

Advanced Watershed Processes
Grades 7-12

Enduring Understandings

1. Understand what a watershed is both literally and conceptually (including the mapped representation of a watershed and the issue of scale).
2. Understand the components and processes of a watershed including runoff, soil, geology, geography, permeability, storage, land cover, land use, vegetation, precipitation, stream flow, flooding, drought (climate), fire, drainage patterns, erosion, deposition and population.
3. Understand a watershed as a system (e.g. a change in one area will affect the dynamics of the entire system) and how that system functions.
4. Understand that watershed management is complex because of culture, economics, politics, social constructs, scientific studies and aesthetics. Some water users include urban, rural, agricultural, business & industry, energy, recreation, fish and wildlife and earth systems.
5. Understand that watersheds change over time both naturally (e.g. flooding, fire) and due to anthropogenic causes (e.g. damming a river, water rights, water withdrawals).
6. Know some of the issues facing the watershed managers of the Colorado River Watershed as well as other Southwestern Watersheds.

Enduring Understanding(s)	Concepts	Activities	Arizona Education Standards	Materials Needed
1	<p>Create a watershed and understand how it functions</p> <p>Describe drainage patterns in watersheds</p> <p>Predict where water will flow in a watershed</p>	<p>Branching Out – Adapted version (Project WET Curriculum & Activity Guide)</p>	<p>Science Strand 6: Concepts 1, 2</p> <p>Social Studies 3SS-E7, P4</p>	<p>Provided in kit: Spray bottles Washable Markers Transparency of <i>Branching Patterns</i></p> <p>Provided by school/class: Paper Scotch Tape Water</p>
1	<p>Locate the main stem, tributaries, and headwaters of a watershed.</p> <p>Outline the boundary of a watershed.</p> <p>Apply this skill to a more detailed map.</p>	<p>Seeing Watersheds and Blue Beads (Discover a Watershed: The Colorado Educators Guide)</p>	<p>Science Strand 6: Concepts 1, 2</p> <p>Math Strand 2: Concepts 1, 4</p> <p>Social Studies 3SS-E4, E5, P1, P2, P4</p>	<p>Seeing Watersheds Provided in kit: Transparencies of Verde River Watershed, Oak Creek Watershed, Arizona Drainage and Relief Maps</p> <p>Provided by school/class: Blue, red, green, orange, and purple markers Copies of <i>Seeing Watersheds Student Copy Page</i> (one per student)</p> <p>Blue Beads Provided in kit: Plastic tokens</p>

				<p>5 - 1 quart containers</p> <p>Provided by school/class: Large ball of string or yarn</p>
1, 2, 3, 4	<p>Describe the water cycle.</p> <p>Identify water users in the Colorado Watershed.</p> <p>Identify the states of water as it moves through the water cycle.</p>	<p>Incredible Journey of the Colorado River (Discover a Watershed: The Colorado Educators Guide)</p>	<p>Science Strand 3: Concepts 1, 3 Strand 4: Concept 3 Strand 6: Concepts 1, 2</p> <p>Social Studies 3SS-E6, E7, P2, P4 4SS-E4, P1</p>	<p>Provided in kit: Transparency of <i>Water Cycle Diagram</i> Laminated stations signs Laminated game boards Laminated explanation cards Laminated <i>Water User Cards</i> Dice</p> <p>Provided by school/class: Copies of the <i>Water Cycle Diagram</i> (1 per student) Copies of <i>Water Molecule Movement Student Copy Page</i> (1 per student)</p>
1, 2, 3, 4, 5	<p>Learn watershed terms.</p> <p>Understand the physical properties or relationships of the watershed vocabulary.</p> <p>Increase the ability to use analogies to explain the world.</p>	<p>River Talk (Discover a Watershed: Watershed Manager, p. 37)</p>	<p>Language Arts Reading Strand 1: Concept 4 Reading Strand 3: Concept 1, 2 Writing Strand 1: Concept 1</p> <p>Science Strand 6: Concept 1, 2</p>	<p>Provided in kit: Transparency of <i>Watershed Diagram</i> Watershed Glossary (pp. 179-190)</p> <p>Provided by school/class: Overhead projector Copies of <i>Watershed Diagram</i> and <i>River Talk Student Copy Page</i> (one of each per student) Dictionary and/or internet access</p>
4	<p>Compare and contrast excerpts written about the Colorado Watershed by different water users and authors.</p> <p>Identify the different values, attitudes, and beliefs about the Colorado that the writing express.</p> <p>Recognize that cultural, historical, social, political, and economic contexts help determine how people think about the Colorado.</p>	<p>One River, Many Voices of the Colorado River Basin (Discover a Watershed: The Colorado Educators Guide)</p>	<p>Language Arts Writing Strand 1: Concept 1</p> <p>Science Strand 3: Concepts 1, 3</p> <p>Social Studies 1SS-E8, P1, P2, P11 3SS-E5, E6, E7, P2, P3, P4, P5 4SS-E4, P1</p>	<p>Provided in kit: Laminated classroom set of <i>One River, Many Voices Water User Cards</i> and <i>River Voice Cards</i> Laminated classroom set of <i>One River, Many Voices Author Cards</i> and <i>Author Voice Cards</i></p> <p>Provided by school/class: Pencil and paper <i>One River, Many Voices Water User Cards</i> and <i>River Voices Cards Student Copy Pages</i> (one copy per student or group) <i>One River, Many Voices Author</i></p>

