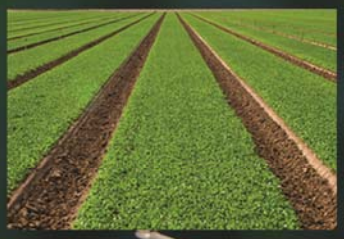
# RECLAMATION

*Managing Water in the West*

Calendar Year 2011

# Estimates of Evapotranspiration and Evaporation Along the Lower Colorado River



U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Region
Boulder Canyon Operations Office

June 2016

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**U.S. Department of the Interior**
**Bureau of Reclamation**
**Lower Colorado Region**
**Boulder Canyon Operations Office**

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# Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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## Acronyms

| | |
|---|---|
| AF | Acre-Feet |
| AZ | Arizona |
| AZMET | Arizona Meteorological Network |
| CA | California |
| CIMIS | California Irrigation Management Information System |
| CVWD | Coachella Valley Water District |
| ET | Evapotranspiration |
| $ET_o$ | Reference Evapotranspiration |
| GIS | Geographic Information System |
| IID | Imperial Irrigation District |
| LCRAS | Lower Colorado River Accounting System |
| NAIP | National Agriculture Imagery Program |
| NCR | Non-Colorado River |
| NV | Nevada |
| NWR | National Wildlife Refuge |
| NWS | National Weather Service |
| RS | Remote Sensing |
| SIB | Southerly International Border |
| TM | Thematic Mapper |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |
| WMIDD | Wellton-Mohawk Irrigation and Drainage District |
| YMIDD | Yuma Mesa Irrigation and Drainage District |
| YPG | Yuma Proving Ground |

# Glossary

AZMET: A network of automated weather stations within the state of Arizona that provide reference evapotranspiration estimates.

CIMIS: A network of automated weather stations within the state of California that provide reference evapotranspiration estimates.

Crop Group: Crops with similar water use rates, grouped for the purpose of calculating evapotranspiration.

Crop Coefficient: The ratio of evapotranspiration observed for the crop studied over that observed for the reference crop under the same conditions.

Evapotranspiration: The combined effect of evaporation from the soil surface and transpiration from the plant canopy.

Fallowed/Idle Acres: The total number of acres that were left fallow or idle for the entire calendar year.

Geographic Information System: An information system that integrates, stores, edits, analyzes, shares, and displays geographic information.

Gross Cropped Acres: The total acres of crops grown, which includes multiple cropping on individual fields. Because permanent crops (i.e. alfalfa, bermuda grass, orchards and dates) may be pulled or replanted during the calendar year, the gross cropped acreage reported for permanent crops represents an average of the quarterly acreage values for a given water user. Gross cropped acres for a particular water user may be less than or greater than net cropped acres based on the following scenarios:

- When gross cropped acres are less than net cropped acres, it reflects a year in which permanent crops were pulled or replanted during the calendar year. Example: A given water user had 200 net acres of land. Of those, all 200 acres were planted in alfalfa in quarter 1. Beginning in quarter 2, 50 acres of alfalfa were pulled, leaving 150 acres of alfalfa in quarters 2, 3 and 4. In this scenario, the gross cropped acreage would be 162.5 acres (i.e. 200 + 150 + 150 + 150)/4 = 162.5 acres). The net cropped acreage would be 200 acres.
- When gross cropped acres are greater than net cropped acres, it reflects a year in which multiple crops were grown on a single field. Example: A given water user had 200 net acres of land. Of those, 200 acres of wheat were planted in the spring and 200 acres of lettuce were planted on the same fields in the fall. In this scenario, the gross cropped acreage would be reported as 200+200 = 400 acres. The net cropped acreage would be 200 acres.

Irrigable Acres: The total acres that can be irrigated and for which there exists adequate infrastructure to irrigate.

Moist Soil Unit: An area gradually flooded in winter to develop migratory waterfowl forage and not irrigated in summer.

Non-Colorado River (NCR): For water users designated as NCR, the origin of water used for agricultural irrigation and by riparian vegetation and open water is considered to come from sources other than the Colorado River.

Net Cropped Acres: The total acres on which one or more crops were grown, which does not include multiple cropping on individual fields. Does not include fallowed/idle acres. Because Reclamation's method uses the average annual acreage for permanent crops (i.e. alfalfa, bermuda, orchards and dates), gross cropped acres may be less than net cropped acres.

Program Area: The area in which Reclamation routinely monitors agricultural and riparian vegetation evapotranspiration and open water evaporation. Includes the lower Colorado River valley from Hoover Dam to the Southerly International Boundary with Mexico; the Wellton-Mohawk Irrigation and Drainage District on the Gila River in Arizona, and the Imperial Irrigation District and the Coachella Valley Water District in California.

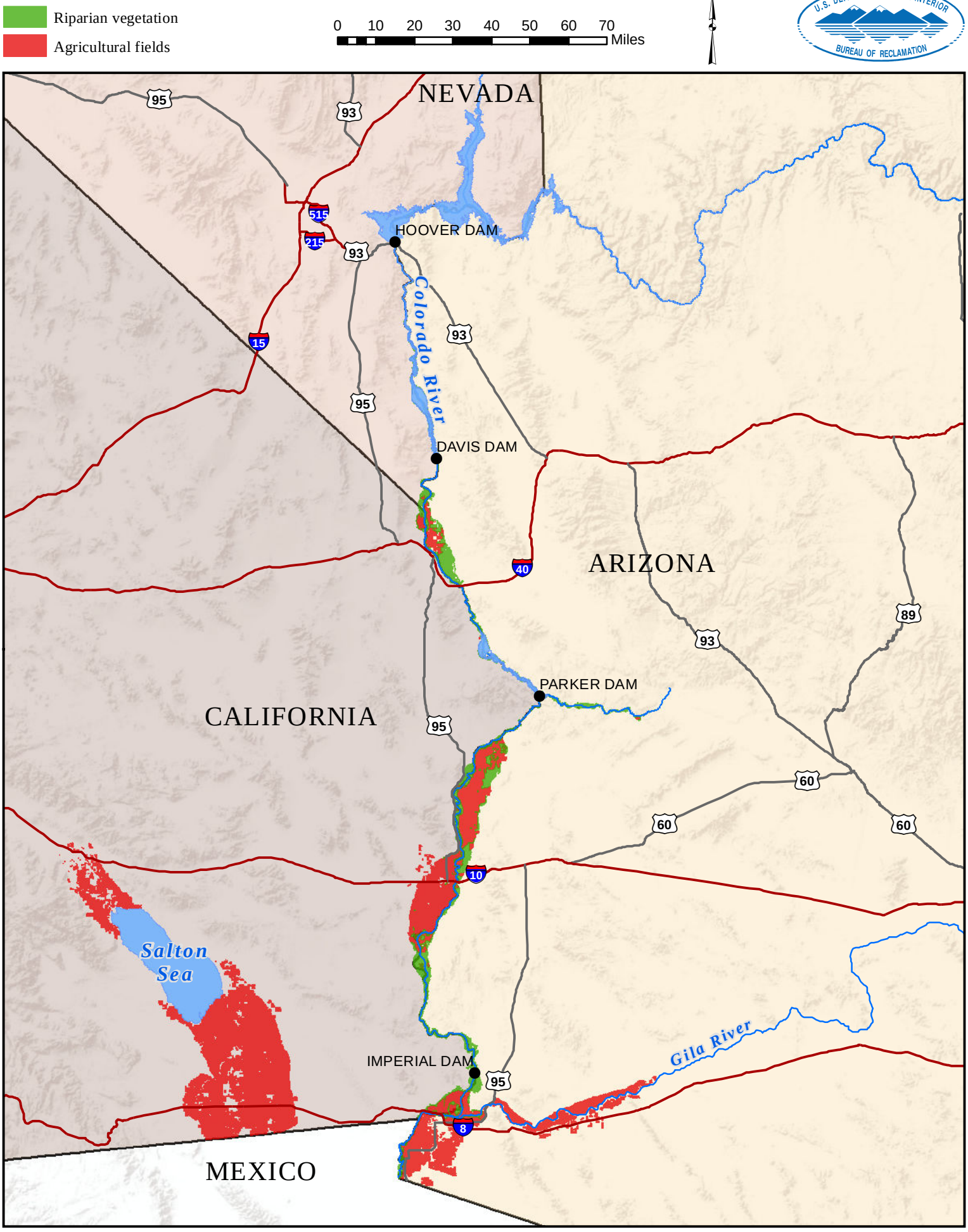
Remote Sensing: A technique for obtaining information from a surface without coming into physical contact with it, using sensors and imagers that are sensing the electromagnetic radiation coming from the surface at specific wavelengths.

Reference Evapotranspiration: The evapotranspiration rate from a reference surface. The reference surface is a hypothetical reference crop with specific characteristics.

Riparian Vegetation: Riparian vegetation refers to the vegetation that grows along the shores of freshwater rivers and lakes, or along some canals. As used in this report, riparian vegetation classes also include wetland types and natural vegetation within the Lower Colorado River floodplain.

Spectral Characteristics: The amount of spectral reflectance from the Earth's surface recorded by the satellite sensors in different portions of the electromagnetic spectrum for different land cover types.

# PROGRAM AREA



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# Executive Summary

The Secretary of the Interior, as the "Watermaster" for the Lower Colorado River, acts through the Bureau of Reclamation (Reclamation) to manage the waters of the Colorado River for the benefit of water users in the Southwestern United States and Mexico. A significant component of the Watermaster role, a component mandated by the United States Supreme Court Decree of 1964 in *Arizona* v. *California*, is to account for water use by each state and individual water user. In this capacity, Reclamation administers a number of programs, some of which utilize remote sensing technology to monitor and estimate annual agricultural and riparian vegetation water use, and open water evaporation along the lower Colorado River from Hoover Dam to the Southerly International Border with Mexico. Reclamation provides an annual summary of this information through publication of this report.[1]

Specifically, Reclamation calculates estimates of:

- Evapotranspiration (ET) from irrigated agricultural areas.
- ET from riparian vegetation.
- Evaporation from the mainstream channel and reservoirs of the lower Colorado River.
- Evaporation from major delivery canals, lakes, lagoons, and other open water areas along the river.
- Agricultural data, by water user, including the types of crops grown and acreages.

More than 3.5 million acres are monitored within the program area. This acreage includes:

- Irrigation districts, Indian reservations, Federal recreation areas, and wildlife refuges located along the mainstream of the lower Colorado River.
- The Bill Williams River below Alamo Dam.
- The Wellton-Mohawk Irrigation and Drainage District on the Gila River in Arizona.
- The Imperial Irrigation District and the Coachella Valley Water District in California.

The total estimated agricultural ET in 2011 was approximately 2,936,200 acre-feet (AF). Total estimated agricultural ET in 2010 was approximately 2,765,100 AF, hence a 6.2% increase in 2011 over the 2010 level is indicated.

[1] Copies of this and previous years' reports may be found on Reclamation's website at: www.usbr.gov/lc/region/g4000/wtracct.html.

Table ES-1 provides a summary of the predominant crops grown within the program area during calendar year 2011 and the acreages associated with each crop. More detailed information including water users' agricultural acreage (irrigable, gross cropped, net cropped, and fallowed/idle acres), crop types and acreages, agricultural ET by crop type, riparian vegetation acreage and ET, and open water acreage and evaporation has been included in Appendix 1. For select water users, the appendix also provides the historical 5-year trend (calendar years 2007-2011) of the user's total diversions, consumptive use (diversions less measured and unmeasured return flows, as reported in Reclamation's 2011 *Colorado River Accounting and Water Use Report, Arizona, California, and Nevada*), and agricultural ET (crop ET minus effective precipitation).

Table ES-1. Major Crops Grown in the Program Area in Calendar Year 2011.

| **Crop** | **Gross Cropped Acres** |
|---|---|
| Alfalfa | 248,496 |
| Lettuce (Head, Leaf Red, Leaf Green, Spinach) | 164,714 |
| Small Grains (Wheat, Oats, Rye, Barley, Millet) | 145,102 |
| Sudan (Includes Sesbania and Clover) | 93,518 |
| Cotton | 66,629 |
| Bermuda/Grass (Bermuda Overseeded with Rye, Klein, Timothy) | 62,718 |
| Other (e.g. Small Vegetables, Sugar Beets, Citrus, Crucifers, Dates, Field grains, Grapes, Melons, etc.) | 248,624 |
| **Total** | **1,029,802** |

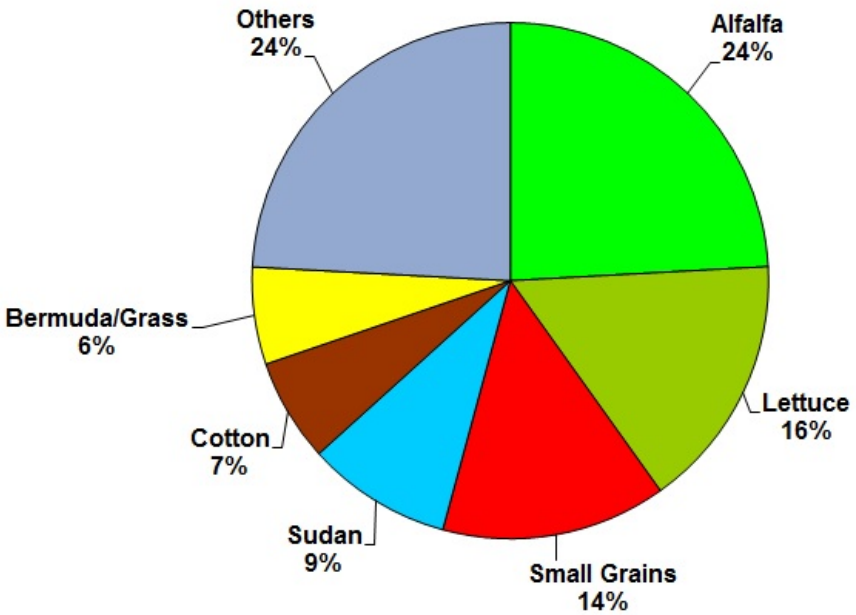


Figure ES-1. Major Crops Grown in the Program Area in Calendar Year 2011.
(Based on Gross Cropped Acres.)

# 1.0 Introduction

The Colorado River has often been termed the "Lifeblood of the Southwest." Beginning in the Rocky Mountains of north central Colorado, the river travels more than 1,400 miles before it empties into the Gulf of California, commonly referred to the Sea of Cortez. Together with its tributaries, the Colorado River drains approximately 242,000 square miles in the United States, one-twelfth of the country's continental land area, and 2,000 square miles in Mexico.

The Colorado River and its tributaries provide water to nearly 40 million people for municipal use, supply water to irrigate nearly 5.5 million acres of land, and are the lifeblood for at least 22 federally recognized tribes, 7 National Wildlife Refuges, 4 National Recreation Areas, and 11 National Parks. In the Lower Colorado River Basin States of Arizona, California, and Nevada (Lower Division States), the river serves major cities such as Phoenix, Los Angeles, and Las Vegas. The dry, arid climate of the lower Colorado River basin lends itself to being one of the most productive agricultural regions in the nation. Agriculture use accounts for the largest component of the river's consumptive use in the lower basin, supporting an agricultural economy worth billions of dollars.


Figure 1. Map of the Colorado River hydrologic basin and areas adjacent to the hydrologic basin that receive Colorado River water.

As the Watermaster for the lower Colorado River, the Bureau of Reclamation must understand the disposition of water once it is released from Hoover Dam in order to effectively manage resources of the lower Colorado River. Because the agricultural sector comprises such a large component of the river's use in this region, it is important to have a comprehensive understanding of current agricultural practices and their associated water use. As competition for the Colorado River resource continues to escalate, water managers will increasingly rely on accurate and reliable sources of data upon which to make sound decisions regarding future water management policies to ensure

a sustainable water supply is available to meet future demands. This is particularly true for the Lower Division States, as each of these states has the ability to fully utilize its Colorado River apportionment.

# 2.0 Lower Colorado River Acreage and Water Use Estimates

This report provides estimates of agricultural, riparian vegetation, and open water acreages and water uses along the lower Colorado River from Hoover Dam to the Southerly International Border (SIB) with Mexico. Reclamation has reported these data since 1995, in reports previously entitled, "Lower Colorado River Accounting System [LCRAS] Evapotranspiration and Evaporation Calculations." A detailed history of the LCRAS program and the work that was performed related to its development is presented in the United States Geological Survey (USGS) Water Supply Paper 2407 (Owen-Joyce and Raymond, 1996). Beginning with the 2009 report, Reclamation reformatted the way in which the data are presented in an effort to provide a more user-friendly product that better serves the end-user.

This section provides a general overview of Reclamation's acreage and water use monitoring program, including a description of the program area and program elements. Section 3 provides a description of the procedures and methods; Section 4 provides the results of the 2011 monitoring program; and Section 5 discusses program improvements and/or changes that occurred in 2011.

## 2.1 Program Area

The area monitored by Reclamation includes the lower Colorado River valley from Hoover Dam to the SIB. Reclamation has routinely monitored agricultural and riparian vegetation ET and open water evaporation along the mainstream since 1994, and along the mainstream and Bill Williams River below Alamo Dam since 2001. Beginning in 2004, the program area was expanded to include the Wellton-Mohawk Irrigation and Drainage District (WMIDD) on the Gila River in Arizona, and the Imperial Irrigation District (IID) and the Coachella Valley Water District (CVWD) in California. With this expansion, the extent of the area analyzed more than doubled from approximately 1.2 million acres to nearly 3.5 million acres (Figure 2). Correspondingly, the number of fields analyzed also increased from approximately 50,000 fields to over 125,000 fields. Figure 2 illustrates the program area before and after the expansion.

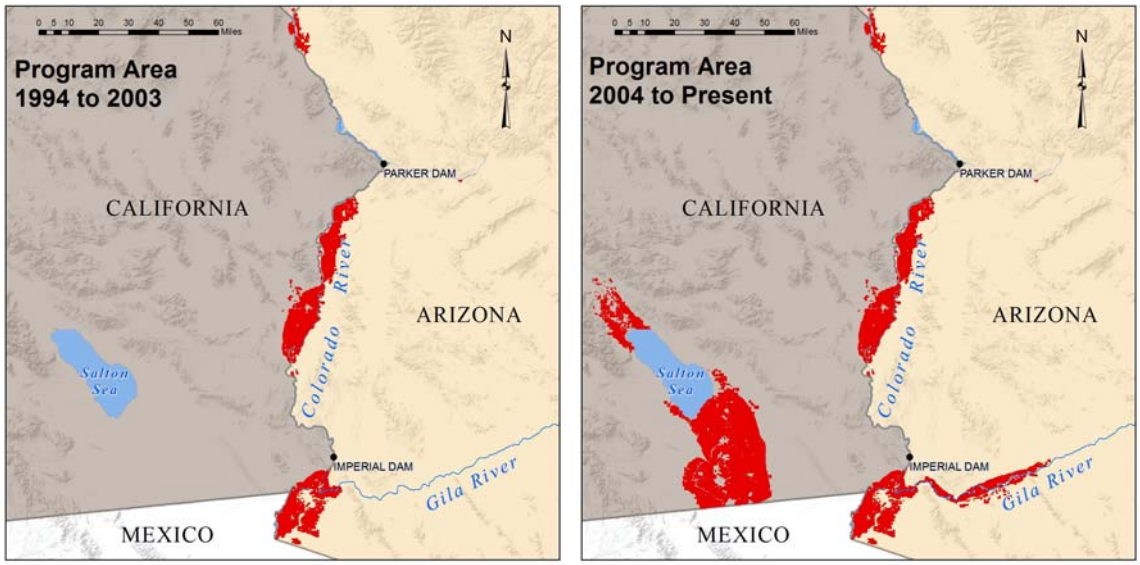


Figure 2. Program Area Extent: (1) 1994-2003 (original) and (2) 2004-Present (with the addition of WMIDD, IID, and CVWD). Program area includes riparian and open water areas, which are not shown here.

## 2.2 Program Elements

Reclamation's remotely-sensed data collection and monitoring program provides the following types of data:

1. Estimates of ET from irrigated agricultural areas.
2. Estimates of ET from riparian vegetation.
3. Estimates of evaporation from the mainstream channel and reservoirs of the lower Colorado River.
4. Estimates of evaporation from major delivery canals, lakes, lagoons, and other open water areas along the river.
5. Estimates of agricultural data, by water user, including the types of crops grown and acreages.

Reclamation uses this information to support a variety of program-related administrative requirements, including to monitor the current state of the river system, to assess potential impacts of changes to the river system, and as inputs to management decisions involving the administration of the federal laws, compacts, court decisions and decrees, contracts, and regulatory guidelines, collectively known as "The Law of the River," which govern the diversion and use of Colorado River water. Examples of how Reclamation uses this data include:

1. To assist in verifying Colorado River water users' success in meeting conservation targets under the Inadvertent Overrun and Payback Policy, Intentionally Created Surplus, and/or System Conservation programs.
2. To develop spatial databases representing locations of crops, riparian vegetation, and open water surfaces of the Colorado River, lakes, and canal systems.
3. To statistically quantify the types and acres of crops, riparian vegetation groups, and open water surface areas.
4. To perform economic analyses for land use conversions.
5. To refine and improve upon unmeasured return flow estimates.
6. To assist in making water entitlement and beneficial use determinations.
7. To assist in making determinations of unauthorized use.

Reclamation provides an annual summary of the land cover types, acreages, and associated evapotranspiration and evaporation for agricultural, riparian vegetation, and open water areas within the program area through publication of this report. Copies of this and previous years' reports can be found on Reclamation's website at: www.usbr.gov/lc/region/g4000/wtracct.html.

# 3.0 Procedures and Methods

Reclamation uses Remote Sensing (RS) and Geographic Information Systems (GIS) technologies to identify the location and quantify the acreages of crop groups, riparian vegetation groups, and open water areas in the program area. Riparian vegetation is monitored only in the Colorado River floodplain and along the Bill Williams River below Alamo Dam; it is not monitored in the IID, CVWD, or WMIDD areas. The spatial extent (location and area of coverage) of the crop groups, riparian vegetation groups, and open water areas is stored in digital spatial databases collectively referred to as a GIS database. Reclamation uses the data generated from the RS and GIS processes to calculate ET from crops and riparian vegetation, and evaporation from open water areas.

When RS processes alone are insufficient to map crop and riparian vegetation groups or open water areas, data collected on the ground (ground reference surveys) are also used. For example, orchards are mapped using data collected from ground reference surveys due to the difficulty of correctly identifying features related to this type of crop using RS processes alone. Once the data are entered into a GIS database, programs are used to calculate the number of acres of each crop group and riparian vegetation group for each water user, as well as the number of acres of open water areas. Acreage calculations are completed for areas located within the program area.

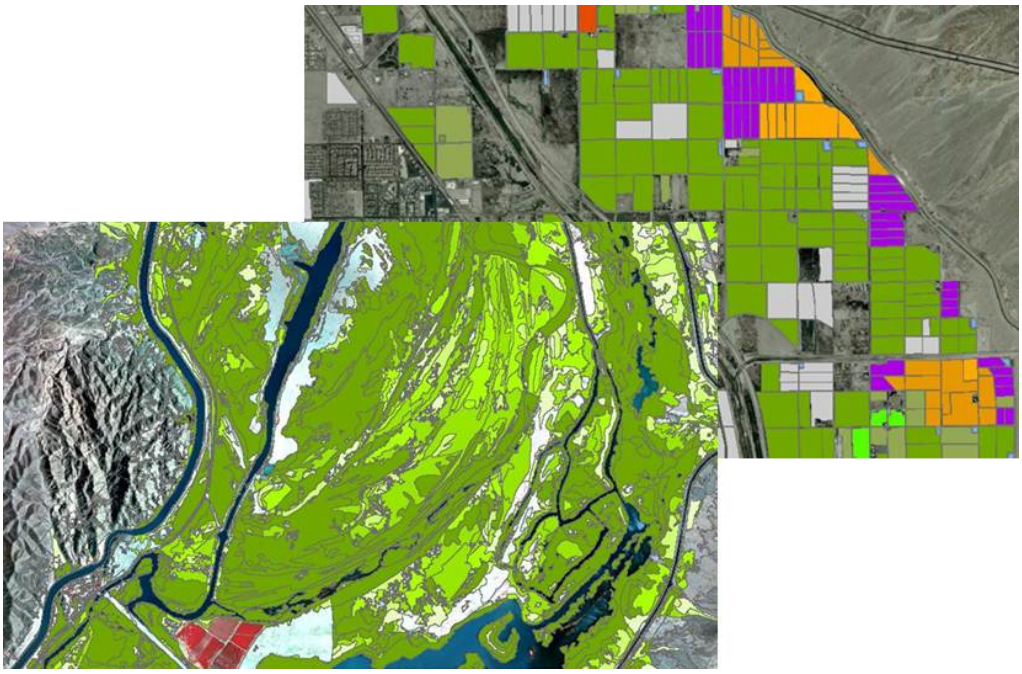

Figure 3. Reclamation uses RS and GIS processes to map crop and riparian vegetation groups and to estimate the evapotranspiration associated with these groups.

Once Reclamation maps the crop and riparian vegetation groups and open water areas (as discussed in the following sections), Reclamation calculates the ET from crops and riparian vegetation for each water user, and evaporation from open water areas. Currently, this analysis does not include estimates of ET or evaporation within the boundaries of domestic water users. Areas with identified crops and/or riparian vegetation located outside of a known water user boundary are mapped and labeled with the name of the state in which they are located (e.g. State of Arizona, Other Users, Davis Dam to Parker Dam).

The key components of ET and evaporation calculations include:

1. Identifying crop and riparian vegetation groups, and open water areas.
2. Calculating ET for crop groups and riparian vegetation groups.
3. Calculating evaporation from open water areas (i.e. the mainstream channel and reservoirs of the lower Colorado River, major delivery canals, lakes, lagoons, and other open water areas).

Sections 3.1 through 3.3 present a brief description of each of these components.

## 3.1 Identifying Crop Groups, Riparian Vegetation Groups, and Open Water Areas

This section provides an overview of the image classification processes and GIS technologies Reclamation uses to identify and map crop and riparian vegetation groups, and open water areas within the program area.

### *3.1.1 Collecting and Analyzing Remotely-Sensed Data*

Satellite imagery is acquired from Landsat Thematic Mapper (TM) sensors and other satellite or airborne imaging systems as needed. For its analysis, Reclamation selects satellite images that adequately cover the program area, are cloud-free, and capture the variation in crop planting practices during the year.

### *3.1.2 Collecting Ground Reference Data*

Correctly identifying and mapping crop and riparian vegetation groups using remotely-sensed data requires a thorough understanding of the spectral characteristics of vegetation types for representative (ground reference survey) sites throughout the program area. TM satellite image data contain digital values that represent the spectral characteristics of these crop and riparian vegetation groups. Reclamation analyzes these digital values within ground reference survey sites to generate spectral statistics for specific crop and riparian vegetation groups.

Reclamation collects ground reference survey data for approximately 12 percent of the irrigated fields in the program area. Reclamation uses 60 to 65 percent of the ground reference survey data for image classification processing (to identify crop groups) and the remaining 35 to 40 percent to assess the accuracy of the image classifications. Reclamation selects ground reference survey sites in each major irrigated area involved in this analysis. To provide a statistically valid data set, Reclamation selects irrigated fields from a GIS database using a stratified random sample and adds additional fields to the random sample, where necessary, to ensure representation of all major crop groups.

Table 1 provides a listing and description of the common crop groups identified within the program area. Although cropping patterns may vary yearly depending on market conditions, the types of crops grown within the program area generally remain consistent over the long-term.

Table 1. Crop Groups Identified within the Program Area.

| Crop Group | Description |
|---|---|
| Alfalfa | Alfalfa |
| Aloe | Aloe |
| Bermuda/Grass | Bermuda, Bermuda Overseeded with Rye, Klein grass, Timothy grass |
| Cane/Bamboo | Cane/Bamboo |
| Citrus | Young (1-2 meters tall)<br>Mature (2+ meters tall)<br>Declining |
| Cotton | Cotton |
| Crucifers | Broccoli, Cauliflower, Cabbage, Bok-Choy, Mustard, Kale, Okra |
| Dates | Dates |
| Deciduous Orchards | Pecans, Peaches, Almonds |
| Fallow/Idle | Fields currently not in production; includes bare cultivated soil |
| Field grains | Field Corn, Sorghum, Milo |
| Grapes | Grapes |
| Jojoba | Jojoba |
| Legumes/Solanum Vegetables | Green, Dry and Garbanzo Beans; Peas, Peanuts, Fresh Peppers, Potatoes |
| Lettuce | Spring and Fall (Head, Leaf [Red], Leaf [Green], Spinach, Other Lettuce) |
| Maintained Marsh | Maintained Marsh |
| Melons | Spring and Fall (Watermelon, Honeydew, Cantaloupe, Squash, Cucumbers) |
| Miscellaneous Herbs | Anise, Mint, other |
| Moist Soil Unit | An area gradually flooded in winter to develop migratory waterfowl forage and not irrigated in summer |
| Nursery or Greenhouse | Citrus Nursery, Native Nursery, Greenhouse, Other Nursery |
| Oil Crops | Safflower, Canola, Sunflower, Sesame |
| Perennial Vegetables | Artichoke, Asparagus, Guayule |
| Root Vegetables | Table Beets, Parsnip, Turnip, Rutabaga |
| Small Grains | Oats, Rye, Barley, Millet, Wheat |
| Small Vegetables | Carrots, Cilantro, Celery, Garlic, Dry Onions, Onions, Parsley, Radishes, Flowers |
| Sudan | Includes Sesbania and Clover |
| Sugar Beets | Summer and Winter |
| Tomatoes | Tomatoes |
| Wildlife Forage Maintained | Wildlife Forage Maintained |

Table 2 provides a list and description of the riparian vegetation groups identified within the program area.

Table 2. Riparian Vegetation Groups Identified within the Program Area.

| Riparian Group | Description |
|---|---|
| Barren | Less than 10% vegetation |
| Cottonwood/Willow | 61% to 100% cottonwood and willow |
| Marsh | 40% cattail, bulrush, and phragmites |
| Mixed Veg Low | Mixed vegetation types that may include salt cedar, mesquite, or arrowweed with crown closure greater than or equal to 10% and less than 40% |
| Mixed Veg Medium | Mixed vegetation types that may include salt cedar, mesquite, or arrowweed with crown closure greater than or equal to 40% and less than or equal to 80% |
| Salt Cedar Dense | Predominant salt cedar with crown closure greater than 80% |

### *3.1.3 Delineating Cropped Areas*

Reclamation has developed a spatial relational database that delineates field borders for all irrigated areas included in this analysis (field-border database). Reclamation has linked all ground reference survey data collected for image classification to this field-border database.

Reclamation routinely updates the field border database to reflect actual conditions observed in the field during collection of the ground reference sample data. Reclamation also uses 30 meter TM imagery, and 1- and 2-meter United States Department of Agriculture National Agricultural Imaging Program (NAIP) digital photography to update and create new field-border databases.

Delineated cropped areas include all areas known by Reclamation to divert or pump water along the mainstream of the lower Colorado River from Davis Dam to Mexico, WMIDD, IID, CVWD, and irrigated areas along the Bill Williams River from below Alamo Dam to Lake Havasu. (See Appendix 3, Exhibit 1 for an index of water user boundaries, and Exhibits 1 through 7 for illustrations of these areas.)

