Technical Appendix 18

Indian Trust Assets

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Acronyms and Abbreviations

Acronym or Abbreviation	Full Phrase
ADM	Alternative Distribution Model
afy	acre-feet per Year
AZ	Arizona
BIA	Bureau of Indian Affairs
CA	California
CAP	Central Arizona Project
CCS	Continued Current Strategies
Department	Department of the Interior
DMDU	decision making under deep uncertainty
Draft EIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
ICS	intentionally created surplus
ITA	Indian trust asset
LB Priority	Lower Basin Priority
LB Pro Rata	Lower Basin Pro Rata
M&I	municipal and industrial
maf	million acre-feet
NIA	non-Indian agriculture
NV	Nevada
PPR	present perfected right
Reclamation	Bureau of Reclamation
SAM	Shortage Allocation Model
U.S.	United States

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TA 18. Indian Trust Assets

TA 18.1 Affected Environment

The United States (U.S.) has a trust responsibility to tribes as defined by statutes, court decrees, treaties, or other applicable law.[1] Indian trust assets (ITAs) are legal interests in assets held in trust by the federal government for the benefit of federally recognized Native American tribes or individual Native Americans (Reclamation 1994). ITAs can be located on or off established reservation lands and can consist of land, rights, or entitlements[2], natural resources, monies (e.g., trust funds), mineral rights, hunting, fishing, trapping, and gathering rights, and others. Beneficiaries of the Indian trust relationship are tribes and individual Native Americans; the U.S. is the trustee. ITAs are generally restricted against alienation. With federal authority and approval, ITAs may be leased to generate income for tribes or individual Native Americans (Department 2025).

It is the general policy of the Department of the Interior (Department) to carry out activities in a manner that protects ITAs and avoids adverse effects whenever possible (Reclamation 1993). In accordance with Bureau of Reclamation (Reclamation) ITA Policy and Guidance (Reclamation 1994), tribal consultation addressing trust assets should be initiated with appropriate tribal groups and the Bureau of Indian Affairs (BIA), and the presence or absence of ITAs should be addressed explicitly in all National Environmental Policy Act documents. Reclamation is consulting with tribes regarding the proposed Post-2026 Operational Guidelines.

TA 18.1.1 Trust Lands

Indian trust lands are lands that the U.S. holds in trust for the benefit of a tribe (tribal trust land) or for an individual Native American (individual trust land). Trust lands may be located on or off a reservation. While reservations are not always synonymous with trust lands, the exterior boundaries of reservations are used to define the trust land assets for purposes of this National Environmental Policy Act analysis. There are 30 federally recognized tribes in the Colorado River Basin, 29 of which have established reservations (**Map TA 18-1**). The San Juan Southern Paiute tribe does not have their own reservation. Tribal land uses include but are not limited to communal and spiritual uses, domestic use, and agriculture and economic development.

[1] Nothing in this Appendix is intended to modify, abrogate, or create ITAs. Any particular ITA remains defined by and subject to applicable authority.
[2] Rights and entitlements may be used interchangeably in this Appendix for simplicity, and no legal change to any ITA is intended.

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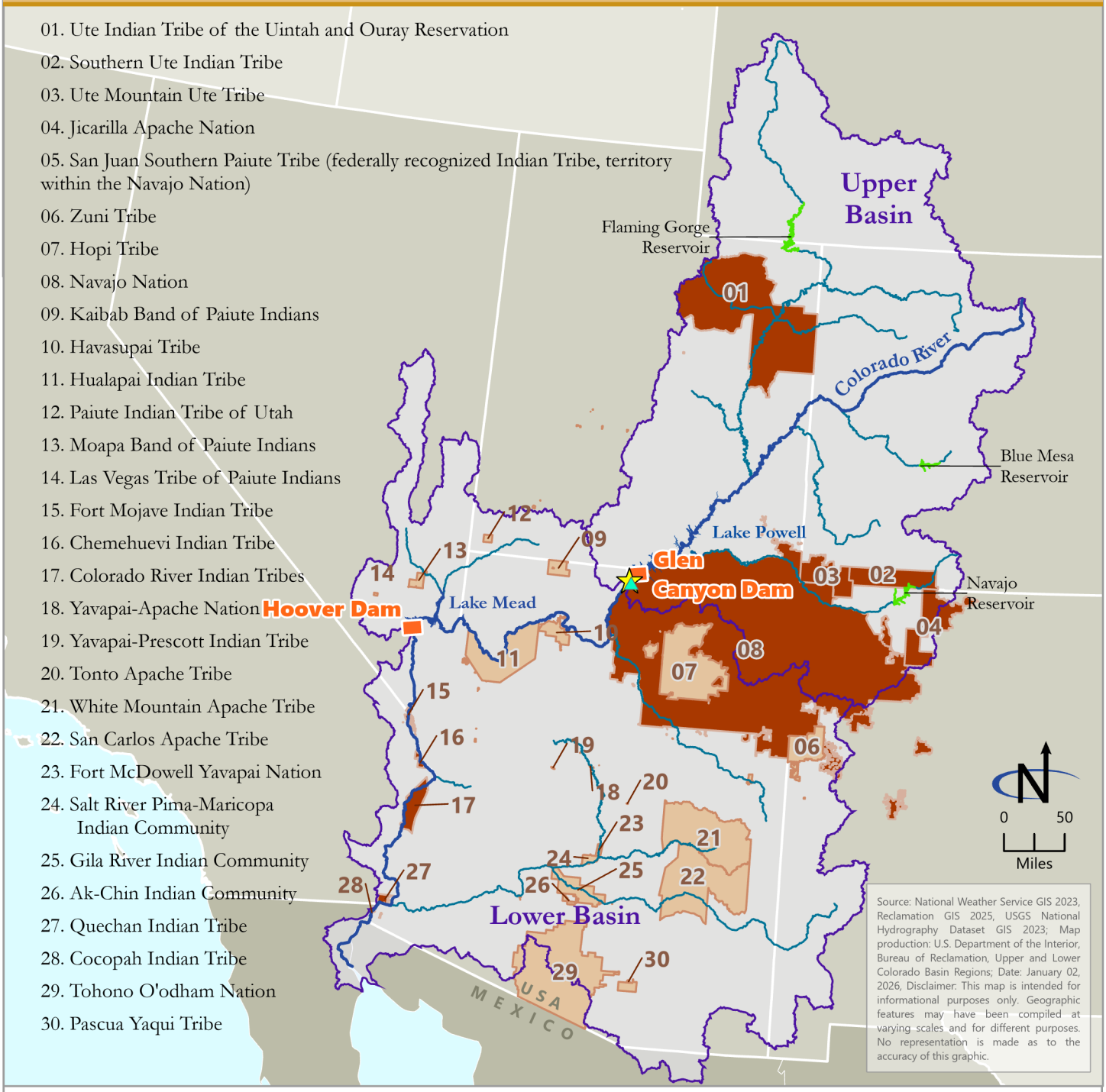
Map TA 18-1
Tribes and Reservations within the Colorado River Basin



Native American reservations in the U.S. were created and modified through a complex history of statutes, treaties, executive orders, agreements, and federal policies (BIA 2025a). The Indian Removal Act of 1830 resulted in the forced removal of tribes from their ancestral lands east of the Mississippi River into the Western U.S. Lands inhabited by these relocated groups came to be known as "Indian territory", which served as the precursor to federal reservations (BIA 2025a). The Indian Appropriations Act of 1851 resulted in further confinement of Native Americans to areas called "reservations" (Elliott 2025). The General Allotment Act (also known as the Dawes Act) of 1887 divided communal reservation lands into trust land allotted to individual Native Americans and their families (BIA 2025a). It also opened non-allotted land to non-tribal ownership, resulting in significant fractionalization and loss of tribal-controlled land (BIA 2025a). In the twentieth and twenty-first centuries, federal policies have attempted to help restore the self-determination of Native American tribes and reduce the effects of reservation fractionalization (BIA 2025a, 2025b). See the Tribal Treaties Database (OSU 2025) for detailed information on treaties, agreements, and executive orders.

Upper Basin

From approximately Northeast to Southeast, the Upper Basin reservations include those associated with the Ute Indian Tribe of the Uintah and Ouray Reservation (Utah), the Southern Ute Indian Tribe (Colorado), the Ute Mountain Ute Tribe (Colorado, New Mexico, Utah), the Jicarilla Apache Nation (New Mexico), and the Navajo Nation (Arizona, New Mexico, Utah).

Lower Basin

From approximately Northeast to Southeast, Lower Basin reservations include those associated with the Zuni Tribe (Arizona, New Mexico), the Hopi Tribe (Arizona), the Kaibab Band of Paiute Indians (Arizona), the Havasupai Tribe (Arizona), the Hualapai Indian Tribe (Arizona), the Shivwits Band of Paiute Indian Tribe (Utah), the Moapa Band of Paiute Indians (Nevada), the Las Vegas Tribe of Paiute Indians (Nevada), the Fort Mojave Indian Tribe (Arizona, California, Nevada), the Chemehuevi Indian Tribe (California), the Colorado Indian River Tribes (Arizona, California),[3] the Yavapai-Apache Nation (Arizona), the Yavapai-Prescott Indian Tribe (Arizona), the Tonto Apache Tribe (Arizona), the White Mountain Apache Tribe (Arizona), the San Carlos Apache Tribe (Arizona), the Fort McDowell Yavapai Nation (Arizona), the Salt River Pima-Maricopa Indian Community (Arizona), the Gila River Indian Community (Arizona), the Ak-Chin Indian Community (Arizona), the Fort Yuma Quechan Indian Tribe (Arizona, California), the Cocopah Indian Tribe (Arizona), the Tohono O'odham Nation (Arizona), and the Pascua Yaqui Tribe (Arizona).

In addition, trust land includes the Fort Mojave off-reservation trust land in San Bernardino County, California. No other off-reservation trust land along the mainstream Colorado River has been identified.

[3] Colorado River Indian Tribes is comprised of members of four distinct tribes: the Mohave, Chemehuevi, Hopi, and Navajo.

TA 18.1.2 Water Entitlements, Water Deliveries, and Storage and Conservation Options

TA 4, Water Deliveries, summarizes the "Law of the River" that governs the management and operation of the Colorado River. This section includes a discussion of tribal mainstream Colorado River water entitlements and Central Arizona Project (CAP) contracts.[4] The entitlements included in this analysis are consistent with those in the Shortage Allocation Models (SAMs) and Alternative Distribution Models (ADMs; see **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation) and other sections of the Draft Environmental Impact Statement (Draft EIS).[5]

Upper Basin

Water Entitlements

The five Upper Basin tribes draw from various tributaries to the Colorado River (**Table TA 18-1**).

Table TA 18-1
Upper Basin Native American Water Rights

Tribe or Reservation	Basin	Diversion Right (Acre-feet per year [afy])	Depletion Right Acre-feet per year (afy)
Jicarilla Apache Nation	San Juan River	45,683	34,195
Navajo Nation	San Juan River	606,600	325,670
Southern Ute Indian Tribe	San Juan, Piedra, Pine, Florida, Animas, La Plata, and Mancos	137,090	74,138
Ute Indian Tribe of the Uintah and Ouray Reservation	Duchesne, Lake Fork, Yellowstone, Uinta, Whiterocks, White, and Green Rivers; Bitter, Sweet Water, Willow, and Hill Creeks	480,594	258,943
Ute Mountain Ute Tribe	San Juan, Animas, La Plata, Mancos, McElmo, and Dolores Rivers	88,358	51,081

Source: Reclamation 2012

Lower Basin

Water Entitlements

Lower Basin tribes have mainstream Colorado River water entitlements as determined and quantified under the 2006 Consolidated Decree, and water entitlements and settlements, including CAP water.

