)	**1.41** (1.08-1.78)	**1.53** (1.12-1.98)	**1.68** (1.17-2.24)	**1.78** (1.21-2.43)
15-min	**0.756** (0.654-0.884)	**0.876** (0.757-1.03)	**1.07** (0.918-1.25)	**1.22** (1.04-1.44)	**1.42** (1.16-1.72)	**1.58** (1.26-1.94)	**1.72** (1.32-2.17)	**1.86** (1.36-2.42)	**2.05** (1.43-2.73)	**2.18** (1.48-2.97)
30-min	**1.12** (0.965-1.30)	**1.30** (1.12-1.52)	**1.59** (1.37-1.86)	**1.82** (1.55-2.14)	**2.12** (1.73-2.55)	**2.34** (1.86-2.86)	**2.55** (1.95-3.20)	**2.75** (2.00-3.56)	**3.00** (2.09-4.00)	**3.18** (2.16-4.33)
60-min	**1.48** (1.28-1.72)	**1.71** (1.48-2.00)	**2.09** (1.80-2.45)	**2.40** (2.05-2.82)	**2.80** (2.29-3.39)	**3.11** (2.48-3.82)	**3.40** (2.61-4.29)	**3.69** (2.70-4.79)	**4.06** (2.84-5.43)	**4.34** (2.95-5.91)
2-hr	**1.83** (1.60-2.13)	**2.12** (1.85-2.47)	**2.59** (2.24-3.02)	**2.98** (2.56-3.48)	**3.49** (2.88-4.20)	**3.88** (3.12-4.74)	**4.26** (3.29-5.34)	**4.64** (3.41-5.98)	**5.13** (3.61-6.81)	**5.49** (3.76-7.44)
3-hr	**2.06** (1.80-2.38)	**2.38** (2.07-2.75)	**2.90** (2.52-3.36)	**3.33** (2.87-3.89)	**3.93** (3.26-4.73)	**4.40** (3.55-5.38)	**4.87** (3.78-6.10)	**5.35** (3.96-6.89)	**5.98** (4.23-7.94)	**6.47** (4.44-8.73)
6-hr	**2.50** (2.20-2.88)	**2.86** (2.51-3.30)	**3.49** (3.05-4.02)	**4.04** (3.50-4.67)	**4.83** (4.05-5.82)	**5.47** (4.46-6.68)	**6.15** (4.81-7.69)	**6.86** (5.12-8.83)	**7.84** (5.60-10.4)	**8.63** (5.96-11.6)
12-hr	**3.02** (2.67-3.45)	**3.45** (3.04-3.94)	**4.20** (3.69-4.81)	**4.89** (4.27-5.63)	**5.94** (5.03-7.16)	**6.82** (5.61-8.31)	**7.76** (6.13-9.70)	**8.79** (6.62-11.3)	**10.3** (7.38-13.5)	**11.4** (7.96-15.2)
24-hr	**3.59** (3.19-4.07)	**4.09** (3.63-4.64)	**5.01** (4.42-5.70)	**5.87** (5.15-6.71)	**7.19** (6.14-8.65)	**8.32** (6.90-10.1)	**9.56** (7.60-11.9)	**10.9** (8.27-13.9)	**12.8** (9.32-16.9)	**14.4** (10.1-19.1)
2-day	**4.16** (3.72-4.69)	**4.75** (4.24-5.36)	**5.84** (5.19-6.60)	**6.85** (6.05-7.78)	**8.41** (7.23-10.0)	**9.75** (8.12-11.8)	**11.2** (8.97-13.8)	**12.8** (9.76-16.2)	**15.1** (11.0-19.7)	**16.9** (11.9-22.2)
3-day	**4.53** (4.05-5.08)	**5.14** (4.60-5.77)	**6.27** (5.59-7.06)	**7.32** (6.48-8.28)	**8.95** (7.72-10.6)	**10.3** (8.65-12.4)	**11.9** (9.53-14.6)	**13.5** (10.4-17.1)	**15.9** (11.7-20.7)	**17.8** (12.6-23.4)
4-day	**4.87** (4.37-5.44)	**5.48** (4.91-6.13)	**6.60** (5.90-7.40)	**7.65** (6.79-8.63)	**9.29** (8.03-11.0)	**10.7** (8.97-12.8)	**12.2** (9.85-15.0)	**13.9** (10.7-17.5)	**16.3** (12.0-21.1)	**18.3** (13.0-23.9)
7-day	**5.87** (5.29-6.52)	**6.43** (5.80-7.16)	**7.50** (6.73-8.36)	**8.50** (7.58-9.53)	**10.1** (8.77-11.9)	**11.5** (9.66-13.6)	**13.0** (10.5-15.8)	**14.6** (11.3-18.3)	**17.0** (12.6-21.9)	**19.0** (13.6-24.7)
10-day	**6.72** (6.08-7.44)	**7.30** (6.60-8.09)	**8.38** (7.54-9.31)	**9.39** (8.40-10.5)	**11.0** (9.56-12.8)	**12.3** (10.4-14.6)	**13.8** (11.2-16.8)	**15.5** (12.0-19.3)	**17.8** (13.2-22.9)	**19.8** (14.2-25.6)
20-day	**8.94** (8.13-9.83)	**9.76** (8.87-10.7)	**11.2** (10.1-12.3)	**12.4** (11.2-13.8)	**14.2** (12.4-16.4)	**15.7** (13.3-18.3)	**17.3** (14.1-20.7)	**18.9** (14.7-23.3)	**21.2** (15.8-26.9)	**23.1** (16.6-29.6)
30-day	**10.9** (9.92-11.9)	**11.9** (10.9-13.1)	**13.7** (12.4-15.1)	**15.2** (13.7-16.8)	**17.3** (15.0-19.7)	**18.9** (16.0-21.8)	**20.5** (16.7-24.3)	**22.2** (17.3-27.1)	**24.4** (18.2-30.7)	**26.2** (18.9-33.5)
45-day	**13.5** (12.3-14.7)	**14.9** (13.6-16.2)	**17.1** (15.6-18.7)	**18.8** (17.1-20.7)	**21.2** (18.5-23.9)	**23.0** (19.5-26.4)	**24.7** (20.2-29.1)	**26.4** (20.6-32.0)	**28.6** (21.4-35.7)	**30.2** (21.9-38.5)
60-day	**15.9** (14.6-17.2)	**17.5** (16.0-19.0)	**20.0** (18.3-21.8)	**22.0** (20.0-24.2)	**24.6** (21.5-27.6)	**26.5** (22.6-30.3)	**28.3** (23.2-33.2)	**30.0** (23.5-36.2)	**32.1** (24.1-39.9)	**33.6** (24.5-42.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Tuscaloosa, AL
Lat.: 33.1809°, Long.: -87.5473°, Elev.: 193 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.08** (4.39-5.94)	**5.89** (5.09-6.89)	**7.18** (6.17-8.41)	**8.21** (7.01-9.67)	**9.58** (7.84-11.6)	**10.6** (8.45-13.0)	**11.6** (8.87-14.6)	**12.5** (9.16-16.2)	**13.8** (9.60-18.3)	**14.6** (9.95-19.9)
10-min	**3.72** (3.22-4.35)	**4.31** (3.73-5.05)	**5.25** (4.52-6.16)	**6.01** (5.14-7.08)	**7.01** (5.73-8.47)	**7.75** (6.19-9.52)	**8.47** (6.50-10.7)	**9.17** (6.70-11.9)	**10.1** (7.03-13.4)	**10.7** (7.28-14.6)
15-min	**3.02** (2.62-3.54)	**3.50** (3.03-4.10)	**4.27** (3.67-5.01)	**4.88** (4.18-5.76)	**5.70** (4.66-6.89)	**6.30** (5.03-7.74)	**6.89** (5.28-8.68)	**7.46** (5.45-9.67)	**8.18** (5.72-10.9)	**8.70** (5.92-11.9)
30-min	**2.23** (1.93-2.61)	**2.60** (2.24-3.04)	**3.17** (2.73-3.72)	**3.63** (3.11-4.28)	**4.23** (3.46-5.11)	**4.67** (3.72-5.73)	**5.09** (3.90-6.41)	**5.50** (4.01-7.11)	**6.00** (4.19-7.99)	**6.35** (4.32-8.66)
60-min	**1.48** (1.28-1.72)	**1.71** (1.48-2.00)	**2.09** (1.80-2.45)	**2.40** (2.05-2.82)	**2.80** (2.29-3.39)	**3.11** (2.48-3.82)	**3.40** (2.61-4.29)	**3.69** (2.70-4.79)	**4.06** (2.84-5.43)	**4.34** (2.95-5.91)
2-hr	**0.917** (0.797-1.06)	**1.06** (0.923-1.24)	**1.30** (1.12-1.51)	**1.49** (1.28-1.74)	**1.74** (1.44-2.10)	**1.94** (1.56-2.37)	**2.13** (1.64-2.67)	**2.32** (1.71-2.99)	**2.56** (1.80-3.41)	**2.75** (1.88-3.72)
3-hr	**0.686** (0.598-0.793)	**0.791** (0.689-0.916)	**0.965** (0.837-1.12)	**1.11** (0.957-1.29)	**1.31** (1.08-1.58)	**1.46** (1.18-1.79)	**1.62** (1.26-2.03)	**1.78** (1.32-2.30)	**1.99** (1.41-2.64)	**2.15** (1.48-2.91)
6-hr	**0.417** (0.366-0.480)	**0.478** (0.419-0.550)	**0.582** (0.508-0.672)	**0.673** (0.584-0.780)	**0.806** (0.675-0.971)	**0.913** (0.744-1.12)	**1.03** (0.803-1.28)	**1.14** (0.854-1.47)	**1.31** (0.935-1.73)	**1.44** (0.995-1.93)
12-hr	**0.251** (0.221-0.286)	**0.286** (0.252-0.326)	**0.348** (0.306-0.399)	**0.405** (0.354-0.467)	**0.492** (0.417-0.594)	**0.565** (0.465-0.689)	**0.644** (0.509-0.805)	**0.729** (0.549-0.937)	**0.850** (0.612-1.12)	**0.949** (0.660-1.26)
24-hr	**0.149** (0.132-0.169)	**0.170** (0.151-0.193)	**0.208** (0.184-0.237)	**0.244** (0.214-0.279)	**0.299** (0.256-0.360)	**0.346** (0.287-0.421)	**0.398** (0.316-0.495)	**0.454** (0.344-0.581)	**0.535** (0.388-0.702)	**0.601** (0.420-0.795)
2-day	**0.086** (0.077-0.097)	**0.099** (0.088-0.111)	**0.121** (0.108-0.137)	**0.142** (0.125-0.162)	**0.175** (0.150-0.209)	**0.203** (0.169-0.244)	**0.233** (0.186-0.288)	**0.266** (0.203-0.338)	**0.313** (0.229-0.409)	**0.352** (0.248-0.463)
3-day	**0.062** (0.056-0.070)	**0.071** (0.063-0.080)	**0.087** (0.077-0.097)	**0.101** (0.090-0.114)	**0.124** (0.107-0.147)	**0.143** (0.120-0.172)	**0.164** (0.132-0.202)	**0.187** (0.143-0.237)	**0.220** (0.161-0.287)	**0.247** (0.175-0.324)
4-day	**0.050** (0.045-0.056)	**0.057** (0.051-0.063)	**0.068** (0.061-0.077)	**0.079** (0.070-0.089)	**0.096** (0.083-0.114)	**0.111** (0.093-0.133)	**0.127** (0.102-0.156)	**0.144** (0.111-0.182)	**0.169** (0.124-0.220)	**0.190** (0.135-0.248)
7-day	**0.034** (0.031-0.038)	**0.038** (0.034-0.042)	**0.044** (0.040-0.049)	**0.050** (0.045-0.056)	**0.060** (0.052-0.070)	**0.068** (0.057-0.081)	**0.077** (0.062-0.094)	**0.087** (0.067-0.109)	**0.101** (0.074-0.130)	**0.113** (0.080-0.146)
10-day	**0.028** (0.025-0.031)	**0.030** (0.027-0.033)	**0.034** (0.031-0.038)	**0.039** (0.035-0.043)	**0.045** (0.039-0.053)	**0.051** (0.043-0.060)	**0.057** (0.046-0.069)	**0.064** (0.049-0.080)	**0.074** (0.055-0.095)	**0.082** (0.059-0.106)
20-day	**0.018** (0.016-0.020)	**0.020** (0.018-0.022)	**0.023** (0.021-0.025)	**0.025** (0.023-0.028)	**0.029** (0.025-0.034)	**0.032** (0.027-0.038)	**0.035** (0.029-0.043)	**0.039** (0.030-0.048)	**0.044** (0.032-0.056)	**0.048** (0.034-0.061)
30-day	**0.015** (0.013-0.016)	**0.016** (0.015-0.018)	**0.019** (0.017-0.020)	**0.021** (0.019-0.023)	**0.023** (0.020-0.027)	**0.026** (0.022-0.030)	**0.028** (0.023-0.033)	**0.030** (0.023-0.037)	**0.033** (0.025-0.042)	**0.036** (0.026-0.046)
45-day	**0.012** (0.011-0.013)	**0.013** (0.012-0.015)	**0.015** (0.014-0.017)	**0.017** (0.015-0.019)	**0.019** (0.017-0.022)	**0.021** (0.018-0.024)	**0.022** (0.018-0.026)	**0.024** (0.019-0.029)	**0.026** (0.019-0.033)	**0.027** (0.020-0.035)
60-day	**0.011** (0.010-0.011)	**0.012** (0.011-0.013)	**0.013** (0.012-0.015)	**0.015** (0.013-0.016)	**0.017** (0.014-0.019)	**0.018** (0.015-0.021)	**0.019** (0.016-0.023)	**0.020** (0.016-0.025)	**0.022** (0.016-0.027)	**0.023** (0.017-0.029)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Tuscaloosa, AL
Lat.: 33.1809°, Long.: -87.5473°, Elev.: 193 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.432** (0.352-0.531)	**0.493** (0.402-0.608)	**0.597** (0.485-0.737)	**0.685** (0.553-0.850)	**0.810** (0.631-1.04)	**0.910** (0.689-1.18)	**1.01** (0.737-1.34)	**1.12** (0.777-1.52)	**1.26** (0.839-1.77)	**1.37** (0.887-1.95)
10-min	**0.632** (0.516-0.778)	**0.722** (0.589-0.890)	**0.874** (0.710-1.08)	**1.00** (0.810-1.24)	**1.19** (0.923-1.52)	**1.33** (1.01-1.73)	**1.48** (1.08-1.97)	**1.64** (1.14-2.23)	**1.85** (1.23-2.59)	**2.01** (1.30-2.86)
15-min	**0.771** (0.629-0.949)	**0.881** (0.718-1.08)	**1.07** (0.866-1.32)	**1.22** (0.987-1.52)	**1.45** (1.13-1.85)	**1.62** (1.23-2.11)	**1.81** (1.32-2.40)	**2.00** (1.39-2.72)	**2.25** (1.50-3.15)	**2.45** (1.58-3.48)
30-min	**1.14** (0.928-1.40)	**1.30** (1.06-1.60)	**1.58** (1.28-1.95)	**1.81** (1.46-2.25)	**2.14** (1.67-2.75)	**2.41** (1.83-3.13)	**2.69** (1.96-3.57)	**2.97** (2.07-4.05)	**3.36** (2.24-4.71)	**3.66** (2.36-5.20)
60-min	**1.49** (1.22-1.84)	**1.71** (1.39-2.10)	**2.07** (1.68-2.56)	**2.38** (1.92-2.96)	**2.83** (2.21-3.64)	**3.19** (2.42-4.15)	**3.56** (2.60-4.74)	**3.95** (2.75-5.40)	**4.48** (2.98-6.28)	**4.90** (3.16-6.96)
2-hr	**1.85** (1.52-2.26)	**2.12** (1.74-2.58)	**2.57** (2.10-3.14)	**2.96** (2.41-3.64)	**3.52** (2.77-4.48)	**3.97** (3.04-5.12)	**4.44** (3.26-5.86)	**4.93** (3.46-6.68)	**5.61** (3.76-7.80)	**6.14** (4.00-8.65)
3-hr	**2.07** (1.71-2.52)	**2.36** (1.95-2.87)	**2.87** (2.36-3.49)	**3.31** (2.70-4.04)	**3.95** (3.12-5.01)	**4.47** (3.44-5.74)	**5.01** (3.71-6.59)	**5.59** (3.94-7.55)	**6.38** (4.31-8.86)	**7.02** (4.59-9.85)
6-hr	**2.52** (2.10-3.03)	**2.85** (2.37-3.43)	**3.44** (2.86-4.15)	**3.98** (3.28-4.82)	**4.78** (3.82-6.04)	**5.45** (4.24-6.97)	**6.17** (4.61-8.08)	**6.94** (4.95-9.33)	**8.04** (5.48-11.1)	**8.92** (5.89-12.4)
12-hr	**3.06** (2.57-3.65)	**3.44** (2.89-4.10)	**4.14** (3.46-4.94)	**4.79** (3.98-5.75)	**5.81** (4.71-7.32)	**6.68** (5.25-8.51)	**7.64** (5.77-9.96)	**8.69** (6.26-11.6)	**10.2** (7.03-14.0)	**11.4** (7.62-15.8)
24-hr	**3.63** (3.08-4.28)	**4.11** (3.48-4.85)	**5.00** (4.22-5.92)	**5.84** (4.90-6.95)	**7.15** (5.84-8.94)	**8.27** (6.56-10.4)	**9.50** (7.24-12.3)	**10.8** (7.88-14.4)	**12.8** (8.90-17.4)	**14.4** (9.66-19.7)
2-day	**4.18** (3.58-4.89)	**4.83** (4.12-5.65)	**6.00** (5.10-7.03)	**7.07** (5.97-8.33)	**8.69** (7.15-10.8)	**10.1** (8.04-12.6)	**11.6** (8.87-14.8)	**13.2** (9.64-17.3)	**15.5** (10.8-20.9)	**17.3** (11.7-23.6)
3-day	**4.59** (3.94-5.33)	**5.27** (4.52-6.13)	**6.50** (5.56-7.59)	**7.64** (6.49-8.96)	**9.38** (7.76-11.5)	**10.9** (8.72-13.5)	**12.5** (9.61-15.9)	**14.2** (10.5-18.6)	**16.7** (11.8-22.4)	**18.7** (12.7-25.3)
4-day	**4.97** (4.28-5.75)	**5.64** (4.86-6.54)	**6.88** (5.90-7.99)	**8.03** (6.84-9.37)	**9.80** (8.14-12.0)	**11.3** (9.11-14.0)	**12.9** (10.0-16.4)	**14.7** (10.9-19.2)	**17.3** (12.2-23.2)	**19.4** (13.3-26.2)
7-day	**6.02** (5.23-6.91)	**6.66** (5.78-7.66)	**7.86** (6.79-9.06)	**8.98** (7.71-10.4)	**10.7** (8.96-13.0)	**12.2** (9.92-15.0)	**13.8** (10.8-17.4)	**15.6** (11.6-20.2)	**18.2** (13.0-24.2)	**20.3** (14.0-27.2)
10-day	**6.90** (6.02-7.88)	**7.57** (6.59-8.66)	**8.79** (7.63-10.1)	**9.92** (8.56-11.4)	**11.7** (9.78-14.1)	**13.1** (10.7-16.0)	**14.7** (11.6-18.4)	**16.5** (12.3-21.2)	**19.0** (13.6-25.1)	**21.0** (14.5-28.1)
20-day	**9.18** (8.08-10.4)	**10.1** (8.88-11.4)	**11.7** (10.2-13.3)	**13.0** (11.3-14.9)	**15.0** (12.6-17.7)	**16.5** (13.5-19.8)	**18.1** (14.3-22.3)	**19.8** (14.9-25.1)	**22.1** (15.9-28.8)	**23.9** (16.7-31.7)
30-day	**11.1** (9.86-12.5)	**12.3** (10.9-13.9)	**14.2** (12.5-16.0)	**15.8** (13.8-17.9)	**17.9** (15.1-20.9)	**19.5** (16.1-23.2)	**21.2** (16.7-25.8)	**22.8** (17.2-28.6)	**25.0** (18.0-32.3)	**26.6** (18.6-35.0)
45-day	**13.8** (12.3-15.4)	**15.2** (13.5-17.1)	**17.5** (15.5-19.6)	**19.3** (17.0-21.8)	**21.6** (18.3-25.0)	**23.4** (19.3-27.5)	**25.0** (19.9-30.2)	**26.6** (20.2-33.1)	**28.6** (20.8-36.7)	**30.0** (21.2-39.4)
60-day	**16.2** (14.5-18.1)	**17.8** (15.9-19.9)	**20.3** (18.1-22.7)	**22.3** (19.7-25.0)	**24.8** (21.0-28.5)	**26.6** (22.0-31.1)	**28.3** (22.5-34.0)	**29.8** (22.7-36.9)	**31.7** (23.1-40.5)	**33.0** (23.4-43.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Birmingham, AL
Lat.: 33.5113°, Long.: -86.7893°, Elev.: 635 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.18** (4.22-6.37)	**5.92** (4.82-7.30)	**7.16** (5.82-8.84)	**8.22** (6.64-10.2)	**9.72** (7.57-12.5)	**10.9** (8.27-14.2)	**12.1** (8.84-16.1)	**13.4** (9.32-18.3)	**15.1** (10.1-21.2)	**16.5** (10.6-23.4)
10-min	**3.79** (3.10-4.67)	**4.33** (3.53-5.34)	**5.24** (4.26-6.48)	**6.02** (4.86-7.46)	**7.12** (5.54-9.12)	**7.99** (6.05-10.4)	**8.89** (6.47-11.8)	**9.82** (6.82-13.4)	**11.1** (7.37-15.5)	**12.1** (7.79-17.1)
15-min	**3.08** (2.52-3.80)	**3.52** (2.87-4.34)	**4.26** (3.46-5.27)	**4.89** (3.95-6.07)	**5.79** (4.50-7.42)	**6.50** (4.92-8.44)	**7.22** (5.26-9.60)	**7.98** (5.55-10.9)	**9.01** (6.00-12.6)	**9.80** (6.33-13.9)
30-min	**2.27** (1.86-2.80)	**2.60** (2.12-3.20)	**3.15** (2.56-3.89)	**3.62** (2.92-4.49)	**4.29** (3.34-5.50)	**4.82** (3.66-6.26)	**5.37** (3.92-7.14)	**5.94** (4.13-8.11)	**6.72** (4.47-9.42)	**7.33** (4.73-10.4)
60-min	**1.49** (1.22-1.84)	**1.71** (1.39-2.10)	**2.07** (1.68-2.56)	**2.38** (1.92-2.96)	**2.83** (2.21-3.64)	**3.19** (2.42-4.15)	**3.56** (2.60-4.74)	**3.95** (2.75-5.40)	**4.48** (2.98-6.28)	**4.90** (3.16-6.96)
2-hr	**0.925** (0.761-1.13)	**1.06** (0.869-1.29)	**1.28** (1.05-1.57)	**1.48** (1.20-1.82)	**1.76** (1.38-2.24)	**1.99** (1.52-2.56)	**2.22** (1.63-2.93)	**2.46** (1.73-3.34)	**2.80** (1.88-3.90)	**3.07** (2.00-4.32)
3-hr	**0.690** (0.570-0.837)	**0.787** (0.650-0.956)	**0.954** (0.785-1.16)	**1.10** (0.900-1.35)	**1.31** (1.04-1.67)	**1.49** (1.14-1.91)	**1.67** (1.23-2.20)	**1.86** (1.31-2.51)	**2.13** (1.44-2.95)	**2.34** (1.53-3.28)
6-hr	**0.420** (0.350-0.505)	**0.476** (0.396-0.572)	**0.574** (0.476-0.693)	**0.663** (0.547-0.804)	**0.798** (0.638-1.01)	**0.910** (0.707-1.16)	**1.03** (0.769-1.35)	**1.16** (0.826-1.56)	**1.34** (0.915-1.85)	**1.49** (0.983-2.07)
12-hr	**0.254** (0.213-0.302)	**0.285** (0.239-0.340)	**0.343** (0.287-0.410)	**0.397** (0.330-0.477)	**0.482** (0.390-0.607)	**0.554** (0.436-0.706)	**0.633** (0.478-0.826)	**0.721** (0.519-0.965)	**0.846** (0.583-1.16)	**0.949** (0.632-1.31)
24-hr	**0.151** (0.128-0.178)	**0.171** (0.145-0.202)	**0.208** (0.175-0.246)	**0.243** (0.204-0.289)	**0.297** (0.243-0.372)	**0.344** (0.273-0.435)	**0.395** (0.301-0.512)	**0.451** (0.328-0.600)	**0.532** (0.370-0.726)	**0.599** (0.402-0.822)
2-day	**0.087** (0.074-0.101)	**0.100** (0.085-0.117)	**0.124** (0.106-0.146)	**0.147** (0.124-0.173)	**0.181** (0.148-0.223)	**0.209** (0.167-0.262)	**0.240** (0.184-0.308)	**0.274** (0.200-0.360)	**0.322** (0.225-0.435)	**0.361** (0.244-0.491)
3-day	**0.063** (0.054-0.074)	**0.073** (0.062-0.085)	**0.090** (0.077-0.105)	**0.106** (0.090-0.124)	**0.130** (0.107-0.160)	**0.150** (0.121-0.187)	**0.172** (0.133-0.220)	**0.197** (0.145-0.258)	**0.231** (0.163-0.311)	**0.259** (0.176-0.351)
4-day	**0.051** (0.044-0.059)	**0.058** (0.050-0.068)	**0.071** (0.061-0.083)	**0.083** (0.071-0.097)	**0.102** (0.084-0.125)	**0.117** (0.094-0.145)	**0.134** (0.104-0.171)	**0.153** (0.113-0.200)	**0.180** (0.127-0.241)	**0.202** (0.138-0.272)
7-day	**0.035** (0.031-0.041)	**0.039** (0.034-0.045)	**0.046** (0.040-0.053)	**0.053** (0.045-0.061)	**0.063** (0.053-0.077)	**0.072** (0.059-0.089)	**0.082** (0.064-0.103)	**0.092** (0.069-0.120)	**0.108** (0.077-0.144)	**0.120** (0.083-0.162)
10-day	**0.028** (0.025-0.032)	**0.031** (0.027-0.036)	**0.036** (0.031-0.042)	**0.041** (0.035-0.047)	**0.048** (0.040-0.058)	**0.054** (0.044-0.066)	**0.061** (0.048-0.076)	**0.068** (0.051-0.088)	**0.079** (0.056-0.104)	**0.087** (0.060-0.117)
20-day	**0.019** (0.016-0.021)	**0.021** (0.018-0.023)	**0.024** (0.021-0.027)	**0.027** (0.023-0.030)	**0.031** (0.026-0.036)	**0.034** (0.028-0.041)	**0.037** (0.029-0.046)	**0.041** (0.031-0.052)	**0.046** (0.033-0.060)	**0.049** (0.034-0.065)
30-day	**0.015** (0.013-0.017)	**0.017** (0.015-0.019)	**0.019** (0.017-0.022)	**0.021** (0.019-0.024)	**0.024** (0.020-0.029)	**0.027** (0.022-0.032)	**0.029** (0.023-0.035)	**0.031** (0.023-0.039)	**0.034** (0.025-0.044)	**0.036** (0.025-0.048)
45-day	**0.012** (0.011-0.014)	**0.014** (0.012-0.015)	**0.016** (0.014-0.018)	**0.017** (0.015-0.020)	**0.020** (0.016-0.023)	**0.021** (0.017-0.025)	**0.023** (0.018-0.027)	**0.024** (0.018-0.030)	**0.026** (0.019-0.034)	**0.027** (0.019-0.036)
60-day	**0.011** (0.010-0.012)	**0.012** (0.011-0.013)	**0.014** (0.012-0.015)	**0.015** (0.013-0.017)	**0.017** (0.014-0.019)	**0.018** (0.015-0.021)	**0.019** (0.015-0.023)	**0.020** (0.015-0.025)	**0.022** (0.016-0.028)	**0.022** (0.016-0.029)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Birmingham, AL
Lat.: 33.5113°, Long.: -86.7893°, Elev.: 635 ft