Using the RS technology with the GIS field border database, Reclamation identifies the crop(s) grown in each agricultural field throughout the calendar year. Post-classification accuracy assessments show that, overall, Reclamation routinely achieves an average accuracy of 90 percent or greater when mapping crop groups in the program area.

Reclamation completed a study with an independent statistician to quantify the effects of remote sensing-based crop classification error on accuracies of ET estimates. To review the results of this study, see Stehman, S.V. and Milliken, J.A. (2007), "Estimating the effect of crop classification error on evapotranspiration derived from remote sensing in the lower Colorado River basin, USA." *Remote Sensing of Environment*, 106, pp. 217 – 227.


Figure 4. Landsat satellite image showing agricultural fields in the Imperial Irrigation District with digitized field borders.

### 3.1.4 Delineating Riparian Vegetation Areas

Reclamation updates riparian vegetation areas along the Colorado River floodplain by comparing the current year Landsat TM summer satellite images to the previous year's images (change detection methods[2]). Reclamation field checks areas of spectral change to confirm that the change is actually due to a change in land cover. Reclamation then remaps areas of land cover change and uses these maps to update the riparian vegetation database. Additionally, Reclamation completed a significant update to the riparian vegetation database utilizing 1 meter resolution digital imagery from calendars years 2010 and 2011. For additional information, see Section 5.1

### 3.1.5 Delineating Open Water Areas

Reclamation maintains an open water GIS database which contains the spatial boundaries of open water surfaces within the program area including: the mainstream of the Colorado River, reservoirs, major delivery canals, lakes, lagoons and other backwater areas. Reclamation annually compares current-year satellite imagery to previous year imagery and updates the open water surface area as necessary.

Reclamation calculates evaporation from major delivery canals that serve water users within the Yuma area. Reclamation identifies bank-to-bank area (in acres) in these canals by digitizing canal banks from satellite and airborne imagery.

[2]See, *Lower Colorado River Accounting System, Calendar Year 2001*, *Demonstration of Technology Report*, Chapter 6, 6.23 - 6.26.

## 3.2 Calculating Crop and Riparian Vegetation ET

Reclamation calculates ET from crop groups and riparian vegetation groups using the following data:

1. Reference ET.
2. ET coefficients for each crop and riparian vegetation group.
3. Number of acres and location of each crop and riparian vegetation group.
4. Effective precipitation (used to calculate crop ET only).

The following sections describe the methods utilized by Reclamation to calculate these data.

### *3.2.1 Calculating Reference ET*

Reference ET represents a fundamental measure of the rate of water use by vegetation (in linear units, such as inches) to which the rate of water use of all types of vegetation (as well as the rate of evaporation from a water body) can be related.

Reclamation calculates reference ET values using the standardized Penman-Monteith equation developed by the American Society of Civil Engineers (standardized equation), and climatological data provided by California Irrigation Management Information System (CIMIS) and Arizona Meteorological Network (AZMET) automated weather stations located in irrigated areas along the Colorado River from Davis Dam to Mexico. The standardized equation is widely accepted by science/engineering communities, and is considered the most accurate method currently available. The AZMET and CIMIS stations continuously collect maximum, minimum, and average air temperature and relative humidity; average soil temperature at depths of 2- and 4-inches, wind speed, and precipitation data; and calculate net solar radiation. These parameters, with the exception of precipitation, are used to calculate hourly and daily reference ET values.

Table 3 provides a list of the stations used to collect the reference ET data used in Reclamation's calculations and the corresponding geographical areas for which each station's data are applied. Appendix 2 contains the following additional information (averaged for each geographical area referenced in Table 3): monthly reference ET, monthly precipitation, and monthly ET rates for crop and riparian groups.

Table 3. Area Weather Stations Used for the Calculation of Average Reference ET and Precipitation.

| Geographical Area | Weather Stations | | |
|---|---|---|---|
| | AZMET | CIMIS | NWS* |
| Mohave Valley area | Mohave<br>Mohave II<br>Mohave ETo | -- | Bullhead City |
| Parker/Palo Verde valleys | Parker<br>Parker II | Blythe NE<br>Ripley<br>Palo Verde II | Blythe-Airport<br>Ehrenberg 2E<br>Parker<br>Blythe |
| Wellton-Mohawk area | Roll<br>Roll ETo | -- | Tacna 3 NE |
| Imperial/Coachella valleys | -- | Calipatria/Mulberry<br>Seeley<br>Meloland<br>La Quinta II<br>Indio 2<br>Oasis<br>Westmorland North | Calexico 2 NE<br>El Centro 2 SSW<br>Imperial<br>Indio FS<br>Mecca FS<br>Niland<br>Desert Resorts Airport |
| Yuma area | Yuma North Gila<br>Yuma South<br>Yuma Valley<br>Yuma Valley ETo | -- | Yuma Proving Ground<br>Yuma Quartermaster<br>Yuma 13.8 ESE<br>Yuma MCAS |

*National Weather Station (NWS) stations collect precipitation data only.

Although the AZMET and CIMIS networks perform calculations of reference ET, it was discovered that there was a disparity in the values reported by each network for the lower Colorado River. Upon investigation, it was determined that the reason for the disparity was because the AZMET and CIMIS networks each use slightly different equations to calculate reference ET. Within the Parker and Palo Verde valleys, both CIMIS and AZMET stations are used to derive average reference ET values. By calculating reference ET using the standardized equation with the climatological data provided by the AZMET and CIMIS networks, this disparity is eliminated, and leaves only site conditions, equipment calibration, and micro-climatic differences between sites as sources of site to site variations in reference-ET values. Reclamation currently uses the reference ET values provided by the CIMIS network for the Imperial and Coachella valleys, and reference ET values from the AZMET network for the Mohave Valley and Wellton-Mohawk areas.

Reclamation develops area-specific reference ET values for the Mohave Valley, the Parker/ Palo Verde Valleys, the Imperial/Coachella valleys, the Wellton-Mohawk area (when more than one station is available), and the Yuma Area by averaging reference ET values from multiple sites within these areas. Figure 5 shows the reference ET and precipitation values used to develop the 2011 ET rates, which are then used to calculate ET from crop and riparian vegetation groups.

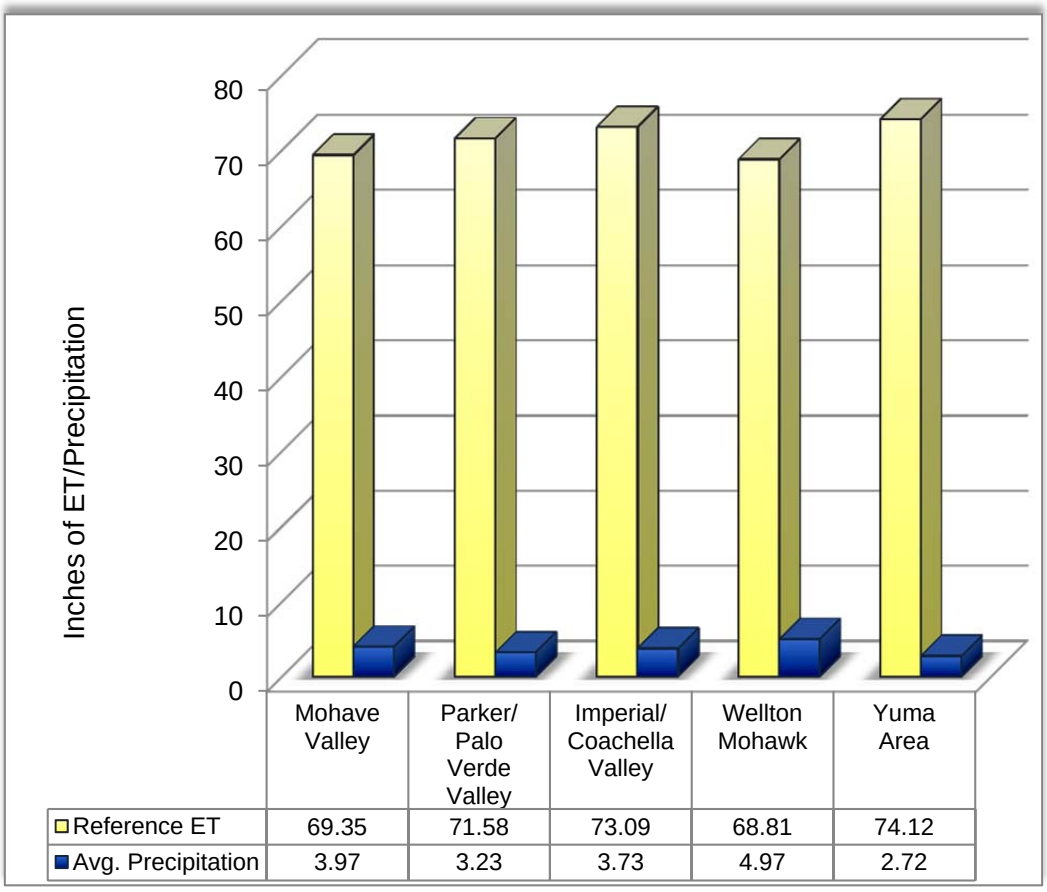


Figure 5. Reference ET and precipitation. Units: Inches.

### 3.2.2 ET Coefficients for Crop and Riparian Vegetation Groups

ET coefficients are the values that relate reference ET to the ET rate of a specific crop or riparian vegetation group, as well as to the evaporation rate from a water body. Jensen, Marvin E. (1998*), Coefficients for Vegetative Evapotranspiration and Open Water Evaporation for the Lower Colorado River Accounting System*, presents the rationale used to develop the original crop and riparian vegetation groups along the lower Colorado River and the Bill Williams River, their respective ET coefficients, and open water evaporation coefficients. Jensen, Marvin E. (2003), *Vegetative and Open Water Coefficients for the Lower Colorado River Accounting System (LCRAS), Addendum to the 1998 Report*, presents the adjustments made to the crop and riparian vegetation groups and the ET and evaporation coefficients, which are used in this report. The ET coefficients developed for the Yuma area are used to calculate crop ET for WMIDD.

The ET coefficients used for crops grown in IID and CVWD are derived from coefficients reported in Jensen, Marvin E. and Walter, Ivan A. (1997), *Assessment of 1987-1996 Water Use by the Imperial Irrigation District using Water Balance and Cropping Data Special Report, June 1997*. These ET coefficients were compared with crop ET coefficients for CVWD developed by

Lord, J.M. (1994), reported in *Water Use Assessment, Coachella Valley Water District and Imperial Irrigation District, Phase I Report*, and found to be similar; therefore the same ET coefficients are used for IID and CVWD. For a more in-depth description of the ET coefficients used for IID and CVWD, see *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations, Calendar Year 2004.*

### 3.2.3 Calculating Effective Precipitation

Effective precipitation is that portion of precipitation which infiltrates and remains in the soil so as to be available for crop consumptive use. A correction to the ET rate for crop groups is required to remove the impact of precipitation so the ET calculated reflects only the consumptive use of Colorado River water. Reclamation calculates effective precipitation as the product of recorded precipitation and an effective precipitation coefficient. Precipitation is recorded by rain gauges located at CIMIS and AZMET stations, and at stations operated by the NWS along the lower Colorado River. Table 3 provides a list of the stations used to collect the precipitation data used in Reclamation's calculations and the corresponding geographical areas for which each station's data are applied.

Reclamation developed a single daily, area-specific precipitation value for the Mohave Valley, the Parker/Palo Verde valleys, the Wellton-Mohawk area, the Imperial and Coachella valleys, and the Yuma area by averaging precipitation measured at the CIMIS, AZMET, and NWS stations in each area. Jensen, Marvin E. (1993), *Evaluating Effective Rainfall in CVWD*, contains the documentation for the effective precipitation coefficients used in this report. Reclamation uses the following equation to calculate effective precipitation:

$$\textit{Effective Precipitation} = \textit{Daily Precipitation} \times \textit{Monthly Effective Precipitation Coefficient}$$

Because the amount of precipitation in the lower Colorado River basin is typically very small, the correction to the ET rate for precipitation is also typically very small.

### 3.2.4 Calculating Crop ET

To calculate ET from crops in the program area, Reclamation calculates an ET rate (in inches) for each crop group by multiplying the average daily reference ET values (inches) by each group's unique daily ET coefficient (dimensionless). (See Appendix, Part 2 of the *Lower Colorado River Accounting System Evapotranspiration and Evaporation Calculations, Calendar Year2008* report for daily Kc values.) Reclamation considers the effect of rainfall on crop water use by subtracting effective precipitation (inches) from the ET rate for each crop group to yield a net ET rate (inches). Reclamation sums the daily ET rates to produce a monthly ET rate (inches) for each crop group.

Reclamation determines the acreage of each crop group within each water user's boundary using GIS technologies, RS, and field survey data as previously described. For multi-year crops that are present during only part of the year, such as alfalfa and orchards, Reclamation uses quarterly acreage estimates for the ET calculation.

Figure 6. AZMET weather station, Mohave 2, located in the Mohave Valley, AZ.

Reclamation calculates the ET (in acre-feet) within each water user's boundary by multiplying the ET rate for each crop group by the acreage of each crop group. These calculations are performed on a monthly time-step and the results summed to produce annual agricultural ET values within each water user's boundary. The following equation is used to calculate ET for a specific crop group:

$$\text{Annual ET} = \sum_{t=0}^{n} \frac{[(ET_o \times K_c) - \text{Effective PPT}]\ AC}{12 \text{ inches/foot}}$$

Where:

| | | |
|---|---|---|
| ET | = | Annual ET by crop group (acre-feet) |
| n | = | Time-step (monthly) |
| $ET_o$ | = | Daily reference ET (inches) |
| $K_c$ | = | Daily ET coefficient for a specific crop (dimensionless) |
| AC | = | Acres of crop |
| Effective PPT | = | Effective precipitation (inches) |

### *3.2.5 Calculating ET from Riparian Vegetation*

Reclamation calculates ET from riparian vegetation for this report the same way it calculates agricultural ET, except that no correction is made to the ET rates of riparian vegetation for effective precipitation. The sum of the ET from all riparian vegetation groups within a water user's boundary yields the riparian vegetation ET for that individual water user. Riparian vegetation is monitored only in the Colorado River floodplain and along the Bill Williams River below Alamo Dam; it is not monitored in the IID, CVWD, or WMIDD areas.

## 3.3 Calculating Evaporation from Open Water Areas

Reclamation calculates evaporation from open water areas within the program area using the following data:

1. Reference ET.
2. Monthly evaporation coefficients.
3. Number of acres and location of the open water area.
4. Precipitation.

The following sections describe the methods utilized by Reclamation to calculate open water evaporation from the mainstream and from major delivery canals.

### *3.3.1 Mainstream*

Reclamation calculates evaporation from Lakes Mohave and Havasu, and the open water areas of the mainstream Colorado River channel and its adjacent backwaters (such as Topock Marsh and Mittry Lake) from below Hoover Dam to Mexico. The following equation is used to calculate evaporation from open water areas:

$$\text{Annual EVAP} = \sum_{t=0}^{n} \frac{[(ET_o \times K_c)\text{-PPT}]\ AC}{12 \text{ inches/foot}}$$

Where:

| | | |
|---|---|---|
| EVAP | = | Annual Evaporation by open water (acre-feet) |
| n | = | Time-step (monthly) |
| $ET_o$ | = | Daily reference ET (inches) |
| $K_c$ | = | Monthly Evaporation coefficient for water (dimensionless) |
| AC | = | Acres of water |
| PPT | = | Precipitation (inches) |

Reclamation verified the open water area for this report using the method described in Section 3.1.5, “Delineating Open Water Areas.”

### *3.3.2 Calculating Evaporation from Major Delivery Canals*

Reclamation calculates evaporation from the All American Canal, Gila Gravity Main Canal and other major delivery canals in the Yuma area using the same equation used to calculate evaporation from the mainstream. Reclamation categorized major delivery canals into two groups: (1) those that deliver water to a single water user (single-user canals) and, (2) those that deliver water to two or more water users (shared canals).

Evaporation from a shared canal is proportioned among the water users which receive water from the canal. Reclamation calculates each water user's proportionate share of evaporation using the following process:

1. Calculate the distance from the canal headworks to the user's point(s) of delivery. In cases where a user has more than one delivery point, Reclamation calculates a single point of delivery using a weighted average based on the user's diversion amounts at each point of delivery. These values have units of miles.
2. Multiply the mileage value from (1) by the user's total diversion to derive what is referred to as the pro-rata factor. These values have units of acre-foot miles.
3. Divide the pro-rata factor for each water user (derived in (2)) by the sum of the pro-rata factors for all water users that receive water from the canal. This value, which can be expressed as a fraction or percentage, represents each user's percentage use of the canal.
4. Multiply each user's percentage use of the canal by the total volume of evaporation from the canal to determine each user's share of evaporation from the canal.

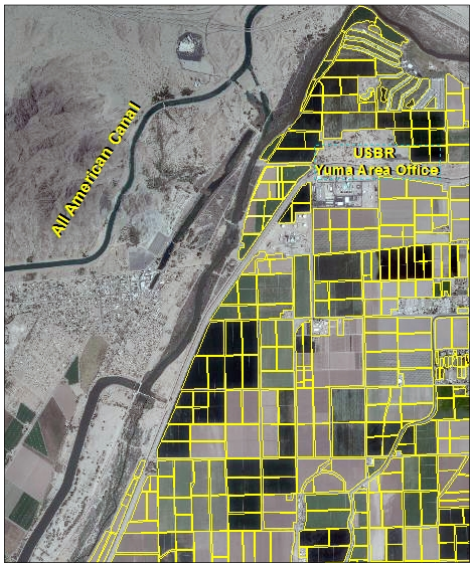


Figure 7. Digital image showing the All-American Canal, one of the canals from which Reclamation estimates evaporation.

# 4.0 Results

For each specified water user, Table 4 shows the ET from agriculture and riparian vegetation; and evaporation from the open water surfaces within that water user's boundary. As previously mentioned, areas with identified crops and/or riparian vegetation not located within a known water user boundary are mapped and labeled with the name of the state in which they are located. Table 4 includes water users which are not located on the river but are irrigated with water diverted from the Colorado River; specifically WMIDD in Arizona, and IID and CVWD in California.

Table 4. Agricultural ET, Riparian Vegetation ET, and Open Water Evaporation by Water User, Lower Colorado River, Hoover Dam to Mexico. Units: Annual Acre-Feet.

| Water User | Agricultural ET | Riparian Vegetation ET[3] | Open Water Evaporation |
|---|---|---|---|
| **Nevada (below Hoover Dam)** | | | |
| Fort Mojave Indian Reservation | 1,049 | 5,121 | 57 |
| Lake Mead National Recreation Area (Hoover Dam to Davis Dam) | 0 | 1,975 | 24 |
| Lake Mead National Recreation Area (Davis Dam to Parker Dam) | 0 | 0 | 0 |
| State of Nevada (Davis Dam to Parker Dam) | 0 | 8,951 | 281 |
| **Nevada Totals*** | **1,049** | **16,048** | **362** |
| **California** | | | |
| Chemehuevi Indian Reservation | 0 | 23 | 0 |
| Cibola National Wildlife Refuge | 0 | 13,141 | 643 |
| Coachella Valley Water District | 163,897 | 0 | 5,583 |
| Colorado River Indian Reservation | 1,409 | 24,196 | 327 |
| Fort Mojave Indian Reservation | 10,410 | 2,577 | 0 |
| Fort Yuma Indian Reservation | 1,795 | 10,768 | 248 |
| Havasu National Wildlife Refuge | 0 | 4,835 | 541 |
| Imperial Irrigation District | 1,528,247 | 0 | 13,302 |
| Imperial National Wildlife Refuge (Imperial Dam to Mexico) | 0 | 11,081 | 1,061 |
| Lake Enterprises of California, LLC | 0 | 527 | 35 |
| Palo Verde Irrigation District | 264,347 | 8,893 | 929 |
| State of California, Other Users (Davis Dam to Parker Dam) | 0 | 11,152 | 430 |
| State of California, Other Users (Parker Dam to Imperial Dam) | 1,793 | 30,288 | 6,520 |
| State of California, Other Users (Imperial Dam to Mexico) | 4,936 | 8,982 | 261 |
| Yuma Project Reservation Division, Bard Unit | 22,702 | 772 | 172 |
| Yuma Project Reservation Division, Indian Unit | 17,997 | 675 | 122 |
| **California Totals*** | **2,017,533** | **127,910** | **30,174** |

[3] Riparian Vegetation ET is monitored only in the Colorado River floodplain.

| Water User | Agricultural ET | Riparian Vegetation ET[3] | Open Water Evaporation |
|---|---|---|---|
| **Arizona** | | | |
| Arizona State Land Department (Parker Dam To Imperial Dam) | 1,148 | 1,956 | 0 |
| Arizona State Land Department (Imperial Dam To Mexico) | 3,879 | 569 | 66 |
| Beattie Farms Southwest | 1,002 | 248 | 0 |
| Bill Williams National Wildlife Refuge | 0 | 7,312 | 204 |
| Cha Cha, LLC | 1,267 | 335 | 21 |
| Cibola National Wildlife Refuge | 8,294 | 29,769 | 2,390 |
| Cibola Valley Irrigation and Drainage District | 12,203 | 6,121 | 0 |
| City of Yuma (Yuma East Wetlands) | 0 | 287 | 56 |
| Colorado River Indian Reservation | 321,599 | 91,368 | 971 |
| Curtis, Armon | 77 | 19 | 0 |
| East Cocopah Indian Reservation | 24 | 0 | 0 |
| Fort Mojave Indian Reservation | 33,517 | 20,161 | 153 |
| Fort Yuma Indian Reservation | 54 | 5,227 | 167 |
| Gila Monster Farms | 3,862 | 164 | 46 |
| Havasu National Wildlife Refuge | 237 | 40,581 | 14,802 |
| Imperial National Wildlife Refuge (Parker Dam to Imperial Dam) | 280 | 21,243 | 3,244 |
| JRJ Partners, LLC | 716 | 9 | 0 |
| Lake Havasu State Park | 0 | 1,253 | 0 |
| Lake Mead National Recreation Area (Hoover Dam to Davis Dam) | 0 | 2,009 | 32 |
| Lake Mead National Recreation Area (Davis Dam to Parker Dam) | 0 | 98 | 5 |
| Mittry Lake Management Area | 0 | 13,647 | 2,638 |
| Mojave Valley Irrigation and Drainage District, | 20,884 | 14,888 | 488 |
| North Baja Pipeline, LLC | 219 | 2 | 0 |
| North Cocopah Indian Reservation | 1,068 | 149 | 51 |
| North Gila Valley Irrigation District | 20,843 | 2,347 | 77 |

| Water User | Agricultural ET | Riparian Vegetation ET[3] | Open Water Evaporation |
|---|---|---|---|
| Ogram Boys Enterprises, Inc. | 794 | 11 | 0 |
| Ogram, George | 238 | 0 | 0 |
| Pasquinelli, Gary & Barbara | 414 | 0 | 0 |
| Powers (Power, R.E. & P.) | 674 | 58 | 0 |
| Rayner Ranches | 2,652 | 3 | 0 |
| State of Arizona, Other Users (Davis Dam to Parker Dam) | 0 | 2,091 | 282 |
| State of Arizona, Other Users (Parker Dam to Imperial Dam) | 373 | 21,783 | 3,830 |
| State of Arizona, Other Users (Imperial Dam to Mexico) | 3,023 | 13,065 | 482 |
| State of Arizona, Other Users (Down Gradient of YMIDD) | 29,157 | 0 | 0 |
| State of Arizona, Other Users (Limitrophe) | 2,892 | 4,144 | 0 |
| Unit B Irrigation and Drainage District | 6,721 | 0 | 122 |
| University of Arizona | 196 | 0 | 0 |
| Wellton-Mohawk Irrigation and Drainage District | 202,826 | 0 | 722 |
| West Cocopah Indian Reservation | 4,434 | 4,853 | 11 |
| Yuma County Water Users Association | 129,187 | 1 | 1,895 |
| Yuma Irrigation District | 33,083 | 671 | 383 |
| Yuma Mesa Irrigation and Drainage District | 63,287 | 0 | 1,016 |
| Yuma Proving Ground | 0 | 266 | 92 |
| **Arizona Totals*** | **911,124** | **306,709** | **34,244** |
| **Hoover Dam to Mexico Totals*** | **2,929,707** | **450,667** | **64,780** |

*Due to rounding, totals shown may differ from the sum of the individual values.

Table 5 provides a summary of ET and evaporation results along the lower Colorado River from Hoover Dam to Mexico. (Note: Bill Williams River National Wildlife Refuge (NWR) is included in the Davis Dam to Parker Dam reach; WMIDD, IID, and CVWD are included in the Imperial Dam to Mexico reach.)

Table 5. Summary of ET and Evaporation along the Lower Colorado River from Hoover Dam to Mexico. Units: Annual Acre-Feet.

| ET Category/Evaporation | Hoover Dam to Davis Dam | Davis Dam to Parker Dam | Parker Dam to Imperial Dam | Imperial Dam To Mexico | Total: Hoover Dam To Mexico* |
|---|---|---|---|---|---|
| Agricultural ET | 0 | 66,097 | 614,318 | 2,249,292 | 2,929,707 |
| Riparian Vegetation[3] | 3,984 | 119,044 | 260,370 | 67,269 | 450,667 |
| Evaporation – Open Water | 56 | 17,243 | 19,950 | 27,532 | 64,780 |
| Evaporation – Mainstream | 129,805 | 95,782 | 48,700 | 4,328 | 278,615 |

*Due to rounding, totals shown may differ from the totals shown in Table 4.

Table 6 shows the ET from agriculture and riparian vegetation and evaporation from open water areas along the Bill Williams River[4], the Bill Williams River NWR[5], the Gila River Valley[6], and South Yuma Mesa[7]. The origin of the water used for agricultural irrigation and by riparian vegetation in these areas is considered to come from sources other than the Colorado River.

Additional information on the water users identified in Tables 4 through 6, including agricultural acreage (irrigable, gross cropped, net cropped, and fallowed/idle acres), crop types and acreages,

Table 6. Agricultural ET, Riparian Vegetation ET, and Open Water Evaporation by Water User: Bill Williams River, Gila River Valley, and South Yuma Mesa. Units: Annual Acre-Feet.

| Water User Name | Agricultural ET | Riparian Vegetation ET[3] | Open Water Evaporation |
|---|---|---|---|
| State of Arizona (Alamo Dam to Bill Williams NWR) | 726 | 15,044 | 523 |
| Bill Williams River NWR | 0 | 1,552 | 48 |
| State of Arizona (Gila River Valley) | 2,928 | 0 | 0 |
| Hillander C Irrigation District | 2,879 | 0 | 0 |
| **Totals** | **6,532** | **16,595** | **571** |

*Due to rounding, totals shown may differ from the sum of the individual values.

[4] Bill Williams River, from Alamo Dam to the eastern boundary of the Bill Williams River NWR.
[5] Bill Williams River NWR, from the eastern extent of the Colorado River aquifer to the eastern extent of the refuge boundary.
[6] Agricultural land outside of WMIDD that is irrigated with wells pumping Gila River Valley ground water.
[7] Hillander C Irrigation District is located on the South Yuma Mesa and is irrigated with ground water not available for other users in the United States or to meet the 1944 Mexican Treaty obligation.

agricultural ET by crop type, riparian vegetation acreage and open water acreage has been included in Appendix 1. For select water users, the appendix also provides the historical 5-year trend (calendar years 2007-2011) of the user's total diversions and consumptive use (as reported in Reclamation's 2011 *Colorado River Accounting and Water Use Report, Arizona, California, and Nevada*), and agricultural ET (crop ET minus effective precipitation). It is important to note that the agricultural ET values presented in this report represent an estimate of the crop ET assuming a healthy crop and an adequate water supply and should not be confused with the consumptive use values reported in Reclamation's Water Accounting Reports, which are calculated as diversions less measured and unmeasured return flows.

The raw data used to develop the results presented in Tables 4 through 6 can be found on Reclamation's website at http://www.usbr.gov/lc/region/g4000/wtracct.html.

# 5.0 Program Improvements for Calendar Year 2011

Reclamation annually reviews each application of the methodology and incorporates "lessons learned" into subsequent reports. Reclamation also modifies each application of the methodology in response to information provided by water users and as modified processes become available after analysis of long-term questions and issues. The following paragraphs describe the program improvements implemented for calendar year 2011.

## 5.1 Improving ET Estimates for Riparian Vegetation

Reclamation completed a significant update to the riparian vegetation database utilizing 1 meter resolution digital imagery from calendars years 2010 and 2011. Based on revised vegetation types and crown closure, ET coefficients were assigned using data from: *Evapotranspiration by Phreatophytes Along the Lower Colorado River at Havasu National Wildlife Refuge, Arizona* (USGS, 2006).

Changes in estimates of ET from calendar year 2010 are predominantly due to the following:

1. Use of higher resolution imagery provided for identifying smaller areas of riparian vegetation that were not discernable in 30 meter Landsat data (used for previous riparian mapping), resulting in an increase in riparian vegetation acreage in some areas.
2. This mapping revision addressed more specific changes in vegetation crown closure, thereby both increasing and /or decreasing ET estimates from previous years.
3. Changes in riparian vegetation extent due to fire, intentional removal, etc.

## 5.2 Adjusting Water User Names and Boundaries

In this calendar year 2011 report, several water user names and boundaries were updated to reflect current conditions. For reference, a summary of the updates that were made to water user names is provided in Table 7.