Water Entitlements Determined under Arizona v. California

The Consolidated Decree determined and quantified mainstream Colorado River water rights for five tribes— Chemehuevi Indian Tribe (Chemehuevi Indian Reservation of California), Colorado

[4] While some entitlements are not ITAs, they are included for reference in this Appendix.
[5] Tribes may have other sources of water, including groundwater and other surface water, which are not part of this analysis.

River Indian Tribes (Colorado River Indian Reservation of Arizona and California), Fort Mojave Indian Tribe (Fort Mojave Indian Reservation of Arizona, California, and Nevada), Fort Yuma Quechan Indian Tribe (Fort Yuma Indian Reservation of Arizona and California), and Cocopah Indian Tribe (Cocopah Indian Reservation of Arizona) water entitlements.

Table TA 18-2 summarizes water entitlements along the Colorado mainstream in the Lower Basin.

Table TA 18-2
Colorado River Mainstream Native American Water Entitlements

Tribe/Reservation	State	Entitlement (afy)	Present Perfected Right (PPR) Number	Priority within State	Priority Date
Chemehuevi Reservation	CA	11,340	22	1	February 2, 1907
Cocopah Indian Reservation	AZ	1,140	8	1	1915
Cocopah Indian Reservation	AZ	7,681	1	1	September 27, 1917
Cocopah Indian Reservation	AZ	2,206	N/A	4	June 24, 1974
Cocopah Indian Reservation	*AZ subtotal*	*10,847*	*N/A*	*N/A*	*N/A*
Colorado River Indian Reservation	AZ	358,400	2	1	March 3, 1865
Colorado River Indian Reservation	AZ	252,016	2	1	November 22, 1873
Colorado River Indian Reservation	AZ	51,986	2	1	November 16, 1874
Colorado River Indian Reservation	*AZ subtotal*	*662,402*	*N/A*	*N/A*	*N/A*
Colorado River Indian Reservation	CA	10,745	24	1	November 22, 1873
Colorado River Indian Reservation	CA	40,241	24	1	November 16, 1874
Colorado River Indian Reservation	CA	5,860	24	1	May 15, 1876
Colorado River Indian Reservation	*CA subtotal*	*56,846*	*N/A*	*N/A*	*N/A*
Colorado River Indian Reservation	*AZ and CA total*	*719,248*	*N/A*	*N/A*	*N/A*
Fort Mojave Reservation	CA	16,720	25	1	September 18, 1890
Fort Mojave Reservation	NV	12,534	81	1	September 18, 1890
Fort Mojave Reservation	*CA and NV total*	*132,789*	*N/A*	*N/A*	*N/A*

Tribe/Reservation	State	Entitlement (afy)	Present Perfected Right (PPR) Number	Priority within State	Priority Date
Fort Yuma (Quechan) Indian Reservation	AZ	6,350	3a	1	January 9, 1884
Fort Yuma (Quechan) Indian Reservation	CA	71,616	23	1	January 9, 1884
Fort Yuma (Quechan) Indian Reservation subtotal	*AZ and CA total*	*77,966*	*N/A*	*N/A*	*N/A*
Hopi Tribe+	AZ	4,278	N/A	4	January 31, 1983
Hopi Tribe+	AZ	500	N/A	5	January 31, 1983
Hopi Tribe+	AZ	1,000	N/A	6	January 31, 1983
Hopi Tribe subtotal+	*AZ*	*5,778*	*N/A*	*N/A*	*N/A*
Hualapai Tribe+	*AZ*	*1,110*	*N/A*	*4*	*February 17, 2006*

Source: Reclamation 2012
+ Indicates that the entitlement is not an ITA.
Notes: Arizona (AZ); California (CA); Nevada (NV)

Central Arizona Project

Several tribes in Arizona hold CAP water entitlements, which are held in trust in accordance with the applicable settlement. These tribal entitlements to CAP water or Colorado River water delivered through the CAP in central Arizona are administered pursuant to settlements and water delivery contracts between tribes and the Secretary of the Interior.

Table TA 18-3
CAP Water Entitlements

Tribe or Reservation	Contract Volume (afy)	Arizona Priority	CAP Priority
Ak-Chin Community	50,000	3	N/A
Ak-Chin Community	58,300	4	Indian
Ak-Chin Community	10,000	Additional water	N/A
Ak-Chin subtotal	*72,000 to 85,000*[6]	*N/A*	*N/A*
Fort McDowell Yavapai Nation	18,233	4	Indian
Gila River Indian Community	191,200	4	Indian
Gila River Indian Community	120,600	4	Non-Indian Agriculture

[6] The U.S. delivers between 72,000 to 85,000 afy to the Ak-Chin Indian Community in accordance with the terms of its settlement, even though Ak-Chin's total entitlement is greater than this amount. The San Carlos Apache Tribe is entitled to the CAP Indian Priority water not required for delivery to the Ak-Chin Indian Community, consistent with the terms of its settlement.

Tribe or Reservation	Contract Volume (afy)	Arizona Priority	CAP Priority
Gila River Indian Community subtotal	*311,800*	*N/A*	*N/A*
Hualapai Tribe	4,000	4	Non-Indian Agriculture
Pascua Yaqui Tribe+	500	4	Indian
Salt River Pima-Maricopa Indian Community	13,300	4	Indian
Salt River Pima-Maricopa Indian Community subtotal	*35,300*	*N/A*	*N/A*
San Carlos Apache Tribe	12,700	4	Indian
San Carlos Apache Tribe	18,145	4	Municipal & Industrial
San Carlos Reservation subtotal	*30,845*[4]	*N/A*	*N/A*
Tohono O'odham Nation – San Xavier District	27,000	4	Indian
Tohono O'odham Nation – San Xavier District	23,000	4	Non-Indian Agriculture
Tohono O'odham Nation – Schuk Toak District	10,800	4	Indian
Tohono O'odham Nation – Schuk Toak District	5,200	4	Non-Indian Agriculture
Tohono O'odham Nation – Sif Oidak District+	8,000	4	Indian
Tohono O'odham Nation subtotal	*74,000*	*N/A*	*N/A*
Tonto Apache Tribe+	128	4	Indian
White Mountain Apache Tribe	23,782	4	Indian
White Mountain Apache Tribe	1,218	4	Indian
White Mountain Apache Tribe subtotal	*25,000*	*N/A*	*N/A*
Yavapai-Apache Nation+	1,200	4	Indian

Source: Reclamation 2012; CAP 2025

+ Indicates that the entitlement is not an ITA.

Unquantified and Undeveloped Water Rights

In the context of tribal water, unquantified water rights refer to federally reserved water rights that have not yet been determined and quantified through an adjudication or settlement. While recognizing this important issue, the water deliveries analysis only considers quantified tribal water rights. This analysis should not be construed to, in any way, preclude or limit any ongoing or future quantification of tribal water rights.

In the context of tribal water, undeveloped water rights refer to quantified rights that are not being fully utilized. Undeveloped water may be due to a lack of the infrastructure needed to divert, transport, and/or use water (Water and Tribes Initiative 2025). While recognizing this important issue, this analysis does not distinguish between developed and undeveloped rights in the water

deliveries analysis. This analysis should not be construed to, in any way, preclude or limit any ongoing or future tribal development of water rights.

TA 18.1.3 Other Indian Trust Assets

ITAs can also include hunting, fishing, trapping, and gathering rights; mineral rights; and cultural, biological, and other resources. Whether or not specific rights or resources legally qualify as an ITA is complicated and depends on multiple factors, such as land status (Reclamation 1994). Reclamation is consulting with tribes and BIA to identify ITAs. To date, potential changes in water deliveries and activities affected by potential changes in water deliveries (e.g., irrigated agriculture) have been the primary concerns related to ITAs. Other ITAs may be incorporated into this analysis for the Final EIS, depending on tribal input.

Reclamation acknowledges that the 30 Basin Tribes depend on the Colorado River and its tributaries for a variety of purposes, including cultural and spiritual activities, wildlife, instream flows, recreation, and other purposes. See **TA 13**, Tribal Resources, and **TA 11**, Cultural Resources, for analysis of tribal and cultural resources, respectively. In general, those analyses apply to tribal and cultural resources that qualify as ITAs.

Although income derived from ITAs is not an ITA in and of itself, income derived from ITAs such as agricultural products, water leases, and fees charged for outdoor recreation on tribal land can be an important source of income for tribes. While this is more of a socioeconomic issue, income derived from ITAs may be considered further in this Appendix of the Final EIS depending on tribal input.

TA 18.2 Environmental Consequences

According to Reclamation ITA policy, actions that affect the value, use, or enjoyment of ITAs should be discussed in an ITA assessment (Reclamation 1994).

TA 18.2.1 Methodology

The methodology varies for each type of ITA. Quantitative metrics are analyzed where possible; otherwise, qualitative discussion is provided.

- For trust lands, potential changes in irrigated acreage due to fluctuating water deliveries are a primary concern. The amount of tribal agricultural land (in acres) estimated to be fallowed under each alternative is presented.
- For water entitlements, the analysis focuses on changes in the quantity of water (in acre-feet) estimated to be delivered to tribes under each alternative. Changes in options to conserve and store water are also discussed.
- For other ITAs, analysis is qualitative.

Impact Analysis Area

The impact analysis area includes land within the boundaries of reservations and off-reservation trust land within the Colorado River Basin (29 reservations listed in **TA 18.1**). [7]

Assumptions

- Trust land includes land within the borders of established reservations and off-reservation trust land.
- For the water deliveries analysis, the assumptions of Colorado River Simulation System modeling (**Appendix A**) and SAM modeling (**Appendix C**) apply.
- For potential impacts on agricultural land, the assumptions of the agricultural modeling apply (see **TA 16**, Socioeconomics, for more details).

Impact Indicators

- Changes in acres of irrigated tribal agricultural land.
- Percent of normal water delivered to Upper and Lower Basin tribes.

TA 18.2.2 Issue 1: How Will Changes in Dam Operations Affect Tribal Water Entitlements, Water Deliveries, and Water Storage and Conservation Options?