	Interpret the work of authors from the watershed to expand their knowledge of the watershed's literature and history.			<i>Cards and Author's Voice Cards Student Copy Pages</i> (one per student or group)
2, 3, 4, 5	Analyze and interpret streamflow data. Identify the risks and the benefits of development in a floodplain.	Back to the Future (Discover a Watershed: Watershed Manager, p. 86)	Language Arts Reading Strand 1: Concept 4, 6 Reading Strand 3: Concept 1, 2, 3 Writing Strand 1: Concept 1 Science Strand 1: Concept 1, 4 Strand 3: Concept 1, 2, 3 Strand 6: Concept 1 Math Strand 2: Concept 1 Social Studies 1SS-P1 3SS-P1, P2, P3, P4, P5 4SS-P1	Provided in kit: Transparency of <i>Community Planning Map</i> Laminated news reports of floods Laminated copies of <i>Community Planning Map</i> Cubic foot model (cardboard box) Provided by school/class: 1 copy of each location view (if being read by students) Graph paper
2, 3, 4, 6	Identify and understand major deposits and withdrawals used by hydrologists to estimate a watershed's hydrologic budget.	Hydrologic Bank Account (Discover a Watershed: Watershed Manager, p. 95)	Language Arts Reading Strand 1: Concept 4, 6 Reading Strand 3: Concept 1, 2 Science Strand 3: Concept 1, 2, 3 Strand 6: Concept 1 Math Strand 2: Concept 1 Social Studies 3SS-P4, P5 4SS-P1	Provided in kit: Transparency of <i>Annual Bank Accounts</i> Provided by school/class: Calculators Copies of <i>Your Hydrologic Bank Account Student Copy Page</i> (one copy per student) Graph paper
1, 3, 4, 5	Discuss water quality in terms of water quality parameters. Infer land uses from water quality data. Distinguish between human-caused and naturally occurring water quality issues.	River Reflections (Discover a Watershed: Watershed Manager, p. 107)	Language Arts Reading Strand 1: Concept 4, 6 Reading Strand 3: Concept 1, 2 Science Strand 1: Concept 1, 3, 4 Strand 3: Concept 1, 2 Strand 6: Concept 1 Social Studies	Provided in kit: Laminated copies of <i>Water Quality Parameters</i> and <i>Water Quality Data Student Copy Pages</i> Transparency of <i>Water Quality Parameter Chart</i> Provided by school/class: Copies of <i>Water Quality Scenarios Student Copy Page</i>

			3SS-P4	(one copy of each per group)
4, 5, 6	<p>Describe the principles of prior appropriation and beneficial use.</p> <p>Compare systems of water allocation used by Mexico and the U.S.</p> <p>Discuss how the “Law of the River” affects water users in the U.S. and Mexico.</p> <p>Evaluate current water management practices and develop solutions to water management challenges.</p>	First Come, First Served (Discover a Watershed: The Colorado Educators Guide)	<p>Science Strand 3: Concepts 1, 2, 3</p> <p>Math Strand 2: Concept 4</p> <p>Social Studies 1SS-E8, P12 3SS-E5, E6, E7, E8, P3, P4, P5 4SS-E4, P1, P6</p>	<p>Provided in kit: Laminated classroom set of <i>First Come, First Served Water User Cards</i> (1 card per student) Laminated classroom set of <i>First Come, First Served Action Cards</i> Laminated set of <i>First Come, First Served Water Unit Squares</i></p> <p>Provided by school/class: Sticky notes (3 per student or group)</p>
1, 5	<p>Recognize that population growth and settlement cause changes in land use.</p> <p>Analyze how land use variations in a watershed can affect the runoff of water.</p>	Color Me a Watershed (Discover a Watershed: Watershed Manager, p. 157)	<p>Language Arts Reading Strand 1: Concept 4 Reading Strand 3: Concept 1, 2</p> <p>Science Strand 1: Concept 1, 3, 4 Strand 3: Concept 1, 2 Strand 6: Concept 1</p> <p>Math Strand 2: Concept 1</p> <p>Social Studies 1SS-P1, P12 2SS-P10 3SS-P1, P2, P3, P4, P5</p>	<p>Provided in kit: Transparencies of Verde River Watershed, Oak Creek Watershed, Arizona Drainage and Relief Maps Transparency of <i>Sample GIS Map</i> (p. 158) Answer key of <i>Area of Land Coverage Chart and Volume of Rain and Volume of Runoff chart</i> (transparency and master) Colored pencils</p> <p>Provided by school/class: Copies of <i>Maps A, B, and C</i>; <i>Area of Land Coverage Chart and Volume of Rain and Volume of Runoff chart</i> (one copy of each per student) Calculators</p>
4, 5, 6	<p>Identify key elements that facilitate collaboration and decision-making.</p> <p>Recognize the challenges of managing transboundary resources.</p> <p>Demonstrate strategies to help facilitate cooperation and</p>	On the Edge (Discover a Watershed Watershed Manager, p. 168)	<p>Science Strand 3: Concept 1, 2 Strand 6: Concept 1</p> <p>Social Studies 1SS-P1, P12 2SS-P10 3SS-P2, P3, P4, P5 4SS-P8</p>	<p>Provided in kit: 80 plastic tokens Rope Laminated ‘Rules of negotiation’ cards</p> <p>Provided by school/class: Masking tape Paper Pens/pencils</p>

	agreement.			
--	------------	--	--	--