Table 7. Summary of Updates Made to Water User Names.

| Water User (as listed in previous reports) | Description of Update |
|---|---|
| **California** | |
| Bernal Farm | Included in Colorado River Indian Reservation, CA. |
| Clark Farm | Included in Colorado River Indian Reservation, CA. |
| Fort Yuma Indian Reservation and Picacho State Recreation Area | Included in Fort Yuma Indian Reservation, CA. |
| Fort Yuma Indian Reservation and Yuma Proving Ground | Included in Fort Yuma Indian Reservation, CA and Yuma Project Reservation Division, Bard Unit, CA. |
| Imperial National Wildlife Refuge and Yuma Proving Ground | Included in State of California (Imperial Dam to Mexico). |
| Lake Enterprises of California, LLC | Added as a user. Formerly included in Imperial National Wildlife Refuge, CA (Parker Dam to Imperial Dam) and Picacho State Recreation Area (Parker Dam to Imperial Dam). |
| Moabi Regional Park | Included in State of California (Other users, Davis Dam to Parker Dam). |
| North Lyn-de Farm | Included in Colorado River Indian Reservation, CA. |
| Picacho State Recreation Area (Parker Dam to Imperial Dam) | Included in State of California (Other users, Parker Dam to Imperial Dam). |
| Picacho State Recreation Area (Imperial Dam to Mexico) | Included in State of California (Other users, Imperial Dam to Mexico). |
| South Lyn-de Farm | Included in Colorado River Indian Reservation, CA. |
| Yuma Proving Ground | Included in Fort Yuma Indian Reservation, CA and State of California (Other users, Imperial Dam to Mexico). |
| **Arizona** | |
| Arkelian Farm | Included in Arizona State Land Department, AZ and North Baja Pipeline, LLC, AZ. |
| Arizona State Land Department (Parker Dam to Imperial Dam) | Added as a user. Formerly included in Arkelian Farm, AZ. |
| Arizona State Land Department (Imperial Dam to Mexico) | Added as a user. Formerly included in Gila Monster Farm, AZ; State of Arizona (Other users, Imperial Dam to Mexico); and Yuma Irrigation District, AZ. |
| Beattie Farms Southwest | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Cha Cha, LLC | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Curtis, Armon | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Ehrenberg Farm | Now “Rayner Ranches, AZ”. |
| Fort Yuma Indian Reservation, Mittry State Wildlife Area and Yuma Proving Ground | Included in Fort Yuma Indian Reservation, AZ and Mittry Lake Management Area, AZ. |

| Water User (as listed in previous reports) | Description of Update |
|---|---|
| Havasu State Park (Windsor Beach) | Now "Lake Havasu State Park, AZ". |
| JRJ Partners, LLC | Added as a user. Formerly included in State of Arizona (Other users, Imperial to Mexico). |
| Lake Havasu State Park | Added as a user. Formerly called "Havasu State Park (Windsor Beach), AZ". |
| Mittry Lake Management Area | Added as a user. Formerly included in Imperial National Wildlife Refuge, AZ and Mittry State Wildlife Area, AZ. |
| North Baja Pipeline, LLC | Added as a user. Formerly included in Arkelian Farm, AZ. |
| Palo Verde Irrigation District | Included in Cibola Valley Irrigation and Drainage District, AZ and State of Arizona (Other users, Parker Dam to Imperial Dam). |
| Ogram Boys Enterprises, Inc. | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Ogram, George | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Pasquinelli, Gary & Barbara | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Powers (Power, R.E. & P.) | Added as a user. Formerly included in State of Arizona (Other users, Imperial Dam to Mexico). |
| Rayner Ranches | Added as a user. Formerly "Ehrenberg Farm, AZ". |
| University of Arizona Agricultural Station | Now "University of Arizona, AZ". |

## 5.3 Refinement of Open Water Areas and Changes to Evaporation Calculations

In 2011, NAIP imagery was not available, thus acreage of open water areas was revised using 2011 Digital Globe Imagery (ESRI) at 0.3 meter resolution for agricultural lands in California. This high-resolution imagery was not available in 2010 for agricultural lands in Arizona. In addition, 30 meter resolution LANDSAT satellite imagery was used to identify areas of large (>1,800 $m^2$) changes in open water surface area not identifiable using 2010 NAIP imagery.

Evaporation calculations for open water surfaces along the main stem of the Lower Colorado River use unique evaporation coefficients for each geographical area (Jensen, 2003).

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# 6.0 References

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# Appendix 1: Water User Fact Sheets

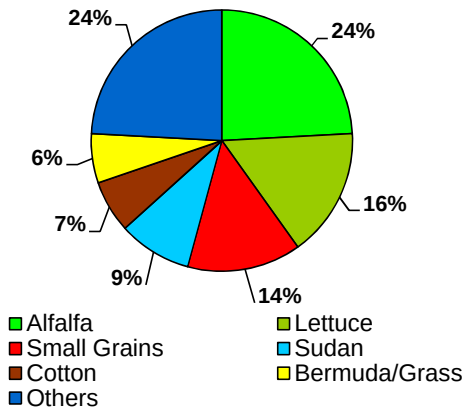
This appendix is intended to supplement the information contained in Table 4, and includes the following information for each water user: agricultural acreage (irrigable acres, gross cropped acres, net cropped acres and fallowed/idle acres); crop types and acreages; agricultural ET by crop type; riparian vegetation acreage and ET; and open water acreage and evaporation. For select users, the appendix also provides a historical 5-year trend (calendar years 2007-2011) of the user's total Colorado River diversions and consumptive use (diversions less measured and unmeasured return flows) – as reported in Reclamation's annual Colorado River Accounting and Water Use Report: Arizona, California, and Nevada – and agricultural ET (crop ET minus effective precipitation – as reported in Reclamation's annual Estimates of Evapotranspiration and Evaporation Along the Lower Colorado River, formerly LCRAS, reports. Copies of these reports may be found on Reclamation's website at: www.usbr.gov/lc/region/g4000/wtracct.html.

# Executive Summary

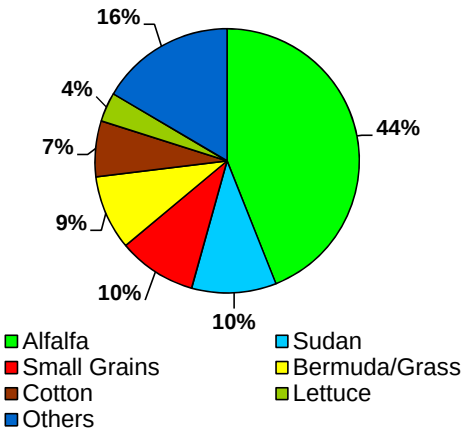
## 2011

| River Reach: | Hoover Dam to Mexico* |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 852,020 |
| Gross Cropped Acres: | 1,029,802 |
| Net Cropped Acres: | 781,971 |
| Fallowed/Idle Acres: | 70,049 |
| Agricultural Evapotranspiration (acre-feet): | 2,936,239 |
| **Riparian** | |
| Riparian Vegetation - Acres: | 147,950 |
| Riparian Evapotranspiration (acre-feet): | 467,263 |
| **Open Water** | |
| Open Water - Acres: | 12,018 |
| Open Water - Evaporation (acre-feet): | 65,351 |
| **Mainstream (Lake and River)** | |
| Acres: | 57,632 |
| Evaporation (acre-feet): | 278,617 |

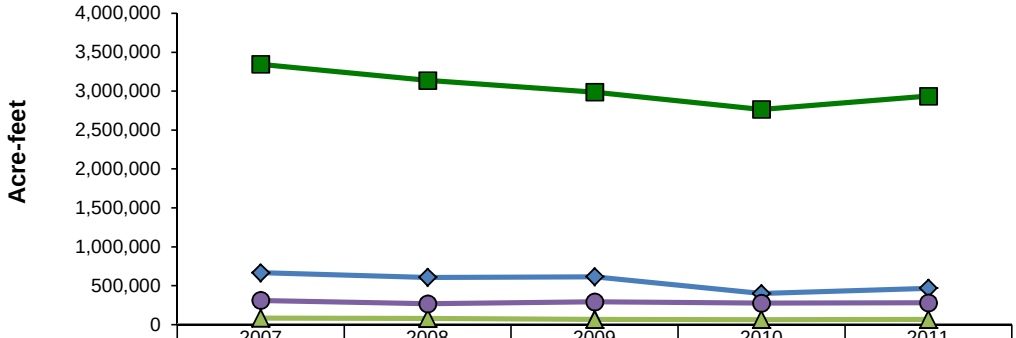

### Major Crop Types




### Annual Agricultural ET




### Evapotranspiration and Evaporation, 2007-2011




| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Agricultural ET | 3,346,041 | 3,137,081 | 2,988,442 | 2,765,141 | 2,936,239 |
| Riparian Vegetation ET | 666,043 | 607,175 | 615,468 | 399,709 | 467,263 |
| Open Water Evaporation | 81,207 | 77,354 | 66,193 | 63,375 | 65,351 |
| Mainstream Evaporation | 309,987 | 266,974 | 293,043 | 274,507 | 278,617 |

*Values displayed in this Executive Summary include water considered to come from sources other than the Colorado River.

# Executive Summary

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 248,496 | 24% | 1,291,567 | 44% |
| Aloe | 73 | <1% | 157 | <1% |
| Bermuda/Grass | 62,718 | 6% | 268,545 | 9% |
| Cane/Bamboo | 63 | <1% | 364 | <1% |
| Citrus | 25,312 | 2% | 86,462 | 3% |
| Cotton | 66,629 | 6% | 199,953 | 7% |
| Crucifers | 45,064 | 4% | 28,783 | <1% |
| Dates | 14,263 | 1% | 82,474 | 3% |
| Deciduous Orchards | 1,746 | <1% | 7,937 | <1% |
| Field Grain | 14,199 | 1% | 41,769 | 1% |
| Grapes | 8,100 | <1% | 25,127 | <1% |
| Jojoba | 234 | <1% | 1,126 | <1% |
| Legume/Solanum Veg. | 9,514 | <1% | 18,228 | <1% |
| Lettuce | 164,714 | 16% | 105,085 | 4% |
| Marsh Maintained | 118 | <1% | 690 | <1% |
| Melons | 15,056 | 1% | 26,861 | <1% |
| Miscellaneous herbs | 1,798 | <1% | 4,131 | <1% |
| Moist Soil Unit | 1,521 | <1% | 7,741 | <1% |
| Nursery/Greenhouse | 2,689 | <1% | 5,833 | <1% |
| Oil Crops | 54 | <1% | 162 | <1% |
| Perennial Vegetables | 1,660 | <1% | 7,641 | <1% |
| Root Vegetables | 1,620 | <1% | 1,080 | <1% |
| Small Grains | 145,102 | 14% | 281,670 | 10% |
| Small Vegetables | 56,238 | 5% | 61,603 | 2% |
| Sudan | 93,518 | 9% | 303,782 | 10% |
| Sugar Beets | 47,892 | 5% | 74,349 | 3% |
| Tomatoes | 366 | <1% | 834 | <1% |
| Wildlife Forage Maintained | 1,044 | <1% | 2,285 | <1% |
| **Total*** | **1,029,802** | **100%** | **2,936,239** | **100%** |

*Due to rounding, totals may differ from the sum of the individual values.

*Values displayed in this Executive Summary include water considered to come from sources other than the Colorado River.

# Hoover Dam to Davis Dam

## 2011

### Agriculture

There is no agricultural use in this reach.

### Riparian

| | |
|---|---|
| Riparian Vegetation Acres: | 1,355 |
| Riparian Evapotranspiration (acre-feet): | 3,984 |

### Open Water

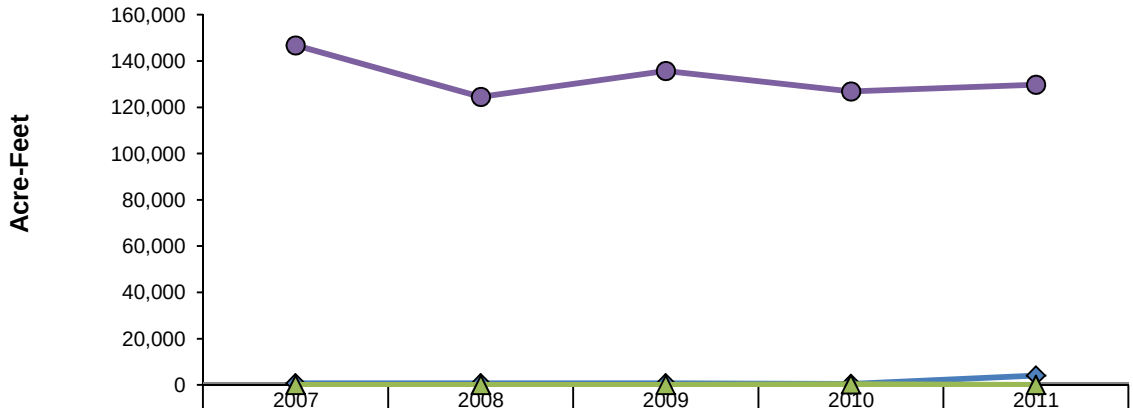
| | |
|---|---|
| Open Water Acres: | 12 |
| Open Water Evaporation (acre-feet): | 56 |

### Mainstream (Lake and River)

| | |
|---|---|
| Acres: | 27,405 |
| Evaporation (acre-feet): | 129,805 |


| Water Users within Reach | Crop Types within Reach | Acres | Annual ET (acre-feet) |
|---|---|---|---|
| Lake Mead National Recreation Area - AZ & NV | Note: There were no crops grown in this reach. | | |

### Evapotranspiration and Evaporation, 2007-2011




| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Riparian Vegetation ET | 772 | 694 | 667 | 474 | 3,984 |
| Open Water Evaporation | 16 | 14 | 20 | 237 | 56 |
| Mainstream Evaporation | 146,810 | 124,469 | 135,666 | 126,813 | 129,805 |

# Davis Dam to Parker Dam

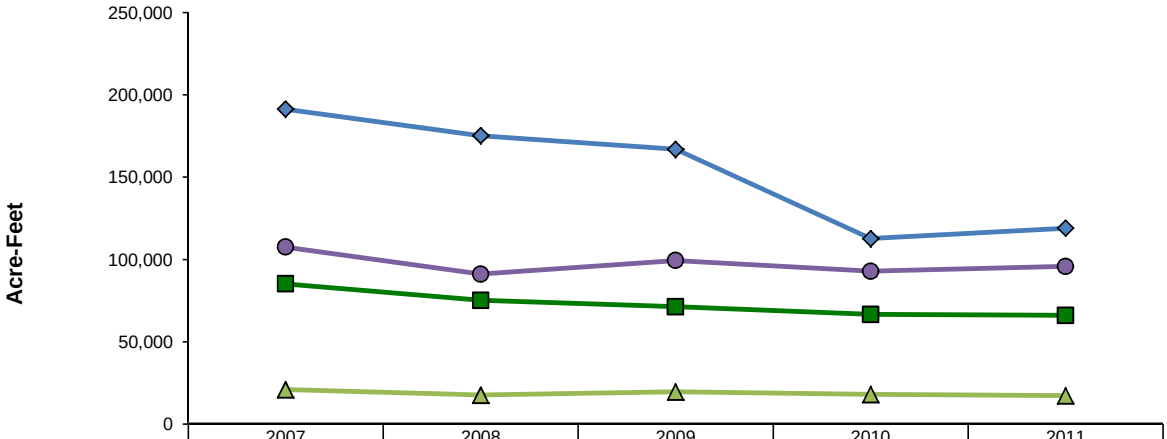
## 2011

| | |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 18,312 |
| Gross Cropped Acres: | 18,536 |
| Net Cropped Acres: | 17,082 |
| Fallowed/Idle Acres: | 1,230 |
| Agricultural Evapotranspiration (acre-feet): | 66,097 |
| **Riparian** | |
| Riparian Vegetation Acres: | 38,367 |
| Riparian Evapotranspiration (acre-feet): | 119,044 |
| **Open Water** | |
| Open Water Acres: | 3,641 |
| Open Water Evaporation (acre-feet): | 17,243 |
| **Mainstream (Lake and River)** | |
| Acres: | 20,222 |
| Evaporation (acre-feet): | 95,782 |


| Water Users within Reach |
|---|
| Bill Williams River National Wildlife Refuge - AZ |
| Chemehuevi Indian Reservation - CA |
| Fort Mojave Indian Reservation - AZ, CA, & NV |
| Havasu National Wildlife Refuge - AZ & CA |
| Lake Havasu State Park - AZ |
| Lake Mead National Recreation Area - AZ |
| Mohave Valley Irrigation & Drainage District - AZ |
| State of Arizona (Other Users) |
| State of California (Other Users) |
| State of Nevada (Other Users) |

| Crop Types within Reach | Acres | Annual ET (acre-feet) |
|---|---|---|
| Alfalfa | 8,221 | 42,511 |
| Bermuda/Grass | 962 | 2,836 |
| Cotton | 6,507 | 16,800 |
| Field Grain | 25 | 60 |
| Small Grains | 2,669 | 3,375 |
| Sudan | 152 | 514 |
| **Total** | **18,536** | **66,097** |

### Evapotranspiration and Evaporation, 2007-2011




| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Agricultural ET | 85,223 | 75,210 | 71,353 | 66,672 | 66,097 |
| Riparian Vegetation ET | 191,328 | 175,194 | 166,893 | 112,657 | 119,044 |
| Open Water Evaporation | 20,914 | 17,734 | 19,632 | 18,128 | 17,243 |
| Mainstream Evaporation | 107,586 | 91,214 | 99,426 | 92,906 | 95,782 |

# Parker Dam to Imperial Dam

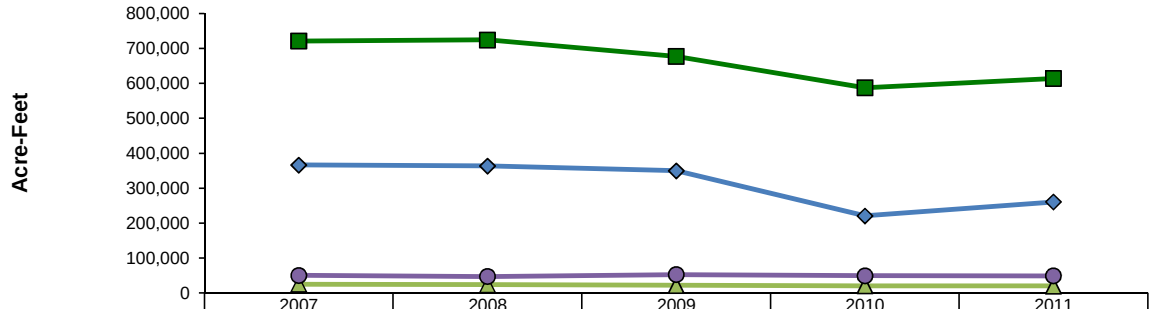
## 2011

| | |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 174,359 |
| Gross Cropped Acres: | 141,835 |
| Net Cropped Acres: | 148,055 |
| Fallowed/Idle Acres: | 26,304 |
| Agricultural Evapotranspiration (acre-feet): | 614,318 |
| **Riparian** | |
| Riparian Vegetation Acres: | 81,324 |
| Riparian Evapotranspiration (acre-feet): | 260,370 |
| **Open Water** | |
| Open Water Acres: | 3,807 |
| Open Water Evaporation (acre-feet): | 19,950 |
| **Mainstream (Lake and River)** | |
| Acres: | 9,292 |
| Evaporation (acre-feet): | 48,700 |


| Water Users within Reach |
|---|
| Arizona State Land Department - AZ |
| Cibola National Wildlife Refuge - AZ & CA |
| Cibola Valley Irrigation & Drainage District - AZ |
| Colorado River Indian Reservation - AZ & CA |
| Imperial National Wildlife Refuge - AZ & CA |
| Lake Enterprises of California, LLC - CA |
| North Baja Pipeline, LLC - AZ |
| Palo Verde Irrigation District - CA |
| Rayner Ranches - AZ |
| State of Arizona (Other Users) |
| State of California (Other Users) |

| Crop Types within Reach | Acres | Annual ET (acre-feet) |
|---|---|---|
| Alfalfa | 89,063 | 470,346 |
| Bermuda/Grass | 3,906 | 12,424 |
| Citrus | 2,034 | 6,994 |
| Cotton | 33,895 | 96,261 |
| Crucifers | 1,734 | 852 |
| Dates | 363 | 2,061 |
| Deciduous Orchards | 456 | 2,050 |
| Field Grain | 114 | 286 |
| Grapes | 49 | 153 |
| Lettuce | 661 | 431 |
| Melons | 1,994 | 4,030 |
| Moist Soil Unit | 285 | 1,438 |
| Nursery/Greenhouse | 27 | 57 |
| Perennial Vegetables | 185 | 841 |
| Small Grains | 5,265 | 10,135 |
| Small Vegetables | 110 | 66 |
| Sudan | 1,615 | 5,725 |
| Wildlife Forage Maintained | 78 | 168 |
| **Total** | **141,835** | **614,318** |

### Evapotranspiration and Evaporation, 2007-2011

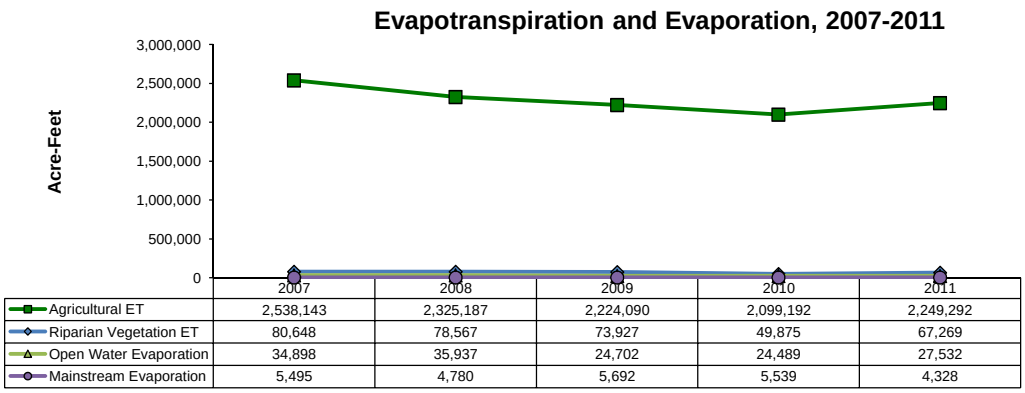



| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Agricultural ET | 721,465 | 724,704 | 677,540 | 587,900 | 614,318 |
| Riparian Vegetation ET | 366,439 | 363,385 | 349,722 | 220,474 | 260,370 |
| Open Water Evaporation | 25,030 | 23,711 | 21,516 | 20,220 | 19,950 |
| Mainstream Evaporation | 50,096 | 46,914 | 52,259 | 49,248 | 48,700 |

# Imperial Dam to Mexico
## 2011

| Agriculture | |
|---|---|
| Irrigable Acres: | 653,788 |
| Gross Cropped Acres: | 867,861 |
| Net Cropped Acres: | 615,293 |
| Fallowed/Idle Acres: | 38,495 |
| Agricultural Evapotranspiration (acre-feet): | 2,249,292 |
| **Riparian** | |
| Riparian Vegetation Acres: | 20,089 |
| Riparian Evapotranspiration (acre-feet): | 67,269 |
| **Open Water** | |
| Open Water Acres: | 4,439 |
| Open Water Evaporation (acre-feet): | 27,532 |
| **Mainstream (Lake and River)** | |
| Acres: | 712 |
| Evaporation (acre-feet): | 4,328 |


| Water Users within Reach | Crop Types within Reach | Acres | Annual ET (acre-feet) |
|---|---|---|---|
| Arizona State Land Department - AZ | Alfalfa | 150,765 | 776,356 |
| Beattie Farms Southwest - AZ | Aloe | 73 | 157 |
| Cha Cha, LLC - AZ | Bermuda/Grass | 57,849 | 253,284 |
| City of Yuma (Yuma East Wetlands), AZ | Cane/Bamboo | 63 | 364 |
| Coachella Valley Water District - CA | Citrus | 23,278 | 79,468 |
| Cocopah Indian Reservation (incl. East, North & West Reservations) - AZ | Cotton | 26,100 | 86,481 |
| Curtis, Armon - AZ | Crucifers | 43,330 | 27,931 |
| Fort Yuma Indian Reservation - AZ & CA | Dates | 13,645 | 79,021 |
| Gila Monster Farms, AZ | Deciduous Orchards | 1,290 | 5,887 |
| Imperial Irrigation District - CA | Field Grain | 14,059 | 41,423 |
| JRJ Partners, LLC - AZ | Grapes | 8,052 | 24,974 |
| Mittry Lake Management Area - AZ | Legume/Solanum Veg. | 9,514 | 18,228 |
| North Gila Valley Irrigation District - AZ | Lettuce | 164,054 | 104,654 |
| Ogram Boys Enterprises, Inc. - AZ | Marsh Maintained | 118 | 690 |
| Ogram, George - AZ | Melons | 13,062 | 22,830 |
| Pasquinelli, Gary & Barbara - AZ | Miscellaneous herbs | 1,798 | 4,131 |
| Powers (Power, R.E. & P.) - AZ | Moist Soil Unit | 1,236 | 6,302 |
| State of Arizona (Downgradient of YMIDD) | Nursery/Greenhouse | 2,663 | 5,776 |
| State of Arizona (Limitrophe) | Oil Crops | 54 | 162 |
| State of Arizona (Other Users) | Perennial Vegetables | 1,474 | 6,800 |
| State of California (Other Users) | Root Vegetables | 1,620 | 1,080 |
| Unit B Irrigation and Drainage District - AZ | Small Grains | 136,876 | 267,636 |
| University of Arizona - AZ | Small Vegetables | 56,128 | 61,537 |
| Wellton Mohawk Irrigation and Drainage District - AZ | Sudan | 91,537 | 296,818 |
| Yuma County Water Users' Association - AZ | Sugar Beets | 47,892 | 74,349 |
| Yuma Irrigation District - AZ | Tomatoes | 366 | 834 |
| Yuma Mesa Irrigation and Drainage District - AZ | Wildlife Forage Maintained | 966 | 2,118 |
| Yuma Project Reservation Division, Bard Unit - CA | | | |
| Yuma Project Reservation Division, Indian Unit - CA | | | |
| Yuma Proving Ground - AZ | **Total** | **867,861** | **2,249,292** |



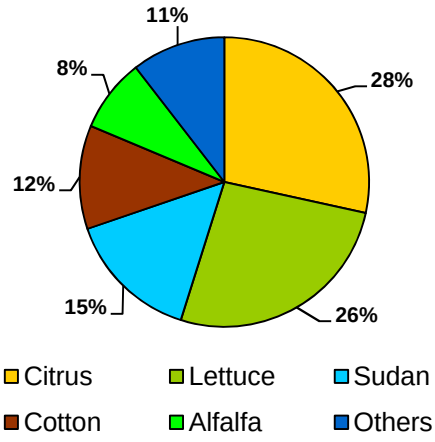

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Agricultural ET | 2,538,143 | 2,325,187 | 2,224,090 | 2,099,192 | 2,249,292 |
| Riparian Vegetation ET | 80,648 | 78,567 | 73,927 | 49,875 | 67,269 |
| Open Water Evaporation | 34,898 | 35,937 | 24,702 | 24,489 | 27,532 |
| Mainstream Evaporation | 5,495 | 4,780 | 5,692 | 5,539 | 4,328 |

# Arizona State Land Department - AZ

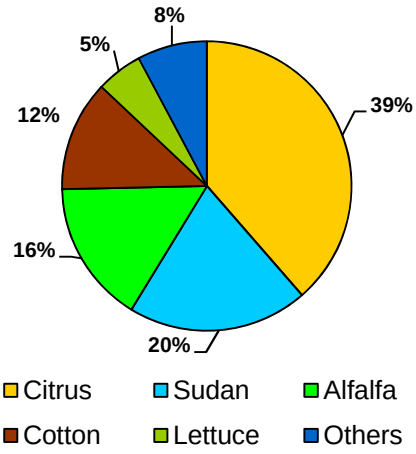
## 2011

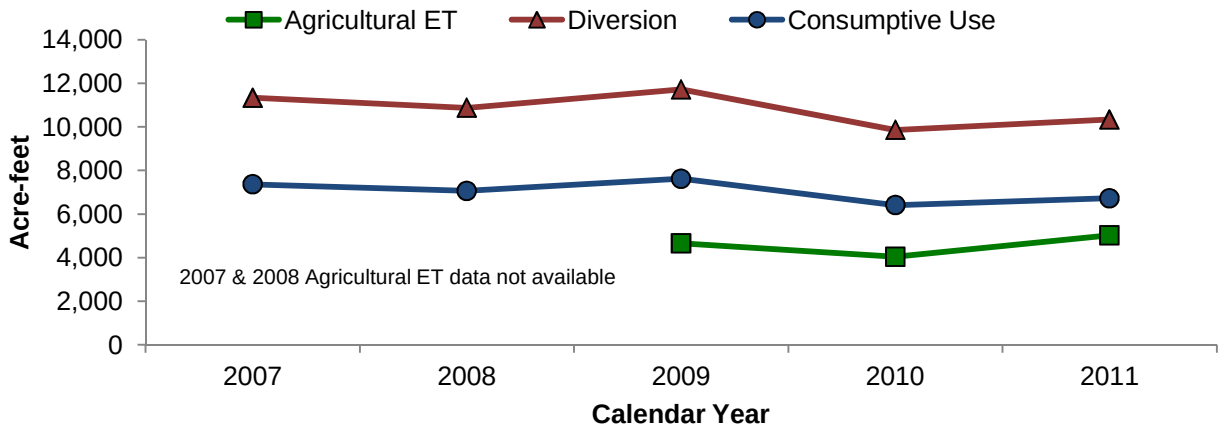
| River Reach: | Parker Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 1,452 |
| Gross Cropped Acres: | 1,880 |
| Net Cropped Acres: | 1,383 |
| Fallowed/Idle Acres: | 69 |
| Agricultural Evapotranspiration (acre-feet): | 5,027 |
| **Riparian** | |
| Riparian Vegetation Acres: | 909 |
| Riparian Evapotranspiration (acre-feet): | 2,525 |
| **Open Water** | |
| Open Water Acres: | 11 |
| Open Water Evaporation (acre-feet): | 66 |


### Major Crop Types




### Annual Agricultural ET



# Arizona State Land Department - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 154 | 8 | 800 | 16 |
| Citrus | 535 | 28 | 1,939 | 39 |
| Cotton | 217 | 12 | 622 | 12 |
| Crucifers | 23 | 1 | 5 | <1 |
| Dates | 13 | 1 | 79 | 2 |
| Legume/Solanum Veg. | 28 | 2 | 72 | 1 |
| Lettuce | 497 | 26 | 261 | 5 |
| Small Grains | 109 | 6 | 196 | 4 |
| Small Vegetables | 23 | 1 | 40 | 1 |
| Sudan | 280 | 15 | 1,013 | 20 |
| **Total*** | **1,880** | **100%** | **5,027** | **100%** |

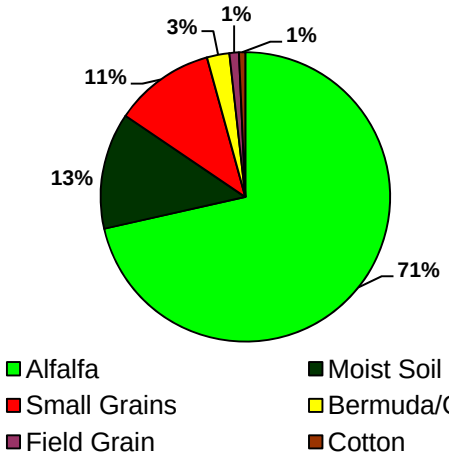
*Due to rounding, totals may differ from the sum of the individual values.