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PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.399** (0.322-0.500)	**0.467** (0.376-0.585)	**0.582** (0.467-0.732)	**0.682** (0.544-0.861)	**0.826** (0.636-1.09)	**0.943** (0.706-1.26)	**1.06** (0.765-1.45)	**1.19** (0.816-1.67)	**1.36** (0.895-1.98)	**1.50** (0.955-2.20)
10-min	**0.585** (0.472-0.732)	**0.684** (0.551-0.857)	**0.853** (0.685-1.07)	**0.999** (0.797-1.26)	**1.21** (0.931-1.59)	**1.38** (1.03-1.84)	**1.56** (1.12-2.13)	**1.74** (1.20-2.45)	**2.00** (1.31-2.89)	**2.20** (1.40-3.23)
15-min	**0.713** (0.575-0.893)	**0.834** (0.672-1.04)	**1.04** (0.835-1.31)	**1.22** (0.972-1.54)	**1.48** (1.14-1.94)	**1.68** (1.26-2.24)	**1.90** (1.37-2.60)	**2.12** (1.46-2.99)	**2.44** (1.60-3.53)	**2.68** (1.70-3.94)
30-min	**1.03** (0.832-1.29)	**1.20** (0.968-1.50)	**1.49** (1.20-1.88)	**1.75** (1.39-2.20)	**2.12** (1.63-2.78)	**2.42** (1.81-3.22)	**2.73** (1.96-3.73)	**3.06** (2.10-4.30)	**3.52** (2.31-5.09)	**3.88** (2.46-5.69)
60-min	**1.39** (1.12-1.74)	**1.60** (1.29-2.01)	**1.97** (1.58-2.48)	**2.29** (1.83-2.89)	**2.75** (2.12-3.62)	**3.12** (2.34-4.16)	**3.51** (2.53-4.80)	**3.92** (2.69-5.52)	**4.49** (2.95-6.50)	**4.94** (3.14-7.25)
2-hr	**1.75** (1.42-2.17)	**2.01** (1.63-2.50)	**2.45** (1.98-3.05)	**2.83** (2.28-3.54)	**3.39** (2.63-4.40)	**3.84** (2.90-5.05)	**4.30** (3.13-5.82)	**4.79** (3.32-6.66)	**5.47** (3.63-7.83)	**6.00** (3.86-8.71)
3-hr	**2.00** (1.64-2.47)	**2.29** (1.87-2.83)	**2.78** (2.26-3.44)	**3.20** (2.58-3.97)	**3.80** (2.97-4.90)	**4.28** (3.26-5.61)	**4.79** (3.50-6.43)	**5.31** (3.71-7.34)	**6.04** (4.03-8.58)	**6.61** (4.28-9.52)
6-hr	**2.46** (2.03-3.00)	**2.81** (2.31-3.43)	**3.40** (2.79-4.16)	**3.90** (3.18-4.81)	**4.63** (3.64-5.90)	**5.20** (3.99-6.73)	**5.80** (4.28-7.69)	**6.42** (4.52-8.75)	**7.26** (4.91-10.2)	**7.92** (5.20-11.3)
12-hr	**2.93** (2.44-3.54)	**3.37** (2.80-4.08)	**4.11** (3.40-4.99)	**4.74** (3.90-5.78)	**5.64** (4.48-7.11)	**6.35** (4.91-8.12)	**7.08** (5.28-9.28)	**7.83** (5.58-10.6)	**8.86** (6.06-12.3)	**9.66** (6.42-13.6)
24-hr	**3.45** (2.89-4.13)	**3.98** (3.34-4.78)	**4.88** (4.07-5.86)	**5.63** (4.67-6.80)	**6.69** (5.36-8.35)	**7.53** (5.88-9.52)	**8.39** (6.32-10.9)	**9.27** (6.68-12.3)	**10.5** (7.23-14.3)	**11.4** (7.65-15.8)
2-day	**4.04** (3.42-4.79)	**4.65** (3.92-5.51)	**5.64** (4.75-6.71)	**6.48** (5.42-7.74)	**7.64** (6.17-9.42)	**8.55** (6.74-10.7)	**9.47** (7.21-12.1)	**10.4** (7.59-13.7)	**11.7** (8.17-15.8)	**12.6** (8.62-17.4)
3-day	**4.44** (3.78-5.23)	**5.06** (4.30-5.97)	**6.09** (5.15-7.20)	**6.95** (5.84-8.25)	**8.14** (6.62-9.97)	**9.08** (7.20-11.3)	**10.0** (7.68-12.7)	**11.0** (8.06-14.4)	**12.3** (8.66-16.5)	**13.3** (9.11-18.1)
4-day	**4.78** (4.08-5.61)	**5.42** (4.62-6.36)	**6.46** (5.49-7.61)	**7.34** (6.19-8.68)	**8.56** (6.98-10.4)	**9.51** (7.57-11.7)	**10.5** (8.05-13.2)	**11.4** (8.44-14.9)	**12.8** (9.04-17.0)	**13.8** (9.49-18.7)
7-day	**5.70** (4.89-6.63)	**6.38** (5.47-7.43)	**7.49** (6.41-8.75)	**8.42** (7.16-9.87)	**9.69** (7.96-11.7)	**10.7** (8.57-13.0)	**11.7** (9.05-14.6)	**12.7** (9.42-16.3)	**14.0** (10.0-18.5)	**15.0** (10.4-20.1)
10-day	**6.52** (5.62-7.54)	**7.24** (6.24-8.38)	**8.41** (7.22-9.76)	**9.37** (8.00-10.9)	**10.7** (8.82-12.8)	**11.7** (9.44-14.2)	**12.7** (9.90-15.8)	**13.7** (10.3-17.5)	**15.0** (10.8-19.7)	**16.0** (11.2-21.4)
20-day	**8.89** (7.74-10.2)	**9.71** (8.44-11.1)	**11.0** (9.56-12.7)	**12.1** (10.4-14.0)	**13.5** (11.3-16.0)	**14.6** (11.9-17.5)	**15.6** (12.3-19.2)	**16.7** (12.6-21.0)	**18.0** (13.1-23.3)	**19.0** (13.5-25.0)
30-day	**11.0** (9.60-12.5)	**11.9** (10.4-13.6)	**13.4** (11.7-15.3)	**14.6** (12.7-16.7)	**16.2** (13.5-18.9)	**17.3** (14.2-20.5)	**18.4** (14.6-22.3)	**19.4** (14.8-24.2)	**20.7** (15.2-26.5)	**21.6** (15.5-28.3)
45-day	**13.7** (12.1-15.5)	**14.9** (13.1-16.9)	**16.7** (14.6-19.0)	**18.1** (15.8-20.6)	**19.9** (16.7-23.0)	**21.1** (17.4-24.8)	**22.2** (17.7-26.8)	**23.3** (17.8-28.7)	**24.5** (18.1-31.1)	**25.3** (18.3-32.8)
60-day	**16.2** (14.3-18.2)	**17.6** (15.5-19.8)	**19.7** (17.3-22.3)	**21.3** (18.6-24.2)	**23.3** (19.6-26.8)	**24.6** (20.4-28.8)	**25.8** (20.7-30.9)	**26.8** (20.8-32.9)	**28.0** (20.9-35.2)	**28.6** (21.0-36.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