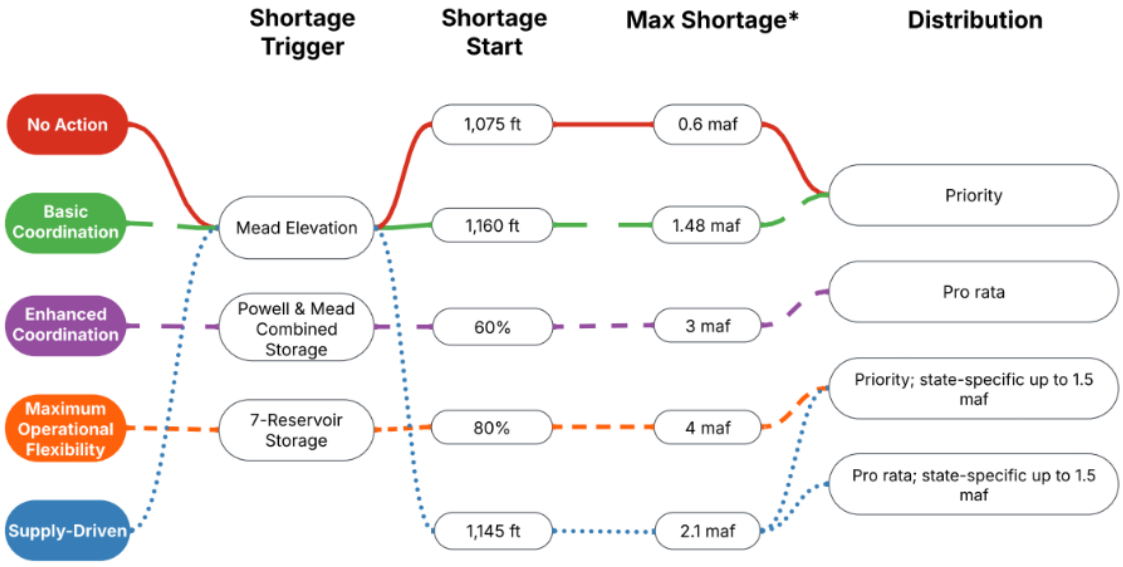
Some alternatives (e.g., No Action Alternative, Basic Coordination Alternative, Supply Driven Alternative [Lower Basin (LB) Priority approach]) maintain existing LB priority systems, while other alternatives deviate from them. With respect to potential tribal water deliveries, the alternatives can be distinguished based on the following characteristics:

- The maximum shortage, which affects the relative frequency and severity of Lower Basin water shortages, including potential dead pool–related reductions.
- The method used to allocate Lower Basin water under shortages (e.g., Supply Driven Alternative (LB Priority or LB Pro Rata approaches). Priority refers to the order in which entitlements are to be satisfied based on existing statutory, case law, and contractual provisions. The Pro Rata approach, in contrast, refers to dividing shortages differently across water users.
- Options for tribes and other water users to conserve and store water in Lake Powell or Lake Mead.

Figure TA 18-1 and **Table TA 18-5** summarize the alternatives based on these characteristics. **Figure TA 18-1** provides summary information on the shortage triggering metric, when shortages start relative to that metric, maximum operational shortage volume, and modeled distribution method. **Table TA 18-5** provides information on the maximum shortage volume, distribution method, and water storage and conservation options. **Table TA 18-5** includes the Continued Current Strategies (CCS) Comparative Baseline for comparison. See **Chapter 2**, Description of Alternatives, of the Draft EIS for a more detailed discussion of the alternatives.

[7] As discussed in **Section TA 18.1**, one of the 30 Basin tribes does not have an established reservation; therefore, there are 29 reservations.

Figure TA 18-1
Lower Basin Shortage Guidelines



*larger reductions may occur in modeling due to dead pool or infrastructure constraints, but these are not considered an operational component

Table TA 18-4
Comparison of Key Factors Affecting Tribal Water Deliveries among Alternatives and the CCS Comparative Baseline

Scenario	Maximum Shortage (million acre-feet [maf])	Distribution Method	Water Storage and Conservation Options
CCS Comparative Baseline	1.375[a]	Priority	Continued intentionally created surplus (ICS). No new mechanisms.
No Action Alternative	0.6	Priority	Water conserved under previous mechanisms that remains in Lake Mead in 2027 would be delivered in accordance with existing agreements. No new mechanisms.
Basic Coordination Alternative	1.48	Priority	Water conserved under previous mechanisms that remains in Lake Mead in 2027 would be delivered in accordance with existing agreements. No new mechanisms.

Scenario	Maximum Shortage (million acre-feet [maf])	Distribution Method	Water Storage and Conservation Options
Enhanced Coordination Alternative	3	Pro rata independent of state	Yes, three new mechanisms in place of ICS (one conservation pool in Lake Powell and two in Lake Mead)
Maximum Operational Flexibility Alternative	4	Priority within specified state-specific distributions up to 1.5 maf, then based on interpretation of priority	Yes, one new mechanism in place of ICS (a combined Lake Powell and Lake Mead conservation pool)
Supply Driven Alternative (LB Priority approach)	2.1	Priority within specified state-specific distributions up to 1.5 maf, then based on interpretation of priority	Yes, two new mechanisms in place of ICS (one conservation pool in Lake Powell and one in Lake Mead)
Supply Driven Alternative (LB Pro Rata approach)	2.1	Pro rata within specified state-specific distributions up to 1.5 maf, then pro rata based on unreduced apportionments	Yes, two new mechanisms in place of ICS (one conservation pool in Lake Powell and one in Lake Mead)

Source: **Chapter 2**, Description of Alternatives
[a] Includes the 2007 Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead, Minute 323 Bi-national Water Scarcity Contingency Plan, and Drought Contingency Plans.

Upper Basin

Water Deliveries

None of the alternatives would directly or indirectly affect Upper Basin tribal water entitlements. As discussed below, water storage and conservation mechanisms under some alternatives could indirectly affect the amount of stored conservation water available to Upper Basin tribes.

Storage and Conservation Options

The No Action and Basic Coordination Alternatives have no new water storage mechanisms and would not affect water storage and conservation by Upper Basin tribes. The other three alternatives do have new storage and conservation mechanisms, which are summarized below. See **Chapter 2**, Description of Alternatives, for a full description of these mechanisms and how they would operate. Note that in all cases, stored water would be available for water transactions with other Upper Basin water users, both within and across Upper Division States.

- Under the Enhanced Coordination Alternative, up to 2.0 maf of water conserved by Upper Basin water users could be stored in Lake Powell. Under certain conditions, the stored water would be made available to offset portions of Lower Basin shortages, thereby reducing the amount of stored water available to Upper Basin tribes that have participated in the mechanism.
- Under the Maximum Operational Flexibility Alternative, up to 3.0 maf of water conserved by Upper Basin water users could be stored in a combined pool managed across both Lake

Powell and Lake Mead. Under certain conditions, stored water could be converted to system water, thereby reducing the amount of stored water available to Upper Basin tribes that have participated in the mechanism.

- Under the Supply Driven Alternative, Upper Basin water users could contribute up to 3.0 maf of water to a storage pool in Lake Powell. Water in the pool could be released if needed to meet the determined water-year volume, thereby reducing the amount of stored water available to Upper Basin tribes that have participated in the mechanism.

In general, the four alternatives above that include new mechanisms for storage and conservation of water would provide additional options to Upper Basin tribes. Assuming these methods could be implemented with appropriate authority, first, the mechanisms would allow tribes to store water as insurance against potential future changes in water demand or supply. Second, the mechanisms would create a new way for tribes to lease or transfer water from or to other Upper Basin water users.

Lower Basin

Water Deliveries

Some alternatives impact Lower Basin tribal entitlements by altering the shortage distribution methodologies. The alternatives also impact water deliveries to some degree. Reclamation modeled water deliveries in the Lower Basin using SAM. There are three unique SAMs and five ADMs to capture the nuances of the alternatives and sensitivity analyses, which are further explained in **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation.

In this analysis, three main factors combine to determine potential Lower Basin tribal water deliveries in any given year:[8]

1. The severity of potential shortages
2. The distribution method used to allocate water under shortages
3. The frequency of dead pool–related reductions[9]

This analysis focuses on the first two factors. The third factor, dead pool–related reductions, is not a focus of this analysis.[10] In general, Reclamation anticipates acting to minimize dead pool–related reductions. However, the methods for doing so and the methods for allocating water under a dead pool–related release are unknown and too speculative to be included in this Draft EIS.

[8] The phrase "potential water deliveries" is intended to recognize that some tribal entitlements are not fully developed and/or utilized. For simplicity, this analysis assumes that water deliveries and entitlements refer to the same quantities of water.
[9] Conditions that might cause a dead pool–related release are described in **TA 4, Water Deliveries**.
[10] Modeling results related to the potential frequency of dead pool–related reductions are discussed further below.

Figure TA 18-2 illustrates how the percentage of water delivery changes as shortages become more severe. There are four tables in **Figure TA 18-2**, one for each of the different distribution methods included in the alternatives. For the purposes of this analysis, tribes are aggregated into four groups based on entitlement priorities, which are contained in the rows of **Figure TA 18-2**:[11]

- The "AZ CAP NIA" group are the most junior entitlements and includes tribes with Arizona CAP non-Indian agriculture (NIA)-A and NIA-B priorities. This group consists of four tribes with contracts totaling approximately 177,000 afy.
- The "AZ CAP Indian, CAP municipal and industrial (M&I), AZ 4i" group includes tribes with Arizona CAP Indian, CAP Municipal & Industrial, and Arizona 4i priorities. This group consists of 13 tribes and 16 individual entitlements (including mainstream water reserved for future settlement and unallocated) totaling approximately 374,000 afy.
- The "AZ 3" includes one tribe with Arizona 3rd priority, totaling 50,000 afy.
- The present perfected right or "PPR" group are the most senior entitlements; this group includes five tribes in all three Lower Division States. Five tribes with 15 discretely quantified entitlements totaling approximately 503,000 afy are included in this group.

The columns in **Figure TA 18-2** represent different total Lower Basin shortage levels. The cells in **Figure TA 18-2** show the percentage delivery of water entitlements for each group. Note that the cells in **Figure TA 18-2** are combined results for each group, not for any single tribe within a group; therefore, the data for individual tribes within a group may differ from the group's data. Similar information on potential deliveries for individual tribes is presented in **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation.

It is important to note that the shortages depicted in **Figure TA 18-2** extend beyond the maximum shortages specified in the alternatives, which range from 0.6 maf to 4.0 maf (**Table TA 18-5**). The inclusion of larger shortages in **Figure TA 18-2** should not be taken to imply that these specific distributions would, in fact, apply to shortages higher than the maximum shortages (such as might happen during a dead pool–related release); rather, it is intended to better illustrate the implications of the different distribution methods. Please refer to the maximum shortages in **Table TA 18-5** when interpreting the information in **Figure TA 18-2**.

In **Figure TA 18-2**, the difference that the priority and pro rata distribution methods (the first two tables) have on the percentage delivery of water is readily apparent. Under the priority distribution system, less water is delivered to groups with more junior water entitlements and more water is delivered to groups with more senior water entitlements. The differences in the percentage of water delivered increase as the shortage volume increases. In contrast, the percentage of water delivered under the pro rata distribution method is the same across the groups for all levels of shortages.

[11] The number of tribes, water entitlements, and amounts listed below come from the SAM (see **Appendix C**, Shortage Allocation Model and Alternative Distribution Model Documentation, for modeling assumptions and descriptions of priority nomenclature).