# Cibola National Wildlife Refuge - AZ

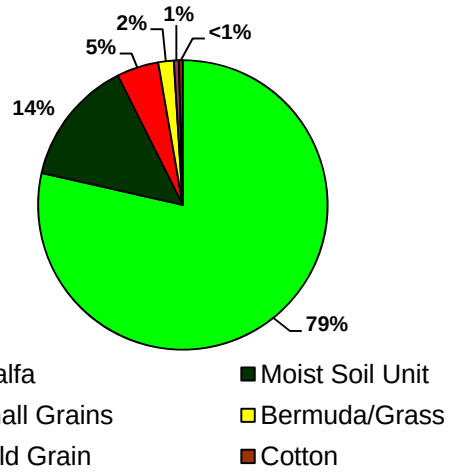
## 2011

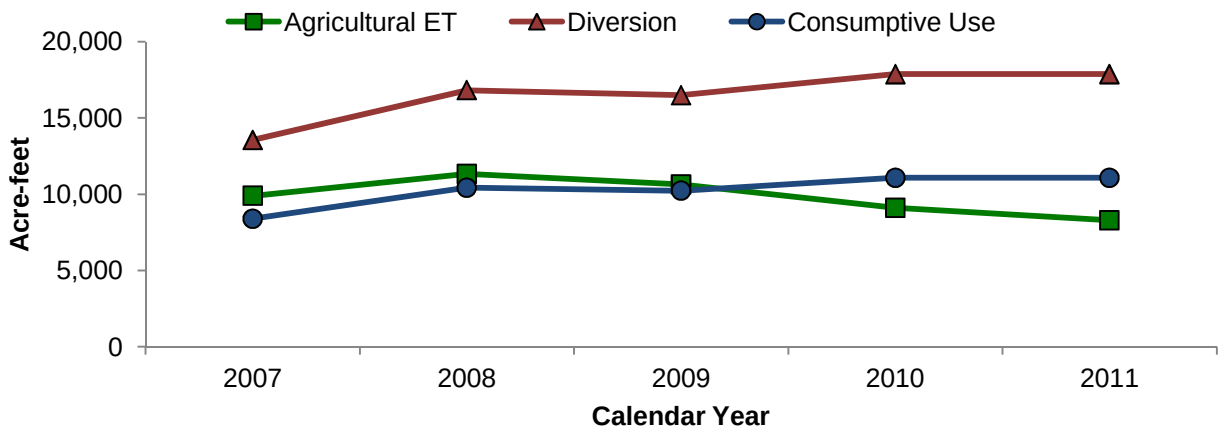
| River Reach: | Parker Dam to Imperial Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 2,493 |
| Gross Cropped Acres: | 1,777 |
| Net Cropped Acres: | 2,428 |
| Fallowed/Idle Acres: | 65 |
| Agricultural Evapotranspiration (acre-feet): | 8,294 |
| **Riparian** | |
| Riparian Vegetation Acres: | 9,578 |
| Riparian Evapotranspiration (acre-feet): | 29,769 |
| **Open Water** | |
| Open Water Acres: | 456 |
| Open Water Evaporation (acre-feet): | 2,390 |


### Major Crop Types




### Annual Agricultural ET



# Cibola National Wildlife Refuge - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 1,270 | 71 | 6,514 | 79 |
| Bermuda/Grass | 44 | 3 | 145 | 2 |
| Cotton | 12 | 1 | 35 | <1 |
| Field Grain | 19 | 1 | 48 | 1 |
| Moist Soil Unit | 231 | 13 | 1,166 | 14 |
| Small Grains | 200 | 11 | 386 | 5 |
| **Total*** | **1,777** | **100%** | **8,294** | **100%** |

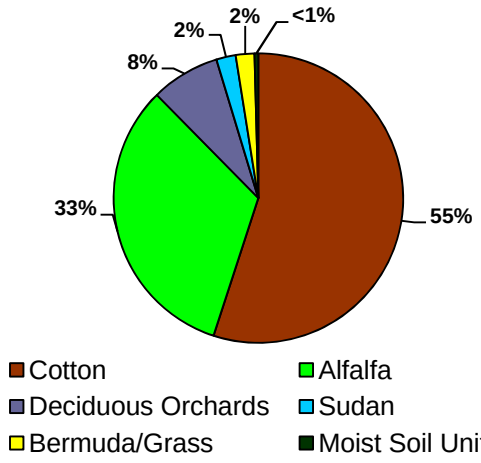
*Due to rounding, totals may differ from the sum of the individual values.

# Cibola Valley Irrigation and Drainage District - AZ

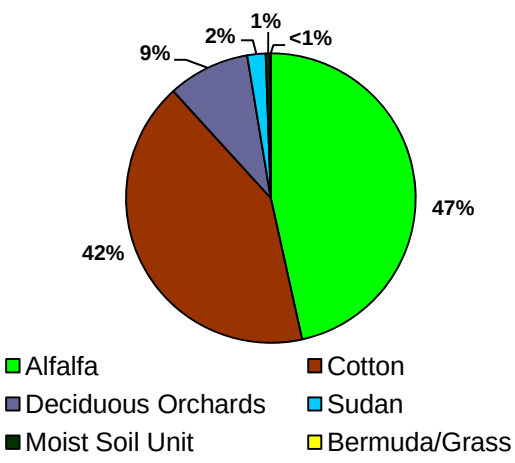
## 2011

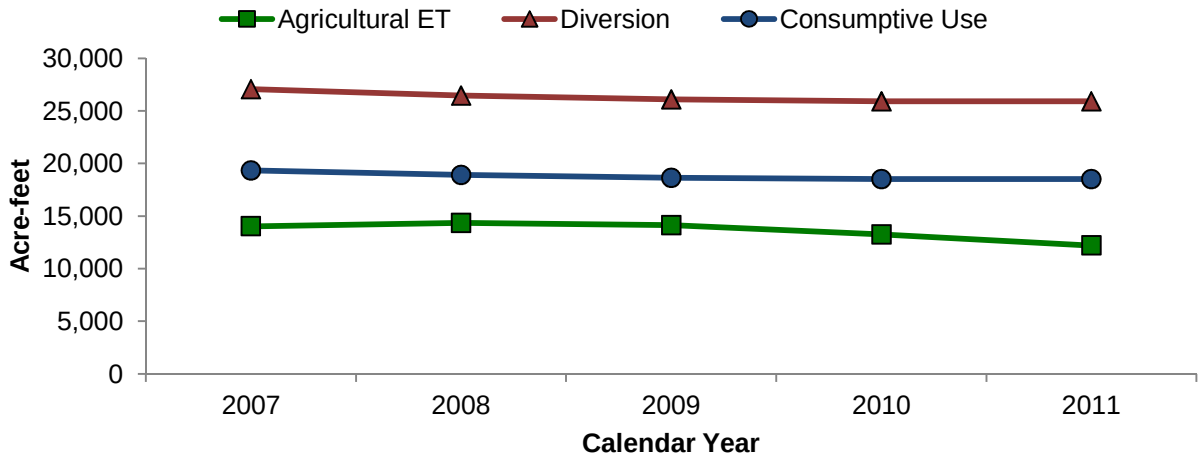
| River Reach: | Parker Dam to Imperial Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 3,762 |
| Gross Cropped Acres: | 3,256 |
| Net Cropped Acres: | 3,571 |
| Fallowed/Idle Acres: | 192 |
| Agricultural Evapotranspiration (acre-feet): | 12,203 |
| **Riparian** | |
| Riparian Vegetation Acres: | 1,936 |
| Riparian Evapotranspiration (acre-feet): | 6,121 |
| **Open Water** | |
| Open Water Acres: | 0 |
| Open Water Evaporation (acre-feet): | 0 |


### Major Crop Types




### Annual Agricultural ET



# Cibola Valley Irrigation and Drainage District - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 1,062 | 33 | 5,680 | 47 |
| Bermuda/Grass | 68 | 2 | 2 | <1 |
| Cotton | 1,791 | 55 | 5,087 | 42 |
| Deciduous Orchards | 251 | 8 | 1,117 | 9 |
| Moist Soil Unit | 13 | <1 | 68 | 1 |
| Sudan | 71 | 2 | 250 | 2 |
| **Total*** | **3,256** | **100%** | **12,203** | **100%** |

*Due to rounding, totals may differ from the sum of the individual values.

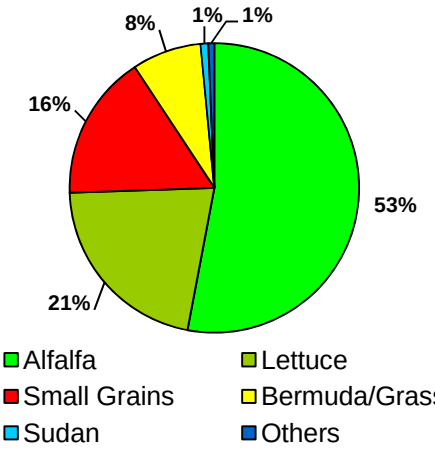
# Cocopah Indian Reservation - AZ

## (Includes East, North and West Reservations)

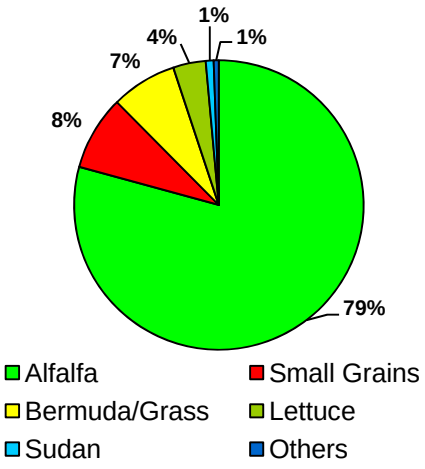
## 2011

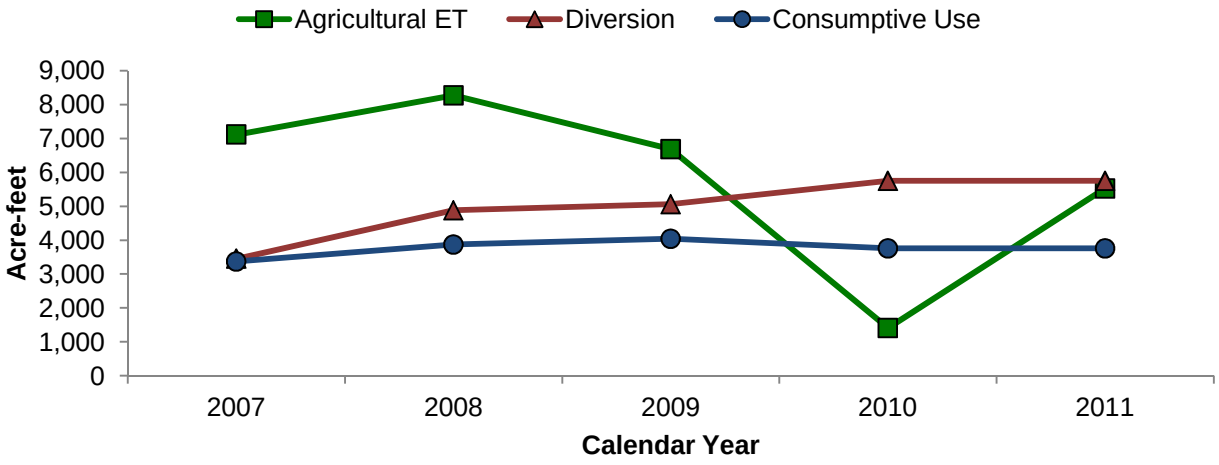
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 1,907 |
| Gross Cropped Acres: | 1,572 |
| Net Cropped Acres: | 1,410 |
| Fallowed/Idle Acres: | 497 |
| Agricultural Evapotranspiration (acre-feet): | 5,526 |
| **Riparian** | |
| Riparian Vegetation Acres: | 1,714 |
| Riparian Evapotranspiration (acre-feet): | 5,003 |
| **Open Water** | |
| Open Water Acres: | 10 |
| Open Water Evaporation (acre-feet): | 61 |


### Major Crop Types




### Annual Agricultural ET



# Cocopah Indian Reservation - AZ

## (Includes East, North and West Reservations)

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 833 | 53 | 4,379 | 79 |
| Bermuda/Grass | 122 | 8 | 405 | 7 |
| Cotton | 7 | <1 | 24 | <1 |
| Lettuce | 338 | 21 | 202 | 4 |
| Melons | 4 | <1 | 7 | <1 |
| Small Grains | 256 | 16 | 461 | 8 |
| Sudan | 13 | 1 | 49 | 1 |
| **Total*** | **1,572** | **100%** | **5,526** | **100%** |

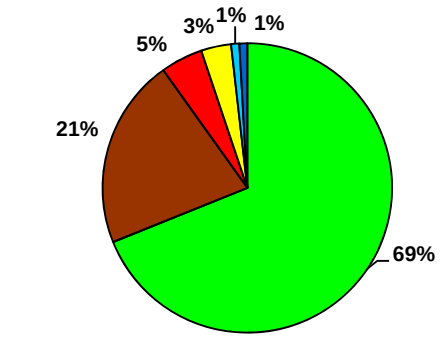
*Due to rounding, totals may differ from the sum of the individual values.

# Colorado River Indian Reservation - AZ

## 2011

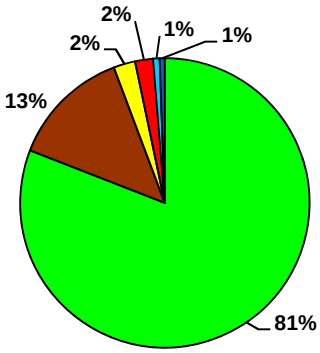
| River Reach: | Parker Dam to Imperial Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 74,987 |
| Gross Cropped Acres: | 71,328 |
| Net Cropped Acres: | 70,603 |
| Fallowed/Idle Acres: | 4,384 |
| Agricultural Evapotranspiration (acre-feet): | 321,599 |
| **Riparian** | |
| Riparian Vegetation Acres: | 31,877 |
| Riparian Evapotranspiration (acre-feet): | 91,368 |
| **Open Water** | |
| Open Water Acres: | 185 |
| Open Water Evaporation (acre-feet): | 971 |


### Major Crop Types

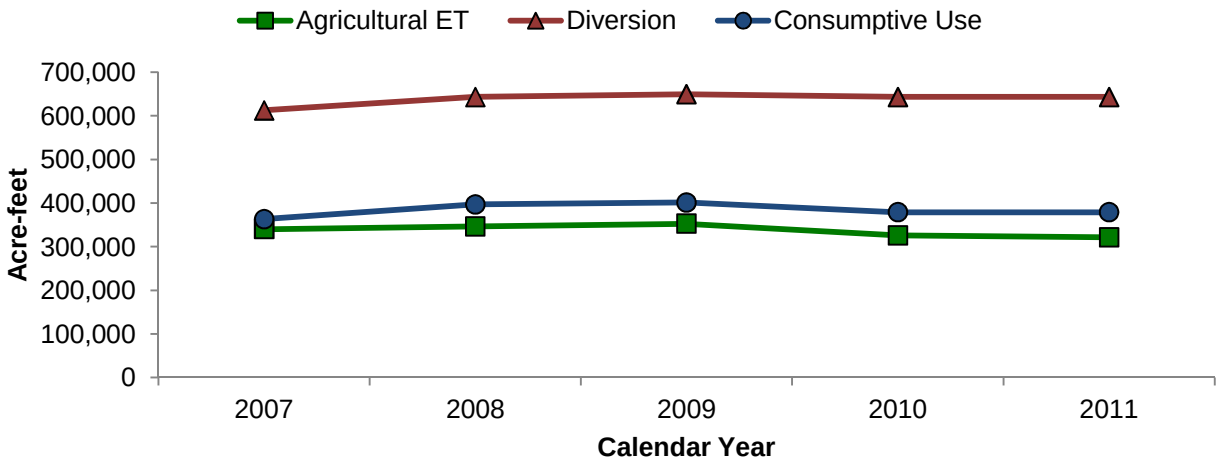



Alfalfa, Cotton, Small Grains, Bermuda/Grass, Sudan, Others

### Annual Agricultural ET




Alfalfa, Cotton, Bermuda/Grass, Small Grains, Sudan, Others



# Colorado River Indian Reservation - AZ

## 2011

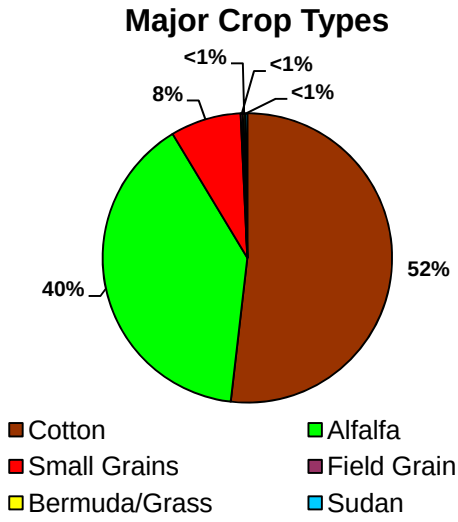
| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 49,155 | 69 | 260,215 | 81 |
| Bermuda/Grass | 2,380 | 3 | 7,747 | 2 |
| Cotton | 15,135 | 21 | 42,983 | 13 |
| Crucifers | 163 | <1 | 101 | <1 |
| Deciduous Orchards | 179 | <1 | 830 | <1 |
| Grapes | 5 | <1 | 15 | <1 |
| Perennial Vegetables | 185 | <1 | 841 | <1 |
| Small Grains | 3,365 | 5 | 6,498 | 2 |
| Small Vegetables | 110 | <1 | 66 | <1 |
| Sudan | 650 | 1 | 2,305 | 1 |
| **Total*** | **71,328** | **100%** | **321,599** | **100%** |

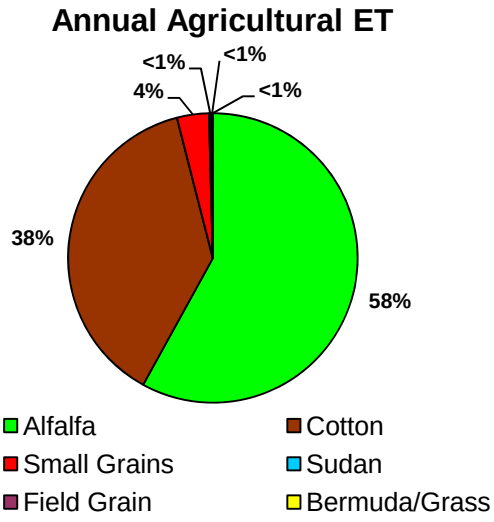
*Due to rounding, totals may differ from the sum of the individual values.

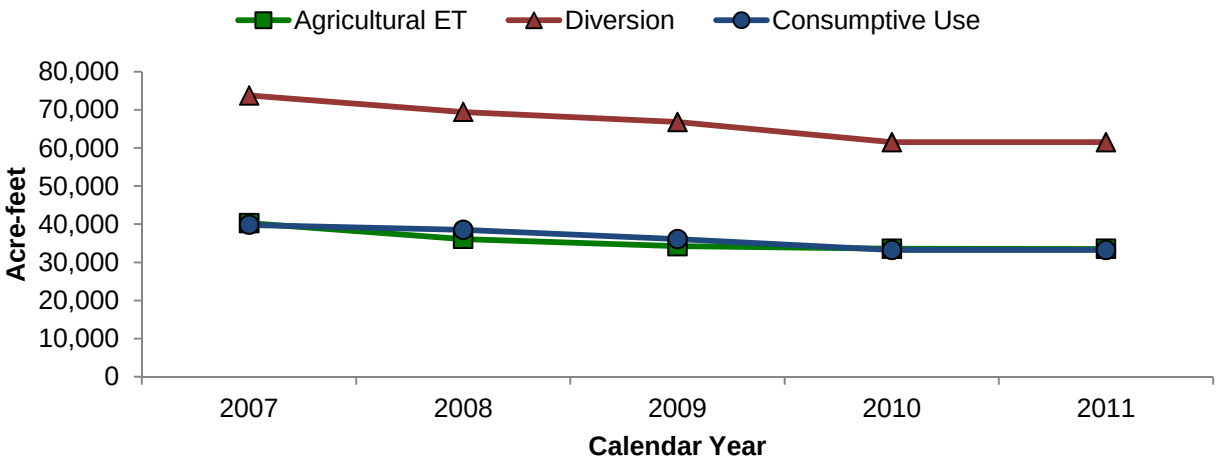
# Fort Mojave Indian Reservation - AZ

## 2011

| River Reach: | Davis Dam to Parker Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 9,000 |
| Gross Cropped Acres: | 9,522 |
| Net Cropped Acres: | 8,884 |
| Fallowed/Idle Acres: | 115 |
| Agricultural Evapotranspiration (acre-feet): | 33,517 |
| **Riparian** | |
| Riparian Vegetation Acres: | 7,511 |
| Riparian Evapotranspiration (acre-feet): | 20,161 |
| **Open Water** | |
| Open Water Acres: | 32 |
| Open Water Evaporation (acre-feet): | 153 |

# Fort Mojave Indian Reservation - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 3,762 | 40 | 19,435 | 58 |
| Bermuda/Grass | 23 | <1 | 0 | <1 |
| Cotton | 4,937 | 52 | 12,746 | 38 |
| Field Grain | 25 | <1 | 60 | <1 |
| Small Grains | 752 | 8 | 1,198 | 4 |
| Sudan | 23 | <1 | 78 | <1 |
| **Total*** | **9,522** | **100%** | **33,517** | **100%** |

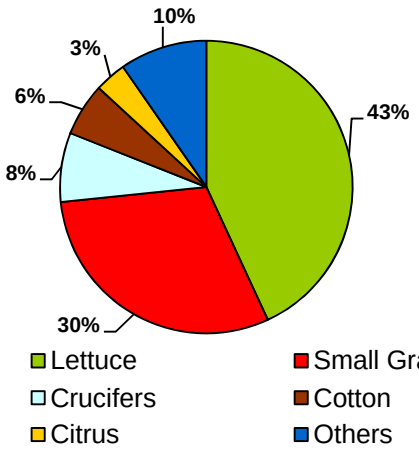
*Due to rounding, totals may differ from the sum of the individual values.

# Gila Monster Farms - AZ

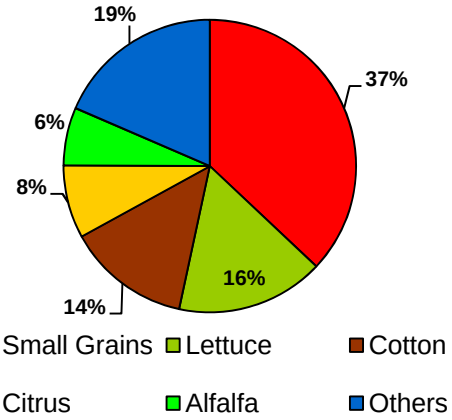
## 2011

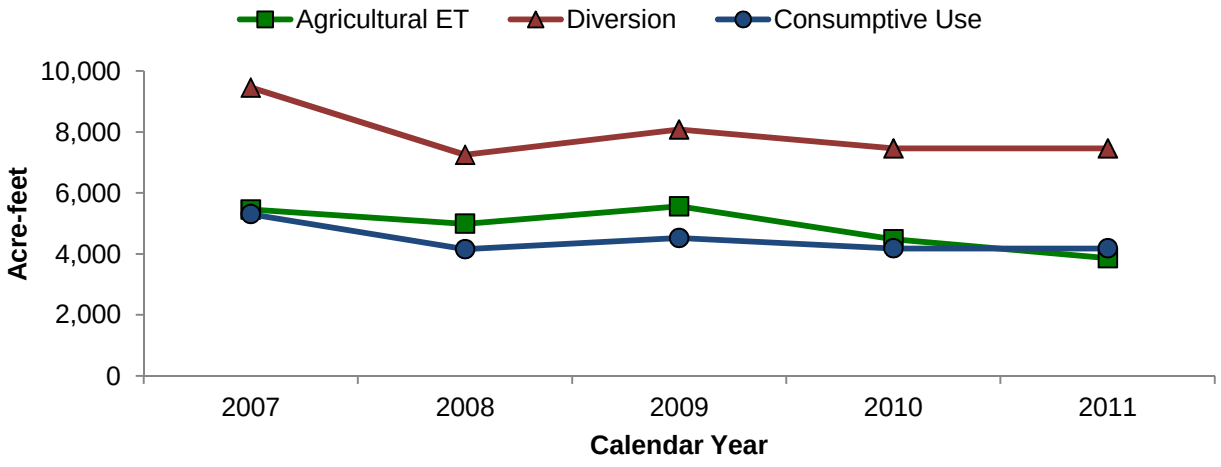
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 1,378 |
| Gross Cropped Acres: | 2,624 |
| Net Cropped Acres: | 1,299 |
| Fallowed/Idle Acres: | 80 |
| Agricultural Evapotranspiration (acre-feet): | 3,862 |
| **Riparian** | |
| Riparian Vegetation Acres: | 39 |
| Riparian Evapotranspiration (acre-feet): | 164 |
| **Open Water** | |
| Open Water Acres: | 8 |
| Open Water Evaporation (acre-feet): | 46 |


### Major Crop Types




### Annual Agricultural ET



# Gila Monster Farms - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 46 | 2 | 248 | 6 |
| Bermuda/Grass | 31 | 1 | 103 | 3 |
| Citrus | 91 | 3 | 312 | 8 |
| Cotton | 153 | 6 | 526 | 14 |
| Crucifers | 200 | 8 | 106 | 3 |
| Legume/Solanum Veg. | 5 | <1 | 12 | <1 |
| Lettuce | 1,131 | 43 | 631 | 16 |
| Melons | 14 | 1 | 25 | 1 |
| Oil Crops | 54 | 2 | 162 | 4 |
| Perennial Vegetables | 6 | <1 | 29 | 1 |
| Small Grains | 794 | 30 | 1,430 | 37 |
| Small Vegetables | 35 | 1 | 51 | 1 |
| Sudan | 62 | 2 | 226 | 6 |
| **Total*** | **2,624** | **100%** | **3,862** | **100%** |

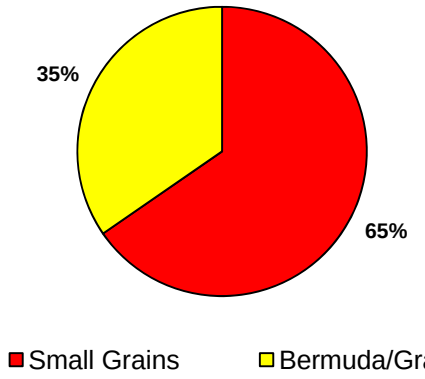
*Due to rounding, totals may differ from the sum of the individual values.

# Havasu National Wildlife Refuge - AZ

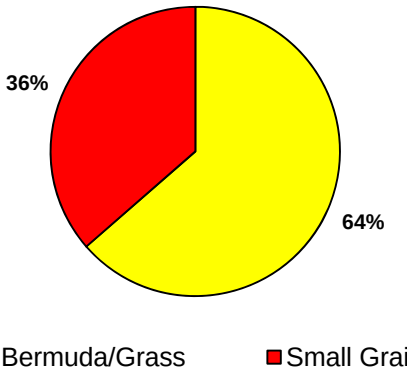
## 2011

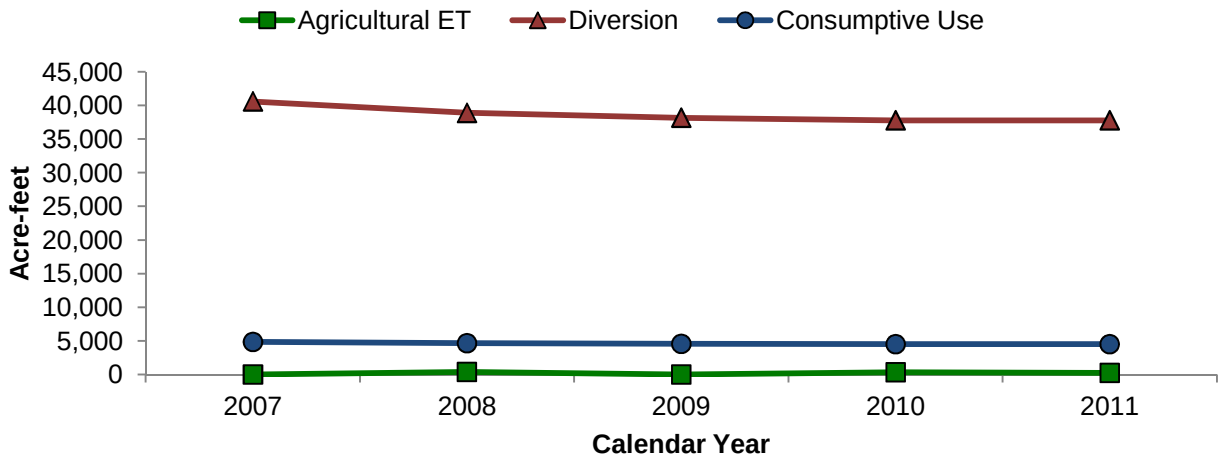
| River Reach: | Davis Dam to Parker Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 121 |
| Gross Cropped Acres: | 145 |
| Net Cropped Acres: | 121 |
| Fallowed/Idle Acres: | 0 |
| Agricultural Evapotranspiration (acre-feet): | 237 |
| **Riparian** | |
| Riparian Vegetation Acres: | 10,697 |
| Riparian Evapotranspiration (acre-feet): | 40,581 |
| **Open Water** | |
| Open Water Acres: | 3,125 |
| Open Water Evaporation (acre-feet): | 14,802 |


**Major Crop Types**




**Annual Agricultural ET**



# Havasu National Wildlife Refuge - AZ

## 2011

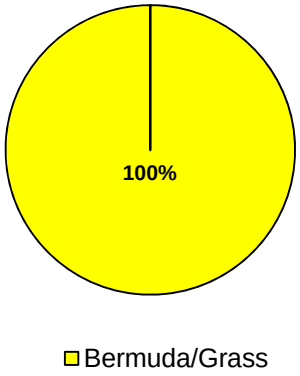
| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Bermuda/Grass | 50 | 35 | 151 | 64 |
| Small Grains | 95 | 65 | 86 | 36 |
| **Total** | **145** | **100%** | **237** | **100%** |

# Imperial National Wildlife Refuge - AZ

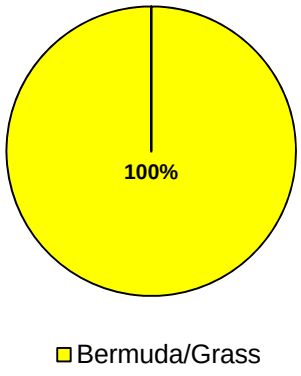
## 2011

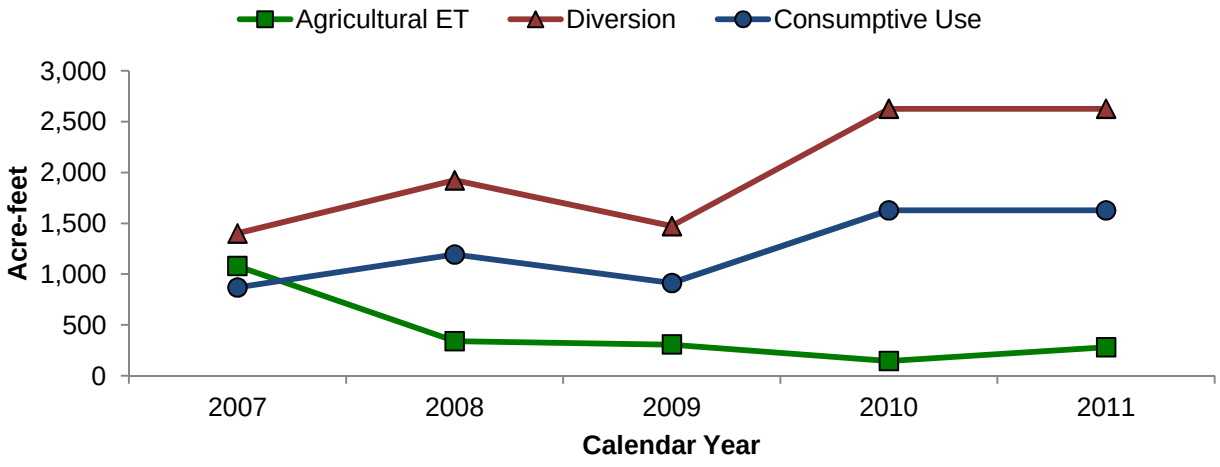
| River Reach: | Parker Dam to Imperial Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 86 |
| Gross Cropped Acres: | 86 |
| Net Cropped Acres: | 86 |
| Fallowed/Idle Acres: | 0 |
| Agricultural Evapotranspiration (acre-feet): | 280 |
| **Riparian** | |
| Riparian Vegetation Acres: | 4,850 |
| Riparian Evapotranspiration (acre-feet): | 21,243 |
| **Open Water** | |
| Open Water Acres: | 619 |
| Open Water Evaporation (acre-feet): | 3,244 |


**Major Crop Types**




**Annual Agricultural ET**



# Imperial National Wildlife Refuge - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Bermuda/Grass | 86 | 100 | 280 | 100 |
| **Total*** | **86** | **100%** | **280** | **100%** |

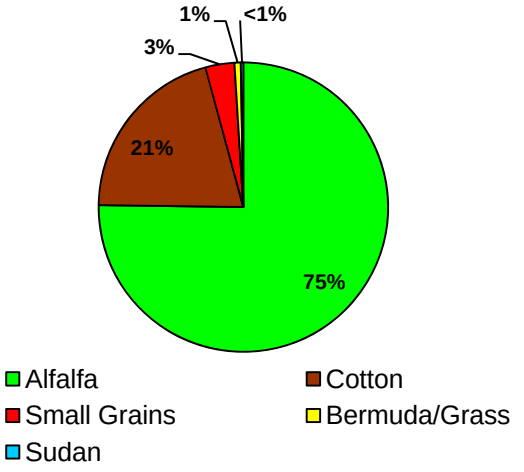
*Due to rounding, totals may differ from the sum of the individual values.