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Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in.): Huntsville, AL
Lat.: 34.7300°, Long.: -86.5476°, Elev.: 1034 ft

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.79** (3.86-6.00)	**5.60** (4.51-7.02)	**6.98** (5.60-8.78)	**8.18** (6.53-10.3)	**9.91** (7.63-13.0)	**11.3** (8.47-15.1)	**12.8** (9.18-17.4)	**14.3** (9.79-20.1)	**16.4** (10.7-23.7)	**18.0** (11.5-26.4)
10-min	**3.51** (2.83-4.39)	**4.10** (3.31-5.14)	**5.12** (4.11-6.43)	**5.99** (4.78-7.57)	**7.26** (5.59-9.54)	**8.28** (6.20-11.0)	**9.34** (6.72-12.8)	**10.5** (7.17-14.7)	**12.0** (7.86-17.4)	**13.2** (8.39-19.4)
15-min	**2.85** (2.30-3.57)	**3.34** (2.69-4.18)	**4.16** (3.34-5.23)	**4.87** (3.89-6.15)	**5.90** (4.54-7.76)	**6.73** (5.04-8.97)	**7.59** (5.46-10.4)	**8.50** (5.83-12.0)	**9.75** (6.39-14.1)	**10.7** (6.82-15.7)
30-min	**2.06** (1.66-2.58)	**2.40** (1.94-3.01)	**2.98** (2.40-3.75)	**3.49** (2.79-4.41)	**4.23** (3.26-5.56)	**4.83** (3.62-6.44)	**5.45** (3.93-7.46)	**6.12** (4.19-8.61)	**7.03** (4.61-10.2)	**7.75** (4.93-11.4)
60-min	**1.39** (1.12-1.74)	**1.60** (1.29-2.01)	**1.97** (1.58-2.48)	**2.29** (1.83-2.89)	**2.75** (2.12-3.62)	**3.12** (2.34-4.16)	**3.51** (2.53-4.80)	**3.92** (2.69-5.52)	**4.49** (2.95-6.50)	**4.94** (3.14-7.25)
2-hr	**0.875** (0.712-1.09)	**1.00** (0.816-1.25)	**1.22** (0.992-1.52)	**1.42** (1.14-1.77)	**1.69** (1.32-2.20)	**1.92** (1.45-2.53)	**2.15** (1.56-2.91)	**2.40** (1.66-3.33)	**2.73** (1.81-3.91)	**3.00** (1.93-4.35)
3-hr	**0.667** (0.545-0.823)	**0.762** (0.622-0.941)	**0.924** (0.751-1.14)	**1.06** (0.860-1.32)	**1.26** (0.987-1.63)	**1.43** (1.08-1.87)	**1.59** (1.16-2.14)	**1.77** (1.23-2.44)	**2.01** (1.34-2.86)	**2.20** (1.42-3.17)
6-hr	**0.410** (0.338-0.501)	**0.468** (0.386-0.573)	**0.567** (0.465-0.695)	**0.652** (0.531-0.802)	**0.772** (0.608-0.985)	**0.868** (0.666-1.12)	**0.968** (0.714-1.28)	**1.07** (0.755-1.46)	**1.21** (0.819-1.70)	**1.32** (0.867-1.88)
12-hr	**0.243** (0.202-0.294)	**0.279** (0.232-0.338)	**0.341** (0.282-0.414)	**0.393** (0.323-0.479)	**0.467** (0.371-0.590)	**0.526** (0.407-0.673)	**0.587** (0.437-0.770)	**0.650** (0.463-0.876)	**0.735** (0.502-1.02)	**0.802** (0.532-1.13)
24-hr	**0.143** (0.120-0.172)	**0.166** (0.139-0.198)	**0.203** (0.169-0.244)	**0.234** (0.194-0.283)	**0.278** (0.223-0.347)	**0.313** (0.245-0.396)	**0.349** (0.263-0.452)	**0.386** (0.278-0.514)	**0.435** (0.301-0.597)	**0.474** (0.318-0.659)
2-day	**0.084** (0.071-0.099)	**0.096** (0.081-0.114)	**0.117** (0.098-0.139)	**0.134** (0.112-0.161)	**0.159** (0.128-0.196)	**0.178** (0.140-0.222)	**0.197** (0.150-0.252)	**0.216** (0.158-0.285)	**0.243** (0.170-0.328)	**0.263** (0.179-0.361)
3-day	**0.061** (0.052-0.072)	**0.070** (0.059-0.082)	**0.084** (0.071-0.099)	**0.096** (0.081-0.114)	**0.113** (0.091-0.138)	**0.126** (0.100-0.156)	**0.139** (0.106-0.176)	**0.152** (0.111-0.199)	**0.170** (0.120-0.229)	**0.184** (0.126-0.251)
4-day	**0.049** (0.042-0.058)	**0.056** (0.048-0.066)	**0.067** (0.057-0.079)	**0.076** (0.064-0.090)	**0.089** (0.072-0.108)	**0.099** (0.078-0.122)	**0.109** (0.083-0.137)	**0.119** (0.087-0.154)	**0.132** (0.094-0.177)	**0.143** (0.098-0.194)
7-day	**0.033** (0.029-0.039)	**0.037** (0.032-0.044)	**0.044** (0.038-0.052)	**0.050** (0.042-0.058)	**0.057** (0.047-0.069)	**0.063** (0.051-0.077)	**0.069** (0.053-0.086)	**0.075** (0.056-0.096)	**0.083** (0.059-0.109)	**0.089** (0.062-0.119)
10-day	**0.027** (0.023-0.031)	**0.030** (0.025-0.034)	**0.035** (0.030-0.040)	**0.039** (0.033-0.045)	**0.044** (0.036-0.053)	**0.048** (0.039-0.059)	**0.052** (0.041-0.065)	**0.057** (0.042-0.072)	**0.062** (0.045-0.082)	**0.066** (0.046-0.089)
20-day	**0.018** (0.016-0.021)	**0.020** (0.017-0.023)	**0.022** (0.019-0.026)	**0.025** (0.021-0.029)	**0.028** (0.023-0.033)	**0.030** (0.024-0.036)	**0.032** (0.025-0.039)	**0.034** (0.026-0.043)	**0.037** (0.027-0.048)	**0.039** (0.028-0.052)
30-day	**0.015** (0.013-0.017)	**0.016** (0.014-0.018)	**0.018** (0.016-0.021)	**0.020** (0.017-0.023)	**0.022** (0.018-0.026)	**0.023** (0.019-0.028)	**0.025** (0.020-0.030)	**0.026** (0.020-0.033)	**0.028** (0.021-0.036)	**0.029** (0.021-0.039)
45-day	**0.012** (0.011-0.014)	**0.013** (0.012-0.015)	**0.015** (0.013-0.017)	**0.016** (0.014-0.019)	**0.018** (0.015-0.021)	**0.019** (0.016-0.022)	**0.020** (0.016-0.024)	**0.021** (0.016-0.026)	**0.022** (0.016-0.028)	**0.023** (0.016-0.030)
60-day	**0.011** (0.009-0.012)	**0.012** (0.010-0.013)	**0.013** (0.012-0.015)	**0.014** (0.012-0.016)	**0.016** (0.013-0.018)	**0.017** (0.014-0.019)	**0.017** (0.014-0.021)	**0.018** (0.014-0.022)	**0.019** (0.014-0.024)	**0.019** (0.014-0.025)

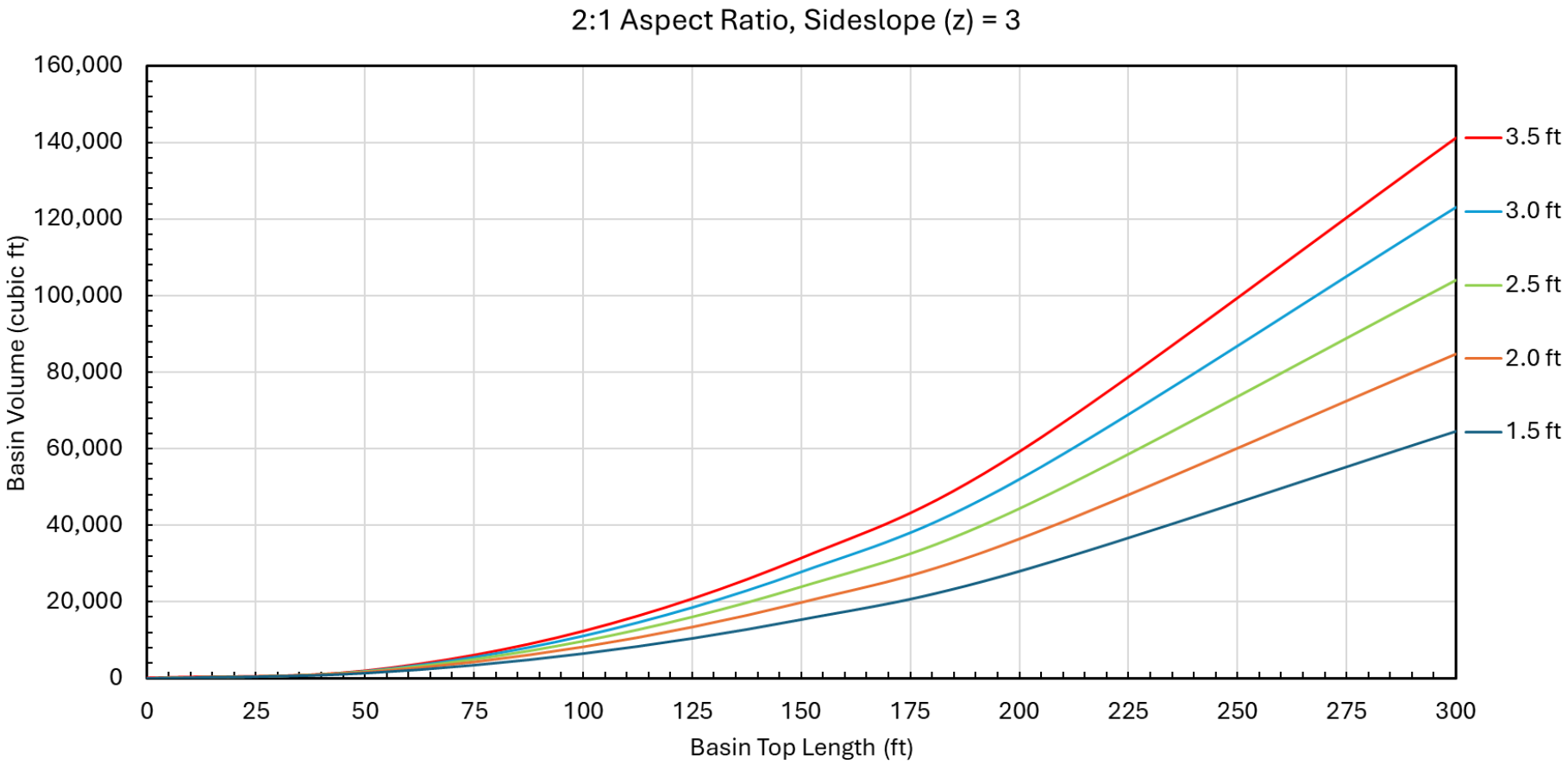
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates | Submit

Point Precipitation Frequency Estimates (in./hr): Huntsville, AL
Lat.: 34.7300°, Long.: -86.5476°, Elev.: 1034 ft


2:1 Aspect Ratio, Sideslope (z) = 3
Basin Volume (cubic ft)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
0
25
50
75
100
125
150
175
200
225
250
275
300
Basin Top Length (ft)
3.5 ft
3.0 ft
2.5 ft
2.0 ft
1.5 ft