Figure TA 18-2
Comparison of Water Deliveries by Distribution Method, Tribal Priority Group, and Shortage Amount

Percent Delivery by Total Shortage Volume (maf) under the Priority Distribution Method (Used in No Action and Basic Coordination Alternatives)

Tribal Priority Group	0.0	0.2	0.4	0.6	0.8	1.0	1.5	3.0	4.0	5.0	6.0	7.0
AZ CAP NIA	100.0	39.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AZ CAP Indian, CAP M&I, AZ 4i	100.0	100.0	95.5	82.7	68.0	53.3	16.5	0.0	0.0	0.0	0.0	0.0
AZ 3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	66.2	31.5	0.0	0.0	0.0
PPR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Percent Delivery by Total Shortage Volume (maf) under the Pro Rata Distribution Method (Used in Enhanced Coordination Alternative)

Tribal Priority Group	0.0	0.2	0.4	0.6	0.8	1.0	1.5	3.0	4.0	5.0	6.0	7.0
AZ CAP NIA	100.0	97.8	95.5	93.3	91.1	88.8	83.2	66.5	55.3	44.1	33.0	21.8
AZ CAP Indian, CAP M&I, AZ 4i	100.0	97.8	95.5	93.3	91.1	88.8	83.2	66.5	55.3	44.1	33.0	21.8
AZ 3	100.0	97.8	95.5	93.3	91.1	88.8	83.2	66.5	55.3	44.1	33.0	21.8
PPR	100.0	97.8	95.5	93.3	91.1	88.8	83.3	66.5	55.4	44.2	33.1	21.9

Percent Delivery by Total Shortage Volume (maf) under the State-Specific up to 1.5 maf, then Priority Distribution Method (Used in the Maximum Operational Flexibility and Supply Driven Alternatives with Priority Distribution)

Tribal Priority Group	0.0	0.2	0.4	0.6	0.8	1.0	1.5	3.0	4.0	5.0	6.0	7.0
AZ CAP NIA	100.0	37.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AZ CAP Indian, CAP M&I, AZ 4i	100.0	100.0	97.5	91.3	83.5	75.2	54.6	0.0	0.0	0.0	0.0	0.0
AZ 3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	79.8	38.1	0.0	0.0	0.0
PPR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Percent Delivery by Total Shortage Volume (maf) under the State-Specific up to 1.5 maf, then Pro Rata Distribution Method (Used in the Supply Driven Alternative with Pro Rata Distribution)

Tribal Priority Group	0.0	0.2	0.4	0.6	0.8	1.0	1.5	3.0	4.0	5.0	6.0	7.0
AZ CAP NIA	100.0	94.3	89.9	86.8	83.7	80.6	72.9	58.3	48.6	38.9	29.1	19.4
AZ CAP Indian, CAP M&I, AZ 4i	100.0	94.3	89.9	86.8	83.7	80.6	72.9	58.3	48.6	38.9	29.1	19.4
AZ 3	100.0	94.3	89.9	86.8	83.7	80.6	72.9	58.3	48.6	38.9	29.1	19.4
PPR	100.0	95.3	91.5	88.7	85.9	83.0	75.9	60.7	50.6	40.5	30.4	20.2

Source: SAMs and ADMs.

The third table shows the state-specific percentages up to 1.5 maf, then priority distribution method. It is similar to the priority distribution for all priority groups except the AZ CAP Indian, CAP M&I, AZ4 group. This group receives more water under shortages up to 1.5 maf than the straight priority distribution method.

The fourth table shows the state-specific percentages up to 1.5 maf, then pro rata distribution method. It has a similar pattern to the pro rata distribution (the second table) but has differences in the specific numbers in each cell. Like the pro rata distribution, the state-specific up to 1.5 maf then pro rata distribution allocates more water to junior water entitlements holders and less water to senior water entitlements holders, compared to the priority distribution methods.

Decision making under deep uncertainty (DMDU) analysis expands the above analysis by integrating information on the percentage of futures in which different amounts of shortages are estimated to occur under the different alternatives. For tribal water deliveries, percentage deliveries of 20 percent, 40 percent, 60 percent, and 80 percent of normal deliveries are modeled. As explained further below, the results show the percentage of futures in which these thresholds are met in 90 percent or more of the years within each modeled future.

The DMDU figures are presented in **Figure TA 18-3** through **Figure TA 18-11**. The rows contain different percentages of normal water deliveries, where "normal" means under non-Shortage Conditions. The top row contains the highest modeled level of water delivery (80 percent of normal deliveries), which is the hardest threshold to achieve. The columns contain the CCS Comparative Baseline, the No Action Alternative, and the action alternatives. Cells are color-coded to indicate the percentage of modeled futures in which water deliveries exceed the thresholds in the row headers in at least 90 percent of the years of a future. The row indicating water deliveries of at least 80 percent of normal deliveries has a purple border. Solely for the purposes of considering vulnerability within the DMDU modeling framework, a "preferred minimum performance" outcome is defined as a future trace in which at least 80 percent of normal water deliveries is estimated to be delivered in at least 90 percent of the years in a modeled future. In contrast, an "undesirable performance" future means that the preferred minimum performance criteria are not met. The 80 percent threshold was chosen as the "preferred minimum performance" because it is the model outcome with the largest quantity of water delivered.[12] Within the purple-bordered rows, the percentage of futures that meet the preferred criteria is presented.

Note that the non-gray cells (i.e., those except the bottom row) in the DMDU figures present the percentage of futures associated with shortages only. A shortage is prescribed by each alternative. Another type of reduction in water delivery results from a dead pool–related release, which occurs when conditions do not support unconstrained releases.[13] Different shortage volumes under the different alternatives affect the frequency of dead pool–related reductions.[14] The percentage of

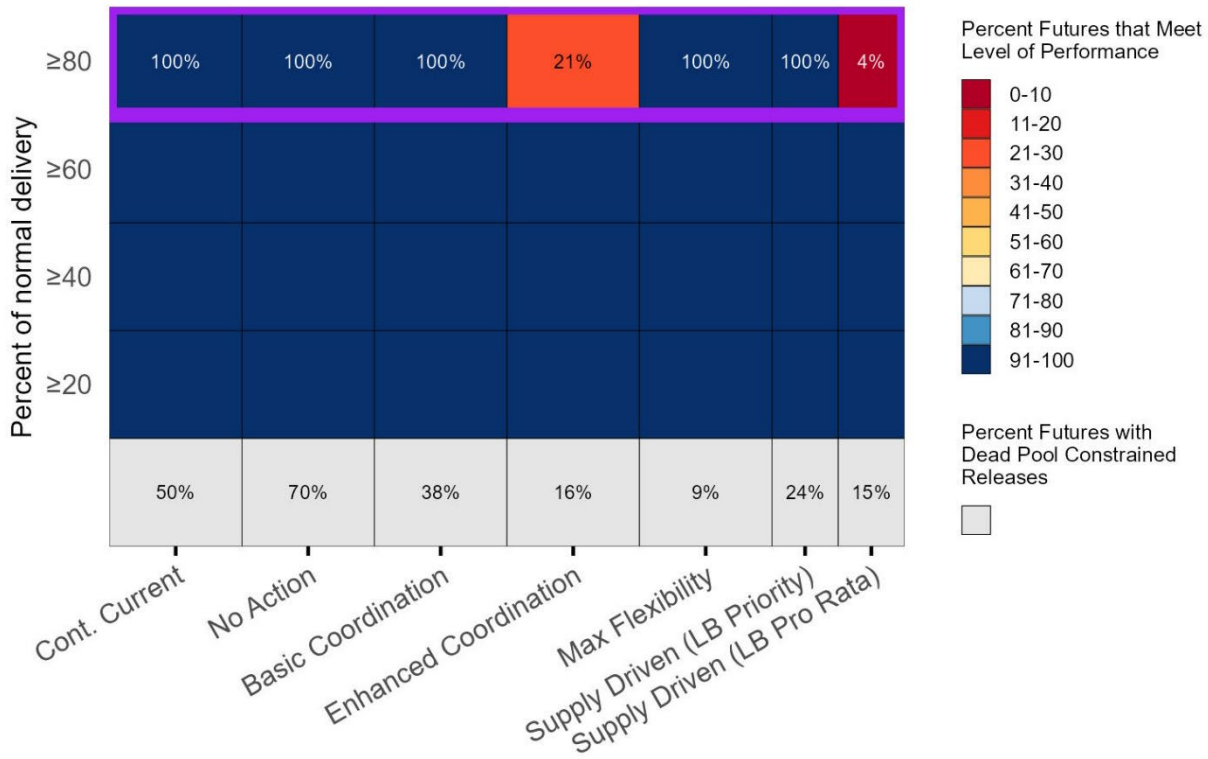
[12] In this context, "preferred minimum performance" and "undesirable performance" are terms selected to understand a modeling analysis, and they do not imply any policy, legal, or other conclusions about the analysis or ITAs.
[13] See **TA 4**, Water Deliveries for more information.
[14] In general, more frequent dead pool–related reductions are associated with lower maximum shortages, and vice-versa.

futures in which dead pool–related reductions occur under each alternative is presented in the gray cells at the bottom of the DMDU figures.

The DMDU figures are discussed below, in order of the priority groups with the most senior water entitlements to the group with the most junior entitlements.

Figure TA 18-3 contains the DMDU full analysis period modeling results for the PPR group. The PPR group contains the most senior water entitlements in the Lower Basin. As shown in the purple-bordered row, in the CCS Comparative Baseline and all alternatives other than the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, 100 percent of futures meet the assumed preferred minimum performance criteria, meaning that at least 80 percent of the normal water delivery is delivered in 90 percent of the years of a modeled future. This occurs because these are the most senior water entitlements in the Lower Basin, and all alternatives that have 100 percent in the purple-bordered row use a variation of the priority system. Because at least 80 percent of water is delivered in 100 percent of futures for these alternatives, the rows below the purple-bordered row for those alternatives (which indicate lower quantities of delivered water) are also 100 percent and thus are classified into the 91-100 percent category.

Figure TA 18-3
Present Perfected Rights: Robustness (Full Period).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years

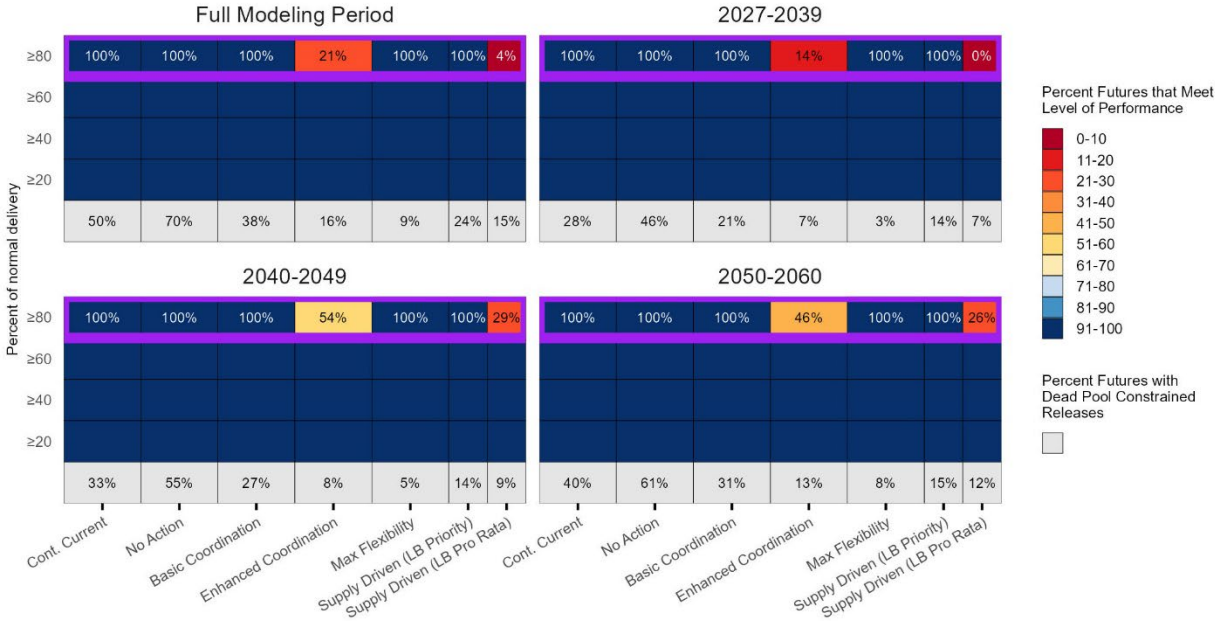


For the Enhanced Coordination Alternative, the preferred minimum performance criteria (at least 80 percent of normal water delivery in 90 percent of the years of a future) is met in 21 percent of modeled futures. For the Supply Driven (LB Pro Rata approach) Alternative, 4 percent of futures meet the preferred minimum performance criteria. The lower result for these two alternatives is likely due, in part, to these alternatives using a variation of the pro rata distribution, which fulfills these senior water entitlements as though they were equal in priority to other Lower Basin entitlements. While 80 percent of normal water deliveries in 90 percent of years of a future occur in 21 percent of modeled futures under the Enhanced Coordination Alternative, at least 60 percent of water deliveries in all years of a future occur in 91-100 percent of modeled futures. Similarly, at least 60 percent of normal water deliveries would occur in 91-100 percent of modeled futures for the Supply Driven (LB Pro Rata approach) Alternative.