# Mohave Valley Irrigation and Drainage District - AZ

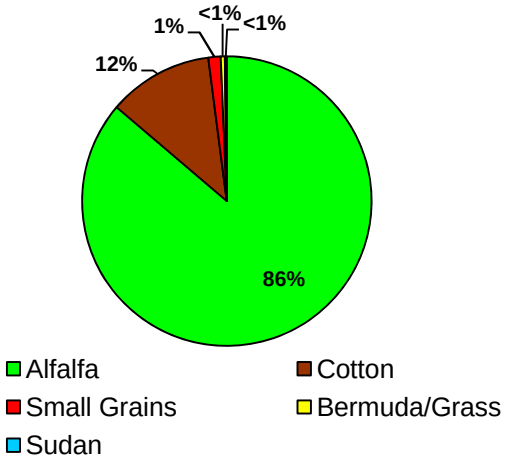
## 2011

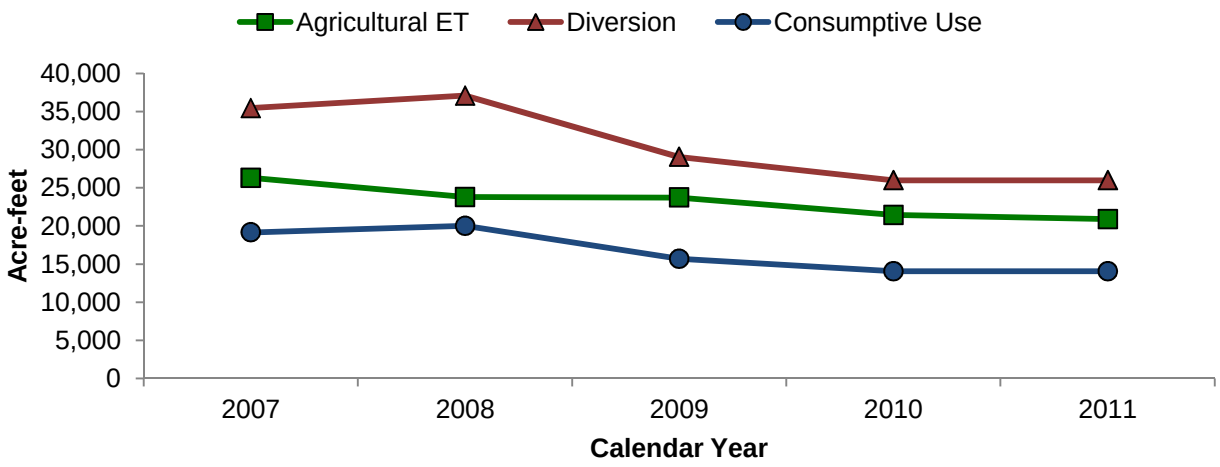
| River Reach: | Davis Dam to Parker Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 5,141 |
| Gross Cropped Acres: | 4,612 |
| Net Cropped Acres: | 4,611 |
| Fallowed/Idle Acres: | 530 |
| Agricultural Evapotranspiration (acre-feet): | 20,884 |
| **Riparian** | |
| Riparian Vegetation Acres: | 5,421 |
| Riparian Evapotranspiration (acre-feet): | 14,888 |
| **Open Water** | |
| Open Water Acres: | 103 |
| Open Water Evaporation (acre-feet): | 488 |


### Major Crop Types




### Annual Agricultural ET



# Mohave Valley Irrigation and Drainage District - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 3,469 | 75 | 18,005 | 86 |
| Bermuda/Grass | 33 | 1 | 98 | <1 |
| Cotton | 949 | 21 | 2,450 | 12 |
| Small Grains | 149 | 3 | 287 | 1 |
| Sudan | 13 | <1 | 45 | <1 |
| **Total*** | **4,612** | **100%** | **20,884** | **100%** |

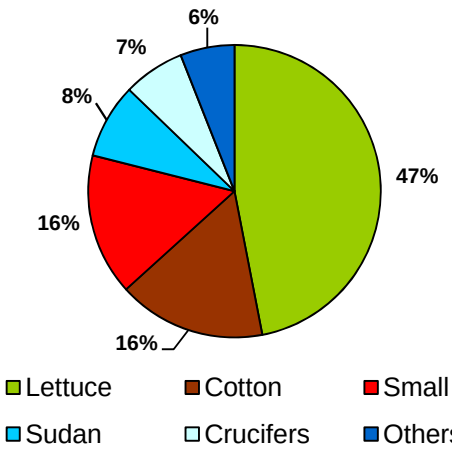
*Due to rounding, totals may differ from the sum of the individual values.

# North Gila Valley Irrigation and Drainage District - AZ

## 2011

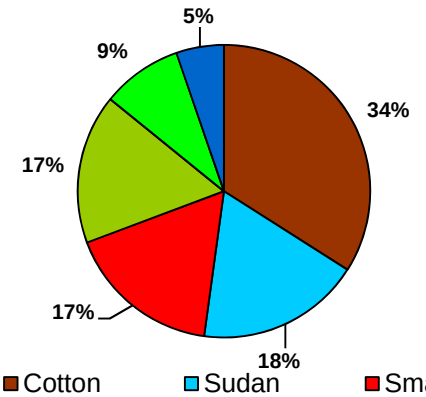
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 5,837 |
| Gross Cropped Acres: | 12,651 |
| Net Cropped Acres: | 5,732 |
| Fallowed/Idle Acres: | 105 |
| Agricultural Evapotranspiration (acre-feet): | 20,843 |
| **Riparian** | |
| Riparian Vegetation Acres: | 676 |
| Riparian Evapotranspiration (acre-feet): | 2,347 |
| **Open Water** | |
| Open Water Acres: | 13 |
| Open Water Evaporation (acre-feet): | 77 |


### Major Crop Types

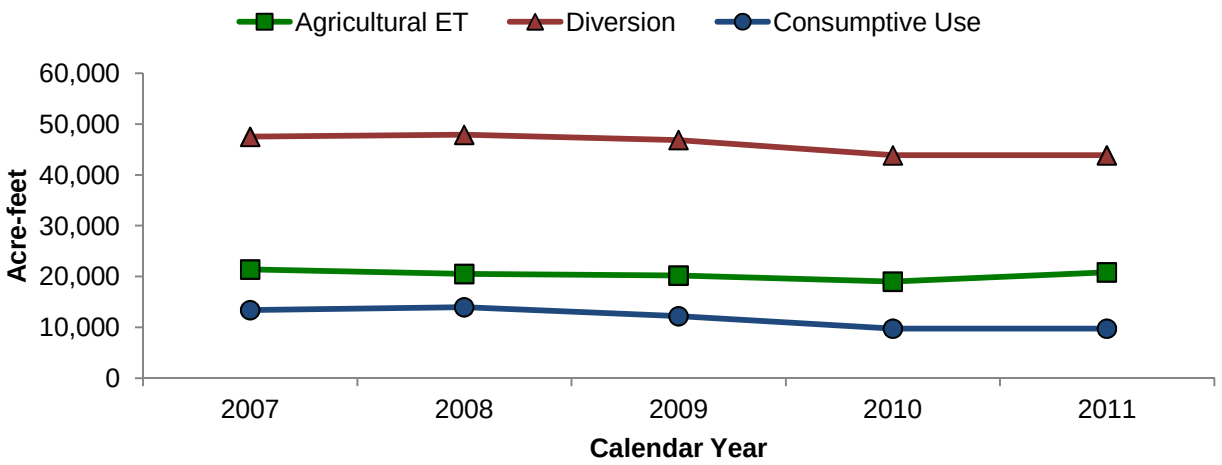



Lettuce, Cotton, Small Grains, Sudan, Crucifers, Others

### Annual Agricultural ET




Cotton, Sudan, Small Grains, Lettuce, Alfalfa, Others



# North Gila Valley Irrigation and Drainage District - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 341 | 3 | 1,853 | 9 |
| Bermuda/Grass | 60 | <1 | 189 | 1 |
| Citrus | 13 | <1 | 45 | <1 |
| Cotton | 2,067 | 16 | 7,088 | 34 |
| Crucifers | 859 | 7 | 397 | 2 |
| Dates | 15 | <1 | 87 | <1 |
| Legume/Solanum Veg. | 17 | <1 | 44 | <1 |
| Lettuce | 5,939 | 47 | 3,448 | 17 |
| Melons | 53 | <1 | 98 | <1 |
| Small Grains | 1,982 | 16 | 3,569 | 17 |
| Small Vegetables | 237 | 2 | 226 | 1 |
| Sudan | 1,046 | 8 | 3,786 | 18 |
| Sugar Beets | 21 | <1 | 12 | <1 |
| **Total*** | **12,651** | **100%** | **20,843** | **100%** |

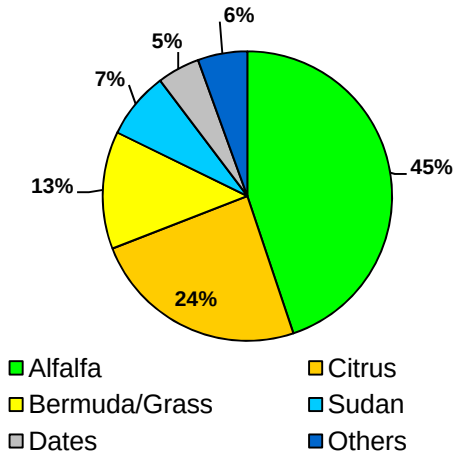
*Due to rounding, totals may differ from the sum of the individual values.

# Unit B Irrigation and Drainage District - AZ

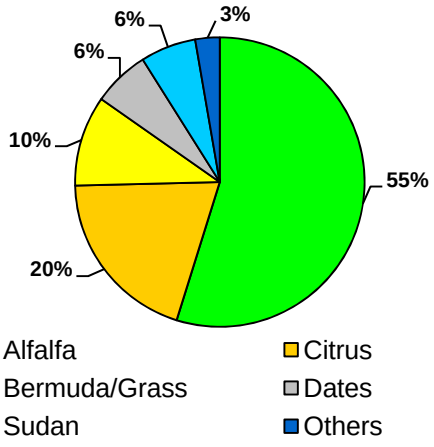
## 2011

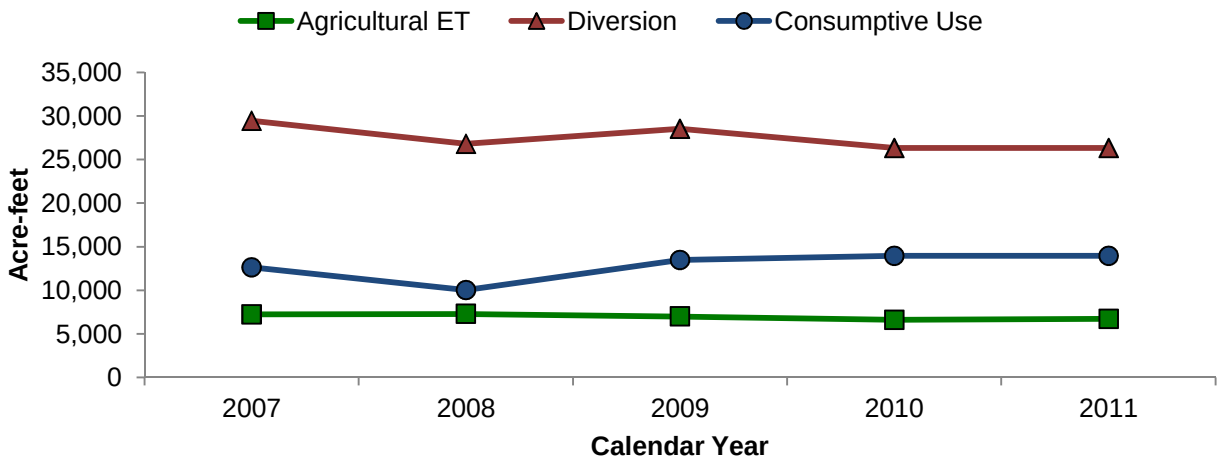
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 1,871 |
| Gross Cropped Acres: | 1,549 |
| Net Cropped Acres: | 1,557 |
| Fallowed/Idle Acres: | 315 |
| Agricultural Evapotranspiration (acre-feet): | 6,721 |
| **Riparian** | |
| Riparian Vegetation Acres: | 0 |
| Riparian Evapotranspiration (acre-feet): | 0 |
| **Open Water** | |
| Open Water Acres: | 20 |
| Open Water Evaporation (acre-feet): | 122 |


### Major Crop Types




### Annual Agricultural ET



# Unit B Irrigation and Drainage District - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 695 | 45 | 3,685 | 55 |
| Bermuda/Grass | 204 | 13 | 679 | 10 |
| Citrus | 376 | 24 | 1,330 | 20 |
| Dates | 74 | 5 | 427 | 6 |
| Deciduous Orchards | 6 | <1 | 26 | <1 |
| Legume/Solanum Veg. | 34 | 2 | 88 | 1 |
| Lettuce | 20 | 1 | 14 | <1 |
| Nursery/Greenhouse | 18 | 1 | 41 | 1 |
| Small Grains | 8 | <1 | 14 | <1 |
| Sudan | 116 | 7 | 418 | 6 |
| **Total*** | **1,549** | **100%** | **6,721** | **100%** |

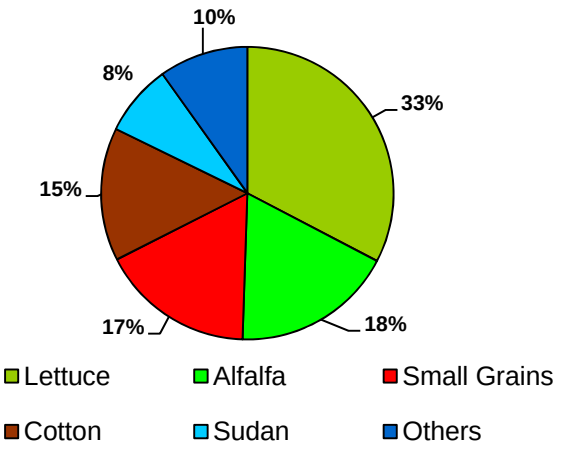
*Due to rounding, totals may differ from the sum of the individual values.

# Wellton-Mohawk Irrigation and Drainage District - AZ

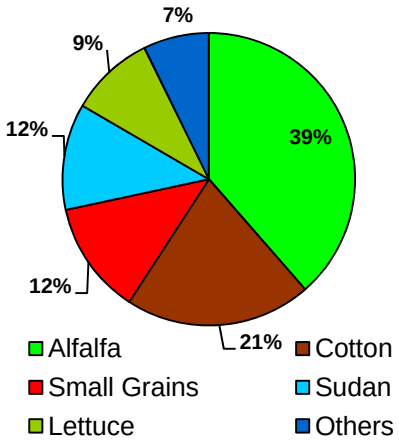
## 2011

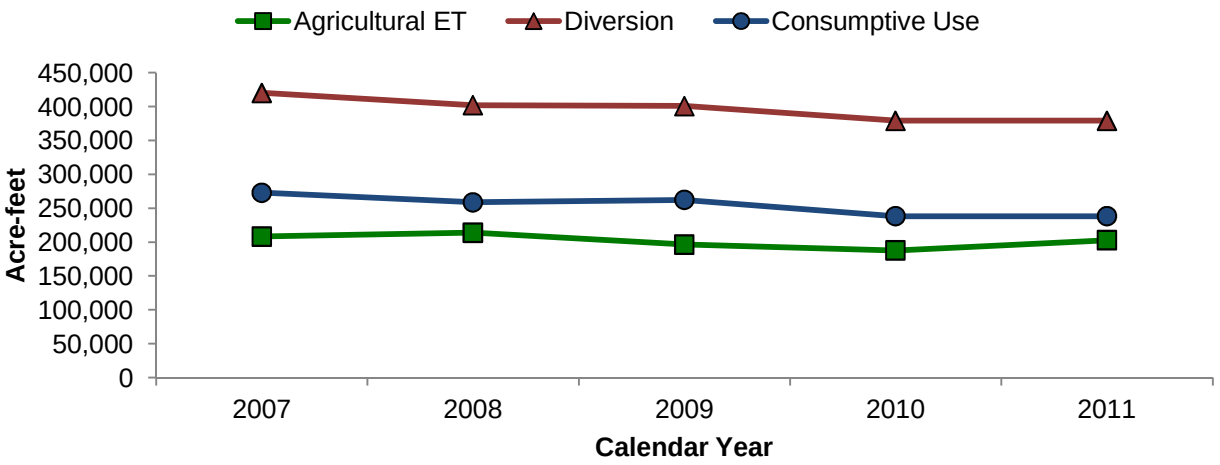
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 58,271 |
| Gross Cropped Acres: | 88,388 |
| Net Cropped Acres: | 56,263 |
| Fallowed/Idle Acres: | 2,008 |
| Agricultural Evapotranspiration (acre-feet): | 202,826 |
| **Riparian** | |
| Riparian Vegetation Acres: | 0 |
| Riparian Evapotranspiration (acre-feet): | 0 |
| **Open Water** | |
| Open Water Acres: | 131 |
| Open Water Evaporation (acre-feet): | 722 |


### Major Crop Types




### Annual Agricultural ET



# Wellton-Mohawk Irrigation and Drainage District - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 15,775 | 18 | 78,221 | 39 |
| Bermuda/Grass | 2,344 | 3 | 7,405 | 4 |
| Citrus | 373 | <1 | 1,207 | 1 |
| Cotton | 12,991 | 15 | 41,798 | 21 |
| Crucifers | 2,787 | 3 | 1,248 | 1 |
| Dates | 7 | <1 | 37 | <1 |
| Deciduous Orchards | 30 | <1 | 118 | <1 |
| Field Grain | 241 | <1 | 563 | <1 |
| Legume/Solanum Veg. | 453 | 1 | 1,089 | 1 |
| Lettuce | 28,876 | 33 | 18,969 | 9 |
| Melons | 1,293 | 1 | 1,750 | 1 |
| Perennial Vegetables | 43 | <1 | 185 | <1 |
| Root Vegetables | 32 | <1 | 28 | <1 |
| Small Grains | 15,038 | 17 | 25,263 | 12 |
| Small Vegetables | 894 | 1 | 937 | <1 |
| Sudan | 7,004 | 8 | 23,865 | 12 |
| Sugar Beets | 209 | <1 | 144 | <1 |
| **Total*** | **88,388** | **100%** | **202,826** | **100%** |

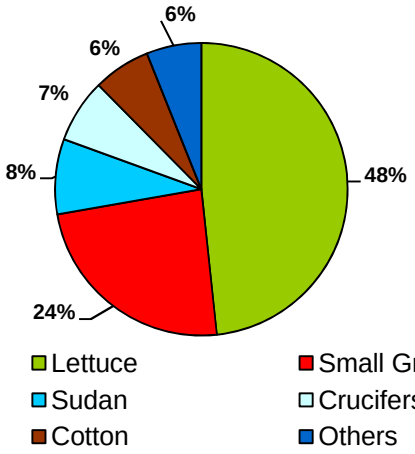
*Due to rounding, totals may differ from the sum of the individual values.

# Yuma County Water Users' Association - AZ

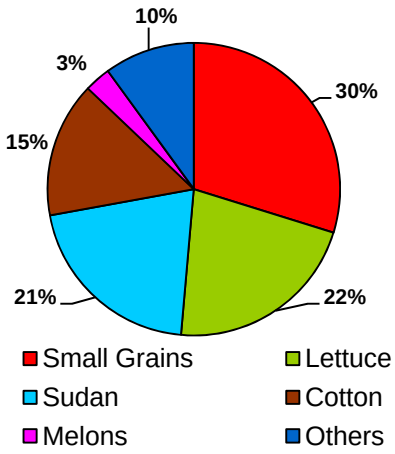
## 2011

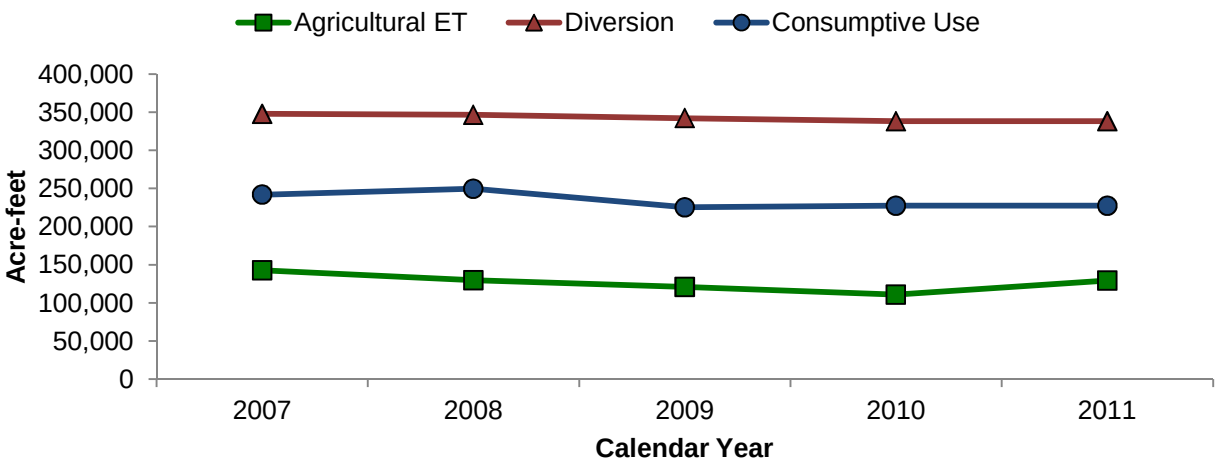
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 41,563 |
| Gross Cropped Acres: | 89,286 |
| Net Cropped Acres: | 41,319 |
| Fallowed/Idle Acres: | 244 |
| Agricultural Evapotranspiration (acre-feet): | 129,187 |
| **Riparian** | |
| Riparian Vegetation Acres: | 2 |
| Riparian Evapotranspiration (acre-feet): | 1 |
| **Open Water** | |
| Open Water Acres: | 312 |
| Open Water Evaporation (acre-feet): | 1,895 |


### Major Crop Types




### Annual Agricultural ET



# Yuma County Water Users' Association - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 389 | <1 | 2,052 | 2 |
| Bermuda/Grass | 364 | <1 | 1,352 | 1 |
| Citrus | 288 | <1 | 1,042 | 1 |
| Cotton | 5,640 | 6 | 19,339 | 15 |
| Crucifers | 6,304 | 7 | 2,963 | 2 |
| Dates | 292 | <1 | 1,717 | 1 |
| Deciduous Orchards | 146 | <1 | 685 | 1 |
| Field Grain | 39 | <1 | 93 | <1 |
| Grapes | 1 | <1 | 2 | <1 |
| Legume/Solanum Veg. | 471 | 1 | 1,202 | 1 |
| Lettuce | 43,137 | 48 | 27,885 | 22 |
| Melons | 2,072 | 2 | 3,737 | 3 |
| Miscellaneous herbs | 35 | <1 | 105 | <1 |
| Nursery/Greenhouse | 286 | <1 | 634 | <1 |
| Perennial Vegetables | 22 | <1 | 103 | <1 |
| Small Grains | 21,377 | 24 | 38,500 | 30 |
| Small Vegetables | 916 | 1 | 906 | 1 |
| Sudan | 7,404 | 8 | 26,809 | 21 |
| Sugar Beets | 103 | <1 | 59 | <1 |
| Wildlife Forage Maintained | 2 | <1 | 3 | <1 |
| **Total*** | **89,286** | **100%** | **129,187** | **100%** |

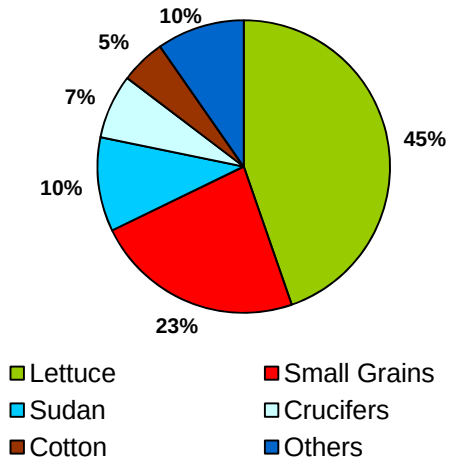
*Due to rounding, totals may differ from the sum of the individual values.

# Yuma Irrigation District - AZ

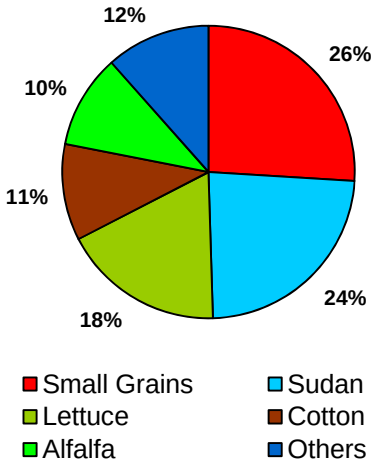
## 2011

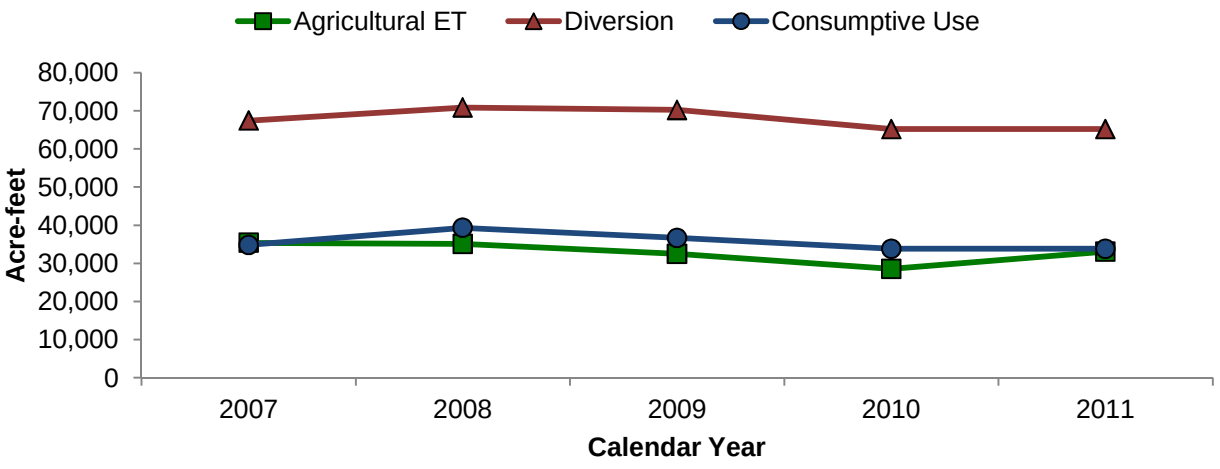
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 10,112 |
| Gross Cropped Acres: | 20,648 |
| Net Cropped Acres: | 10,055 |
| Fallowed/Idle Acres: | 57 |
| Agricultural Evapotranspiration (acre-feet): | 33,083 |
| **Riparian** | |
| Riparian Vegetation Acres: | 224 |
| Riparian Evapotranspiration (acre-feet): | 671 |
| **Open Water** | |
| Open Water Acres: | 63 |
| Open Water Evaporation (acre-feet): | 383 |


### Major Crop Types




### Annual Agricultural ET



# Yuma Irrigation District - AZ

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 627 | 3 | 3,430 | 10 |
| Bermuda/Grass | 83 | <1 | 276 | 1 |
| Citrus | 6 | <1 | 21 | <1 |
| Cotton | 1,028 | 5 | 3,525 | 11 |
| Crucifers | 1,471 | 7 | 741 | 2 |
| Dates | 66 | <1 | 385 | 1 |
| Field Grain | 18 | <1 | 43 | <1 |
| Legume/Solanum Veg. | 448 | 2 | 1,145 | 3 |
| Lettuce | 9,226 | 45 | 5,923 | 18 |
| Melons | 403 | 2 | 716 | 2 |
| Nursery/Greenhouse | 28 | <1 | 63 | <1 |
| Perennial Vegetables | 9 | <1 | 41 | <1 |
| Small Grains | 4,773 | 23 | 8,597 | 26 |
| Small Vegetables | 305 | 1 | 386 | 1 |
| Sudan | 2,151 | 10 | 7,787 | 24 |
| Sugar Beets | 7 | <1 | 4 | <1 |
| **Total*** | **20,648** | **100%** | **33,083** | **100%** |

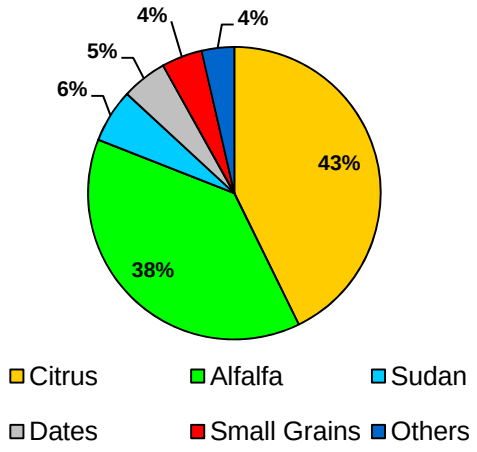
*Due to rounding, totals may differ from the sum of the individual values.