Recommended Manning's Roughness Coefficients for Overland Flow

Cover or treatment	Residue Rate (tons/acre)	Value Recommended	Range
Concrete or asphalt		0.011	0.010–0.013
Bare sand		0.01	0.010–0.016
Graveled surface		0.02	0.012–0.03
Bare clay loam (eroded)		0.02	0.012–0.033
Fallow, no residue		0.05	0.006–0.16
Chisel plow	< 1/4 1/4–1 1–3 > 3	0.07 0.18 0.30 0.40	0.006–0.17 0.07–0.34 0.19–0.47 0.34–0.46
Disk/harrow	< 1/4 1/4–1 1–3 > 3	0.08 0.16 0.25 0.30	0.008–0.41 0.10–0.25 0.14–0.53 –
No till	< 1/4 1/4–1 1–3	0.04 0.07 0.30	0.03–0.07 0.01–0.13 0.16–0.47
Moldboard plow (fall)		0.06	0.02–0.10
Colter		0.10	0.05–0.13
Range (natural)		0.13	0.01–0.32
Range (clipped)		0.10	0.02–0.24
Grass (bluegrass sod)		0.45	0.39–0.63
Short grass prairie		0.15	0.10–0.20
Dense grass[1]		0.24	0.17–0.30
Bermuda grass[1]		0.41	0.30–0.48

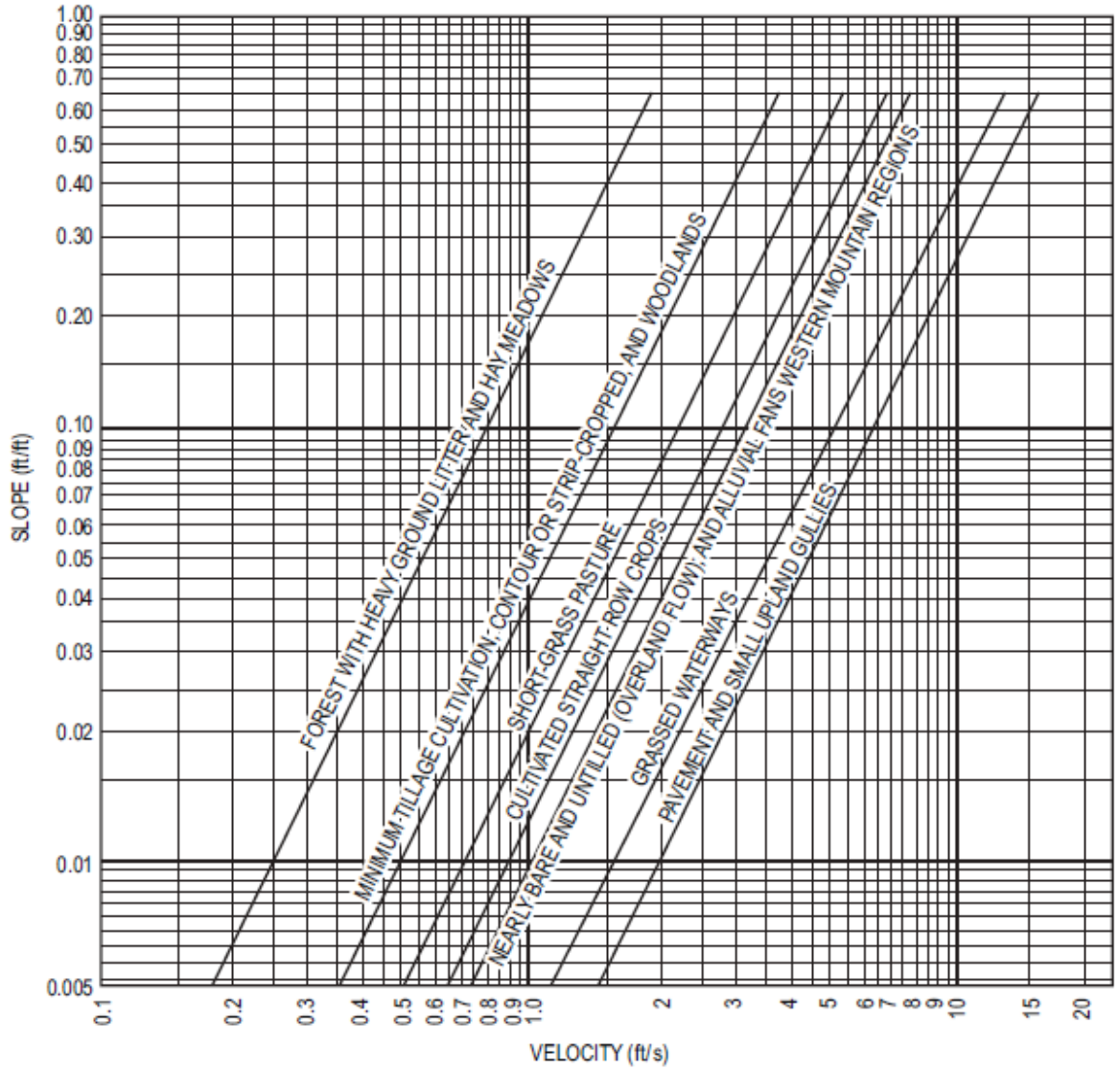
[1]Weeping lovegrass, bluegrass, buffalo grass, blue gamma grass, native grass mix (OK), alfalfa, lespedeza (from Palmer, 1946)

Material		Manning *n*
Closed Conduit or Built-up Channel	Metal:	
	Brass	0.01
	Copper	0.011
	Steel – welded	0.012
	Steel – riveted	0.016
	Cast iron – coated	0.013
	Wrought iron – galvanized	0.016
	Corrugated metal (storm drain)	0.024
	Nonmetal:	
	Glass	0.01
	Cement	0.011
	Cement mortar	0.013
	Concrete culvert	0.013
	Concrete-lined channel/pipe	0.015
	Wood	0.012
	Clay	0.013
	Brickwork	0.013
	Brickwork with cement mortar	0.015
	Masonry/rubble masonry	0.025
	Sanitary sewer coated with slime	0.013
	Asphalt	0.013
	Plastic	0.013
	PVC	0.009–0.011
	Polyethylene	0.009–0.015
Excavated or Dredged Channel	Straight and clean	0.022
	Winding and sluggish	0.025
	Dredged	0.028
	Rock cut/stony	0.035
	Earth bottom, rubble sides	0.03
	Unmaintained/uncut brush	0.08
Natural Streams	On plain, clean, straight, no pools	0.03
	On plain, clean, winding, some pools	0.04
	On plain, sluggish, weedy, deep pools	0.07
	On mountain, few boulders	0.04
	On mountain, large boulders	0.05

Manning's n values for channelized flow conditions

TABLE 3.16. Manning's *n* Values for Different Channel Conditions (Chow, 1959).

Type of Channel and Description of Closed Conduits	Minimum
Concrete Pipe:	
Culverts with bends, connections & debris	0.013
Storm sewer	0.013
Subdrain with open joints	0.016
PVC Pipe	0.011
Concrete Surfaces (bottom & sides):	
Smooth finish	0.015
Unfinished	0.017
Concrete Bottom (with sides made of):	
Mortared stone	0.020
Dry rubble or riprap	0.030
Gravel Bottom (with sides made of):	
Formed concrete	0.020
Dry rubble or riprap	0.040
Excavated or Dredged Channels and Ditches:	
Earthen, straight & uniform, no brush or debris:	
Grassed, less than 6″ high with:	
Depth of flow 2.0 ft	0.035
Depth of flow 2.0 ft	0.030
Grassed, approximately 12″ high with:	
Depth of flow 2.0 ft	0.060
Depth of flow 2.0 ft:	0.035
Grassed, approximately 24ö high with:	
Depth of flow 2.0 ft	0.070
Depth of flow 2.0 ft	0.035
Earth bottom with riprap on sides	0.040
Rock or shale cuts:	
Smooth and uniform	0.035
Jagged and irregular	0.040
Curb and Gutter (Concrete)	0.016



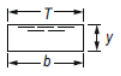
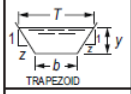
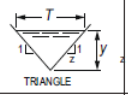
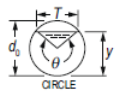
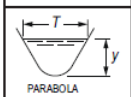
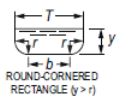
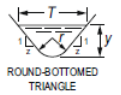
Velocity Versus Slope for Shallow Concentrated Flow

Source: Natural Resources Conservation Service. *National Engineering Handbook: Part 630 Hydrology*. 210-VI-NEH. Washington, DC: U.S. Department of Agriculture, May 2010, Fig. 15-4, p. 15-8. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=27002.wba.

Figure 630F–7: Equations and Assumptions Developed from Figure 630F-6

Flow type	Depth (ft)	Manning's n	Velocity equation (ft/s)
Pavement and small upland gullies	0.2	0.025	$V=20.328(s)^{0.5}$
Nearly bare and untilled (overland flow); and alluvial fans in western mountain regions	0.2	0.051	$V=9.965(s)^{0.5}$
Cultivated straight row crops	0.2	0.058	$V=8.762(s)^{0.5}$
Short-grass pasture	0.2	0.073	$V=6.962(s)^{0.5}$
Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	$V=5.032(s)^{0.5}$
Forest with heavy ground litter and hay meadows	0.2	0.202	$V=2.516(s)^{0.5}$

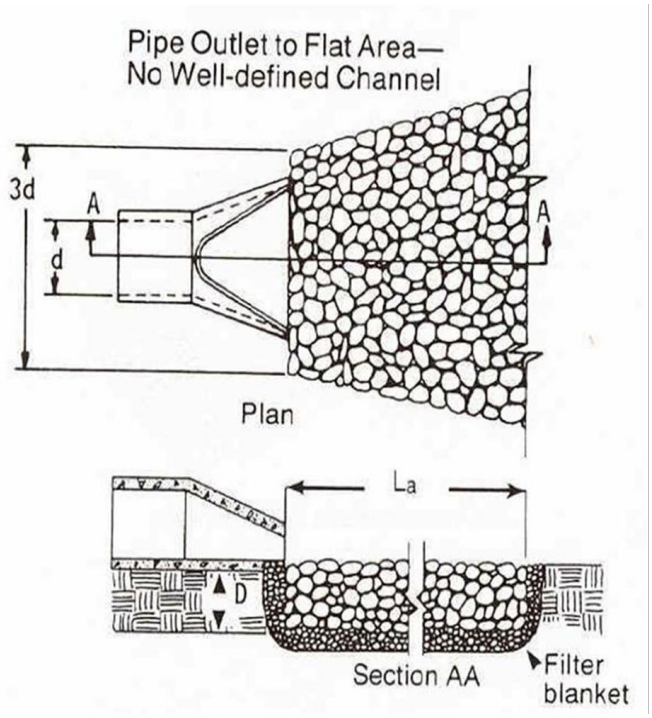
Geometric Elements of Channel Sections

Section	Area A	Wetted Perimeter P	Hydraulic Radius R	Top Width T	Hydraulic Depth D
 RECTANGLE	by	$b+2y$	$\frac{by}{b+2y}$	b	y
 TRAPEZOID	$(b+zy)y$	$b+2y\sqrt{1+z^2}$	$\frac{(b+zy)y}{b+2y\sqrt{1+z^2}}$	$b+2zy$	$\frac{(b+zy)y}{b+2zy}$
 TRIANGLE	zy^2	$2y\sqrt{1+z^2}$	$\frac{zy}{2\sqrt{1+z^2}}$	$2zy$	$\frac{1}{2}y$
 CIRCLE	$1/8(\theta-\sin\theta)d_0^2$	$\frac{1}{2}\theta d_0$	$\frac{1}{4}\left(1-\frac{\sin\theta}{\theta}\right)d_0$	$(\sin 1/2\,\theta)d_0$ or $2\sqrt{y(d_0-y)}$	$\frac{1}{8}\left(\frac{\theta-\sin\theta}{\sin 1/2\,\theta}\right)d_0$
 PARABOLA	$\frac{2}{3}Ty$	$T+\frac{8}{3}\frac{y^2}{T}$ *	$\frac{2T^2y}{3T^2+8y^2}$ *	$\frac{3}{2}\frac{A}{y}$	$\frac{2}{3}y$
 ROUND-CORNERED RECTANGLE (y > r)	$\left(\frac{\pi}{2}-2\right)r^2+(b+2r)y$	$(\pi-2)r+b+2y$	$\frac{(\pi/2-2)r^2+(b+2r)y}{(\pi-2)r+b+2y}$	$b+2r$	$\frac{(\pi/2-2)r^2}{b+2r}+y$
 ROUND-BOTTOMED TRIANGLE	$\frac{T^2}{4z}-\frac{r^2}{z}(1-z\cot^{-1}z)$	$\frac{T}{z}\sqrt{1+z^2}-\frac{2r}{z}(1-z\cot^{-1}z)$	$\frac{A}{P}$	$2\left[z(y-r)+r\sqrt{1+z^2}\right]$	$\frac{A}{T}$

*Satisfactory approximation for the interval $0 < x \le 1$, where $x = 4y/T$. When $x > 1$, use the exact expression $P = (T/2)\left[\sqrt{1+x^2}+1/x\ln\left(x+\sqrt{1+x^2}\right)\right]$.

Table MU-2 Mulching Materials and Application Rates

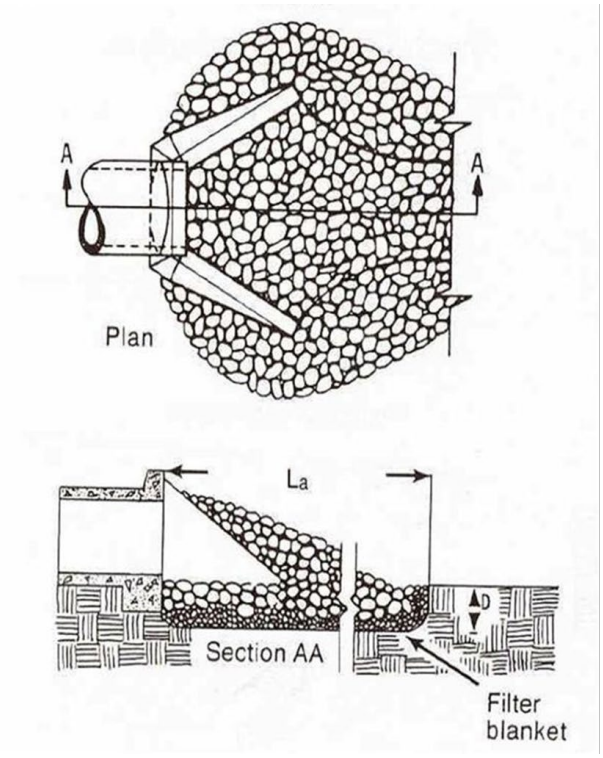
Material	Rate Per Acre and (Per 1000 ft.²)	Notes
Straw with Seed	1 ½-2 tons (70 lbs-90 lbs)	Spread by hand or machine to attain 75% groundcover; anchor when subject to blowing.
Straw Alone (no seed)	2 ½-3 tons (115 lbs-160 lbs)	Spread by hand or machine; anchor when subject to blowing.
Wood Chips	5-6 tons (225 lbs-270 lbs)	Treat with 12 lbs. nitrogen/ton.
Bark	35 cubic yards (0.8 cubic yard)	Can apply with mulch blower.
Pine Straw	1-2 tons (45 lbs-90 lbs)	Spread by hand or machine; will not blow like straw.
Peanut Hulls	10-20 tons (450 lbs-900 lbs)	Will wash off slopes. Treat with 12 lbs. nitrogen/ton.
HECPs	0.75 – 2.25 tons (35 lbs – 103 lbs)	Refer to ECTC or Manufacturer's Specifications.