Importantly, it would be a mistake to conclude that all alternatives that meet the preferred minimum performance criteria (the purple-bordered row) in 100 percent of modeled futures perform equally in terms of water deliveries to the PPR priority group. This is because the alternatives have different frequencies of modeled futures in which there is a dead pool–related release, as shown in the gray row at the bottom of the table. Less frequent dead pool–related reductions are better in terms of water deliveries because it means that there are more consistent water deliveries, all else equal. Therefore, among options that meet the preferred minimum performance criteria in 100 percent of futures, the Maximum Operational Flexibility Alternative would be the most robust (as it minimizes dead pool–related reductions) and the No Action Alternative would be the least robust (as it maximizes dead pool–related reductions).

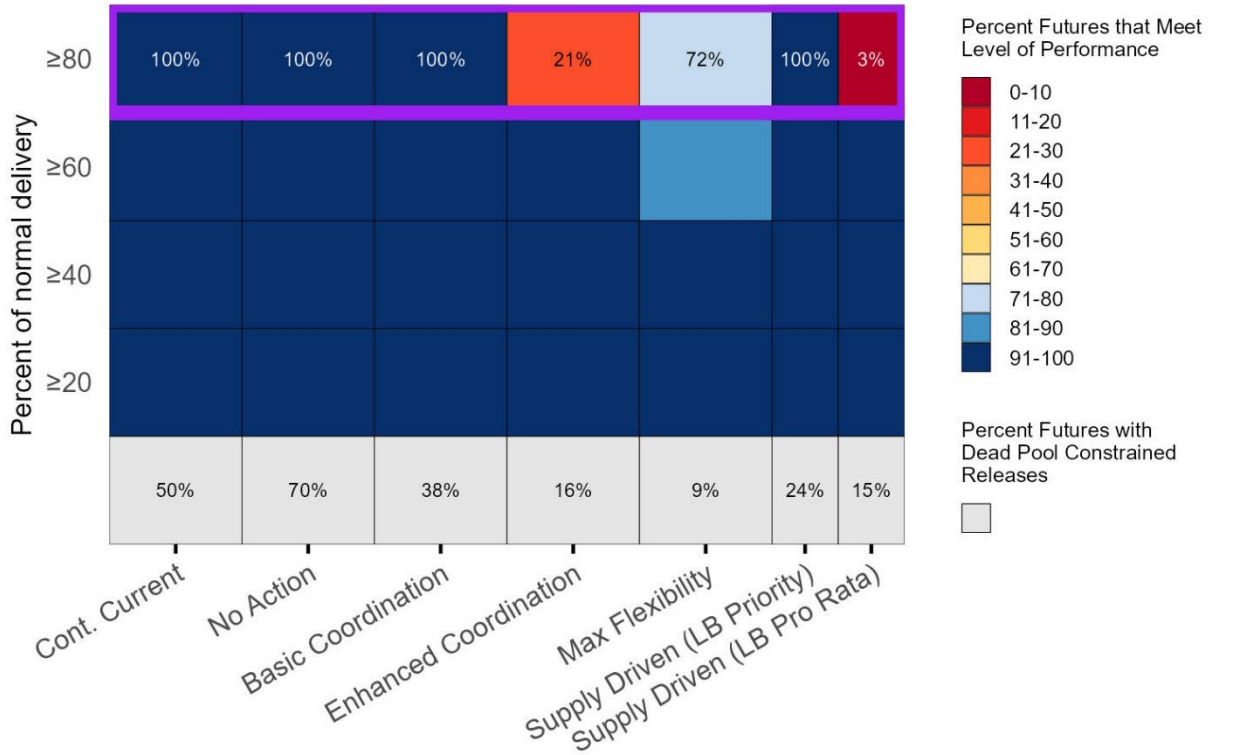
The DMDU modeling results for the PPR priority group by subperiod (**Figure TA 18-4**) indicate generally similar relative performance of the CCS Comparative Baseline and alternatives as those for the full period. As with the full period, in all but the Enhanced Coordination and the Supply Driven (LB Pro Rata approach) Alternatives, at least 80 percent of normal water deliveries in 90 percent of years is estimated to occur in 100 percent of modeled futures. The breakdown by subperiod provides some additional insight into the Enhanced Cooperation Alternative. In the 2027-2039 subperiod, 14 percent of futures meet the preferred minimum performance criteria. However, 54 percent and 46 percent of futures meet the preferred minimum performance criteria in the 2040-2049 and 2050-2060 subperiods, respectively. A similar pattern occurs for the Supply Driven (LB Pro Rata approach) Alternative, with 0 percent, 29 percent, and 26 percent of futures meeting the preferred minimum performance criteria in the three subperiods, respectively. The lower result for the first subperiod for these two alternatives likely occurs because approximately one-third of the modeled futures start at low reservoir conditions, making it more difficult to deliver full water deliveries under variations of the pro rata distribution method during the 2027-2039 subperiod.

Figure TA 18-4
Present Perfected Rights: Robustness (by Subperiod).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years



The full period DMDU results for the Arizona Priority 3 group (**Figure TA 18-5**) are the same as for the PPR group except for the Maximum Operational Flexibility and Supply Driven (LB Pro Rata approach) Alternatives. For the Maximum Operational Flexibility Alternative, the preferred minimum performance criteria (at least 80 percent of normal water deliveries in 90 percent of years of a future) is estimated to occur in 72 percent of modeled futures, an increase in its robustness relative to the PPR group. For the Supply Driven Alternative (LB Pro Rata approach), the preferred minimum performance criteria are met in 3 percent of futures, which is similar to its robustness for the PPR group.

Figure TA 18-5
Arizona Priority 3: Robustness (Full Period).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years

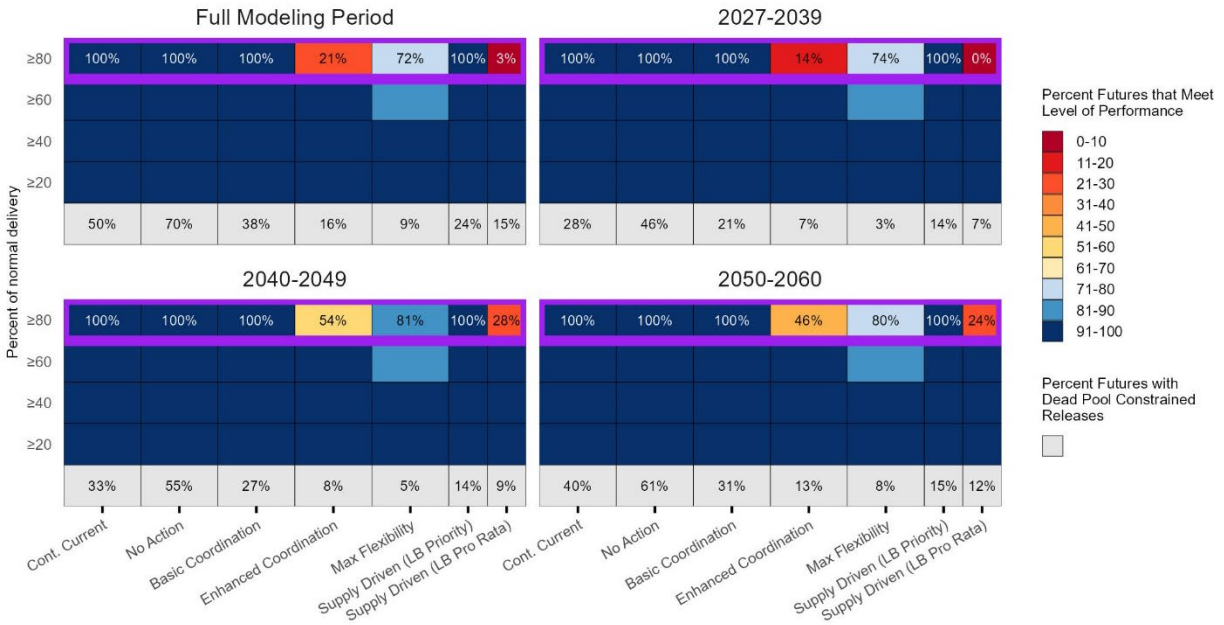


Note that the percentage of futures with a dead pool–related release is independent of the priority group and is therefore the same as in the PPR group results. Similar considerations as described for the PPR group apply.

No alternative is clearly more robust than the others for the Arizona Priority 3 group. Depending on whether one considers the percentage of futures that meet preferred minimum performance criteria or the percentage of futures in which dead pool–related reductions are avoided as more important, the most robust would be either the Supply Driven (LB Priority approach) Alternative (which delivers more water considering only shortages) or the Maximum Operational Flexibility Alternative (which minimizes the frequency of dead pool–related reductions).

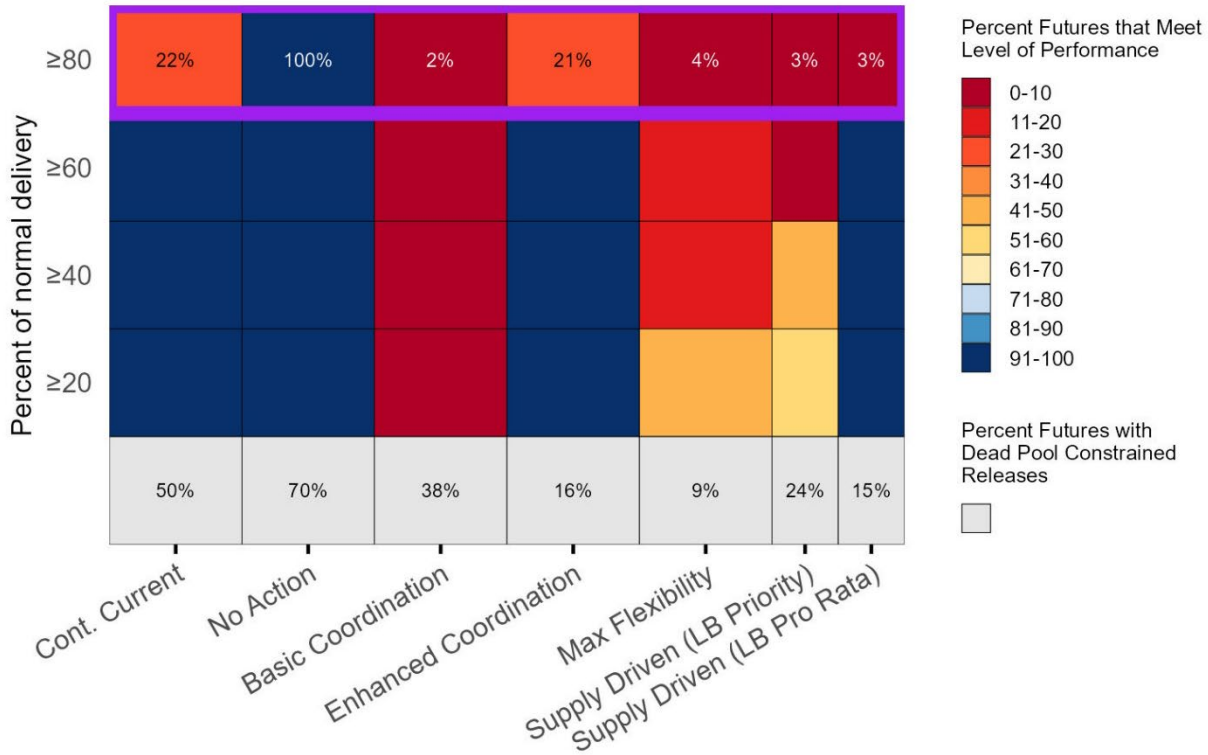
The DMDU results for the Arizona Priority 3 group by subperiod (**Figure TA 18-6**) are the same in each subperiod as for the PPR group, except for the Maximum Operational Flexibility and Supply Driven (LB Pro Rata approach) Alternatives. For the AZ Priority 3 group, these two alternatives are more robust in the 2040-2049 and 2050-2060 subperiods compared to the 2027-2039 subperiod. The results by subperiod do not change the conclusions concerning which alternative is the most robust.