# Yuma Mesa Irrigation and Drainage District - AZ

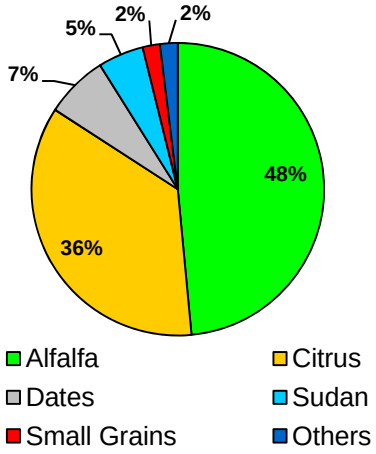
## 2011

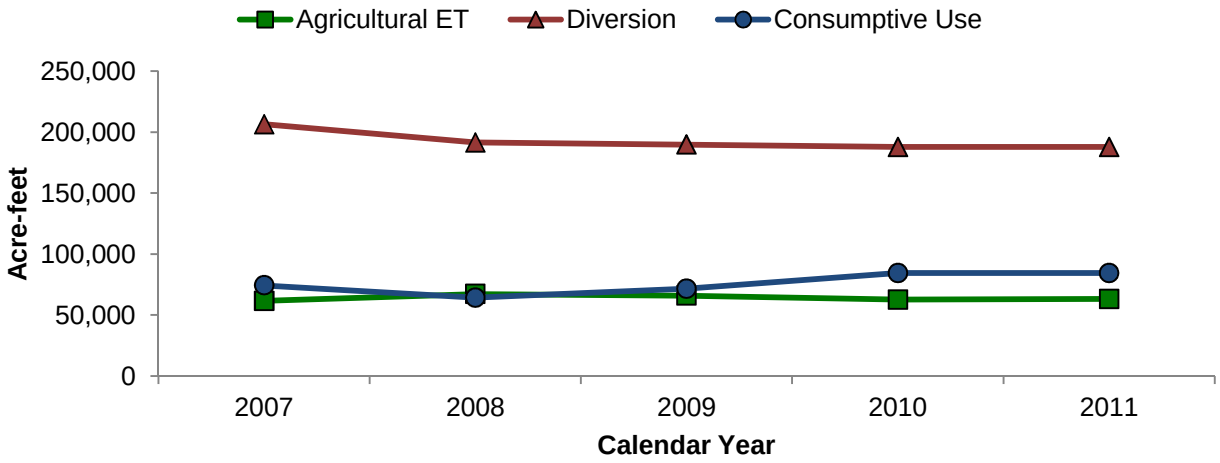
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 16,451 |
| Gross Cropped Acres: | 14,927 |
| Net Cropped Acres: | 15,103 |
| Fallowed/Idle Acres: | 1,347 |
| Agricultural Evapotranspiration (acre-feet): | 63,287 |
| **Riparian** | |
| Riparian Vegetation Acres: | 0 |
| Riparian Evapotranspiration (acre-feet): | 0 |
| **Open Water** | |
| Open Water Acres: | 167 |
| Open Water Evaporation (acre-feet): | 1,016 |


### Major Crop Types




### Annual Agricultural ET



# Yuma Mesa Irrigation and Drainage District - AZ

## 2011

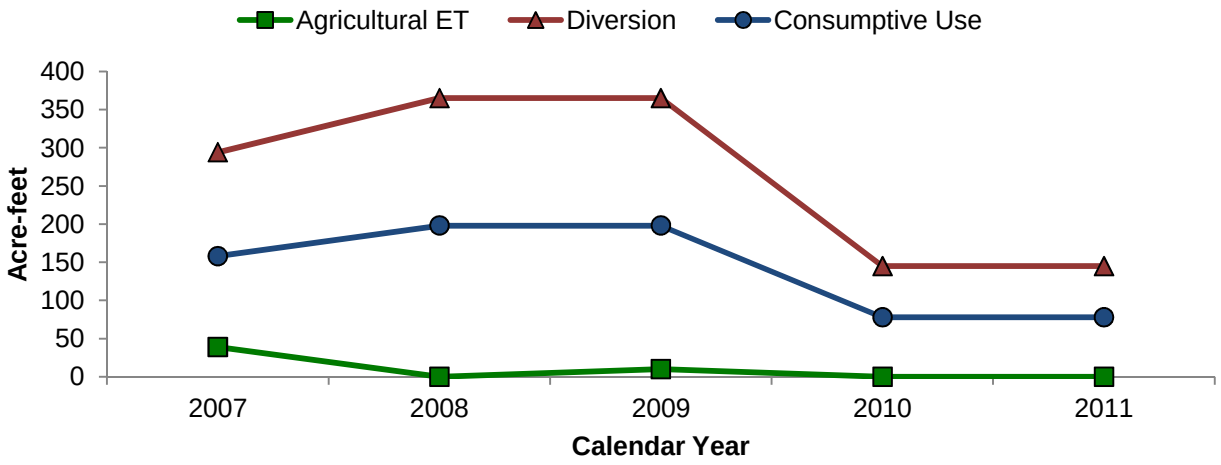
| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 5,706 | 38 | 30,690 | 48 |
| Bermuda/Grass | 184 | 1 | 608 | 1 |
| Citrus | 6,379 | 43 | 22,558 | 36 |
| Crucifers | 8 | <1 | 6 | <1 |
| Dates | 750 | 5 | 4,397 | 7 |
| Deciduous Orchards | 61 | <1 | 276 | <1 |
| Lettuce | 161 | 1 | 106 | <1 |
| Melons | 21 | <1 | 39 | <1 |
| Nursery/Greenhouse | 82 | 1 | 181 | <1 |
| Small Grains | 671 | 4 | 1,209 | 2 |
| Small Vegetables | 9 | <1 | 13 | <1 |
| Sudan | 883 | 6 | 3,198 | 5 |
| Sugar Beets | 13 | <1 | 7 | <1 |
| **Total*** | **14,927** | **100%** | **63,287** | **100%** |

*Due to rounding, totals may differ from the sum of the individual values.

# Chemehuevi Indian Reservation - CA
## 2011

| River Reach: | Davis Dam to Parker Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 58 |
| Gross Cropped Acres: | 0 |
| Net Cropped Acres: | 0 |
| Fallowed/Idle Acres: | 58 |
| Agricultural Evapotranspiration (acre-feet): | 0 |
| **Riparian** | |
| Riparian Vegetation Acres: | 8 |
| Riparian Evapotranspiration (acre-feet): | 23 |
| **Open Water** | |
| Open Water Acres: | 0 |
| Open Water Evaporation (acre-feet): | 0 |


No agricultural crops grown in 2011.



# Chemehuevi Indian Reservation - CA

## 2011

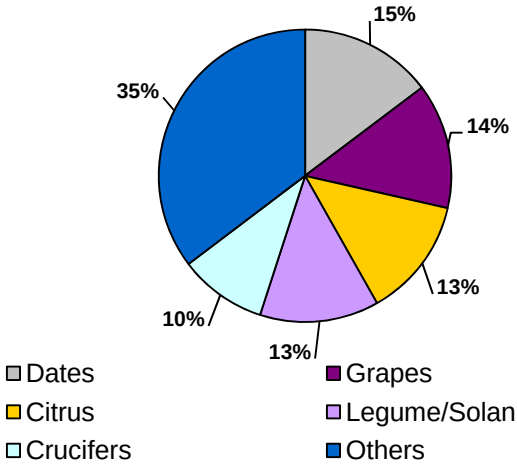
| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| No agricultural crops grown in 2011. | | | | |

# Coachella Valley Water District - CA

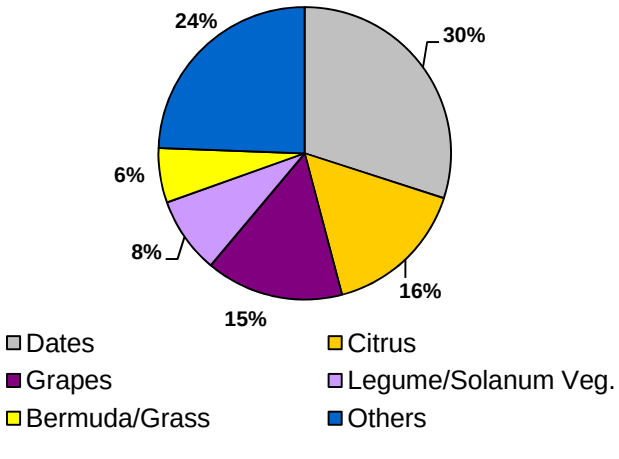
## 2011

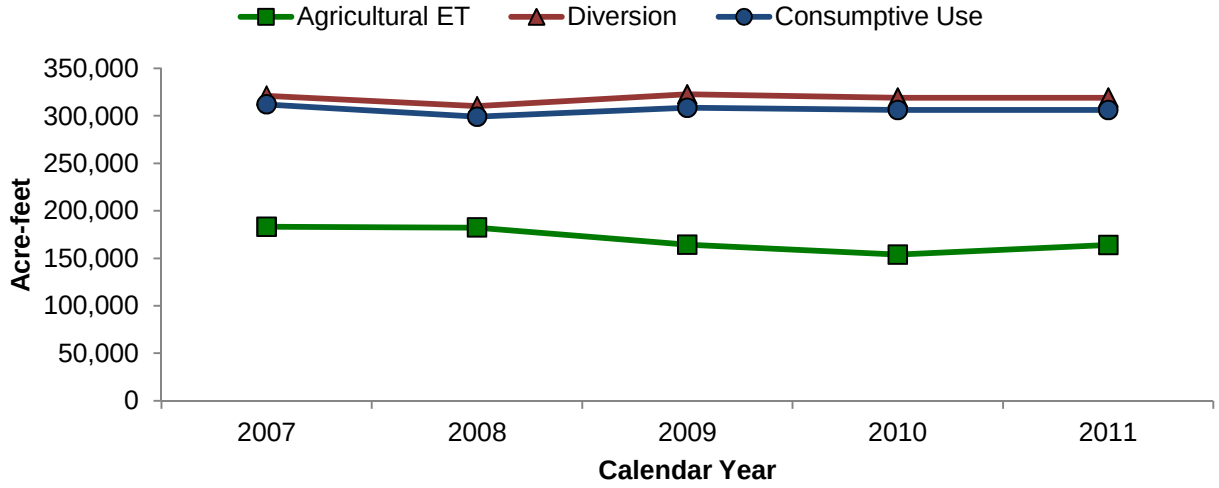
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 57,528 |
| Gross Cropped Acres: | 58,114 |
| Net Cropped Acres: | 50,153 |
| Fallowed/Idle Acres: | 7,375 |
| Agricultural Evapotranspiration (acre-feet): | 163,897 |
| **Riparian** | |
| Riparian Vegetation Acres: | 0 |
| Riparian Evapotranspiration (acre-feet): | 0 |
| **Open Water** | |
| Open Water Acres: | 882 |
| Open Water Evaporation (acre-feet): | 5,583 |


### Major Crop Types




### Annual Agricultural ET



# Coachella Valley Water District - CA

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 473 | 1 | 2,444 | 1 |
| Bermuda/Grass | 2,207 | 4 | 9,861 | 6 |
| Citrus | 7,711 | 13 | 26,076 | 16 |
| Crucifers | 5,631 | 10 | 4,904 | 3 |
| Dates | 8,542 | 15 | 49,122 | 30 |
| Deciduous Orchards | 412 | 1 | 1,879 | 1 |
| Field Grain | 2,622 | 5 | 7,760 | 5 |
| Grapes | 8,051 | 14 | 24,972 | 15 |
| Legume/Solanum Veg. | 7,655 | 13 | 13,827 | 8 |
| Lettuce | 4,806 | 8 | 3,913 | 2 |
| Melons | 1,139 | 2 | 1,929 | 1 |
| Miscellaneous herbs | 733 | 1 | 1,670 | 1 |
| Moist Soil Unit | 87 | <1 | 443 | <1 |
| Nursery/Greenhouse | 1,591 | 3 | 3,436 | 2 |
| Perennial Vegetables | 1,034 | 2 | 4,774 | 3 |
| Root Vegetables | 688 | 1 | 452 | <1 |
| Small Vegetables | 3,869 | 7 | 3,998 | 2 |
| Sudan | 547 | 1 | 1,716 | 1 |
| Tomatoes | 317 | 1 | 722 | <1 |
| **Total*** | **58,114** | **100%** | **163,897** | **100%** |

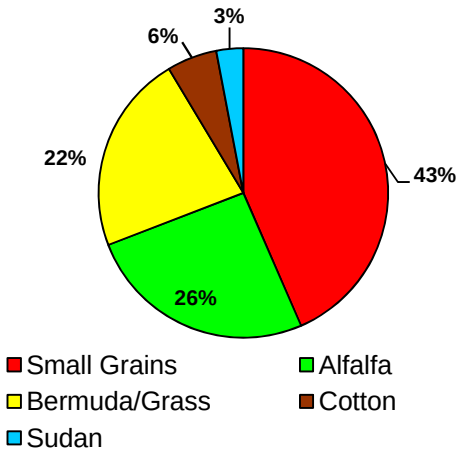
*Due to rounding, totals may differ from the sum of the individual values.

# Fort Mojave Indian Reservation - CA

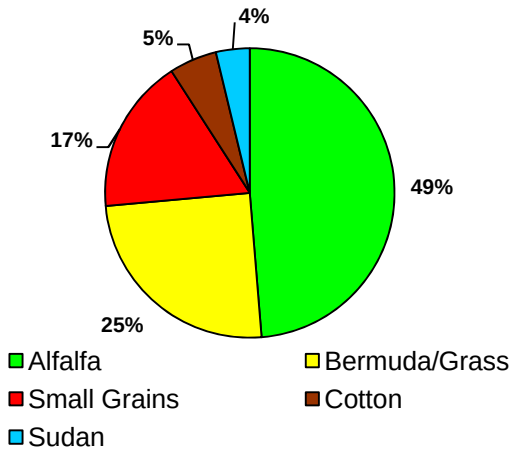
## 2011

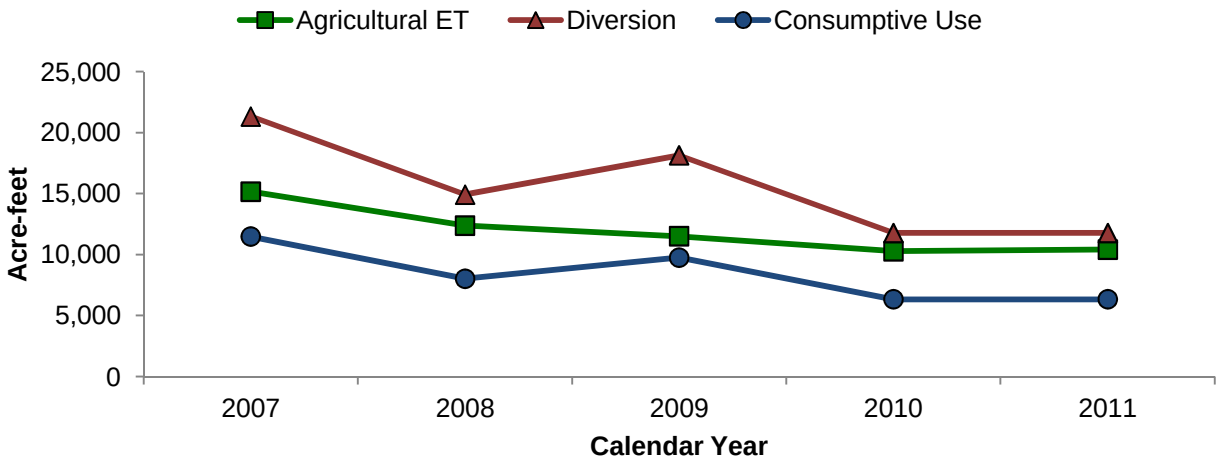
| River Reach: | Davis Dam to Parker Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 3,219 |
| Gross Cropped Acres: | 3,851 |
| Net Cropped Acres: | 3,060 |
| Fallowed/Idle Acres: | 159 |
| Agricultural Evapotranspiration (acre-feet): | 10,410 |
| **Riparian** | |
| Riparian Vegetation Acres: | 919 |
| Riparian Evapotranspiration (acre-feet): | 2,577 |
| **Open Water** | |
| Open Water Acres: | 0 |
| Open Water Evaporation (acre-feet): | 0 |


### Major Crop Types




### Annual Agricultural ET



# Fort Mojave Indian Reservation - CA

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 990 | 26 | 5,071 | 49 |
| Bermuda/Grass | 857 | 22 | 2,588 | 25 |
| Cotton | 215 | 6 | 555 | 5 |
| Small Grains | 1,674 | 43 | 1,804 | 17 |
| Sudan | 116 | 3 | 391 | 4 |
| **Total*** | **3,851** | **100%** | **10,410** | **100%** |

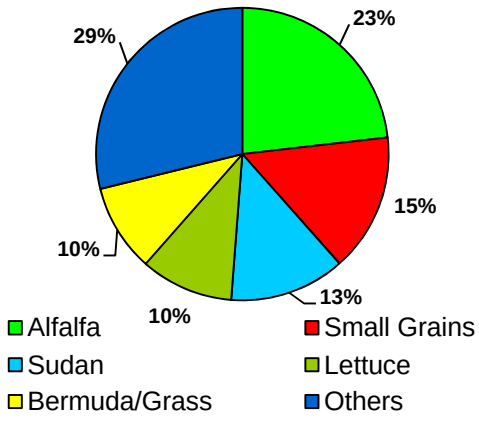
*Due to rounding, totals may differ from the sum of the individual values.

# Imperial Irrigation District - CA

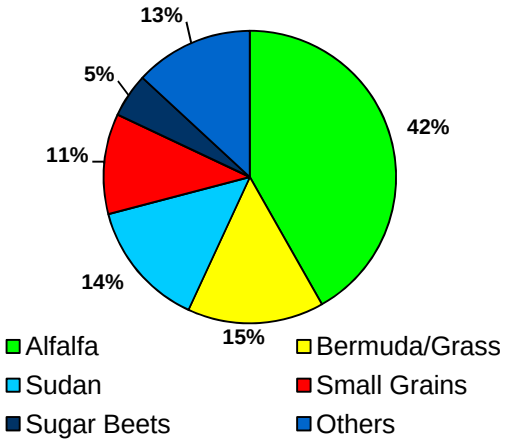
## 2011

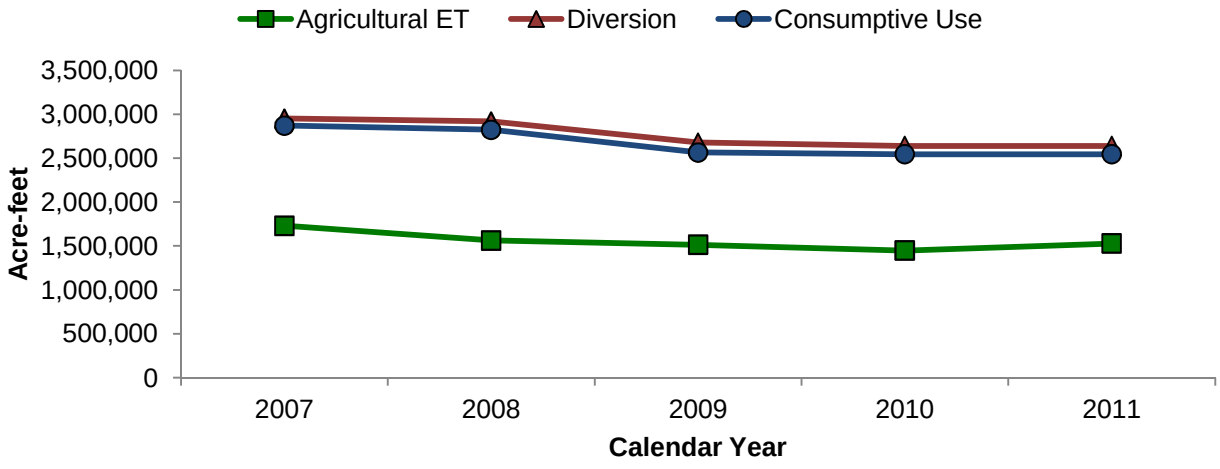
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 431,008 |
| Gross Cropped Acres: | 534,163 |
| Net Cropped Acres: | 407,074 |
| Fallowed/Idle Acres: | 23,934 |
| Agricultural Evapotranspiration (acre-feet): | 1,528,247 |
| **Riparian** | |
| Riparian Vegetation Acres: | 0 |
| Riparian Evapotranspiration (acre-feet): | 0 |
| **Open Water** | |
| Open Water Acres: | 2,122 |
| Open Water Evaporation (acre-feet): | 13,302 |


### Major Crop Types




### Annual Agricultural ET



# Imperial Irrigation District - CA

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 123,834 | 23 | 638,615 | 42 |
| Aloe | 73 | <1 | 157 | <1 |
| Bermuda/Grass | 51,778 | 10 | 230,857 | 15 |
| Cane/Bamboo | 63 | <1 | 364 | <1 |
| Citrus | 6,301 | 1 | 20,496 | 1 |
| Cotton | 1,640 | <1 | 5,358 | <1 |
| Crucifers | 24,179 | 5 | 16,661 | 1 |
| Dates | 795 | <1 | 4,593 | <1 |
| Deciduous Orchards | 585 | <1 | 2,671 | <1 |
| Field Grain | 11,139 | 2 | 32,964 | 2 |
| Legume/Solanum Veg. | 179 | <1 | 177 | <1 |
| Lettuce | 54,790 | 10 | 34,797 | 2 |
| Marsh Maintained | 118 | <1 | 690 | <1 |
| Melons | 7,558 | 1 | 13,610 | 1 |
| Miscellaneous herbs | 1,014 | <1 | 2,308 | <1 |
| Moist Soil Unit | 1,149 | <1 | 5,859 | <1 |
| Nursery/Greenhouse | 657 | <1 | 1,418 | <1 |
| Perennial Vegetables | 361 | <1 | 1,668 | <1 |
| Root Vegetables | 872 | <1 | 572 | <1 |
| Small Grains | 81,582 | 15 | 169,871 | 11 |
| Small Vegetables | 48,712 | 9 | 53,960 | 4 |
| Sudan | 68,245 | 13 | 214,238 | 14 |
| Sugar Beets | 47,527 | 9 | 74,115 | 5 |
| Tomatoes | 49 | <1 | 112 | <1 |
| Wildlife Forage Maintained | 965 | <1 | 2,114 | <1 |
| **Total*** | **534,163** | **100%** | **1,528,247** | **100%** |

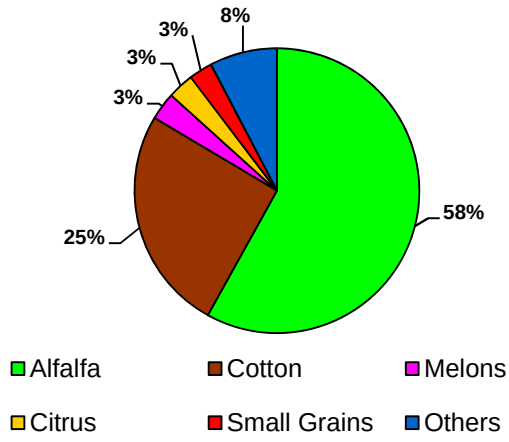
*Due to rounding, totals may differ from the sum of the individual values.

# Palo Verde Irrigation District - CA

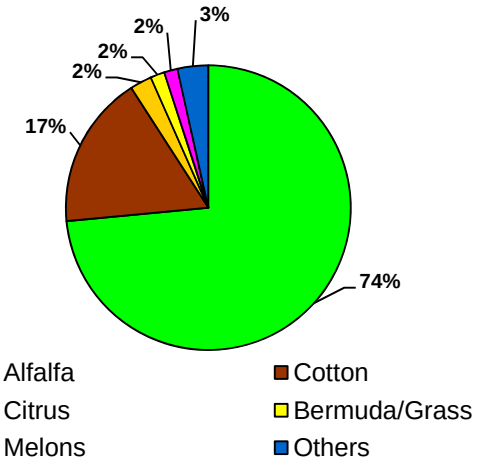
## 2011

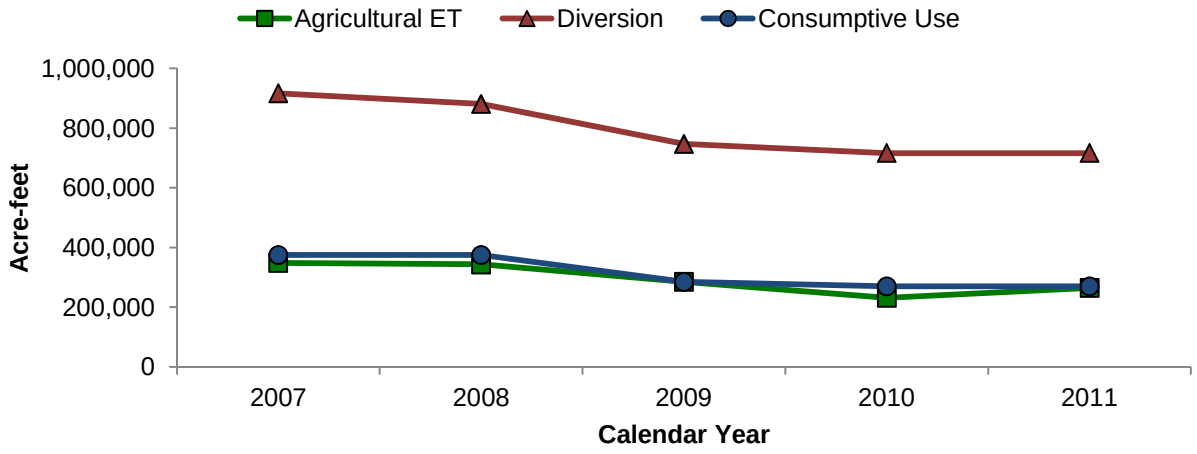
| River Reach: | Parker Dam to Imperial Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 89,877 |
| Gross Cropped Acres: | 63,546 |
| Net Cropped Acres: | 69,524 |
| Fallowed/Idle Acres: | 20,354 |
| Agricultural Evapotranspiration (acre-feet): | 264,347 |
| **Riparian** | |
| Riparian Vegetation Acres: | 2,983 |
| Riparian Evapotranspiration (acre-feet): | 8,893 |
| **Open Water** | |
| Open Water Acres: | 177 |
| Open Water Evaporation (acre-feet): | 929 |


### Major Crop Types




### Annual Agricultural ET



# Palo Verde Irrigation District - CA

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 36,900 | 58 | 194,313 | 74 |
| Bermuda/Grass | 1,326 | 2 | 4,249 | 2 |
| Citrus | 1,888 | 3 | 6,537 | 2 |
| Cotton | 16,193 | 25 | 45,988 | 17 |
| Crucifers | 1,571 | 2 | 751 | <1 |
| Dates | 148 | <1 | 830 | <1 |
| Deciduous Orchards | 22 | <1 | 100 | <1 |
| Field Grain | 95 | <1 | 238 | <1 |
| Grapes | 11 | <1 | 37 | <1 |
| Lettuce | 661 | 1 | 431 | <1 |
| Melons | 1,994 | 3 | 4,030 | 2 |
| Moist Soil Unit | 41 | <1 | 205 | <1 |
| Nursery/Greenhouse | 27 | <1 | 57 | <1 |
| Small Grains | 1,700 | 3 | 3,251 | 1 |
| Sudan | 892 | 1 | 3,164 | 1 |
| Wildlife Forage Maintained | 78 | <1 | 168 | <1 |
| **Total*** | **63,546** | **100%** | **264,347** | **100%** |

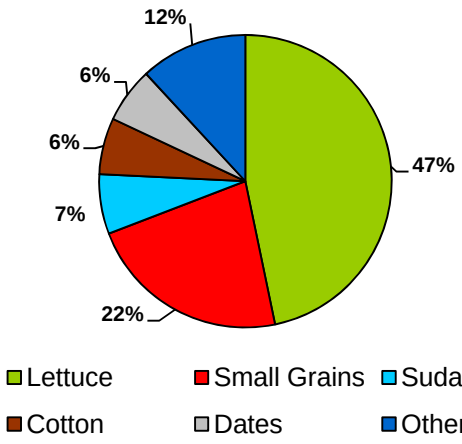
*Due to rounding, totals may differ from the sum of the individual values.

# Yuma Project Reservation Division, Bard Unit - CA

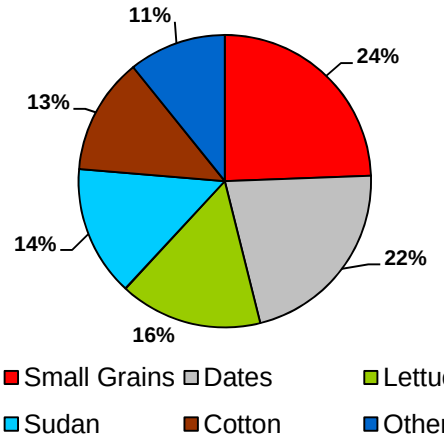
## 2011

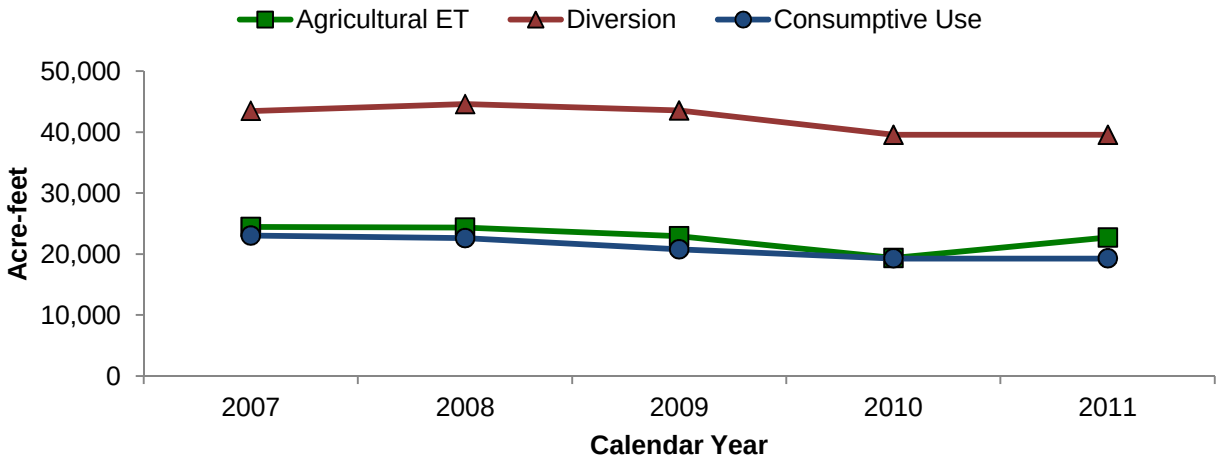
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 6,382 |
| Gross Cropped Acres: | 13,710 |
| Net Cropped Acres: | 6,372 |
| Fallowed/Idle Acres: | 10 |
| Agricultural Evapotranspiration (acre-feet): | 22,702 |
| **Riparian** | |
| Riparian Vegetation Acres: | 229 |
| Riparian Evapotranspiration (acre-feet): | 772 |
| **Open Water** | |
| Open Water Acres: | 28 |
| Open Water Evaporation (acre-feet): | 172 |


### Major Crop Types




### Annual Agricultural ET



# Yuma Project Reservation Division, Bard Unit - CA

## 2011

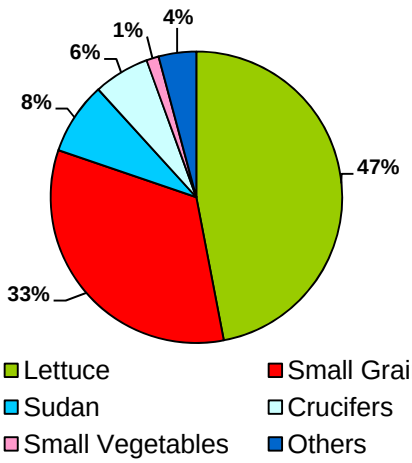
| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 138 | 1 | 744 | 3 |
| Bermuda/Grass | 6 | <1 | 21 | <1 |
| Citrus | 115 | 1 | 425 | 2 |
| Cotton | 854 | 6 | 2,929 | 13 |
| Crucifers | 741 | 5 | 337 | 1 |
| Dates | 840 | 6 | 4,929 | 22 |
| Deciduous Orchards | 7 | <1 | 31 | <1 |
| Legume/Solanum Veg. | 41 | <1 | 105 | <1 |
| Lettuce | 6,409 | 47 | 3,585 | 16 |
| Melons | 286 | 2 | 528 | 2 |
| Miscellaneous herbs | 7 | <1 | 22 | <1 |
| Small Grains | 3,074 | 22 | 5,537 | 24 |
| Small Vegetables | 280 | 2 | 227 | 1 |
| Sudan | 906 | 7 | 3,279 | 14 |
| Sugar Beets | 6 | <1 | 3 | <1 |
| **Total*** | **13,710** | **100%** | **22,702** | **100%** |

*Due to rounding, totals may differ from the sum of the individual values.