Notes

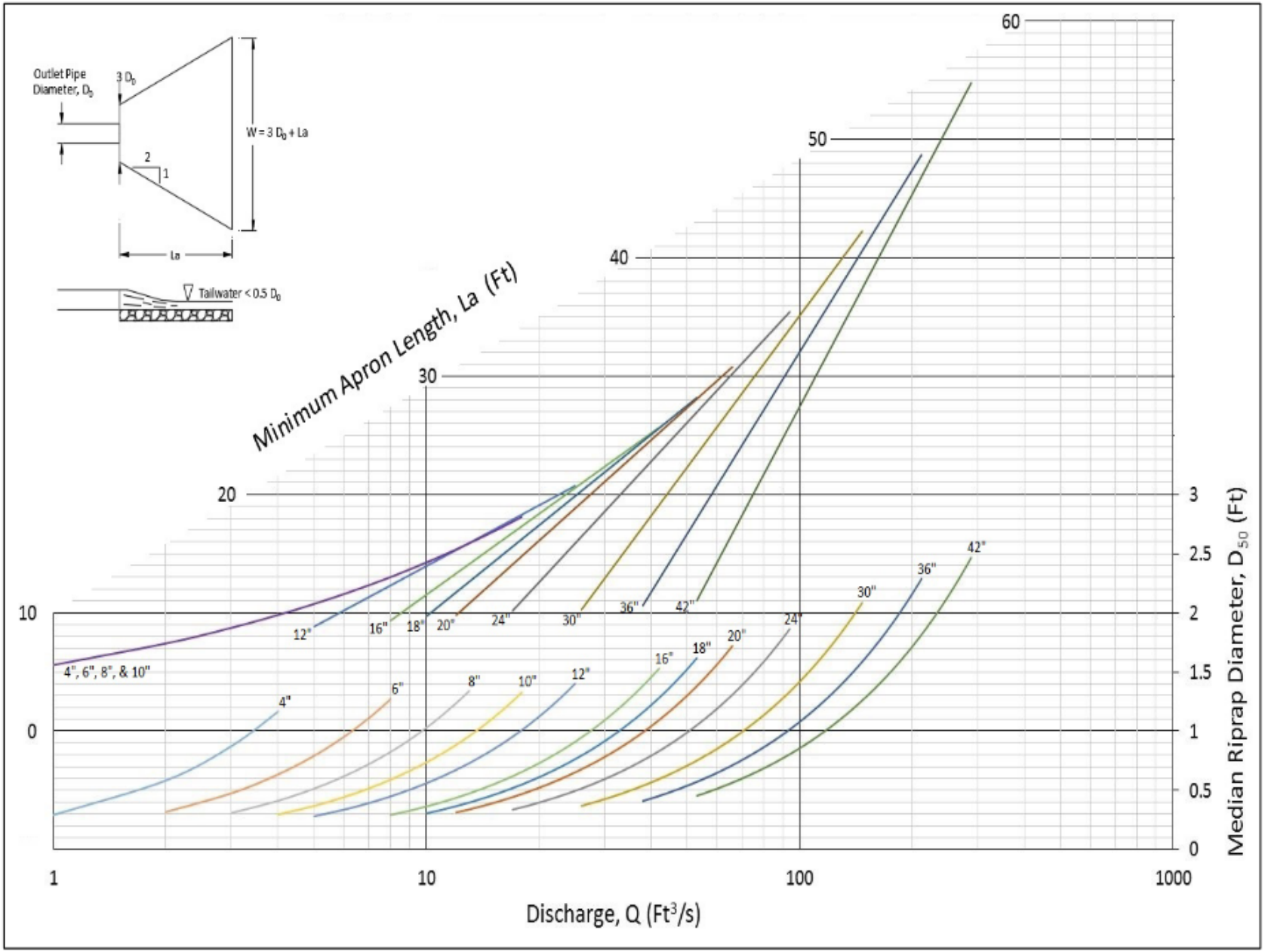
1. L_a is the length of the riprap apron.
2. D = 1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.

Pipe Outlet to Well-Defined Channel



Notes

1. L_a is the length of the riprap apron.
2. D = 1.5 times the maximum stone diameter but not less than 6".
3. In a well-defined channel extend the apron up the channel banks to an elevation of 6" above the maximum tailwater depth or to the top of the bank, whichever is less.
4. A filter blanket or filter fabric should be installed between the riprap and soil foundation.


Outlet Pipe Diameter, D_o
3 D_o
W = 3 D_o + La
2
1
La
Tailwater < 0.5 D_o
Minimum Apron Length, La (Ft)
Discharge, Q (Ft^3/s)
Median Riprap Diameter, D_{50} (Ft)
4", 6", 8", & 10"
4"
6"
8"
10"
12"
16"
18"
20"
24"
30"
36"
42"
60
50
40
30
20
10
0
3
2.5
2
1.5
1
0.5
0
1
10
100
1000

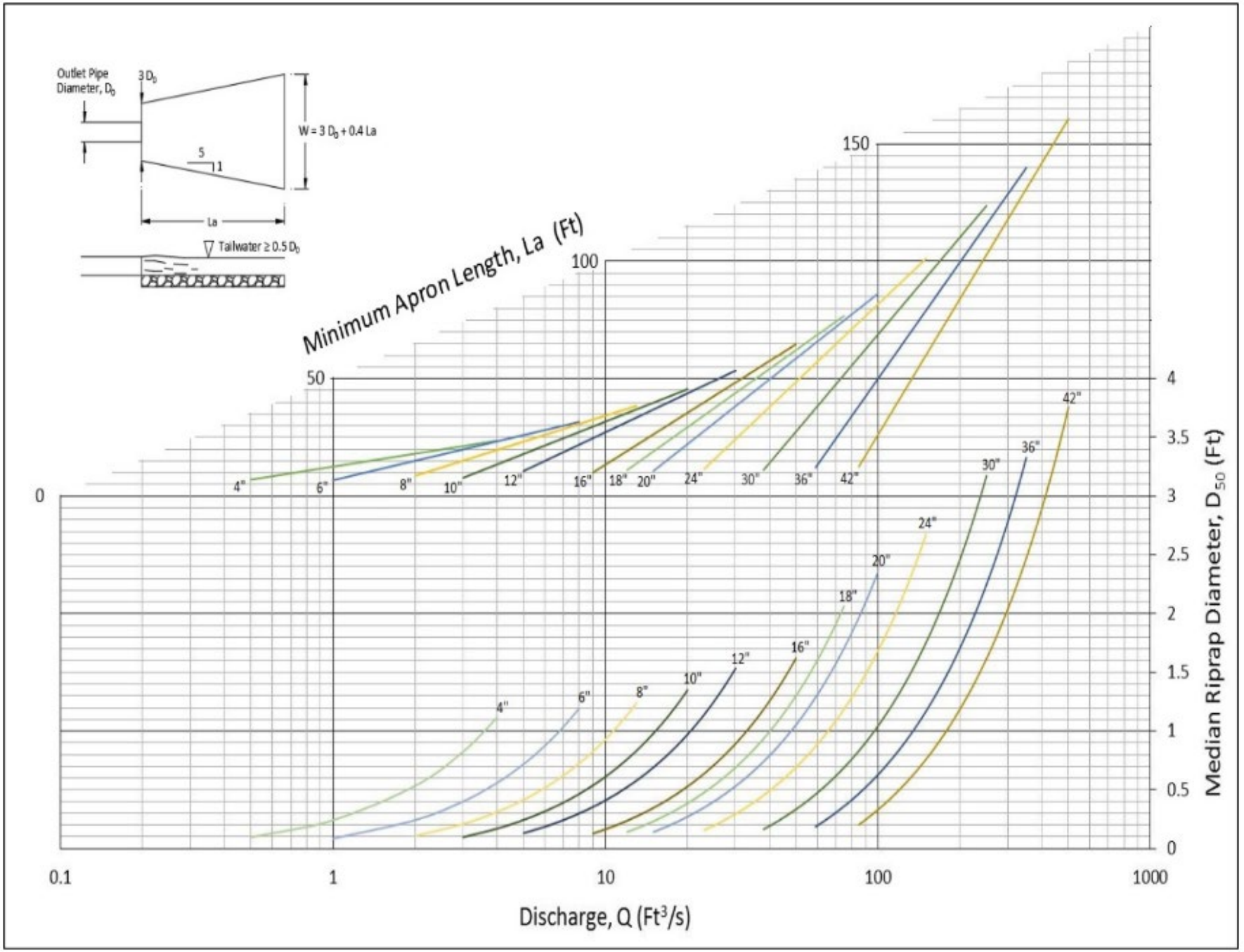

Outlet Pipe Diameter, D_0
3 D_0
W = 3 D_0 + 0.4 La
5
1
La
Tailwater ≥ 0.5 D_0
Minimum Apron Length, La (Ft)
0
50
100
150
4"
6"
8"
10"
12"
16"
18"
20"
24"
30"
36"
42"
0.1
1
10
100
1000
Discharge, Q (Ft^3/s)
0
0.5
1
1.5
2
2.5
3
3.5
4
Median Riprap Diameter, D_{50} (Ft)

Table SBN-1 Design Table for Vegetated Spillways Excavated in Erosion Resistant Soils (side slopes 3 horizontal: 1 vertical)

Discharge Q CFS	Slope Range		Bottom Width Feet	Stage Feet
	Minimum Percent	Maximum Percent		
15	3.3	12.2	8	.83
	3.5	18.2	12	.69
20	3.1	8.9	8	.97
	3.2	13.0	12	.81
	3.3	17.3	16	.70
25	2.9	7.1	8	1.09
	3.2	9.9	12	.91
	3.3	13.2	16	.79
	3.3	17.2	20	.70
30	2.9	6.0	8	1.20
	3.0	8.2	12	1.01
	3.0	10.7	16	.88
	3.3	13.8	20	.78
35	2.8	5.1	8	1.30
	2.9	6.9	12	1.10
	3.1	9.0	16	.94
	3.1	11.3	20	.85
	3.2	14.1	24	.77
40	2.7	4.5	8	1.40
	2.9	6.0	12	1.18
	2.9	7.6	16	1.03
	3.1	9.7	20	.91
	3.1	11.9	24	.83
45	2.6	4.1	8	1.49
	2.8	5.3	12	1.25
	2.9	6.7	16	1.09
	3.0	8.4	20	.98
	3.0	10.4	24	.89
50	2.7	3.7	8	1.57
	2.8	4.7	12	1.33
	2.8	6.0	16	1.16
	2.9	7.3	20	1.03
	3.1	9.0	24	.94
60	2.6	3.1	8	1.73
	2.7	3.9	12	1.47
	2.7	4.8	16	1.28
	2.9	5.9	20	1.15
	2.9	7.3	24	1.05
	3.0	8.6	28	.97
70	2.5	2.8	8	1.88
	2.6	3.3	12	1.60
	2.6	4.1	16	1.40
	2.7	5.0	20	1.26
	2.8	6.1	24	1.15
	2.9	7.0	28	1.05
80	2.5	2.9	12	1.72
	2.6	3.6	16	1.51
	2.7	4.3	20	1.35

Discharge Q CFS	Slope Range		Bottom Width Feet	Stage Feet
	Minimum Percent	Maximum Percent		
80	2.8	5.2	24	1.24
	2.8	5.9	28	1.14
	2.9	7.0	32	1.06
90	2.5	2.6	12	1.84
	2.5	3.1	16	1.61
	2.6	3.8	20	1.45
	2.7	4.5	24	1.32
	2.8	5.3	28	1.22
	2.8	6.1	32	1.14
100	2.5	2.8	16	1.71
	2.6	3.3	20	1.54
	2.6	4.0	24	1.41
	2.7	4.8	28	1.30
	2.7	5.3	32	1.21
	2.8	6.1	36	1.13
120	2.5	2.8	20	1.71
	2.6	3.2	24	1.56
	2.7	3.8	28	1.44
	2.7	4.2	32	1.34
	2.7	4.8	36	1.26
140	2.5	2.7	24	1.71
	2.5	3.2	28	1.58
	2.6	3.6	32	1.47
	2.6	4.0	36	1.38
	2.7	4.5	40	1.30
160	2.5	2.7	28	1.70
	2.5	3.1	32	1.58
	2.6	3.4	36	1.49
	2.6	3.8	40	1.40
	2.7	4.3	44	1.33
180	2.4	2.7	32	1.72
	2.4	3.0	36	1.60
	2.5	3.4	40	1.51
	2.6	3.7	44	1.43
200	2.5	2.7	36	1.70
	2.5	2.9	40	1.60
	2.5	3.3	44	1.52
	2.6	3.6	48	1.45
220	2.4	2.6	40	1.70
	2.5	2.9	44	1.61
	2.5	3.2	48	1.53
240	2.5	2.6	44	1.70
	2.5	2.9	48	1.62
	2.6	3.2	52	1.54
260	2.4	2.6	48	1.70
	2.5	2.9	52	1.62
280	2.4	2.6	52	1.70
300	2.5	2.6	56	1.69