Figure TA 18-6
Arizona Priority 3: Robustness (by Subperiod).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years



The full period DMDU modeling results for the Arizona CAP Indian, CAP M&I, and Arizona Priority 4i group (**Figure TA 18-7**) are very different than the results for the PPR and Arizona Priority 3 groups. Under CCS Comparative Baseline, the preferred minimum performance criteria (at least 80 percent of water is delivered in 90 percent of years of a future) is met in only 22 percent of futures. The No Action Alternative meets the preferred minimum performance criteria in 100 percent of futures. However, as previously noted, this considers only shortages. The No Action Alternative has dead pool–related reductions in 70 percent of futures, implying that full water delivery is unlikely under the No Action Alternative. The Enhanced Coordination Alternative meets the preferred minimum performance criteria in 21 percent of modeled futures. All other alternatives meet the preferred minimum performance criteria in less than 5 percent of modeled futures.

Figure TA 18-7
Arizona CAP Indian, CAP M&I, and Priority 4i: Robustness (Full Period).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years



Dropping down to the next highest water delivery threshold (60 percent), the CCS Comparative Baseline and three alternatives (No Action Alternative, Enhanced Coordination Alternative, and Supply Driven Alternative [LB Pro Rata approach]) provide at least 60 percent of normal deliveries in 90 percent of years of a future in 91-100 percent of futures. Of these, the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives have a lower percentage of futures with dead pool–related reductions, which occur in 16 and 15 percent of futures, respectively.

No alternative is clearly the most robust for this priority group. Depending on whether one considers the percentage of futures that meet preferred minimum performance criteria or the percentage of futures in which dead pool–related reductions are avoided as more important, the more robust alternative would be either the No Action Alternative (more water is delivered, considering only shortages) or the Enhanced Coordination Alternative (has a substantially lower frequency of dead pool–related reductions).

Considering the DMDU modeling for the AZ CAP Indian, CAP M&I, and AZ 4i group results by subperiod (**Figure TA 18-8**), the same high-level performance rankings as the full period continue to hold. However, the Enhanced Coordination Alternative appears more robust than when considering only the full period, as it is estimated to be more robust in the two later subperiods compared to the first subperiod and the full period. While the Basic Coordination, Max Flexibility, and the Supply Driven (both LB Priority and LB Pro Rata approaches) Alternatives would also be more robust in the later two subperiods compared to the first subperiod and full period, the Maximum Operational Flexibility Alternative continues to be more robust than other alternatives for this priority group.

Figure TA 18-8
Arizona CAP Indian, CAP M&I, and Priority 4i: Robustness (by Subperiod).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years

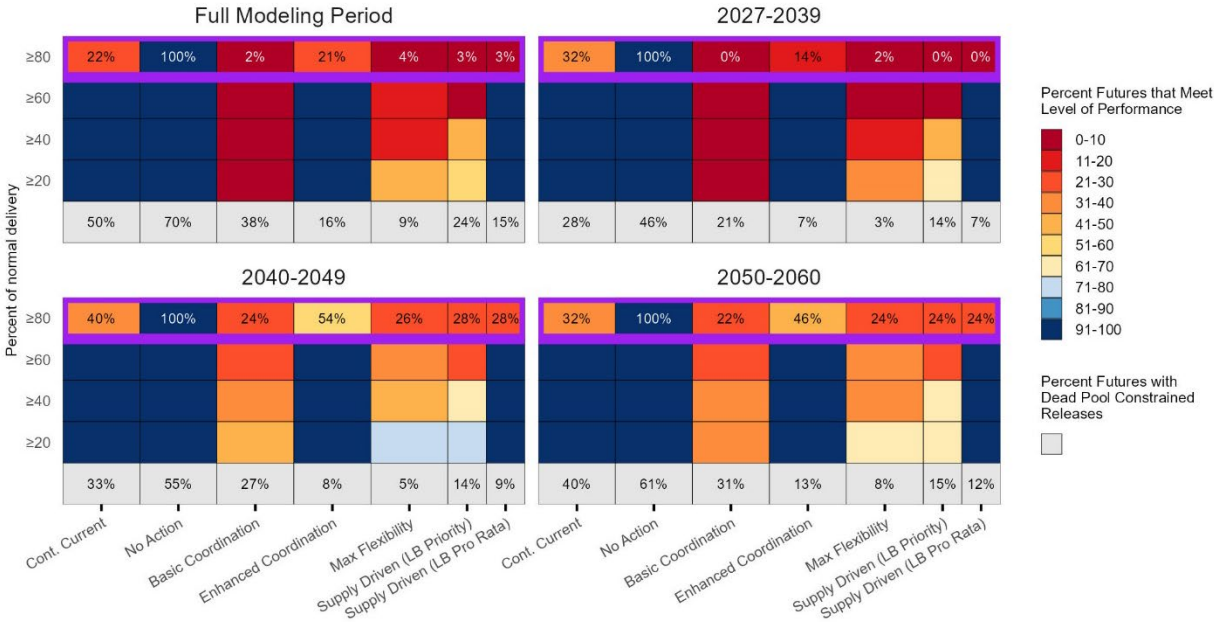
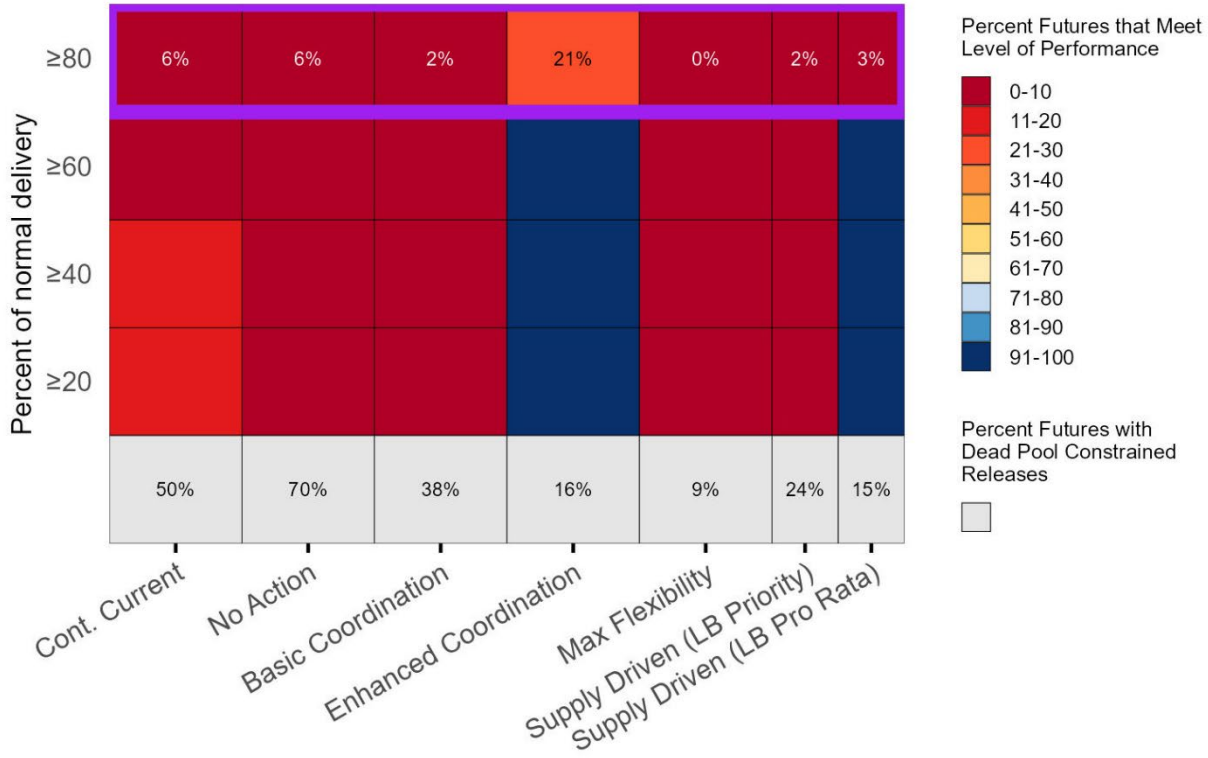


Figure TA 18-9 presents DMDU full period modeling results for the CAP Indian NIA group. These contracts are some of the most junior tribal entitlements in the Lower Basin. As such, it should be expected that deliveries will often be lower during Shortage Conditions compared to other priority groups. With one exception (the Enhanced Coordination Alternative), the CCS Comparative Baseline and alternatives meet the preferred minimum performance criteria in less than 5 percent of modeled futures. The Enhanced Coordination Alternative meets the preferred minimum performance criteria in 21 percent of modeled futures.

Figure TA 18-9
Arizona CAP Non-Indian Agriculture Priority: Robustness (Full Period).
Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years



The only two alternatives that consistently deliver water to this priority group are the Enhanced Coordination and Supply Driven (LB Pro Rata approach) Alternatives, which deliver at least 60 percent of normal water deliveries in 90 percent of years of a future in 91-100 percent of futures. This is likely due to their use of variations of the pro rata distribution method, which deliver more water to junior entitlements as shortages increase compared to the priority distribution, some variation of which is used by CCS Comparative Baseline and the other alternatives. Combined with its relatively low percentage of futures with a dead pool–related release (16 percent), the Enhanced Coordination Alternative is clearly the most robust alternative for this priority group.

The subperiod DMDU modeling results for the CAP Non-Indian Agriculture priority group (**Figure TA 18-10**) show similarities to the subperiod results for other priority groups, specifically that several alternatives are more robust in the later two subperiods compared to the first subperiod and the full period. For this priority group, the rank of the alternatives is not affected by the subperiods; the Enhanced Coordination Alternative continues to be the most robust for this priority group.