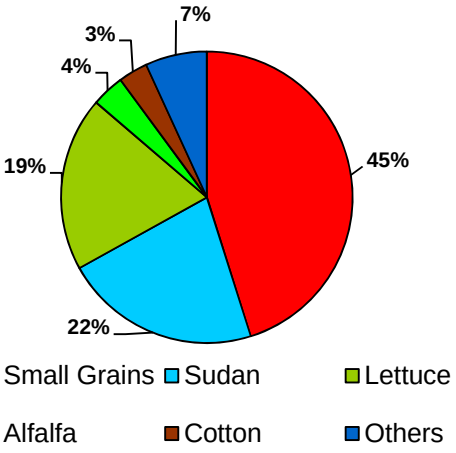
# Yuma Project Reservation Division
# Indian Unit - CA
## 2011

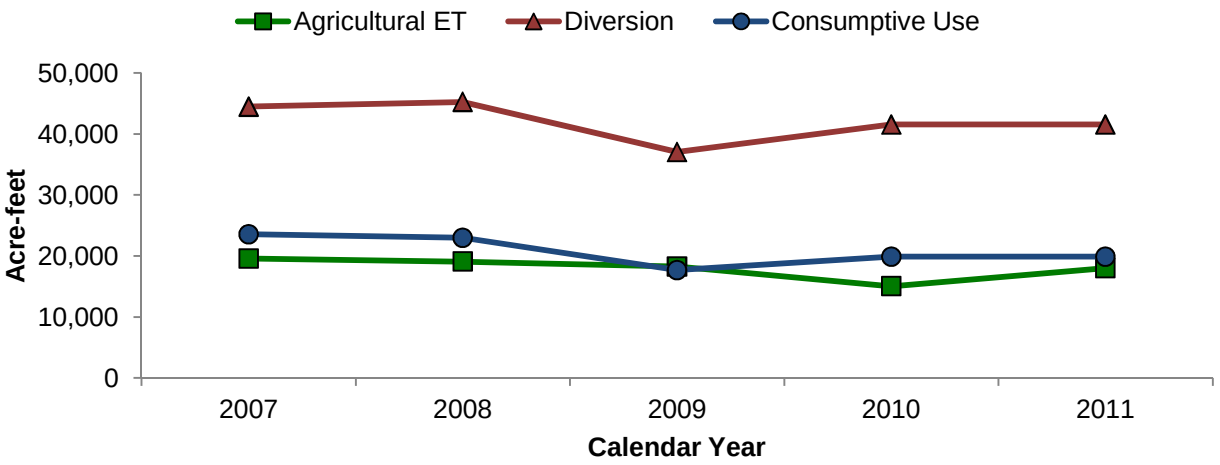
| River Reach: | Imperial Dam to Mexico |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 6,143 |
| Gross Cropped Acres: | 13,550 |
| Net Cropped Acres: | 5,983 |
| Fallowed/Idle Acres: | 160 |
| Agricultural Evapotranspiration (acre-feet): | 17,997 |
| **Riparian** | |
| Riparian Vegetation Acres: | 239 |
| Riparian Evapotranspiration (acre-feet): | 675 |
| **Open Water** | |
| Open Water Acres: | 20 |
| Open Water Evaporation (acre-feet): | 122 |


### Major Crop Types




### Annual Agricultural ET



# Yuma Project Reservation Division
# Indian Unit - CA
## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Alfalfa | 120 | 1 | 652 | 4 |
| Bermuda/Grass | 107 | 1 | 356 | 2 |
| Cotton | 171 | 1 | 588 | 3 |
| Crucifers | 840 | 6 | 391 | 2 |
| Dates | 9 | <1 | 55 | <1 |
| Legume/Solanum Veg. | 37 | <1 | 95 | 1 |
| Lettuce | 6,364 | 47 | 3,482 | 19 |
| Melons | 115 | 1 | 200 | 1 |
| Small Grains | 4,509 | 33 | 8,121 | 45 |
| Small Vegetables | 185 | 1 | 128 | 1 |
| Sudan | 1,084 | 8 | 3,925 | 22 |
| Sugar Beets | 7 | <1 | 4 | <1 |
| **Total*** | **13,550** | **100%** | **17,997** | **100%** |

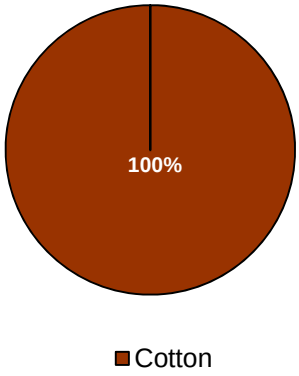
*Due to rounding, totals may differ from the sum of the individual values.

# Fort Mojave Indian Reservation - NV

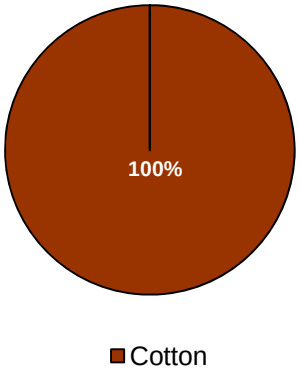
## 2011

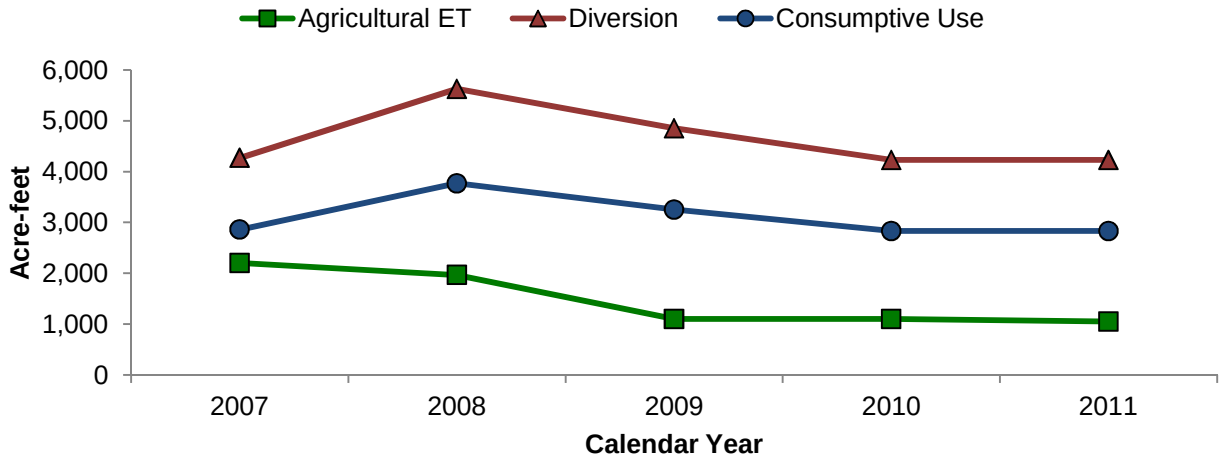
| River Reach: | Davis Dam to Parker Dam |
|---|---|
| **Agriculture** | |
| Irrigable Acres: | 412 |
| Gross Cropped Acres: | 406 |
| Net Cropped Acres: | 406 |
| Fallowed/Idle Acres: | 6 |
| Agricultural Evapotranspiration (acre-feet): | 1,049 |
| **Riparian** | |
| Riparian Vegetation Acres: | 2,256 |
| Riparian Evapotranspiration (acre-feet): | 5,121 |
| **Open Water** | |
| Open Water Acres: | 12 |
| Open Water Evaporation (acre-feet): | 57 |


**Major Crop Types**




**Annual Agricultural ET**



# Fort Mojave Indian Reservation - NV

## 2011

| Crop Type | Acres | Acres % Total | Annual ET (acre-feet) | Annual ET % Total |
|---|---|---|---|---|
| Cotton | 406 | 100 | 1,049 | 100 |
| **Total** | **406** | **100%** | **1,049** | **100%** |

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# Other Water Users Not Reported on Individual Fact Sheets
# 2011

| | | Agricultural Acreage | | | | Agriculture | | | Riparian Vegetation | | Open Water | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water User | River Reach | Irrigable Acres | Gross Cropped Acres | Net Cropped Acres | Fallowed/Idle Acres | Crop Type | Acres | Annual ET (acre-feet) | Acres | Annual ET (acre-feet) | Acres | Annual Evaporation (acre-feet) |
| Note: Due to rounding, totals may differ from the sum of the individual values. | | | | | | | | | | | | |
| **Arizona** | | | | | | | | | | | | |
| Beattie Farms Southwest | Imperial Dam to Mexico | 214 | 261 | 214 | 0 | Alfalfa | 166 | 897 | | | | |
| | | | | | | Small Grains | 47 | 85 | | | | |
| | | | | | | Small Vegetables | 47 | 21 | | | | |
| | | | | | | **Total** | **261** | **1,002** | **89** | **248** | **0** | **0** |
| Bill Williams River National Wildlife Refuge | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | | | | | | | |
| | | | | | | **Total** | **0** | **0** | **2,140** | **7,312** | **43** | **204** |
| Bill Williams River National Wildlife Refuge (NCR)* | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | | 0 | 0 | | | | |
| | | | | | | **Total** | **0** | **0** | **457** | **1,552** | **10** | **48** |
| Cha Cha, LLC | Imperial Dam to Mexico | 339 | 337 | 339 | 0 | Citrus | 325 | 1,193 | | | | |
| | | | | | | Dates | 13 | 74 | | | | |
| | | | | | | **Total** | **337** | **1,267** | **119** | **335** | **4** | **21** |
| Curtis, Armon | Imperial Dam to Mexico | 43 | 43 | 43 | 0 | Small Grains | 43 | 77 | | | | |
| | | | | | | **Total** | **43** | **77** | **5** | **19** | **0** | **0** |
| Fort Yuma Indian Reservation | Imperial Dam to Mexico | 181 | 50 | 25 | 156 | Lettuce | 25 | 9 | | | | |
| | | | | | | Small Grains | 25 | 45 | | | | |
| | | | | | | **Total** | **50** | **54** | **1,643** | **5,227** | **27** | **167** |
| Hillander C Irrigation District (NCR)* | Imperial Dam to Mexico | 2,334 | 738 | 708 | 1,625 | Alfalfa | 447 | 2,354 | | | | |
| | | | | | | Small Grains | 291 | 524 | | | | |
| | | | | | | **Total** | **738** | **2,879** | **0** | **0** | **0** | **0** |
| JRJ Partners, LLC | Imperial Dam to Mexico | 200 | 262 | 150 | 50 | Alfalfa | 6 | 34 | | | | |
| | | | | | | Cotton | 42 | 145 | | | | |
| | | | | | | Dates | 74 | 438 | | | | |
| | | | | | | Lettuce | 126 | 75 | | | | |
| | | | | | | Small Grains | 13 | 24 | | | | |
| | | | | | | **Total** | **262** | **716** | **3** | **9** | **<1** | **<1** |
| Lake Havasu State Park | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | | | | | | | |
| | | | | | | **Total** | **0** | **0** | **399** | **1,253** | **<1** | **<1** |
| Lake Mead National Recreation Area (Hoover Dam to Davis Dam) | Hoover Dam to Davis Dam | 0 | 0 | 0 | 0 | | | | | | | |
| | | | | | | **Total** | **0** | **0** | **666** | **2,009** | **7** | **32** |
| Lake Mead National Recreation Area (Davis Dam to Parker Dam) | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | | | | | | | |
| | | | | | | **Total** | **0** | **0** | **27** | **98** | **1** | **5** |
| Mittry Lake Management Area | Parker Dam to Imperial Dam | 0 | 0 | 0 | 0 | | | | | | | |
| | | | | | | **Total** | **0** | **0** | **3,225** | **13,647** | **434** | **2,638** |
| North Baja Pipeline, LLC | Parker Dam to Imperial Dam | 46 | 46 | 46 | 0 | Alfalfa | 35 | 188 | | | | |
| | | | | | | Cotton | 11 | 31 | | | | |
| | | | | | | **Total** | **46** | **219** | **1** | **2** | **0** | **0** |

*NCR = Non-Colorado River. The origin of water used for agricultural irrigation and by riparian vegetation and open water is considered to come from sources other than the Colorado River.

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# Other Water Users Not Reported on Individual Fact Sheets
# 2011

| | | Agricultural Acreage | | | | Agriculture | | | Riparian Vegetation | | Open Water | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water User | River Reach | Irrigable Acres | Gross Cropped Acres | Net Cropped Acres | Fallowed/Idle Acres | Crop Type | Acres | Annual ET (acre-feet) | Acres | Annual ET (acre-feet) | Acres | Annual Evaporation (acre-feet) |
| Note: Due to rounding, totals may differ from the sum of the individual values. | | | | | | | | | | | | |
| **Arizona (continued)** | | | | | | | | | | | | |
| Ogram Boys Enterprises, Inc. | Imperial Dam to Mexico | 169 | 303 | 169 | 0 | Alfalfa | 42 | 225 | | | | |
| | | | | | | Crucifers | 9 | 7 | | | | |
| | | | | | | Lettuce | 114 | 87 | | | | |
| | | | | | | Small Vegetables | 11 | 16 | | | | |
| | | | | | | Sudan | 127 | 460 | | | | |
| | | | | | | **Total** | **303** | **794** | **2** | **11** | **0** | **0** |
| Ogram, George | Imperial Dam to Mexico | 73 | 64 | 73 | 0 | Alfalfa | 44 | 222 | | | | |
| | | | | | | Lettuce | 20 | 16 | | | | |
| | | | | | | **Total** | **64** | **238** | **0** | **0** | **0** | **0** |
| Pasquinelli, Gary & Barbara | Imperial Dam to Mexico | 76 | 221 | 76 | 0 | Crucifers | 45 | 30 | | | | |
| | | | | | | Lettuce | 41 | 29 | | | | |
| | | | | | | Small Vegetables | 59 | 78 | | | | |
| | | | | | | Sudan | 76 | 277 | | | | |
| | | | | | | **Total** | **221** | **414** | **<1** | **<1** | **0** | **0** |
| Powers (Power, R.E. & P.) | Imperial Dam to Mexico | 172 | 498 | 172 | 0 | Cotton | 78 | 269 | | | | |
| | | | | | | Crucifers | 18 | 3 | | | | |
| | | | | | | Lettuce | 224 | 133 | | | | |
| | | | | | | Small Grains | 75 | 136 | | | | |
| | | | | | | Small Vegetables | 84 | 65 | | | | |
| | | | | | | Sudan | 19 | 68 | | | | |
| | | | | | | **Total** | **498** | **674** | **19** | **58** | **0** | **0** |
| Rayner Ranches | Parker Dam to Imperial Dam | 679 | 695 | 679 | 0 | Alfalfa | 284 | 1,482 | | | | |
| | | | | | | Cotton | 412 | 1,170 | | | | |
| | | | | | | **Total** | **695** | **2,652** | **3** | **3** | **0** | **0** |
| State of Arizona, Alamo Dam to Bill Williams River National Wildlife Refuge (NCR)* | Davis Dam to Parker Dam | 410 | 215 | 215 | 195 | Sudan | 215 | 726 | | | | |
| | | | | | | **Total** | **215** | **726** | **6,357** | **15,044** | **110** | **523** |
| State of Arizona (Other users, Davis Dam to Parker Dam) | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | **900** | **2,091** | **60** | **282** |
| State of Arizona (Other users, Parker Dam to Imperial Dam) | Parker Dam to Imperial Dam | 131 | 131 | 131 | 0 | Cotton | 131 | 373 | | | | |
| | | | | | | **Total** | **131** | **373** | **6,198** | **21,783** | **731** | **3,830** |
| State of Arizona (Other Users, Imperial Dam to Mexico) | Imperial Dam to Mexico | 1,074 | 1,080 | 807 | 268 | Alfalfa | 55 | 287 | | | | |
| | | | | | | Bermuda/Grass | 58 | 193 | | | | |
| | | | | | | Citrus | 2 | 6 | | | | |
| | | | | | | Cotton | 209 | 715 | | | | |
| | | | | | | Crucifers | 64 | 36 | | | | |
| | | | | | | Dates | 189 | 1,113 | | | | |
| | | | | | | Lettuce | 277 | 169 | | | | |
| | | | | | | Melons | 45 | 83 | | | | |
| | | | | | | Small Grains | 125 | 226 | | | | |
| | | | | | | Small Vegetables | 7 | 12 | | | | |
| | | | | | | Sudan | 50 | 182 | | | | |
| | | | | | | **Total** | **1,080** | **3,023** | **3,945** | **13,065** | **79** | **482** |

*NCR = Non-Colorado River. The origin of water used for agricultural irrigation and by riparian vegetation and open water is considered to come from sources other than the Colorado River.

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# Other Water Users Not Reported on Individual Fact Sheets
# 2011

| | | Agricultural Acreage | | | | Agriculture | | | Riparian Vegetation | | Open Water | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water User | River Reach | Irrigable Acres | Gross Cropped Acres | Net Cropped Acres | Fallowed/Idle Acres | Crop Type | Acres | Annual ET (acre-feet) | Acres | Annual ET (acre-feet) | Acres | Annual Evaporation (acre-feet) |
| Note: Due to rounding, totals may differ from the sum of the individual values. | | | | | | | | | | | | |
| **Arizona (continued)** | | | | | | | | | | | | |
| State of Arizona, Other Users (Limitrophe ) | Imperial Dam to Mexico | 793 | 985 | 793 | 0 | Bermuda/Grass | 270 | 898 | | | | |
| | | | | | | Cotton | 279 | 957 | | | | |
| | | | | | | Crucifers | 139 | 90 | | | | |
| | | | | | | Dates | 7 | 39 | | | | |
| | | | | | | Lettuce | 45 | 33 | | | | |
| | | | | | | Melons | 9 | 16 | | | | |
| | | | | | | Sudan | 237 | 859 | | | | |
| | | | | | | **Total** | **985** | **2,892** | **1,448** | **4,144** | **0** | **0** |
| State of Arizona, Other Users (Downgradient from YMIDD) | Imperial Dam to Mexico | 7,497 | 7,514 | 6,486 | 1,011 | Alfalfa | 1,023 | 5,399 | | | | |
| | | | | | | Bermuda/Grass | 3 | 9 | | | | |
| | | | | | | Citrus | 692 | 2,568 | | | | |
| | | | | | | Cotton | 737 | 2,526 | | | | |
| | | | | | | Dates | 1,957 | 11,511 | | | | |
| | | | | | | Deciduous Orchards | 38 | 179 | | | | |
| | | | | | | Lettuce | 122 | 98 | | | | |
| | | | | | | Small Grains | 2,080 | 3,746 | | | | |
| | | | | | | Sudan | 862 | 3,120 | | | | |
| | | | | | | **Total** | **7,514** | **29,157** | **0** | **0** | **0** | **0** |
| State of Arizona, Other Users (Gila River Valley (NCR)*) | Imperial Dam to Mexico | 2,818 | 617 | 617 | 2,201 | Cotton | 128 | 411 | | | | |
| | | | | | | Dates | 255 | 1,391 | | | | |
| | | | | | | Jojoba Beans | 234 | 1,126 | | | | |
| | | | | | | **Total** | **617** | **2,928** | **0** | **0** | **0** | **0** |
| University of Arizona | Imperial Dam to Mexico | 84 | 56 | 56 | 28 | Alfalfa | 4 | 10 | | | | |
| | | | | | | Citrus | 45 | 151 | | | | |
| | | | | | | Dates | 2 | 9 | | | | |
| | | | | | | Deciduous Orchards | 5 | 23 | | | | |
| | | | | | | Nursery/Greenhouse | 1 | 3 | | | | |
| | | | | | | **Total** | **56** | **196** | **0** | **0** | **0** | **0** |
| Yuma Proving Ground | Imperial Dam to Mexico | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | **84** | **266** | **15** | **92** |
| **California** | | | | | | | | | | | | |
| Cibola National Wildlife Refuge | Parker Dam to Imperial Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | **3,914** | **13,141** | **123** | **643** |
| Colorado River Indian Reservation | Parker Dam to Imperial Dam | 567 | 249 | 281 | 286 | Alfalfa | 249 | 1,407 | | | | |
| | | | | | | Bermuda/Grass | 1 | 2 | | | | |
| | | | | | | **Total** | **249** | **1,409** | **8,085** | **24,196** | **62** | **327** |

*NCR = Non-Colorado River. The origin of water used for agricultural irrigation and by riparian vegetation and open water is considered to come from sources other than the Colorado River.

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# Other Water Users Not Reported on Individual Fact Sheets
# 2011

| | | Agricultural Acreage | | | | Agriculture | | | | Riparian Vegetation | | Open Water | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water User | River Reach | Irrigable Acres | Gross Cropped Acres | Net Cropped Acres | Fallowed/Idle Acres | Crop Type | Acres | Annual ET (acre-feet) | | Acres | Annual ET (acre-feet) | Acres | Annual Evaporation (acre-feet) |
| Note: Due to rounding, totals may differ from the sum of the individual values. | | | | | | | | | | | | | |
| **California (continued)** | | | | | | | | | | | | | |
| Fort Yuma Indian Reservation | Imperial Dam to Mexico | 1,307 | 1,429 | 962 | 345 | Alfalfa | 37 | 82 | | | | | |
| | | | | | | Cotton | 127 | 436 | | | | | |
| | | | | | | Crucifers | 11 | 5 | | | | | |
| | | | | | | Dates | 2 | 9 | | | | | |
| | | | | | | Legume/Solanum Veg. | 20 | 51 | | | | | |
| | | | | | | Lettuce | 805 | 465 | | | | | |
| | | | | | | Melons | 50 | 92 | | | | | |
| | | | | | | Miscellaneous herbs | 9 | 26 | | | | | |
| | | | | | | Root Vegetables | 29 | 28 | | | | | |
| | | | | | | Small Grains | 295 | 531 | | | | | |
| | | | | | | Small Vegetables | 30 | 13 | | | | | |
| | | | | | | Sudan | 15 | 55 | | | | | |
| | | | | | | **Total** | **1,429** | **1,795** | | **3,440** | **10,768** | **41** | **248** |
| Havasu National Wildlife Refuge | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **984** | **4,835** | **114** | **541** |
| Imperial National Wildlife Refuge | Parker Dam to Imperial Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **2,678** | **11,081** | **202** | **1,061** |
| Lake Enterprises of California, LLC | Parker Dam to Imperial Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **108** | **527** | **7** | **35** |
| State of California (Other users, Davis Dam to Parker Dam) | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **3,833** | **11,152** | **91** | **430** |
| State of California (Other users, Parker Dam to Imperial Dam) | Parker Dam to Imperial Dam | 1,423 | 400 | 400 | 1,023 | Citrus | 146 | 457 | | | | | |
| | | | | | | Dates | 215 | 1,232 | | | | | |
| | | | | | | Deciduous Orchards | 5 | 3 | | | | | |
| | | | | | | Grapes | 33 | 102 | | | | | |
| | | | | | | **Total** | **400** | **1,793** | | **8,367** | **30,288** | **1,244** | **6,520** |
| State of California (Other users, Imperial Dam to Mexico) | Imperial Dam to Mexico | 1,970 | 2,013 | 1,534 | 436 | Alfalfa | 364 | 1,935 | | | | | |
| | | | | | | Bermuda/Grass | 30 | 71 | | | | | |
| | | | | | | Citrus | 27 | 99 | | | | | |
| | | | | | | Cotton | 67 | 231 | | | | | |
| | | | | | | Legume/Solanum Veg. | 126 | 321 | | | | | |
| | | | | | | Lettuce | 561 | 323 | | | | | |
| | | | | | | Small Vegetables | 425 | 460 | | | | | |
| | | | | | | Sudan | 413 | 1,497 | | | | | |
| | | | | | | **Total** | **2,013** | **4,936** | | **2,712** | **8,982** | **43** | **261** |
| **Nevada** | | | | | | | | | | | | | |
| Lake Mead National Recreation Area - NV (Hoover Dam to Davis Dam) | Hoover Dam to Davis Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **689** | **1,975** | **5** | **24** |
| Lake Mead National Recreation Area - NV (Davis Dam to Parker Dam) | Hoover Dam to Davis Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **0** | **0** | **0** | **0** |
| State of Nevada - Davis to Parker (Davis Dam to Parker Dam) | Davis Dam to Parker Dam | 0 | 0 | 0 | 0 | **Total** | **0** | **0** | | **3,270** | **8,951** | **59** | **281** |

*NCR = Non-Colorado River. The origin of water used for agricultural irrigation and by riparian vegetation and open water is considered to come from sources other than the Colorado River.

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# Appendix 2: Monthly Reference Values for Reference ET, Precipitation, and Crop/Riparian Vegetation ET Rates

This appendix contains area-specific data used by Reclamation to calculate the ET and evaporation estimates provided in this report. Each table displays monthly reference ET and precipitation values, monthly ET rates for crop and riparian groups, and monthly evaporation rates for open water areas.

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## Mohave Area ET Rate Table
## (Inches)
### 2011

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference ET | 3.38 | 3.37 | 5.27 | 7.14 | 8.43 | 9.07 | 8.31 | 8.01 | 5.54 | 5.12 | 3.10 | 2.61 | 69.35 |
| | | | | | | | | | | | | | |
| Precipitation | 0.00 | 1.03 | 0.06 | 0.11 | 0.01 | 0.00 | 0.40 | 0.03 | 1.41 | 0.40 | 0.29 | 0.25 | 3.97 |

| Crop | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alfalfa | 2.41 | 3.34 | 4.33 | 6.59 | 7.74 | 8.00 | 7.39 | 7.47 | 5.85 | 4.11 | 2.55 | 2.83 | 62.61 |
| Bermuda/Grasss | 0.00 | 0.00 | 0.00 | 3.00 | 6.91 | 7.71 | 7.07 | 6.72 | 4.50 | 0.25 | 0.00 | 0.00 | 36.16 |
| Bermuda Overseeded with Rye in Winter | 3.01 | 2.86 | 3.96 | 3.00 | 6.91 | 7.71 | 7.07 | 6.72 | 4.50 | 2.44 | 2.67 | 2.35 | 53.20 |
| Citrus - Declining | 1.63 | 1.60 | 2.35 | 3.07 | 3.44 | 3.63 | 3.30 | 3.19 | 2.27 | 2.21 | 1.48 | 1.31 | 29.48 |
| Citrus - Mature | 2.35 | 2.25 | 3.39 | 4.40 | 4.91 | 5.17 | 4.74 | 4.56 | 3.24 | 3.21 | 2.06 | 1.86 | 42.14 |
| Citrus - Young | 1.40 | 1.34 | 2.02 | 2.61 | 2.96 | 3.10 | 2.87 | 2.77 | 1.96 | 1.92 | 1.22 | 1.14 | 25.31 |
| Cotton | 0.00 | 0.00 | 0.00 | 1.02 | 2.14 | 5.24 | 7.71 | 8.93 | 5.49 | 0.54 | 0.00 | 0.00 | 31.07 |
| Crucifers (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.31 | 1.84 | 2.45 | 6.60 |
| Crucifers (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 1.44 | 1.64 | 3.27 |
| Crucifers (Spring, Early) | 3.38 | 3.31 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.19 |
| Crucifers (Spring, Late) | 3.29 | 3.37 | 5.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.67 |
| Dates | 2.94 | 3.02 | 5.19 | 7.14 | 8.43 | 9.05 | 8.07 | 7.71 | 5.25 | 4.81 | 2.90 | 2.42 | 66.93 |
| Deciduous Orchards | 1.56 | 1.54 | 2.98 | 5.26 | 7.24 | 7.85 | 7.22 | 6.94 | 4.82 | 4.42 | 2.58 | 1.61 | 54.02 |
| Field Grain | 0.00 | 0.00 | 1.84 | 6.48 | 10.10 | 9.39 | 1.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.95 |
| Grapes | 0.00 | 0.18 | 1.54 | 4.60 | 7.13 | 7.70 | 6.71 | 5.06 | 1.52 | 0.00 | 0.00 | 0.00 | 34.44 |
| Legume/Solanum Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.83 | 2.22 | 2.61 | 6.66 |
| Legume/Solanum Vegetables (Spring) | 3.58 | 3.55 | 1.98 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.11 |
| Lettuce (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.16 | 2.62 | 0.00 | 5.78 |
| Lettuce (Spring, Late) | 3.08 | 3.37 | 2.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.55 |
| Melons (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.42 | 3.28 | 5.03 | 3.10 | 1.31 | 14.14 |
| Melons (Spring) | 0.00 | 0.26 | 3.54 | 6.98 | 8.37 | 4.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 24.06 |
| Miscellaneous herbs | 0.00 | 1.28 | 4.03 | 8.37 | 10.42 | 9.96 | 1.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.57 |
| Moist Soil Unit | 3.38 | 3.37 | 5.18 | 7.04 | 4.88 | 3.06 | 8.93 | 9.02 | 3.79 | 5.12 | 3.10 | 2.61 | 59.48 |
| Nursery or greenhouse | 1.40 | 1.34 | 2.02 | 2.61 | 2.96 | 3.10 | 2.87 | 2.77 | 1.96 | 1.92 | 1.22 | 1.14 | 25.31 |
| Oil Crops | 0.00 | 1.28 | 4.03 | 8.37 | 10.42 | 9.96 | 1.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.57 |
| Perennial Vegetables | 1.47 | 1.48 | 2.48 | 5.24 | 7.84 | 8.46 | 7.70 | 7.40 | 4.55 | 3.26 | 1.35 | 1.14 | 52.37 |
| Root Vegetables | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.91 | 3.89 | 3.21 | 2.36 | 11.37 |
| Small Grains (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 1.00 | 1.33 |
| Small Grains (Spring) | 2.91 | 3.79 | 5.94 | 7.77 | 2.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 23.26 |
| Small Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.88 | 2.05 | 2.36 | 2.61 | 7.90 |
| Small Vegetables (Spring) | 3.38 | 3.37 | 4.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.07 |
| Sudan | 0.00 | 0.00 | 2.74 | 7.28 | 9.60 | 10.33 | 9.18 | 1.45 | 0.00 | 0.00 | 0.00 | 0.00 | 40.58 |
| Sugar Beets (Summer) | 3.65 | 3.64 | 5.62 | 7.40 | 6.27 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 26.73 |
| Sugar Beets (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.60 | 1.85 | 1.98 | 2.58 | 7.01 |
| Tomatoes | 0.00 | 2.09 | 4.54 | 8.39 | 9.44 | 3.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.96 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Open Water | 3 | 2.89 | 4.6 | 6.84 | 7.82 | 7.71 | 6.73 | 6.09 | 4.06 | 3.98 | 2.71 | 2.09 | 58.52 |

| Riparian Types | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barren | 0.69 | 0.62 | 0.74 | 0.98 | 1.16 | 1.23 | 1.17 | 1.11 | 0.74 | 0.73 | 0.53 | 0.54 | 10.24 |
| Cottonwood/Willow | 1.12 | 1.12 | 2.52 | 5.38 | 8.27 | 9.23 | 8.35 | 8.03 | 5.54 | 4.61 | 1.71 | 0.6 | 56.48 |
| Marsh | 0.89 | 0.9 | 4.19 | 8.48 | 10.01 | 10.78 | 9.87 | 9.52 | 6.51 | 2.85 | 0.78 | 0.65 | 65.43 |
| Mixed Veg Low | 0.69 | 0.67 | 1.67 | 3.32 | 4.69 | 5.05 | 4.69 | 4.39 | 2.52 | 1.75 | 0.73 | 0.54 | 30.71 |
| Mixed Veg Medium | 1.03 | 1.03 | 1.96 | 3.34 | 4.47 | 4.82 | 4.38 | 3.81 | 2.23 | 1.68 | 0.92 | 0.79 | 30.46 |
| Salt Cedar Dense | 0.75 | 0.72 | 1.49 | 3.63 | 6 | 6.81 | 6.28 | 6.04 | 4.17 | 2.98 | 1.07 | 0.58 | 40.52 |