Figure 1 – EFH-2 Peak Discharge Curves for MSE 4

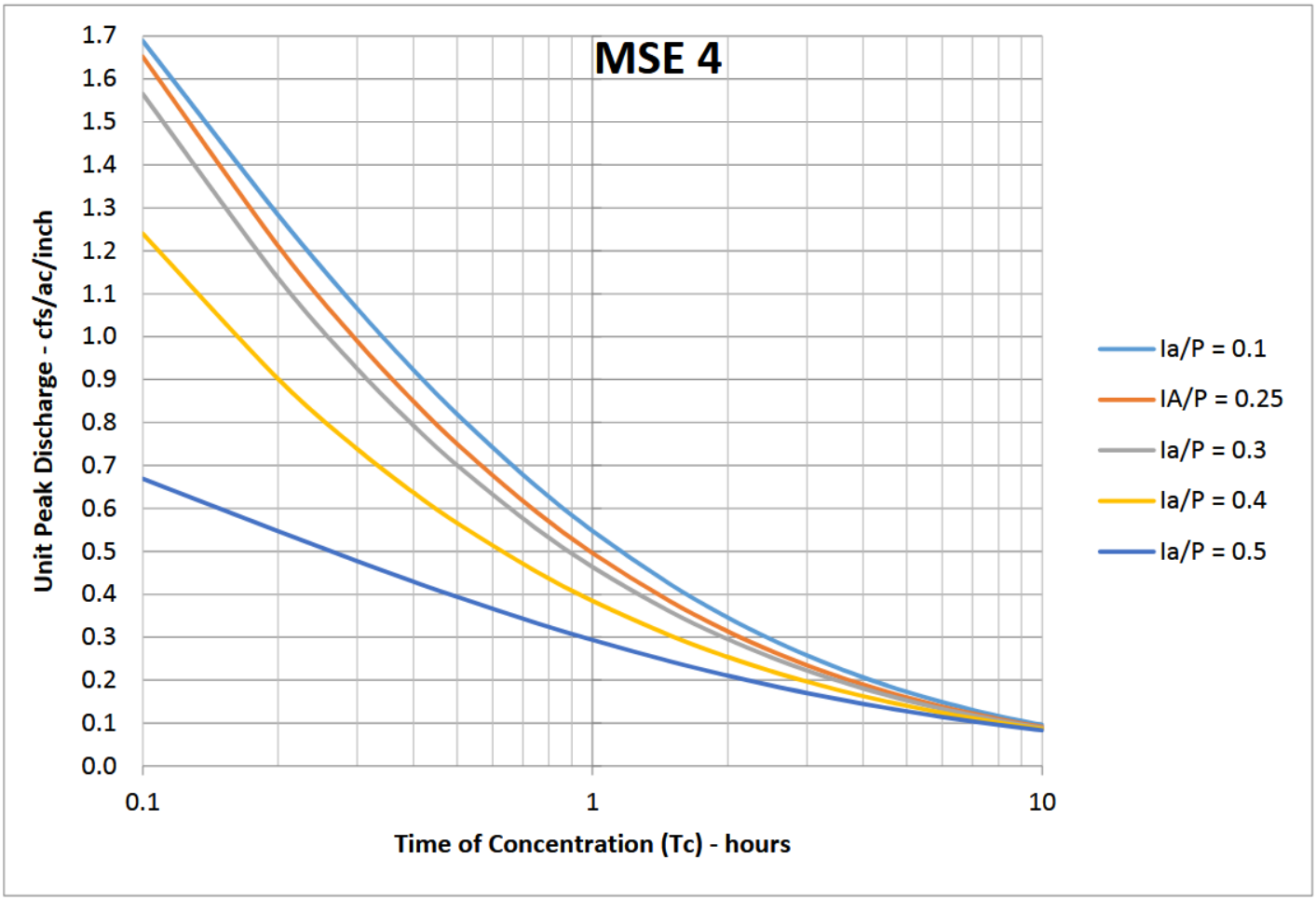


Figure 2 – EFH-2 Peak Discharge Curves for MSE 5

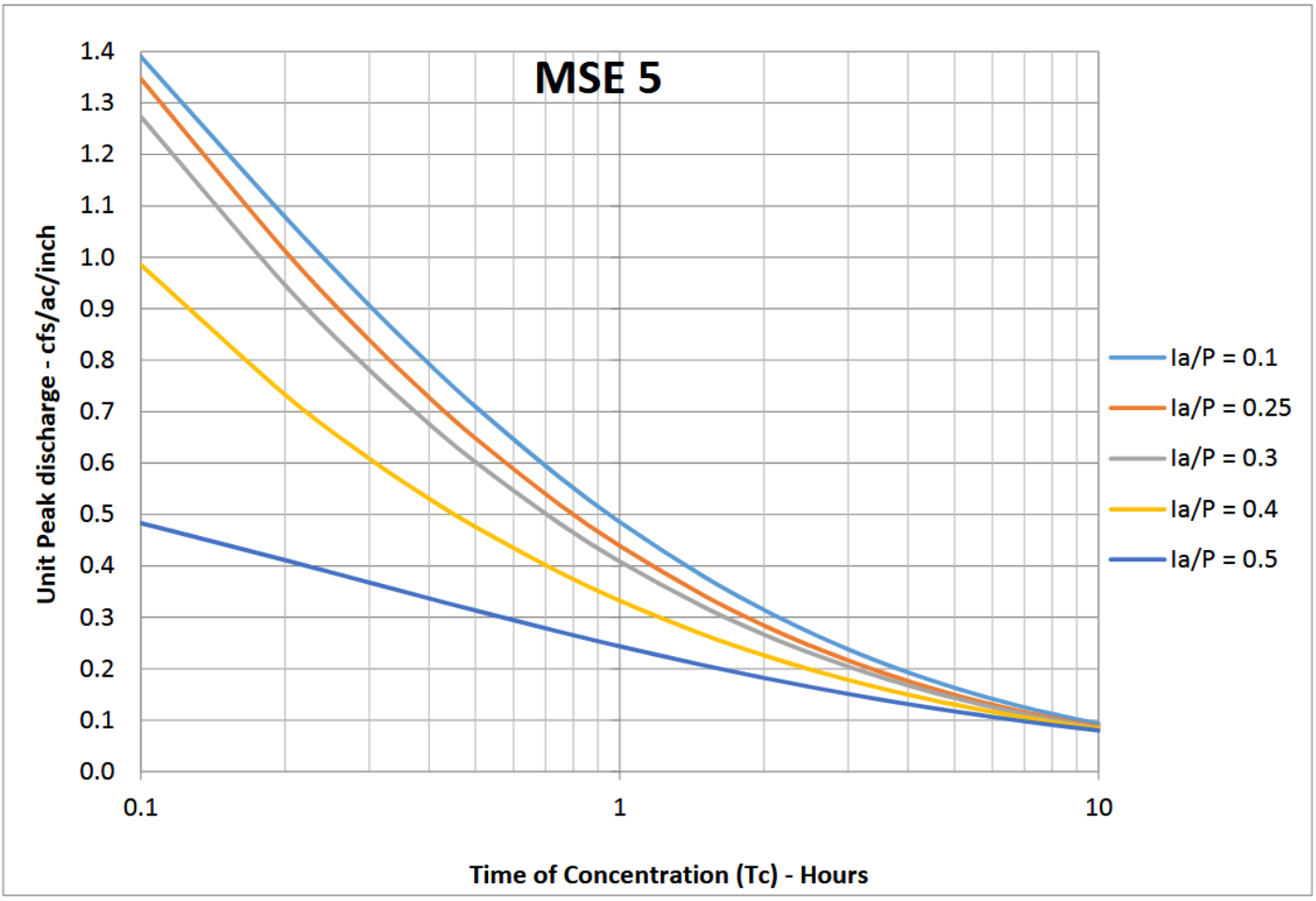
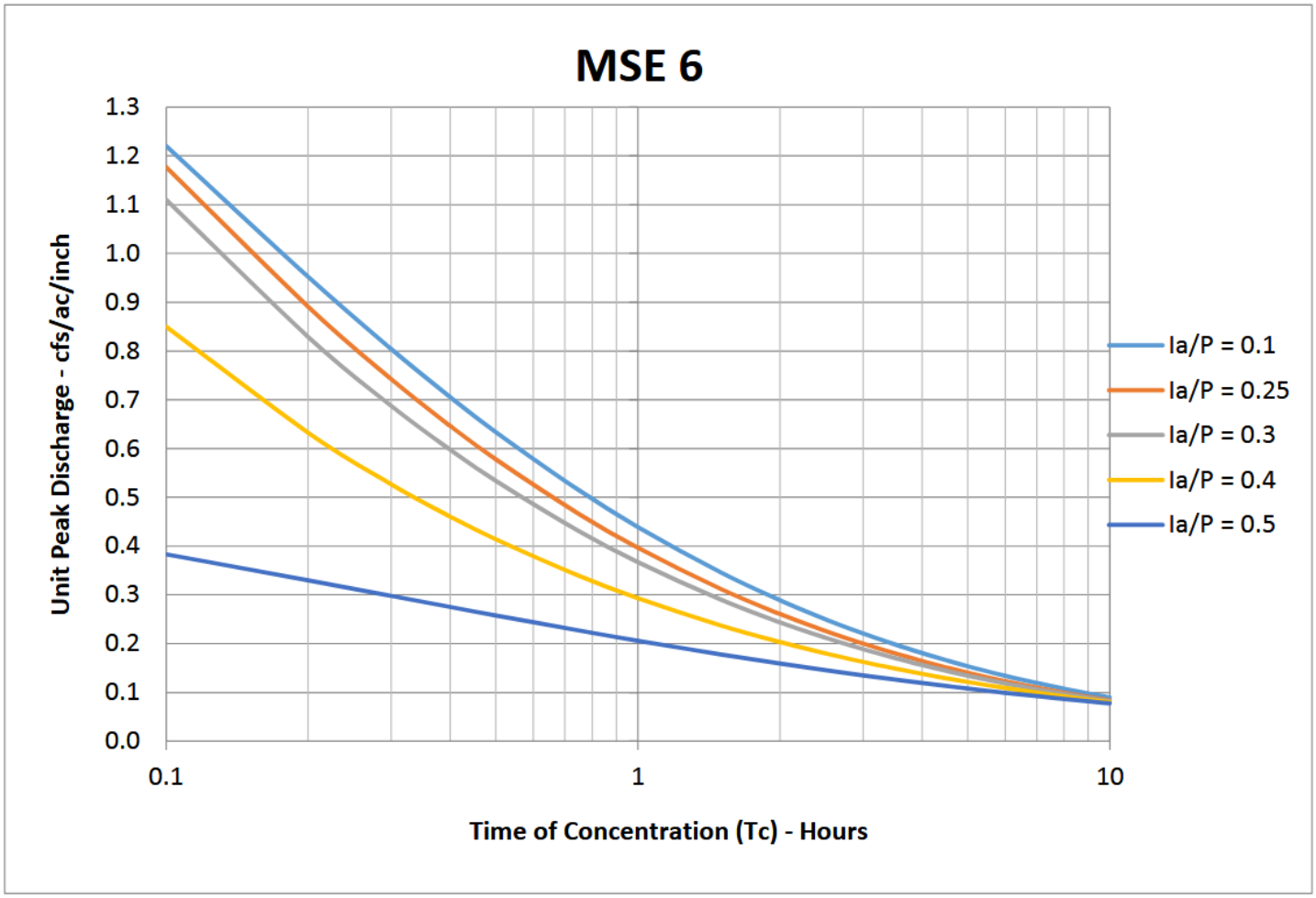


Figure 3 – EFH-2 Peak Discharge Curves for MSE 6



Assumes channel has rough rectangular shape and

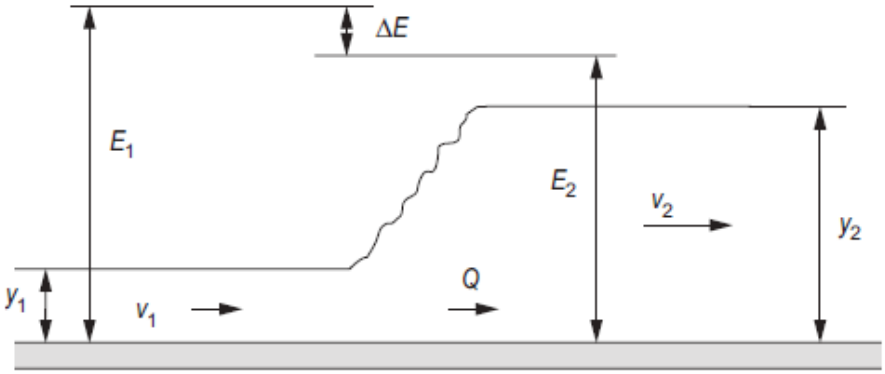
$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1 + 8\,Fr_1^2} - 1\right)$$

where

y_1 = flow depth at upstream supercritical flow location (ft)

y_2 = flow depth at downstream subcritical flow location (ft)

Fr_1 = Froude number at upstream supercritical flow location



$$y_1 = -\frac{1}{2}y_2 + \sqrt{\frac{2v_2^2 y_2}{g} + \frac{y_2^2}{4}}$$

$$y_2 = -\frac{1}{2}y_1 + \sqrt{\frac{2v_1^2 y_1}{g} + \frac{y_1^2}{4}}$$

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1 + 8(Fr_2)^2} - 1\right)$$

$$v_1^2 = \left(\frac{gy_2}{2y_1}\right)(y_1 + y_2)$$

$$\Delta E = \left(y_1 + \frac{v_1^2}{2g}\right) - \left(y_2 + \frac{v_2^2}{2g}\right)$$

where

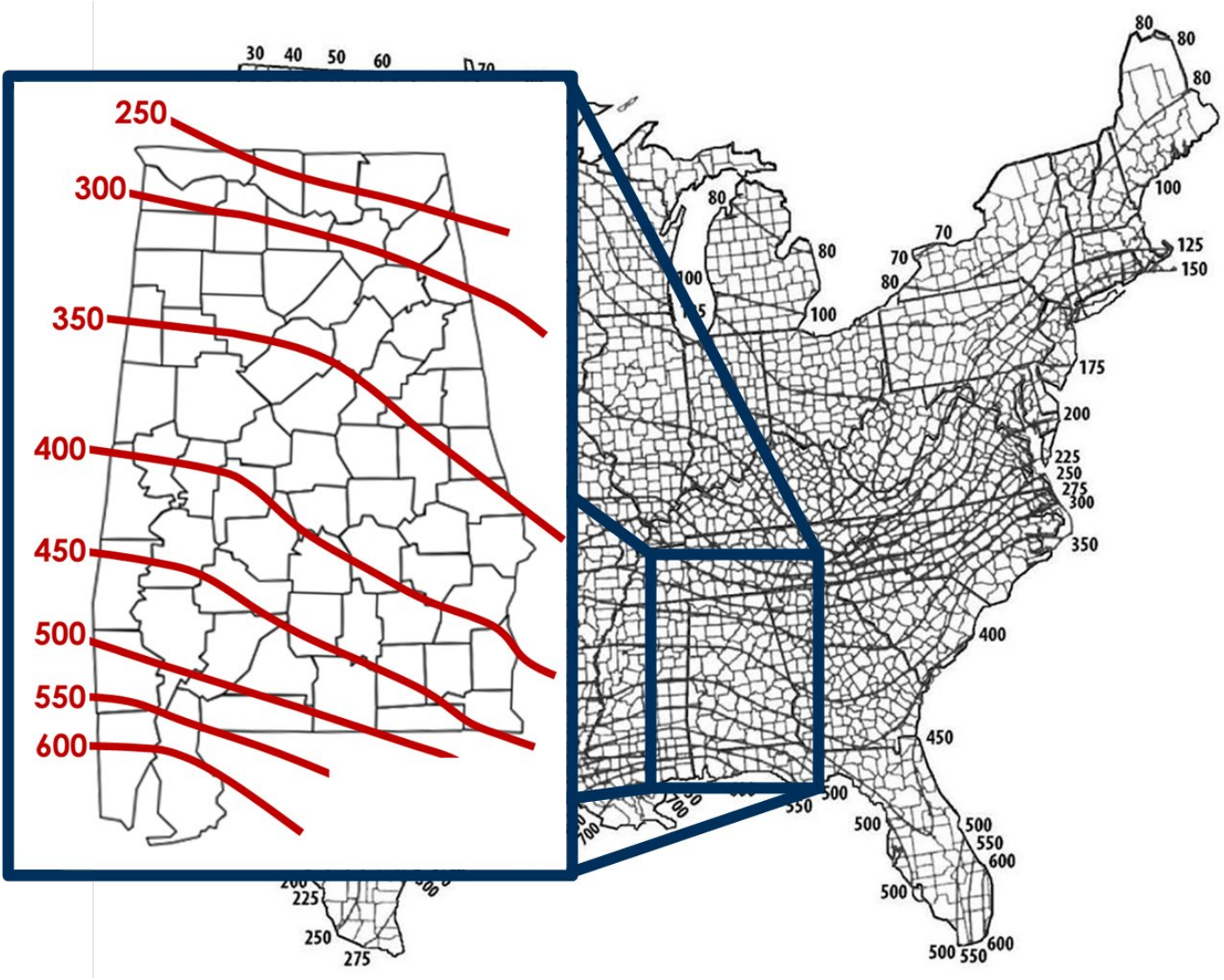
y = depth at point (ft)

g = acceleration due to gravity = 32.2 ft/sec^2 or 9.81 m/s^2

Fr = Froude number

v = velocity (ft/sec)

ΔE = change in energy (ft)