Figure TA 18-10
Arizona CAP Non-Indian Agriculture Priority: Robustness (by Subperiod). Percent of futures in which annual delivery is the percent of normal delivery specified in each row in 90% of years

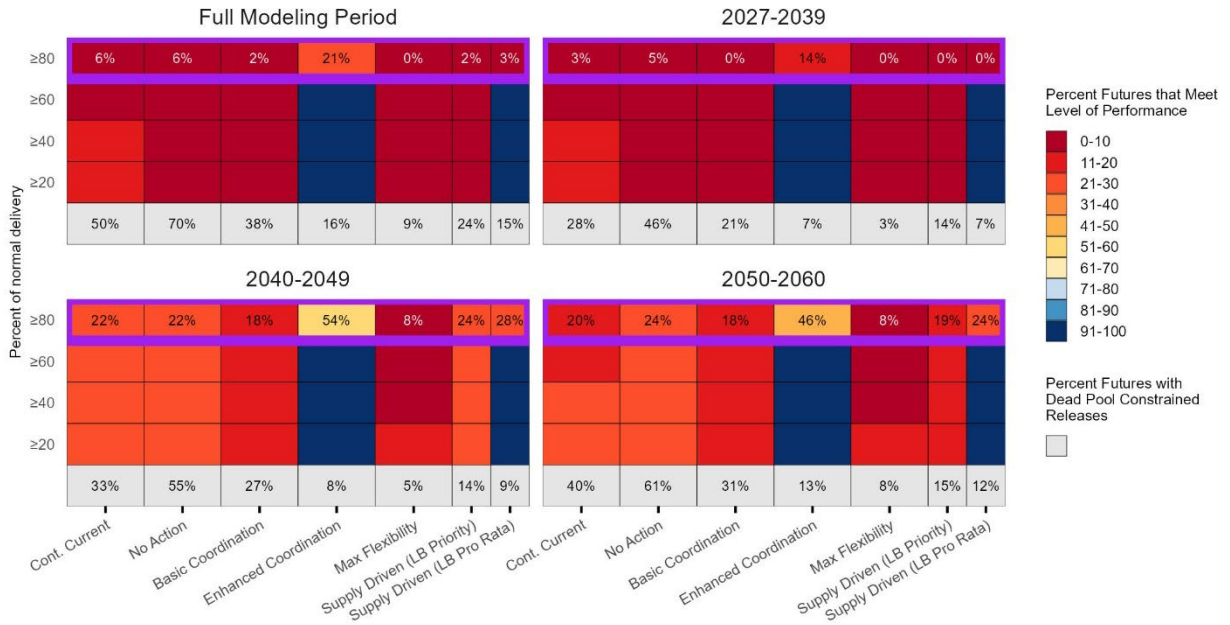
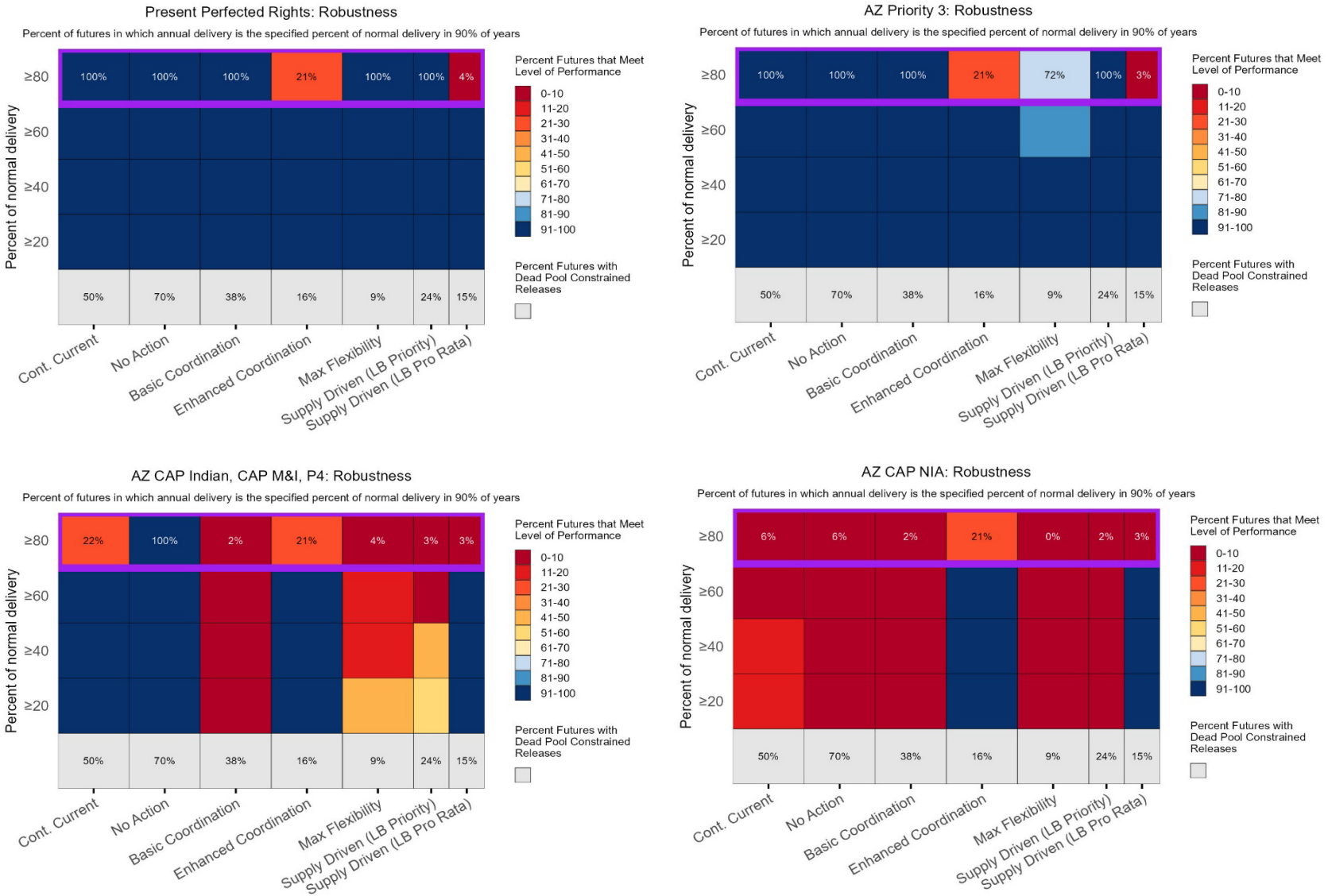


Figure TA 18-11 shows the full-period DMDU modeling results for all priority groups. Key findings differentiating the alternatives in terms of tribal water deliveries across the priority groups based on the DMDU heat maps include the following:[15]

- There is no alternative that is the most robust across the priority groups in terms of maximizing water deliveries to all tribes. The alternatives perform differently for the priority groups and, for some priority groups, depend on the importance placed on results considering only shortages relative to the frequency of futures with dead pool-constrained releases.
- For the most senior water entitlements (the PPR group), the Maximum Operational Flexibility Alternative is the most robust. It meets the preferred minimum performance criteria in 100 percent of modeled futures and has the lowest percentage of futures with dead pool–related reductions.
- For the next most senior water entitlements priority group (the AZ Priority 3 group), a case could be made for either the Maximum Operational Flexibility or Supply Driven (LB Priority approach) Alternatives. Which is more robust depends on how this group trades off water delivery, considering only shortages (which favors the Supply Driven [LB Priority approach] Alternative) or minimizing the percentage of futures with a dead pool–related release (which favors the Maximum Operational Flexibility Alternative).
- For the next most senior water entitlements priority group (the AZ CAP Indian, M&I, AZ 4i group), a case could be made for either the No Action or Enhanced Coordination Alternatives. Which is more robust depends on how this group trades off water delivery, considering only shortages (which favors the No Action Alternative) or minimizing the percentage of futures with a dead pool–related release (which favors the Enhanced Coordination Alternative).
- For the most junior water entitlements priority group (the AZ CAP NIA group), the Enhanced Coordination Alternative is the most robust.
- Considering shortages only (i.e., not considering dead pool–related reductions), the No Action Alternative is estimated to meet the preferred minimum performance criteria in 100 percent of normal water deliveries to all priority groups except the AZ CAP NIA group. This result is likely due to a lower maximum shortage than other alternatives (**Figure TA 18-1** and **Table TA 18-5**). However, the No Action Alternative has the highest potential for dead pool–related reductions of any alternative, with 70 percent of futures estimated to have a dead pool–related release. Therefore, water delivery would be unlikely under the No Action Alternative.
- The CCS Comparative Baseline is similar to the No Action Alternative, except 22 percent of futures meet preferred minimum performance criteria for the CAP Indian, CAP M&I, and AZ 4i priority group, and 6 percent of futures meet the preferred minimum performance criteria for the CAP NIA group. Dead pool–related reductions are estimated to occur in 50 percent of modeled futures, which is less frequent than the No Action Alternative.

[15] Other key metrics are evaluated and discussed elsewhere in the EIS.

Figure TA 18-11
Robustness Comparison for All Priority Groups (Full Period)



- The Basic Coordination Alternative is not among the robust alternatives for any priority group.
- The Enhanced Coordination Alternative has a more complicated pattern of robustness.
  - 21 percent of futures meet the preferred minimum performance criteria for all priority groups, fewer than some other alternatives. This is likely due to the fact that shortages start relatively early compared to other alternatives, and there is a high maximum shortage (see **Figure TA 18-1** and **Table TA 18-5**).
  - However, it performs very well in terms of delivering at least 60 percent of normal water, as it does so in 91-100 percent of modeled futures for all priority groups. This result is likely due, in part, to its use of the pro rata distribution method.
  - Finally, it has 16 percent of futures with dead pool–related reductions, among the fewest of the options modeled.
- Considering only shortages, the Maximum Operational Flexibility Alternative is more robust than the Enhanced Coordination Alternative for the two more senior water entitlements groups (PPR, AZ Priority 3) and less robust than the Enhanced Coordination Alternative for the two less senior water entitlements groups (AZ CAP Indian, M&I, and 4i; CAP NIA). It has the lowest percentage of futures with a dead pool–related release (9 percent) of all the options modeled.
- The Supply Driven (LB Priority approach) Alternative generally is similar or less robust than the Maximum Operational Flexibility Alternative with respect to shortages for three of the four priority groups and has a higher percentage of futures with a dead pool–related release (24 percent).
- The Supply Driven (LB Pro Rata approach) Alternative is closest to the Enhanced Coordination Alternative but does not meet the preferred minimum performance criteria as often, and therefore is less robust.

Storage and Conservation Options

The No Action and Basic Coordination Alternatives have no water storage mechanisms that would affect Lower Basin tribes or the quantities of water available to them. Under both alternatives, water conserved under previous mechanisms that remains in Lake Mead in 2027 would be delivered in accordance with existing agreements. The other three alternatives do contain new water storage and conservation mechanisms, which are summarized below. See **Chapter 2**, Description of Alternatives, for a full description of these mechanisms and how they would operate. Note that in all cases, stored water would be available for water transactions with other Lower Basin water users, both within and across Lower Division States.

- Under the Enhanced Coordination Alternative, water conserved by Lower Basin water users could be stored in a Non-Federal Lake Mead conservation pool. There would also be a Reclamation-controlled Federal Lake Mead conservation pool. Water for the Federal pool could be voluntarily acquired by compensation for conserved water, among other mechanisms. Previously stored ICS water would be transferred into the non-Federal Lake Make conservation pool and would be subject to the new provisions regarding the release of that water.

- Under the Maximum Operational Flexibility Alternative, water conserved by Lower Basin water users could be stored in a combined pool managed across both Lake Powell and Lake Mead. Previously stored ICS water would be transferred into this pool, and the new provisions regarding the release of that water would apply.
- Under the Supply Driven Alternative (both Priority and Pro Rata approaches), Lower Basin water users could contribute to a storage pool in Lake Mead. Previously stored ICS water would be converted into this conservation pool over 10 years, and then the new provisions regarding the release of that water would apply.