250
300
350
400
450
500
550
600

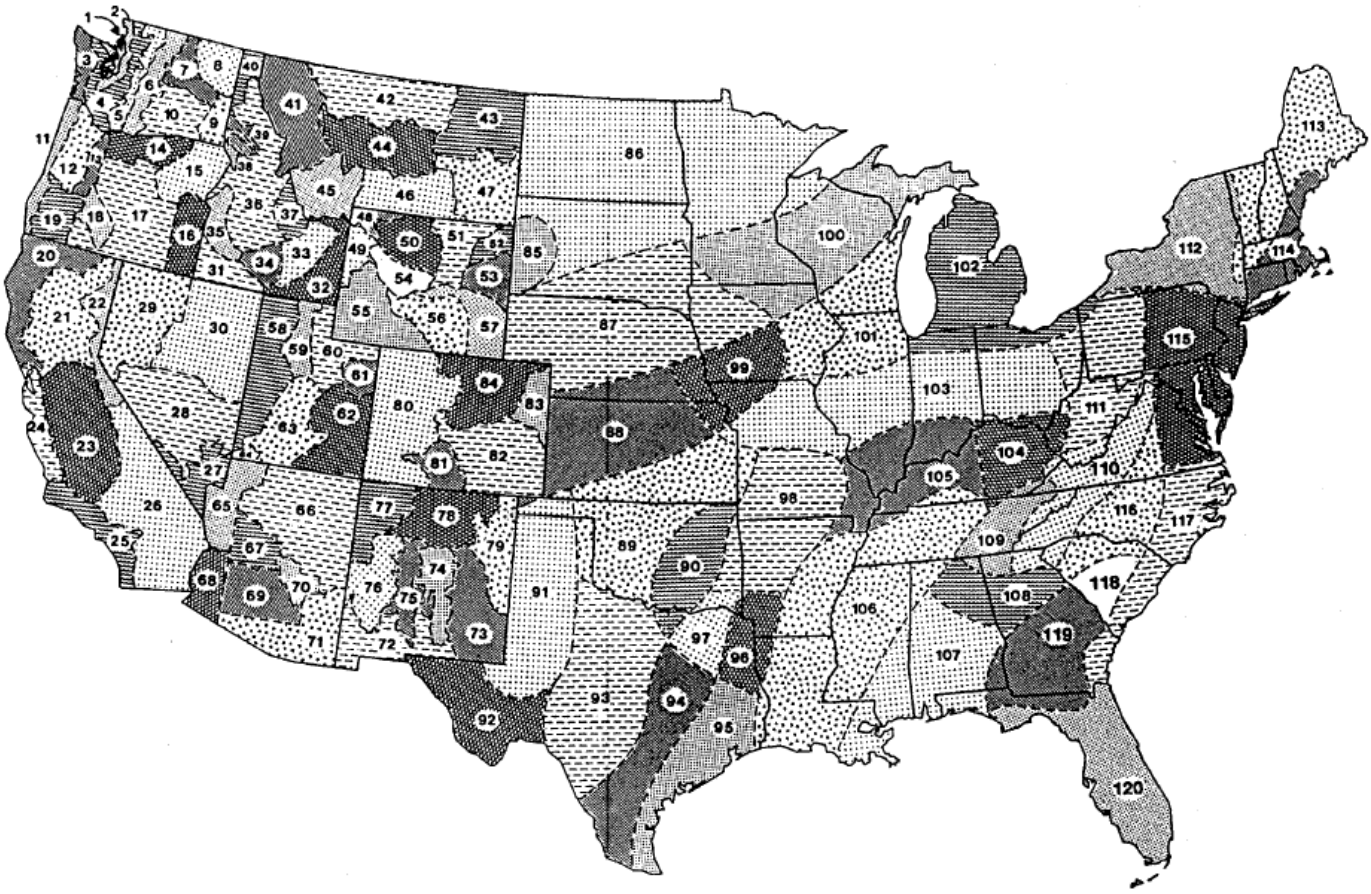


Figure 2-7. EI distribution zones for contiguous United States

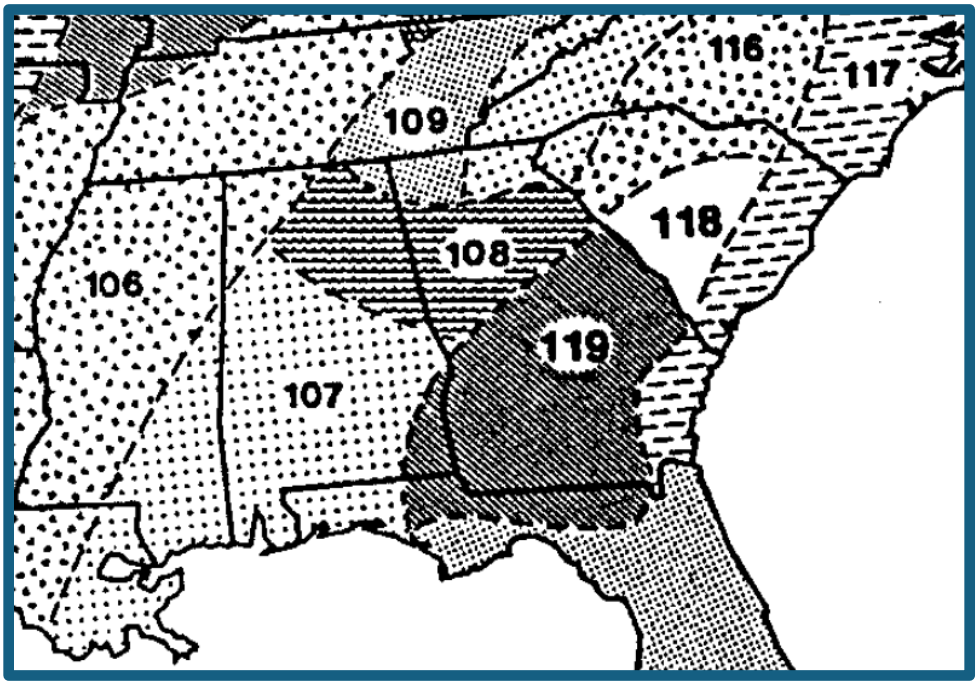


Table 1. Erosivity Index (%EI Values extracted from USDA Manual 703)

All values are at the end of the day listed below - Linear interpolation between dates is acceptable.
EI as a percentage of Average Annual R Value Computed for Geographic Areas Shown in Figure 1

Month	Jan	Jan	Jan	Feb	Mar	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Aug	Sept	Sept	Oct	Oct	Nov	Nov	Dec	Dec
Day	1	16	31	15	1	16	31	15	30	15	30	14	29	14	29	13	28	12	27	12	27	11	26	11	31
EI Zone																									
106	0	3.0	6.0	9.0	13.0	17.0	21.0	27.0	33.0	38.0	44.0	49.0	55.0	61.0	67.0	71.0	75.0	78.0	81.0	84.0	86.0	90.0	94.0	97.0	100
107	0	3.0	5.0	7.0	10.0	14.0	18.0	23.0	27.0	31.0	35.0	39.0	45.0	53.0	60.0	67.0	74.0	80.0	84.0	86.0	88.0	90.0	93.0	95.0	100
108	0	3.0	6.0	9.0	12.0	16.0	20.0	24.0	28.0	33.0	38.0	43.0	50.0	59.0	69.0	75.0	80.0	84.0	87.0	90.0	92.0	94.0	96.0	98.0	100
109	0	3.0	6.0	10.0	13.0	16.0	19.0	23.0	26.0	29.0	33.0	39.0	47.0	58.0	68.0	75.0	80.0	83.0	86.0	88.0	90.0	92.0	95.0	97.0	100
110	0	1.0	3.0	5.0	7.0	9.0	12.0	15.0	18.0	21.0	25.0	29.0	36.0	45.0	56.0	68.0	77.0	83.0	88.0	91.0	93.0	95.0	97.0	99.0	100
111	0	1.0	2.0	3.0	4.0	5.0	6.0	8.0	11.0	15.0	20.0	28.0	41.0	54.0	65.0	74.0	82.0	87.0	92.0	94.0	96.0	97.0	98.0	99.0	100
112	0	0.0	0.0	1.0	2.0	3.0	4.0	5.0	7.0	12.0	17.0	24.0	33.0	42.0	55.0	67.0	76.0	83.0	89.0	92.0	94.0	96.0	98.0	99.0	100
113	0	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	13.0	17.0	22.0	31.0	42.0	52.0	60.0	68.0	75.0	80.0	85.0	89.0	92.0	96.0	98.0	100
114	0	1.0	2.0	4.0	6.0	8.0	11.0	13.0	15.0	18.0	21.0	26.0	32.0	38.0	46.0	55.0	64.0	71.0	77.0	81.0	85.0	89.0	93.0	97.0	100
115	0	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	14.0	19.0	26.0	34.0	45.0	56.0	66.0	76.0	82.0	86.0	90.0	93.0	95.0	97.0	99.0	100
116	0	1.0	3.0	5.0	7.0	9.0	12.0	15.0	18.0	21.0	25.0	29.0	36.0	45.0	56.0	68.0	77.0	83.0	88.0	91.0	93.0	95.0	97.0	99.0	100
117	0	1.0	2.0	3.0	4.0	5.0	7.0	9.0	11.0	14.0	17.0	22.0	31.0	42.0	54.0	65.0	74.0	83.0	89.0	92.0	95.0	97.0	98.0	99.0	100
118	0	1.0	2.0	3.0	5.0	7.0	10.0	14.0	18.0	22.0	27.0	32.0	37.0	46.0	58.0	69.0	80.0	89.0	93.0	94.0	95.0	96.0	97.0	97.0	100
119	0	2.0	4.0	6.0	8.0	12.0	16.0	20.0	25.0	30.0	35.0	41.0	47.0	56.0	67.0	75.0	81.0	85.0	87.0	89.0	91.0	93.0	95.0	97.0	100
120	0	1.0	2.0	4.0	6.0	7.0	9.0	12.0	15.0	18.0	23.0	31.0	40.0	48.0	57.0	63.0	72.0	78.0	88.0	92.0	96.0	97.0	98.0	99.0	100

Values for topographic factor, LS, for low ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
0.5	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
1.0	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.17	0.17
2.0	0.20	0.20	0.20	0.20	0.20	0.21	0.23	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.33	0.34	0.35
3.0	0.26	0.26	0.26	0.26	0.26	0.29	0.33	0.36	0.38	0.40	0.43	0.44	0.46	0.48	0.52	0.55	0.57
4.0	0.33	0.33	0.33	0.33	0.33	0.36	0.43	0.46	0.50	0.54	0.58	0.61	0.63	0.67	0.74	0.78	0.82
5.0	0.38	0.38	0.38	0.38	0.38	0.44	0.52	0.57	0.62	0.68	0.73	0.78	0.81	0.87	0.97	1.04	1.10
6.0	0.44	0.44	0.44	0.44	0.44	0.50	0.61	0.68	0.74	0.83	0.90	0.95	1.00	1.08	1.21	1.31	1.40
8.0	0.54	0.54	0.54	0.54	0.54	0.64	0.79	0.90	0.99	1.12	1.23	1.32	1.40	1.53	1.74	1.91	2.05
10.0	0.60	0.63	0.65	0.66	0.68	0.81	1.03	1.19	1.31	1.51	1.67	1.80	1.92	2.13	2.45	2.71	2.93
12.0	0.61	0.70	0.75	0.80	0.83	1.01	1.31	1.52	1.69	1.97	2.20	2.39	2.56	2.85	3.32	3.70	4.02
14.0	0.63	0.76	0.85	0.92	0.98	1.20	1.58	1.85	2.08	2.44	2.73	2.99	3.21	3.60	4.23	4.74	5.18
16.0	0.65	0.82	0.94	1.04	1.12	1.38	1.85	2.18	2.46	2.91	3.28	3.60	3.88	4.37	5.17	5.82	6.39
20.0	0.68	0.93	1.11	1.26	1.39	1.74	2.37	2.84	3.22	3.85	4.38	4.83	5.24	5.95	7.13	8.10	8.94
25.0	0.73	1.05	1.30	1.51	1.70	2.17	3.00	3.63	4.16	5.03	5.76	6.39	6.96	7.97	9.65	11.04	12.26
30.0	0.77	1.16	1.48	1.75	2.00	2.57	3.60	4.40	5.06	6.18	7.11	7.94	8.68	9.99	12.19	14.04	15.66
40.0	0.85	1.36	1.79	2.17	2.53	3.30	4.73	5.84	6.78	8.37	9.71	10.91	11.99	13.92	17.19	19.96	22.41
50.0	0.91	1.52	2.06	2.54	3.00	3.95	5.74	7.14	8.33	10.37	12.11	13.65	15.06	17.59	21.88	25.55	28.82
60.0	0.97	1.67	2.29	2.86	3.41	4.52	6.63	8.29	9.72	12.16	14.26	16.13	17.84	20.92	26.17	30.68	34.71

[1]Such as for rangeland and other consolidated soil conditions with cover (applicable to thawing soil where both interrill and rill erosion are significant).

Values for topographic factor, LS, for moderate ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10
1.0	0.11	0.11	0.11	0.11	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.20
2.0	0.17	0.17	0.17	0.17	0.17	0.19	0.22	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.41	0.44	0.47
3.0	0.22	0.22	0.22	0.22	0.22	0.25	0.32	0.36	0.39	0.44	0.48	0.52	0.55	0.60	0.68	0.75	0.80
4.0	0.26	0.26	0.26	0.26	0.26	0.31	0.40	0.47	0.52	0.60	0.67	0.72	0.77	0.86	0.99	1.10	1.19
5.0	0.30	0.30	0.30	0.30	0.30	0.37	0.49	0.58	0.65	0.76	0.85	0.93	1.01	1.13	1.33	1.49	1.63
6.0	0.34	0.34	0.34	0.34	0.34	0.43	0.58	0.69	0.78	0.93	1.05	1.16	1.25	1.42	1.69	1.91	2.11
8.0	0.42	0.42	0.42	0.42	0.42	0.53	0.74	0.91	1.04	1.26	1.45	1.62	1.77	2.03	2.47	2.83	3.15
10.0	0.46	0.48	0.50	0.51	0.52	0.67	0.97	1.19	1.38	1.71	1.98	2.22	2.44	2.84	3.50	4.06	4.56
12.0	0.47	0.53	0.58	0.61	0.64	0.84	1.23	1.53	1.79	2.23	2.61	2.95	3.26	3.81	4.75	5.56	6.28
14.0	0.48	0.58	0.65	0.70	0.75	1.00	1.48	1.86	2.19	2.76	3.25	3.69	4.09	4.82	6.07	7.15	8.11
16.0	0.49	0.63	0.72	0.79	0.85	1.15	1.73	2.20	2.60	3.30	3.90	4.45	4.95	5.86	7.43	8.79	10.02
20.0	0.52	0.71	0.85	0.96	1.06	1.45	2.22	2.85	3.40	4.36	5.21	5.97	6.68	7.97	10.23	12.20	13.99
25.0	0.56	0.80	1.00	1.16	1.30	1.81	2.82	3.65	4.39	5.69	6.83	7.88	8.86	10.65	13.80	16.58	19.13
30.0	0.59	0.89	1.13	1.34	1.53	2.15	3.39	4.42	5.34	6.98	8.43	9.76	11.01	13.30	17.37	20.99	24.31
40.0	0.65	1.05	1.38	1.68	1.95	2.77	4.45	5.87	7.14	9.43	11.47	13.37	15.14	18.43	24.32	29.60	34.48
50.0	0.71	1.18	1.59	1.97	2.32	3.32	5.40	7.17	8.78	11.66	14.26	16.67	18.94	23.17	30.78	37.65	44.02
60.0	0.76	1.30	1.78	2.23	2.65	3.81	6.24	8.33	10.23	13.65	16.76	19.64	22.36	27.45	36.63	44.96	52.70

[1]Such as for row-cropped agricultural and other moderately consolidated soil conditions with little-to-moderate cover (not applicable to thawing soil)

Values for topographic factor, LS, for high ratio of rill to interrill erosion.[1]

Slope (%)	Horizontal slope length (ft)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13
1.0	0.09	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.27
2.0	0.13	0.13	0.13	0.13	0.13	0.16	0.21	0.25	0.28	0.33	0.37	0.40	0.43	0.48	0.56	0.63	0.69
3.0	0.17	0.17	0.17	0.17	0.17	0.21	0.30	0.36	0.41	0.50	0.57	0.64	0.69	0.80	0.96	1.10	1.23
4.0	0.20	0.20	0.20	0.20	0.20	0.26	0.38	0.47	0.55	0.68	0.79	0.89	0.98	1.14	1.42	1.65	1.86
5.0	0.23	0.23	0.23	0.23	0.23	0.31	0.46	0.58	0.68	0.86	1.02	1.16	1.28	1.51	1.91	2.25	2.55
6.0	0.26	0.26	0.26	0.26	0.26	0.36	0.54	0.69	0.82	1.05	1.25	1.43	1.60	1.90	2.43	2.89	3.30
8.0	0.32	0.32	0.32	0.32	0.32	0.45	0.70	0.91	1.10	1.43	1.72	1.99	2.24	2.70	3.52	4.24	4.91
10.0	0.35	0.37	0.38	0.39	0.40	0.57	0.91	1.20	1.46	1.92	2.34	2.72	3.09	3.75	4.95	6.03	7.02
12.0	0.36	0.41	0.45	0.47	0.49	0.71	1.15	1.54	1.88	2.51	3.07	3.60	4.09	5.01	6.67	8.17	9.57
14.0	0.38	0.45	0.51	0.55	0.58	0.85	1.40	1.87	2.31	3.09	3.81	4.48	5.11	6.30	8.45	10.40	12.23
16.0	0.39	0.49	0.56	0.62	0.67	0.98	1.64	2.21	2.73	3.68	4.56	5.37	6.15	7.60	10.26	12.69	14.96
20.0	0.41	0.56	0.67	0.76	0.84	1.24	2.10	2.86	3.57	4.85	6.04	7.16	8.23	10.24	13.94	17.35	20.57
25.0	0.45	0.64	0.80	0.93	1.04	1.56	2.67	3.67	4.59	6.30	7.88	9.38	10.81	13.53	18.57	23.24	27.66
30.0	0.48	0.72	0.91	1.08	1.24	1.86	3.22	4.44	5.58	7.70	9.67	11.55	13.35	16.77	23.14	29.07	34.71
40.0	0.53	0.85	1.13	1.37	1.59	2.41	4.24	5.89	7.44	10.35	13.07	15.67	18.17	22.95	31.89	40.29	48.29
50.0	0.58	0.97	1.31	1.62	1.91	2.91	5.16	7.20	9.13	12.75	16.16	19.42	22.57	28.60	39.95	50.63	60.84
60.0	0.63	1.07	1.47	1.84	2.19	3.36	5.97	8.37	10.63	14.89	18.92	22.78	26.51	33.67	47.18	59.93	72.15

[1]Such as for freshly prepared construction and other highly disturbed soil conditions with little or no cover (not applicable to thawing soil)

Soil Erodibility Factor *K* in tons/acre

Textural class	Organic matter content, %	
	0.5	2
Fine sand	0.16	0.14
Very fine sand	0.42	0.36
Loamy sand	0.12	0.10
Loamy very fine sand	0.44	0.38
Sandy loam	0.27	0.24
Very fine sandy loam	0.47	0.41
Silt loam	0.48	0.42
Clay loam	0.28	0.25
Silty clay loam	0.37	0.32
Silty clay	0.25	0.23

Source: Schwab, G., et al. (1981) *Soil and Water Conservation Engineering*. John Wiley Inc., New York.

Mulch Factors and Length Limits for Construction Slopes[1]

Type of Mulch	Mulch Rate (tons/acre)	Land Slope	Factor *C*	Length limit[2] (ft)
None	0	all	1.0	–
Straw or hay, tied down by anchoring and tacking equipment[3]	1.0	1–5%	0.20	200
	1.0	6–10%	0.20	100
	1.5	1–5%	0.12	300
	1.5	6–10%	0.12	150
	2.0	1–5%	0.06	400
	2.0	6–10%	0.06	200
	2.0	11–15%	0.07	150
	2.0	16–20%	0.11	100
	2.0	21–25%	0.14	75
	2.0	26–33%	0.17	50
	2.0	34–50%	0.20	35
Crushed stone, 0.25 to 1.5 in.	135	< 16%	0.05	200
	135	16–20%	0.05	150
	135	21–33%	0.05	100
	135	34–50%	0.05	75
	240	< 21%	0.02	300
	240	21–33%	0.02	200
	240	34–50%	0.02	150
Wood chips	7	< 16%	0.08	75
	7	16–20%	0.08	50
	12	< 16%	0.05	150
	12	16–20%	0.05	100
	12	21–33%	0.05	75
	25	< 16%	0.02	200
	25	16–20%	0.02	150
	25	21–33%	0.02	100
	25	34–50%	0.02	75

[1]From Meyer and Ports (24). Developed by an interagency workshop group on the basis of field experience and limited research data.

[2]Maximum slope length for which the specified mulch rate is considered effective. When this limit is exceeded, either a higher application rate or mechanical shortening of the effective slope length is required.

[3]When the straw or hay mulch is not anchored to the soil, C values on moderate or steep slopes of soils having K values greater than 0.30 should be taken at double the values given in this table.

Source: U.S. Department of Agriculture. *Predicting Rainfall Erosion Losses: A Guide to Conservation Planning*. Agricultural Handbook Number 537. Washington, DC: USDA, 1978, Table 9, p. 31. https://www.ars.usda.gov/ARSUserFiles/64080530/RUSLE/AH_537.pdf.

Factor C for Permanent Pasture, Range, and Idle Land[1]

Vegetative canopy		Cover that contacts the soil surface						
Type and Height[2]	Percent Cover[3]	Type[4]	Percent Ground Cover					
			0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	0.45	0.24	0.15	0.091	0.043	0.011
Tall weeds or short brush with average drop fall height of 20 in.	25	G	0.36	0.17	0.09	0.038	0.013	0.003
		W	0.36	0.20	0.13	0.083	0.041	0.011
	50	G	0.26	0.13	0.07	0.035	0.012	0.003
		W	0.26	0.16	0.11	0.076	0.039	0.011
	75	G	0.17	0.10	0.06	0.032	0.011	0.003
		W	0.17	0.12	0.09	0.068	0.038	0.011
Appreciable brush or bushes, with average drop fall height of 6.5 ft	25	G	0.40	0.18	0.09	0.040	0.013	0.003
		W	0.40	0.22	0.14	0.087	0.042	0.011
	50	G	0.34	0.16	0.08	0.038	0.012	0.003
		W	0.34	0.19	0.13	0.082	0.041	0.011
	75	G	0.28	0.14	0.08	0.036	0.012	0.003
		W	0.28	0.17	0.12	0.078	0.040	0.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	0.42	0.19	0.10	0.041	0.013	0.003
		W	0.42	0.23	0.14	0.089	0.042	0.011
	50	G	0.39	0.18	0.09	0.040	0.013	0.003
		W	0.39	0.21	0.14	0.087	0.042	0.011
	75	G	0.36	0.17	0.09	0.039	0.012	0.003
		W	0.36	0.20	0.13	0.084	0.041	0.011

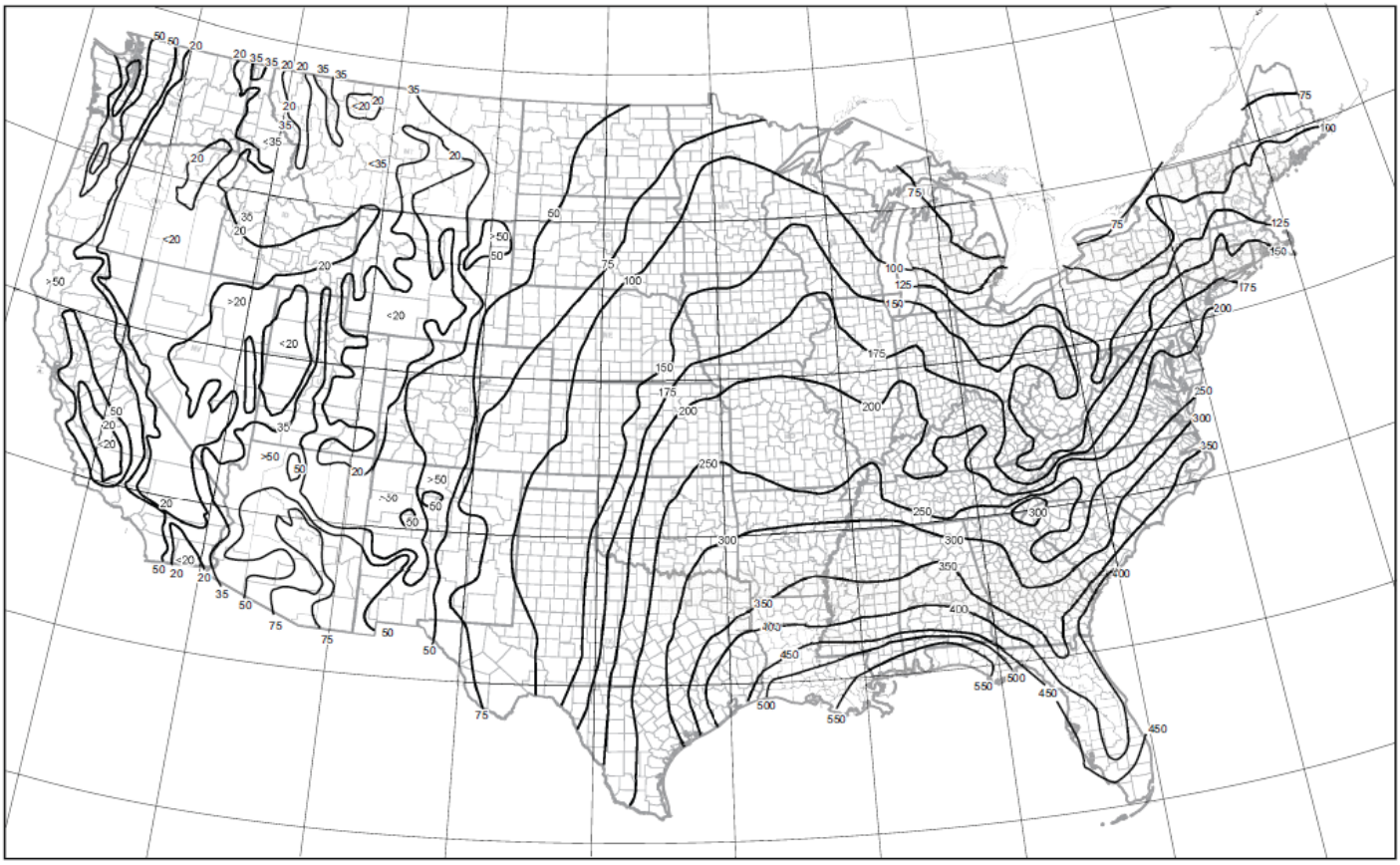
[1] The listed *C* values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

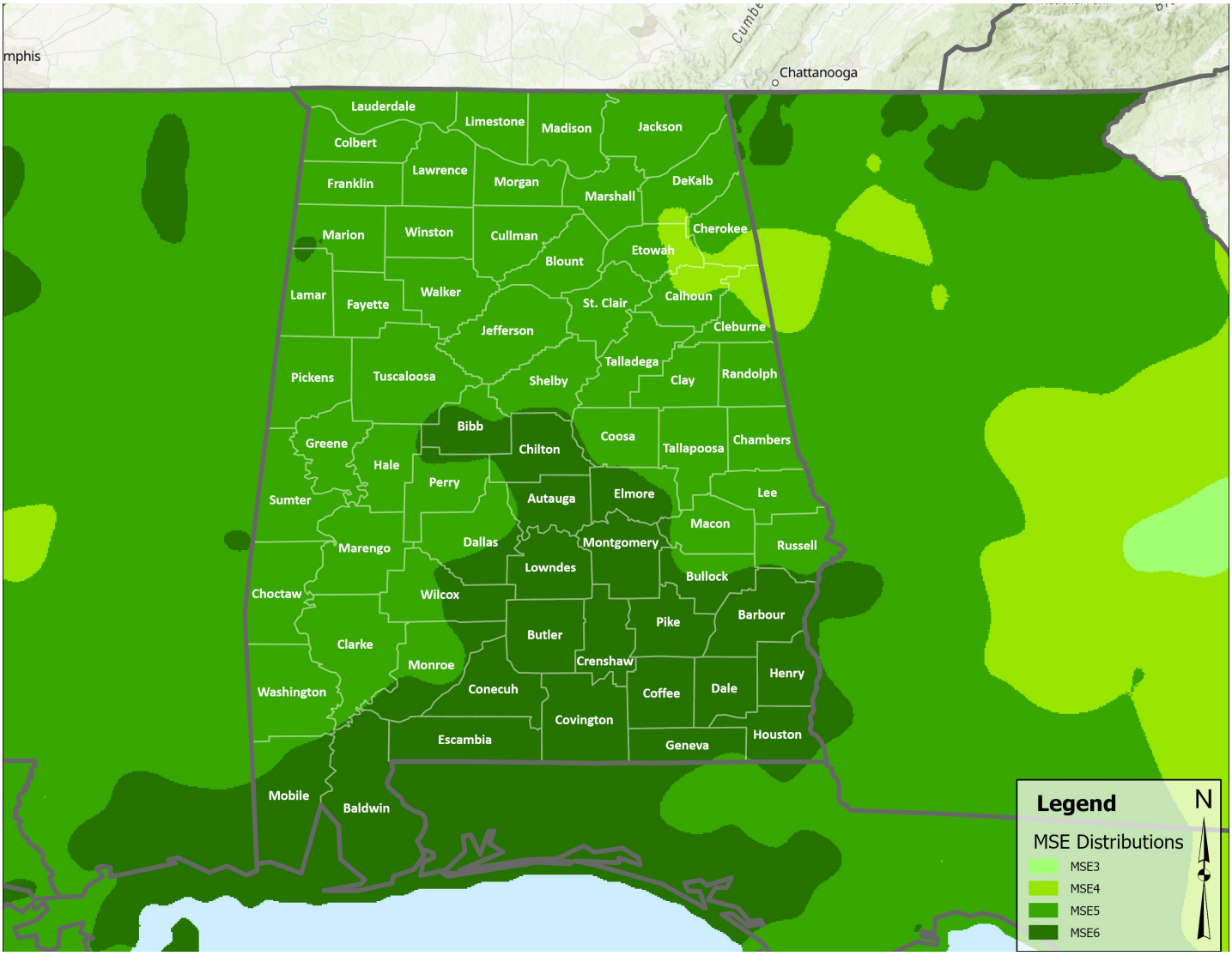
[4] G: Cover at surface is grass, grass-like plants, decaying compacted duff, or litter at least 2 in. deep.
W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

Source: U.S. Department of Agriculture. *Predicting Rainfall Erosion Losses: A Guide to Conservation Planning*. Agricultural Handbook Number 537. Washington, DC: USDA, 1978, Table 10, p. 32. https://www.ars.usda.gov/ARSUserFiles/64080530/RUSLE/AH_537.pdf.



Average Annual Values of the Rainfall Erosion Index

Source: U.S. Department of Agriculture. *Predicting Rainfall Erosion Losses: A Guide to Conservation Planning*. Agricultural Handbook Number 537. Washington, DC: USDA, 1978, Fig. 1, p. 5a.
https://www.ars.usda.gov/ARSUserFiles/64080530/RUSLE/AH_537.pdf.



Alabama MSE Distributions from NOAA Atlas 14 Data

APPENDIX F

Future ACSP Recertification and Continuing Education Opportunities

Recertification and Continuing Education Development Topics

Sector Specific CBMPP Development

- Highway construction
- Horizontal construction
- Residential construction
- Land development
- Linear/utility construction

Designing for CBMPPs

- Sediment containment and perimeter controls
    - Sediment barriers
    - Sediment basins
    - Curb & gutter inlet protection
    - Construction exit pads
        - Porosity of different rock materials
        - Discussion about the geotextile underlay
- Flocculent use on construction sites
- RUSLE and MUSLE for sediment loss calculations
- RUSLE2

Converting Construction BMPs into Post-construction BMPs

- Sediment basins retrofit into bioretention cells
- Sediment basins design into detention/retention ponds
- Underground retention systems

Practical Skills for QCP and QCI Project Management

- Preparing inspection reports and CBMPP documentation
- Communication with site personnel, regulatory agencies, and the public including expectations on conducting meetings and relaying compliance issues
- Conflict resolution and negotiation skills
- Safety and health considerations for inspectors