All else equal, the three alternatives that include new mechanisms for storage and conservation of water would provide additional options to Lower Basin tribes. First, the mechanisms allow tribes to save water as insurance against potential future changes in water demand or supply. Second, the mechanisms create an additional path for tribes to lease or transfer water from/to other Lower Basin water users. Third, the Enhanced Cooperation Alternative explicitly includes a mechanism to compensate tribes for water to fill the Federal Lake Mead conservation pool. However, whether these new mechanisms are better for any specific tribe compared to the current ICS mechanism is outside the scope of this analysis.

TA 18.2.3 Issue 2: How Will Changes in Dam Operations Affect Indian Trust Lands?

Changes in dam operations under the different alternatives would not affect the borders of established reservations or the definitions of any trust lands. However, the different alternatives could affect the value, use, or enjoyment of trust lands. An important aspect of the value and use of trust lands involves agricultural land, as fluctuations in water levels are estimated to result in some tribal agricultural lands being fallowed. Other changes in the use or enjoyment of tribal land and resources are discussed in **TA 13**, Tribal Resources. The considerations therein generally apply to Trust and non-Trust resources.

Agricultural Land

The potential impacts of changes in dam operations on agricultural land are assumed to be inversely dependent on water deliveries, meaning agricultural impacts are estimated to increase as water deliveries decrease.

Upper Basin

As noted in the Upper Basin water deliveries section above, none of the alternatives would directly affect water deliveries to Upper Basin tribes. However, changes in storage and conservation options under some alternatives could indirectly affect the ability for tribes to manage their water. All else equal, the alternatives that provide new mechanisms for conserving and storing water for Upper Basin tribes (the Enhanced Cooperation, Maximum Operational Flexibility, and Supply Driven Alternatives) would provide additional options for managing water used to irrigate tribal agricultural operations in the Upper Basin.

Lower Basin

TA 16, Socioeconomics, of this Draft EIS discusses the potential impacts of changes in dam operations and resulting changes in water deliveries on tribal and non-tribal agricultural economies in the Lower Basin. Estimates are presented for several socioeconomic metrics: acres of fallowed

agricultural land, direct market value, jobs, and economic output. Results are presented at the state level for Arizona, California, and Nevada. See **TA 16**, Socioeconomics, for a full discussion of the modeling and results. This section focuses on the acres of fallowed land as an indicator of potential impacts on Trust land.

Table TA 18-6 summarizes the modeling results for estimated changes in fallowed tribal agricultural land. For each state and alternative and the CCS Comparative Baseline, the table shows the estimated acres fallowed under two scenarios: a shortage of 0.6 maf, which is applicable to all alternatives and the CCS Comparative Baseline; and the acres of fallowed land under the maximum shortage, which varies across each alternative and the CCS Comparative Baseline. As discussed for Lower Basin water deliveries above, focusing only on the results under shortages can be misleading; another important consideration is dead pool–related reductions. See the Water Deliveries section of this Draft EIS for more information on dead pool–related reductions. **Table TA 18-6** contains the percentage of dead pool–related reductions for each alternative and the CCS Comparative Baseline.

Some key findings from **Table TA 18-6** include:

- Similarly to the Lower Basin water deliveries analysis above, the seniority of water entitlements combined with the distribution method makes a large difference in the results.
- Tribal agriculture in Arizona is estimated to experience the largest impacts in terms of the absolute changes in acres of fallowed land. This is likely because the majority of the reservation land is in Arizona (see **Map TA 18-1**).
- No alternative is clearly the most robust for Arizona. The different alternatives and the CCS Comparative Baseline have varying trade-offs between fallowed acreage under shortages and percent of futures with dead pool releases.
- In California and Nevada, impacts are only associated with alternatives that use the pro rata distribution (the Enhanced Coordination and Supply Driven [LB Pro Rata approach] Alternatives).
- All other alternatives and the CCS Comparative Baseline use some variation of the priority system and estimate no reductions in water deliveries, and therefore no fallowed agricultural land, in these states.
- The Maximum Operational Flexibility Alternative performs the best for California and Nevada, as there are zero fallowed acres and the percentage of futures with dead pool–related reductions is minimized. This would be true for PPRs in Arizona as well.

Table TA 18-5
Estimated Tribal Agricultural Land Fallowed under Lower Basin Water Shortages

State	Alternative (or CCS Comparative Baseline)	Acres Fallowed at Shortage of 0.6 maf	Acres Fallowed at Maximum Shortage	Percent of Futures with Dead pool–related Reductions
Arizona	CCS Comparative Baseline	15,576	72,398	50
Arizona	No Action	12,428	12,428	70
Arizona	Basic Coordination	12,428	49,049	38
Arizona	Enhanced Coordination	8,072	39,176	16
Arizona	Maximum Operational Flexibility	6,535	66,987	9
Arizona	Supply Driven (LB Priority)	6,535	52,377	24
Arizona	Supply Driven (LB Pro Rata)	15,801	38,575	24
California	CCS Comparative Baseline	0	0	50
California	No Action	0	0	70
California	Basic Coordination	0	0	38
California	Enhanced Coordination	1,298	5,092	16
California	Maximum Operational Flexibility	0	0	9
California	Supply Driven (LB Priority)	0	0	24
California	Supply Driven (LB Pro Rata)	579	2,803	15
Nevada	CCS Comparative Baseline	0	0	50
Nevada	No Action	0	0	70
Nevada	Basic Coordination	0	0	38
Nevada	Enhanced Coordination	131	656	16
Nevada	Maximum Operational Flexibility	0	0	9
Nevada	Supply Driven (LB Priority)	0	0	24
Nevada	Supply Driven (LB Pro Rata)	131	460	15

Source: **TA 16** Socioeconomics, **Table TA 16-23**

TA 18.2.4 Issue 3: How Will Changes in Dam Operations Affect Other Indian Trust Assets?

Changes in dam operations would not directly affect other ITAs in and of themselves. However, changes in dam operations could affect water levels, vegetation, fish, and wildlife, and therefore could indirectly affect the value, use, or enjoyment of ITAs. General changes in vegetation, fish, and wildlife are discussed in their respective sections of this Draft EIS. Additional analysis will be incorporated if other ITAs are identified through tribal input. Regarding income derived from ITAs, impacts on specific income-generating activities depend on a complex array of legal, contractual, and environmental factors. Because income derived from ITAs varies for each tribe, the effects of changes in water levels and deliveries due to the alternatives will also vary by tribe.

However, several general conclusions can be drawn regarding tribes' ability to generate income from leasing water. First, all else equal, higher quantities of delivered water means more ability to fulfill existing lease agreements and/or enter into new agreements. From this perspective, the conclusions of the water deliveries analysis generally apply to water leases. Second, as noted in the storage and conservation options analysis, new mechanisms for conserving and storing water generally provide additional options for water transactions with other water users.

Fees for outdoor recreation and other services on tribal land that generate income could be affected by changes in dam operations that result in changes in access, changes in river flows, changes in water quality, changes in fish and wildlife, and other resources that affect outdoor recreation. **TA 14**, Recreation, discusses the expected impacts of the alternatives on recreation.

TA 18.2.5 Summary Comparison of Alternatives

Issue 1: Tribal Water Entitlements, Deliveries, and Storage and Conservation Options

Water Entitlements

Some alternatives (e.g., No Action Alternative, Basic Coordination Alternative, Supply Driven Alternative [LB Priority approach]) maintain existing Lower Basin priority systems, while other alternatives deviate from them.

Water Deliveries

The alternatives would not directly affect water entitlements or deliveries to any Upper Basin water users, including tribes. However, under several alternatives (the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven Alternatives), conserved and stored water could be used to satisfy downstream water deliveries, thereby reducing the amount of stored water available to Upper Basin water users and tribes that participate in the water storage and conservation mechanisms.

For water deliveries in the Lower Basin, the most robust alternative in terms of estimated water deliveries depends on the priority group.

- For the most senior water entitlements (the PPR group), the Maximum Operational Flexibility Alternative clearly is the most robust. It meets the preferred minimum

performance criteria in 100 percent of modeled futures and has the lowest percentage of futures with dead pool–related reductions.

- For the next most senior water entitlements priority group (the AZ Priority 3 group), a case could be made for either the Maximum Operational Flexibility or Supply Driven (LB Priority approach) Alternatives. Which is more robust depends on how this group trades off water delivery, considering only shortages (which favors the Supply Driven [LB Priority approach] Alternative) or minimizing the percentage of futures with a dead pool–related release (which favors the Maximum Operational Flexibility Alternative).
- For the next most senior water entitlements priority group (the AZ CAP Indian, M&I, AZ 4i group), a case could be made for either the No Action or Enhanced Coordination Alternatives. Which is more robust depends on how this group trades off water delivery, considering only shortages (which favors the No Action Alternative) or minimizing the percentage of futures with a dead pool–related release (which favors the Enhanced Coordination Alternative).
- For the most junior water entitlements priority group (the AZ CAP NIA group), the Enhanced Coordination Alternative is the most robust.

Storage and Conservation Options

For Upper Basin tribes, options for conserving and storing water vary among the alternatives. For the No Action and Basic Coordination Alternatives, there would be no new mechanisms to conserve and store water. However, the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven Alternative (both Priority and Pro Rata approaches) all have new mechanisms for Upper Basin tribes to conserve and store water in either or both Lake Powell and Lake Mead.

For Lower Basin tribes, options for conserving and storing water vary among the alternatives. For the No Action and Basic Coordination Alternatives, there would be no new mechanisms to conserve and store water. Water conserved under previous mechanisms that remains in Lake Mead in 2027 would be delivered in accordance with existing agreements. However, the Enhanced Coordination, Maximum Operational Flexibility, and Supply Driven Alternatives all have new mechanisms for Lower Basin tribes to conserve and store water in either or both Lake Powell or Lake Mead. These three alternatives also have provisions for converting previously stored ICS water into the new conservation pools. The Enhanced Coordination Alternative is unique in that it would have both user-controlled and Federal-controlled conservation pools in Lake Mead, the latter of which could be filled in part by compensating tribes for voluntarily conserving water.

Issue 2: Indian Trust Lands

None of the alternatives would affect the boundaries of established reservations or Trust lands. However, the alternatives would affect the value, use, or enjoyment of Trust lands. Changes in water deliveries could particularly affect the productivity of agricultural land, an important and valuable land use for tribes (Curtis et al. 2023). It is estimated that agricultural land would be fallowed under some alternatives.

In the Upper Basin, none of the alternatives would directly affect agricultural land. Some alternatives would provide new mechanisms for conserving and storing water for Upper Basin tribes (the Enhanced Cooperation, Maximum Operational Flexibility, and Supply Driven Alternatives).

The following summarizes state-level conclusions in the Lower Basin:

- There is no clear most robust alternative for Arizona. The different alternatives and the CCS Comparative Baseline have varying trade-offs between fallowed acreage under shortages and percent of futures with dead pool releases.
- In California and Nevada, impacts are only associated with alternatives that use a pro rata distribution (the Enhanced Coordination and Supply Driven [LB Pro Rata approach] Alternatives). There are no impacts associated with alternatives that use a variation of a priority distribution.

Issue 3: Other Indian Trust Assets

The alternatives would not generally affect other ITAs in and of themselves, but could affect the value, use, or enjoyment of other ITAs. Because impacts are resource- and tribe-specific, no general comparison of alternatives for other ITAs can be made. If specific other ITAs are identified through additional tribal input, they may be considered in the Final EIS.

TA 18.3 References

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