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## Parker Area ET Rate Table
## (Inches)
### 2011

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference ET | 2.88 | 3.22 | 5.60 | 7.35 | 8.78 | 9.24 | 9.18 | 8.88 | 6.46 | 4.91 | 2.89 | 2.19 | 71.58 |
| | | | | | | | | | | | | | |
| Precipitation | 0.05 | 1.05 | 0.08 | 0.02 | 0.00 | 0.01 | 0.90 | 0.03 | 0.15 | 0.05 | 0.39 | 0.50 | 3.23 |

| Crop | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alfalfa | 2.07 | 3.21 | 4.58 | 6.76 | 8.07 | 8.13 | 8.07 | 8.30 | 6.77 | 3.83 | 2.32 | 2.41 | 64.52 |
| Bermuda/Grass | 0.00 | 0.00 | 0.00 | 3.09 | 7.17 | 7.89 | 7.86 | 7.42 | 5.25 | 0.32 | 0.00 | 0.00 | 39.00 |
| Bermuda Overseeded with Rye in Winter | 2.55 | 2.73 | 4.24 | 3.09 | 7.17 | 7.89 | 7.86 | 7.42 | 5.25 | 2.36 | 2.52 | 1.93 | 55.01 |
| Citrus - Declining | 1.36 | 1.55 | 2.52 | 3.15 | 3.59 | 3.70 | 3.69 | 3.55 | 2.65 | 2.14 | 1.35 | 1.10 | 30.35 |
| Citrus - Mature | 2.02 | 2.16 | 3.60 | 4.50 | 5.14 | 5.29 | 5.26 | 5.09 | 3.72 | 3.07 | 1.91 | 1.59 | 43.35 |
| Citrus - Young | 1.22 | 1.29 | 2.13 | 2.69 | 3.09 | 3.19 | 3.15 | 3.06 | 2.26 | 1.83 | 1.17 | 0.93 | 26.01 |
| Cotton | 0.00 | 0.00 | 0.00 | 1.06 | 2.24 | 5.33 | 8.49 | 9.92 | 6.34 | 0.72 | 0.00 | 0.00 | 34.10 |
| Crucifers (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.21 | 1.68 | 2.05 | 5.94 |
| Crucifers (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 1.34 | 1.36 | 2.86 |
| Crucifers (Spring, Early) | 2.88 | 3.15 | 0.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.52 |
| Crucifers (Spring, Late) | 2.78 | 3.22 | 5.34 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.34 |
| Dates | 2.52 | 2.92 | 5.52 | 7.35 | 8.78 | 9.21 | 8.90 | 8.57 | 6.16 | 4.60 | 2.63 | 2.01 | 69.17 |
| Deciduous Orchards | 1.32 | 1.46 | 3.17 | 5.42 | 7.54 | 7.98 | 7.93 | 7.68 | 5.57 | 4.24 | 2.44 | 1.32 | 56.07 |
| Farm Pond | 2.55 | 2.77 | 4.91 | 7.01 | 8.16 | 7.89 | 7.40 | 6.75 | 4.69 | 3.82 | 2.55 | 1.75 | 60.25 |
| Field Grain | 0.00 | 0.00 | 1.92 | 6.66 | 10.53 | 9.65 | 1.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 29.98 |
| Grapes | 0.00 | 0.16 | 1.66 | 4.74 | 7.40 | 7.87 | 7.42 | 5.67 | 1.70 | 0.00 | 0.00 | 0.00 | 36.62 |
| Legume/Solanum Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.60 | 2.10 | 2.16 | 5.86 |
| Legume/Solanum Vegetables (Spring) | 3.02 | 3.37 | 2.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.43 |
| Lettuce (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.01 | 2.53 | 0.00 | 5.54 |
| Lettuce (Spring, Late) | 2.63 | 3.22 | 2.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.04 |
| Melons (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.53 | 3.89 | 4.81 | 2.89 | 1.09 | 14.21 |
| Melons (Spring) | 0.00 | 0.24 | 3.70 | 7.19 | 8.72 | 5.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 24.92 |
| Miscellaneous herbs | 0.00 | 1.22 | 4.29 | 8.65 | 10.88 | 10.17 | 1.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 36.81 |
| Moist Soil Unit | 2.88 | 3.22 | 5.50 | 7.25 | 5.05 | 3.07 | 9.82 | 9.98 | 4.38 | 4.91 | 2.89 | 2.19 | 61.14 |
| Nursery or greenhouse | 1.22 | 1.29 | 2.13 | 2.69 | 3.09 | 3.19 | 3.15 | 3.06 | 2.26 | 1.83 | 1.17 | 0.93 | 26.01 |
| Oil Crops | 0.00 | 1.22 | 4.29 | 8.65 | 10.88 | 10.17 | 1.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 36.81 |
| Perennial Vegetables | 1.24 | 1.38 | 2.61 | 5.42 | 8.16 | 8.64 | 8.58 | 8.25 | 5.27 | 3.14 | 1.27 | 0.93 | 54.89 |
| Root Vegetables | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.27 | 3.67 | 2.97 | 2.02 | 10.93 |
| Small Grains (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.82 | 1.11 |
| Small Grains (Spring) | 2.52 | 3.64 | 6.29 | 8.02 | 2.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 23.40 |
| Small Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.12 | 1.97 | 2.21 | 2.19 | 7.49 |
| Small Vegetables (Spring) | 2.88 | 3.22 | 4.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.76 |
| Sudan | 0.00 | 0.00 | 2.87 | 7.52 | 10.00 | 10.53 | 10.13 | 1.51 | 0.00 | 0.00 | 0.00 | 0.00 | 42.56 |
| Sugar Beets (Summer) | 3.15 | 3.50 | 5.94 | 7.60 | 6.49 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 26.84 |
| Sugar Beets (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 1.78 | 1.84 | 2.18 | 6.55 |
| Tomatoes | 0.00 | 1.97 | 4.84 | 8.63 | 9.85 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.89 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Open Water | 1.97 | 2.33 | 4.66 | 6.81 | 7.97 | 8.62 | 8.49 | 8.24 | 6.03 | 4.79 | 2.89 | 1.67 | 64.47 |

| Riparian Types | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barren | 0.57 | 0.59 | 0.79 | 0.99 | 1.21 | 1.26 | 1.26 | 1.22 | 0.9 | 0.69 | 0.53 | 0.44 | 10.45 |
| Cottonwood/Willow | 0.93 | 1.06 | 2.7 | 5.5 | 8.65 | 9.41 | 9.34 | 8.99 | 6.46 | 4.46 | 1.59 | 0.52 | 59.61 |
| Marsh | 0.77 | 0.84 | 4.42 | 8.76 | 10.43 | 10.94 | 10.89 | 10.54 | 7.63 | 2.88 | 0.7 | 0.57 | 69.37 |
| Mixed Veg Low | 0.57 | 0.66 | 1.82 | 3.4 | 4.91 | 5.16 | 5.12 | 4.86 | 2.93 | 1.69 | 0.7 | 0.44 | 32.26 |
| Mixed Veg Medium | 0.87 | 1.01 | 2.1 | 3.43 | 4.63 | 4.92 | 4.87 | 4.22 | 2.56 | 1.63 | 0.85 | 0.64 | 31.73 |
| Salt Cedar Dense | 0.65 | 0.72 | 1.59 | 3.73 | 6.28 | 6.96 | 6.94 | 6.71 | 4.87 | 2.92 | 0.99 | 0.51 | 42.87 |

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## Wellton-Mohawk Area ET Rate Table
## (Inches)
### 2011

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference ET | 2.48 | 2.91 | 5.14 | 6.88 | 8.57 | 8.92 | 8.81 | 8.69 | 6.75 | 5.14 | 2.65 | 1.87 | 68.81 |
| | | | | | | | | | | | | | |
| Precipitation | 0.00 | 0.33 | 0.10 | 0.31 | 0.00 | 0.00 | 1.37 | 0.56 | 0.70 | 0.00 | 1.05 | 0.56 | 4.97 |

| Crop | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alfalfa | 1.79 | 2.88 | 4.47 | 5.39 | 7.14 | 7.76 | 7.82 | 7.72 | 5.67 | 5.46 | 2.24 | 1.98 | 60.32 |
| Bermuda/Grass | 0.00 | 0.00 | 0.00 | 2.90 | 6.96 | 7.56 | 7.44 | 7.22 | 5.48 | 0.35 | 0.00 | 0.00 | 37.91 |
| Bermuda Overseeded with Rye in Winter | 2.16 | 2.48 | 3.95 | 2.90 | 6.96 | 7.56 | 7.44 | 7.22 | 5.48 | 2.35 | 2.28 | 1.63 | 52.41 |
| Citrus - Declining | 1.15 | 1.37 | 2.28 | 2.95 | 3.53 | 3.56 | 3.50 | 3.46 | 2.74 | 2.23 | 1.20 | 0.95 | 28.92 |
| Citrus - Mature | 1.74 | 1.94 | 3.30 | 4.23 | 5.00 | 5.09 | 5.04 | 4.97 | 3.93 | 3.21 | 1.79 | 1.34 | 41.58 |
| Citrus - Young | 1.05 | 1.15 | 1.98 | 2.53 | 3.00 | 3.10 | 3.05 | 3.01 | 2.37 | 1.92 | 1.08 | 0.82 | 25.06 |
| Cotton | 0.00 | 0.00 | 0.76 | 1.79 | 3.33 | 6.07 | 8.55 | 9.76 | 6.60 | 1.77 | 0.00 | 0.00 | 38.63 |
| Crucifers (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 1.83 | 1.44 | 1.74 | 5.30 |
| Crucifers (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.90 | 0.98 | 1.88 |
| Crucifers (Spring, Early) | 2.47 | 0.88 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.35 |
| Crucifers (Spring, Late) | 2.30 | 2.91 | 2.44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.65 |
| Dates | 2.05 | 2.49 | 4.97 | 6.88 | 8.40 | 8.62 | 8.50 | 8.38 | 6.45 | 4.86 | 2.57 | 1.85 | 66.02 |
| Deciduous Orchards | 0.94 | 1.12 | 2.62 | 4.81 | 7.22 | 7.59 | 7.49 | 7.39 | 5.73 | 4.38 | 2.22 | 1.17 | 52.68 |
| Farm Pond | 2.17 | 2.48 | 4.49 | 6.58 | 7.94 | 7.59 | 7.13 | 6.64 | 4.97 | 3.98 | 2.34 | 1.49 | 57.80 |
| Field Grain | 0.00 | 0.46 | 2.92 | 7.75 | 10.18 | 6.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.09 |
| Grapes | 0.00 | 0.16 | 1.48 | 4.46 | 7.24 | 7.56 | 7.13 | 5.53 | 1.83 | 0.00 | 0.00 | 0.00 | 35.39 |
| Jojoba Beans | 2.79 | 3.08 | 3.21 | 0.19 | 4.14 | 7.47 | 9.67 | 9.60 | 7.42 | 5.69 | 2.95 | 2.11 | 58.32 |
| Legume/Solanum Vegetables | 0.00 | 0.00 | 0.00 | 2.04 | 5.35 | 8.75 | 9.11 | 3.63 | 0.00 | 0.00 | 0.00 | 0.00 | 28.88 |
| Legume/Solanum Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 1.65 | 1.80 | 4.75 |
| Legume/Solanum Vegetables (Spring) | 2.52 | 3.03 | 1.95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.50 |
| Lettuce (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.72 | 3.72 | 2.48 | 0.00 | 7.92 |
| Lettuce (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.25 | 1.25 |
| Lettuce (Spring, Early) | 2.40 | 1.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.22 |
| Lettuce (Spring, Late) | 1.16 | 2.52 | 5.05 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.93 |
| Melons (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.34 | 4.50 | 2.65 | 1.66 | 12.15 |
| Melons (Spring) | 0.00 | 2.12 | 4.57 | 6.88 | 8.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.62 |
| Miscellaneous herbs | 0.00 | 1.03 | 3.81 | 8.02 | 10.52 | 9.76 | 1.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 34.74 |
| Moist Soil Unit | 2.48 | 2.91 | 5.06 | 6.77 | 4.95 | 2.97 | 9.46 | 9.80 | 4.56 | 5.14 | 2.65 | 1.87 | 58.62 |
| Nursery or greenhouse | 1.05 | 1.15 | 1.98 | 2.53 | 3.00 | 3.10 | 3.05 | 3.01 | 2.37 | 1.92 | 1.08 | 0.82 | 25.06 |
| Oil Crops | 0.00 | 1.03 | 3.81 | 8.02 | 10.52 | 9.76 | 1.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 34.74 |
| Perennial Vegetables | 1.00 | 1.15 | 2.24 | 4.95 | 7.91 | 8.29 | 8.18 | 8.06 | 5.51 | 3.35 | 1.22 | 0.73 | 52.59 |
| Root Vegetables | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.52 | 3.80 | 2.72 | 1.74 | 10.78 |
| Small Grains (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.62 | 0.62 |
| Small Grains (Spring) | 2.35 | 3.22 | 5.74 | 6.49 | 2.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20.31 |
| Small Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.41 | 1.61 | 1.59 | 4.61 |
| Small Vegetables (Spring) | 2.48 | 2.91 | 5.07 | 5.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.13 |
| Small Vegetables (Spring, Late) | 1.90 | 2.23 | 4.73 | 6.03 | 3.87 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 19.61 |
| Sudan | 0.00 | 0.00 | 0.00 | 2.92 | 8.40 | 10.10 | 9.96 | 9.51 | 0.00 | 0.00 | 0.00 | 0.00 | 40.89 |
| Sugar Beets (Summer) | 2.59 | 3.15 | 5.45 | 7.02 | 6.31 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 24.67 |
| Sugar Beets (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.82 | 1.84 | 1.68 | 1.80 | 6.14 |
| Tomatoes | 0.00 | 1.80 | 4.36 | 8.04 | 9.59 | 3.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.27 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Open Water | 2.13 | 2.88 | 5.29 | 7.18 | 8.88 | 9.22 | 9.12 | 9.00 | 6.80 | 5.14 | 2.31 | 1.37 | 69.32 |

| Riparian Types | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barren | 0.50 | 0.53 | 0.70 | 0.95 | 1.20 | 1.22 | 1.18 | 1.19 | 0.94 | 0.73 | 0.45 | 0.38 | 9.97 |
| Cottonwood/Willow | 0.82 | 0.97 | 2.45 | 5.18 | 8.42 | 9.08 | 8.95 | 8.80 | 6.76 | 4.67 | 1.48 | 0.44 | 58.02 |
| Marsh | 0.64 | 0.76 | 3.99 | 8.19 | 10.19 | 10.59 | 10.47 | 10.34 | 7.99 | 3.15 | 0.67 | 0.50 | 67.48 |
| Mixed Veg Low | 0.50 | 0.59 | 1.64 | 3.20 | 4.80 | 5.00 | 4.94 | 4.78 | 3.07 | 1.76 | 0.61 | 0.38 | 31.27 |
| Mixed Veg Medium | 0.76 | 0.88 | 1.89 | 3.18 | 4.52 | 4.76 | 4.68 | 4.15 | 2.68 | 1.69 | 0.79 | 0.57 | 30.55 |
| Salt Cedar Dense | 0.57 | 0.63 | 1.45 | 3.50 | 6.15 | 6.71 | 6.63 | 6.57 | 5.09 | 3.10 | 0.91 | 0.41 | 41.72 |

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## Yuma Area ET Rate Table
## (Inches)
### 2011

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference ET | 3.23 | 3.24 | 5.43 | 7.01 | 8.54 | 9.48 | 9.59 | 9.55 | 7.04 | 5.44 | 3.17 | 2.40 | 74.12 |
| | | | | | | | | | | | | | |
| Precipitation | 0.00 | 0.45 | 0.01 | 0.13 | 0.00 | 0.00 | 0.10 | 0.04 | 0.74 | 0.01 | 0.57 | 0.68 | 2.72 |

| Crop | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alfalfa | 2.33 | 3.22 | 4.76 | 5.46 | 7.09 | 8.25 | 8.53 | 8.50 | 5.96 | 5.79 | 2.63 | 2.56 | 65.08 |
| Bermuda/Grass | 0.00 | 0.00 | 0.00 | 2.96 | 6.94 | 8.02 | 8.10 | 7.93 | 5.69 | 0.32 | 0.00 | 0.00 | 39.96 |
| Bermuda Overseeded with Rye in Winter | 2.86 | 2.76 | 4.17 | 2.96 | 6.94 | 8.02 | 8.10 | 7.93 | 5.69 | 2.54 | 2.77 | 2.12 | 56.86 |
| Citrus - Declining | 1.55 | 1.56 | 2.45 | 3.02 | 3.51 | 3.80 | 3.83 | 3.84 | 2.87 | 2.35 | 1.49 | 1.18 | 31.45 |
| Citrus - Mature | 2.27 | 2.17 | 3.49 | 4.28 | 4.99 | 5.40 | 5.49 | 5.43 | 4.10 | 3.38 | 2.14 | 1.72 | 44.86 |
| Citrus - Young | 1.37 | 1.31 | 2.06 | 2.57 | 3.00 | 3.27 | 3.29 | 3.28 | 2.46 | 2.04 | 1.27 | 1.00 | 26.92 |
| Cotton | 0.00 | 0.00 | 0.81 | 1.83 | 3.34 | 6.48 | 9.30 | 10.73 | 6.89 | 1.77 | 0.00 | 0.00 | 41.15 |
| Crucifers (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 | 1.92 | 1.77 | 2.26 | 6.23 |
| Crucifers (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.15 | 1.35 | 2.50 |
| Crucifers (Spring, Early) | 3.22 | 0.96 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.18 |
| Crucifers (Spring, Late) | 2.97 | 3.24 | 2.55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.76 |
| Dates | 2.63 | 2.79 | 5.26 | 7.01 | 8.38 | 9.18 | 9.28 | 9.24 | 6.74 | 5.14 | 3.04 | 2.31 | 71.00 |
| Deciduous Orchards | 1.23 | 1.25 | 2.79 | 4.91 | 7.17 | 8.09 | 8.21 | 8.16 | 5.99 | 4.60 | 2.61 | 1.46 | 56.47 |
| Farm Pond | 2.86 | 2.79 | 4.79 | 6.70 | 7.91 | 8.09 | 7.75 | 7.29 | 5.17 | 4.24 | 2.79 | 1.90 | 62.28 |
| Field Grain | 0.00 | 0.49 | 3.13 | 7.88 | 10.16 | 7.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.82 |
| Grapes | 0.00 | 0.17 | 1.59 | 4.53 | 7.21 | 8.08 | 7.77 | 6.07 | 1.92 | 0.00 | 0.00 | 0.00 | 37.34 |
| Legume/Solanum Vegetables | 0.00 | 0.00 | 0.00 | 2.08 | 5.36 | 9.31 | 9.93 | 3.97 | 0.00 | 0.00 | 0.00 | 0.00 | 30.65 |
| Legume/Solanum Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.44 | 1.99 | 2.34 | 5.77 |
| Legume/Solanum Vegetables (Spring) | 3.38 | 3.37 | 2.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.83 |
| Lettuce (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.77 | 4.00 | 2.89 | 0.00 | 8.66 |
| Lettuce (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.67 | 1.67 |
| Lettuce (Spring, Early) | 3.12 | 2.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.19 |
| Lettuce (Spring, Late) | 1.43 | 2.80 | 5.33 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.76 |
| Melons (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.44 | 4.79 | 3.17 | 2.11 | 13.51 |
| Melons (Spring) | 0.00 | 2.37 | 4.82 | 7.01 | 8.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 22.20 |
| Miscellaneous herbs | 0.00 | 1.14 | 4.00 | 8.18 | 10.48 | 10.32 | 1.86 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.98 |
| Moist Soil Unit | 3.23 | 3.24 | 5.35 | 6.90 | 4.88 | 3.21 | 10.22 | 10.76 | 4.79 | 5.44 | 3.17 | 2.40 | 63.59 |
| Nursery or greenhouse | 1.37 | 1.31 | 2.06 | 2.57 | 3.00 | 3.27 | 3.29 | 3.28 | 2.46 | 2.04 | 1.27 | 1.00 | 26.92 |
| Oil Crops | 0.00 | 1.14 | 4.00 | 8.18 | 10.48 | 10.32 | 1.86 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.98 |
| Perennial Vegetables | 1.29 | 1.33 | 2.38 | 5.08 | 7.88 | 8.77 | 8.88 | 8.83 | 5.75 | 3.49 | 1.43 | 0.94 | 56.05 |
| Root Vegetables | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.59 | 4.11 | 3.30 | 2.16 | 12.16 |
| Small Grains (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 | 0.83 |
| Small Grains (Spring) | 3.00 | 3.61 | 6.05 | 6.62 | 2.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.73 |
| Small Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.55 | 1.95 | 2.03 | 5.53 |
| Small Vegetables (Spring) | 3.23 | 3.24 | 5.35 | 5.77 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 17.59 |
| Small Vegetables (Spring, Late) | 2.49 | 2.51 | 4.99 | 6.14 | 3.81 | 0.88 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20.82 |
| Sudan | 0.00 | 0.00 | 0.00 | 3.00 | 8.39 | 10.74 | 10.87 | 10.45 | 0.00 | 0.00 | 0.00 | 0.00 | 43.45 |
| Sugar Beets (Summer) | 3.46 | 3.49 | 5.75 | 7.15 | 6.27 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 26.28 |
| Sugar Beets (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.80 | 1.98 | 2.05 | 2.40 | 7.23 |
| Tomatoes | 0.00 | 1.99 | 4.63 | 8.21 | 9.55 | 3.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.07 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Open Water | 2.77 | 3.15 | 5.64 | 7.30 | 8.85 | 9.78 | 9.91 | 9.86 | 7.13 | 5.44 | 2.77 | 1.82 | 74.42 |

| Riparian Types | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barren | 0.63 | 0.62 | 0.77 | 0.95 | 1.18 | 1.31 | 1.31 | 1.30 | 0.98 | 0.76 | 0.55 | 0.50 | 10.86 |
| Cottonwood/Willow | 1.09 | 1.07 | 2.60 | 5.31 | 8.40 | 9.69 | 9.79 | 9.77 | 7.07 | 4.92 | 1.74 | 0.55 | 62.00 |
| Marsh | 0.88 | 0.85 | 4.21 | 8.34 | 10.17 | 11.25 | 11.39 | 11.35 | 8.32 | 3.23 | 0.80 | 0.58 | 71.37 |
| Mixed Veg Low | 0.63 | 0.68 | 1.75 | 3.22 | 4.76 | 5.31 | 5.38 | 5.22 | 3.20 | 1.88 | 0.75 | 0.50 | 33.28 |
| Mixed Veg Medium | 0.97 | 1.00 | 2.06 | 3.28 | 4.53 | 5.04 | 5.08 | 4.53 | 2.82 | 1.80 | 0.93 | 0.72 | 32.76 |
| Salt Cedar Dense | 0.69 | 0.73 | 1.55 | 3.60 | 6.13 | 7.14 | 7.25 | 7.20 | 5.31 | 3.26 | 1.08 | 0.51 | 44.45 |

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## IID and Coachella Area ET Rate Table
## (Inches)
### 2011

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference ET | 2.84 | 3.42 | 5.71 | 7.38 | 9.13 | 9.51 | 9.04 | 8.82 | 6.83 | 5.14 | 2.88 | 2.39 | 73.09 |
| | | | | | | | | | | | | | |
| Precipitation | 0.01 | 0.66 | 0.05 | 0.00 | 0.00 | 0.04 | 0.08 | 0.04 | 0.27 | 2.10 | 0.20 | 0.27 | 3.73 |

| Crop | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alfalfa | 2.16 | 3.93 | 4.66 | 5.77 | 7.39 | 7.48 | 7.30 | 7.29 | 5.55 | 5.97 | 2.35 | 2.72 | 62.57 |
| Aloe | 1.17 | 1.43 | 2.20 | 2.68 | 3.21 | 3.28 | 3.10 | 3.02 | 2.38 | 1.89 | 1.15 | 1.02 | 26.53 |
| Bermuda/Grass | 0.00 | 0.08 | 4.98 | 7.08 | 8.81 | 9.20 | 8.73 | 8.51 | 6.07 | 0.63 | 0.00 | 0.00 | 54.09 |
| Bermuda Overseeded with Rye in Winter | 2.54 | 3.29 | 5.41 | 7.08 | 8.81 | 9.20 | 8.73 | 8.51 | 6.07 | 0.63 | 0.00 | 0.12 | 60.39 |
| Cane/Bamboo | 0.76 | 0.88 | 4.42 | 8.78 | 10.83 | 11.28 | 10.73 | 10.49 | 8.07 | 3.03 | 0.70 | 0.63 | 70.6 |
| Citrus - Declining | 1.37 | 1.64 | 2.56 | 3.20 | 3.77 | 3.81 | 3.60 | 3.52 | 2.78 | 2.22 | 1.34 | 1.18 | 30.99 |
| Citrus - Mature | 2.00 | 2.28 | 3.67 | 4.53 | 5.37 | 5.42 | 5.18 | 5.03 | 3.99 | 3.20 | 1.90 | 1.71 | 44.28 |
| Citrus - Young | 1.17 | 1.43 | 2.20 | 2.68 | 3.21 | 3.28 | 3.10 | 3.02 | 2.38 | 1.89 | 1.15 | 1.02 | 26.53 |
| Cotton | 0.00 | 0.06 | 1.69 | 2.06 | 4.46 | 7.80 | 10.20 | 8.75 | 3.79 | 0.54 | 0.00 | 0.00 | 39.35 |
| Crucifers (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.55 | 2.84 | 5.10 | 3.48 | 2.29 | 17.26 |
| Crucifers (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.47 | 1.81 | 2.59 | 2.86 | 9.73 |
| Crucifers (Spring, Early) | 0.76 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 |
| Crucifers (Spring, Late) | 2.85 | 1.34 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.38 |
| Dates | 2.34 | 2.95 | 5.52 | 7.38 | 8.93 | 9.21 | 8.73 | 8.51 | 6.54 | 4.83 | 2.78 | 2.34 | 70.06 |
| Deciduous Orchards | 1.08 | 1.31 | 2.93 | 5.17 | 7.69 | 8.13 | 7.70 | 7.55 | 5.83 | 4.35 | 2.36 | 1.49 | 55.59 |
| Farm Pond | 3.09 | 3.70 | 6.06 | 7.92 | 9.77 | 10.14 | 9.65 | 9.44 | 7.32 | 5.46 | 3.16 | 2.57 | 78.28 |
| Field Grain | 0.00 | 0.83 | 2.72 | 7.38 | 10.89 | 9.89 | 3.57 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 35.6 |
| Grapes | 0.00 | 0.19 | 1.67 | 4.77 | 7.72 | 8.12 | 7.30 | 5.60 | 1.78 | 0.00 | 0.00 | 0.00 | 37.15 |
| Jojoba Beans | 3.15 | 3.59 | 3.47 | 0.20 | 4.41 | 7.98 | 9.93 | 9.74 | 7.52 | 5.69 | 3.18 | 2.68 | 61.54 |
| Legume/Solanum Vegetables | 0.00 | 0.00 | 2.52 | 4.85 | 10.72 | 8.92 | 3.91 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 31.07 |
| Legume/Solanum Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.22 | 1.39 | 2.36 | 4.97 |
| Legume/Solanum Vegetables (Spring) | 3.15 | 3.33 | 5.40 | 2.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.9 |
| Lettuce (Fall, Early) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.87 | 3.16 | 2.57 | 9.6 |
| Lettuce (Fall, Late) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 | 2.43 | 2.57 | 5.27 |
| Lettuce (Spring, Early) | 3.09 | 1.23 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.33 |
| Lettuce (Spring, Late) | 3.09 | 3.70 | 5.68 | 0.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.31 |
| Marsh Maintained | 0.76 | 0.88 | 4.42 | 8.78 | 10.83 | 11.28 | 10.73 | 10.49 | 8.07 | 3.03 | 0.70 | 0.63 | 70.6 |
| Melons (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 4.28 | 3.97 | 5.34 | 2.96 | 1.65 | 18.67 |
| Melons (Spring) | 0.14 | 1.62 | 5.79 | 7.41 | 5.99 | 0.94 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.89 |
| Miscellaneous herbs | 0.22 | 1.67 | 3.92 | 8.71 | 8.53 | 4.03 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.41 |
| Moist Soil Unit | 2.84 | 3.42 | 5.61 | 7.27 | 5.25 | 3.16 | 9.71 | 9.90 | 4.62 | 5.14 | 2.88 | 2.39 | 62.19 |
| Nursery or greenhouse | 1.17 | 1.43 | 2.20 | 2.68 | 3.21 | 3.28 | 3.10 | 3.02 | 2.38 | 1.89 | 1.15 | 1.02 | 26.53 |
| Oil Crops | 0.22 | 1.67 | 3.92 | 8.71 | 8.53 | 4.03 | 2.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 29.15 |
| Perennial Vegetables | 0.54 | 0.01 | 1.59 | 3.69 | 8.42 | 8.98 | 8.55 | 8.39 | 6.51 | 4.83 | 2.75 | 1.96 | 56.22 |
| Root Vegetables | 0.55 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.76 | 1.88 | 2.67 | 2.53 | 8.4 |
| Small Grains (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 1.11 | 1.16 |
| Small Grains (Spring) | 2.84 | 4.07 | 6.77 | 7.66 | 3.76 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 25.42 |
| Small Vegetables (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 1.88 | 1.87 | 2.28 | 6.14 |
| Small Vegetables (Spring) | 3.01 | 3.49 | 5.20 | 5.68 | 1.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 18.39 |
| Small Vegetables (Spring, Late) | 2.22 | 2.68 | 5.26 | 6.48 | 4.10 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.63 |
| Sudan | 0.00 | 0.00 | 0.27 | 3.10 | 9.12 | 11.33 | 9.21 | 4.39 | 0.26 | 0.00 | 0.00 | 0.00 | 37.68 |
| Sugar Beets (Summer) | 3.21 | 3.92 | 6.21 | 7.14 | 5.98 | 2.48 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 29.24 |
| Sugar Beets (Fall) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 1.90 | 1.66 | 2.34 | 6.08 |
| Tomatoes | 0.22 | 1.67 | 3.92 | 8.71 | 8.53 | 4.03 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 27.41 |
| Wildlife Forage Maintained | 2.84 | 4.07 | 6.77 | 7.66 | 3.76 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 1.11 | 26.58 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Open Water | 3.09 | 3.70 | 6.06 | 7.92 | 9.77 | 10.14 | 9.65 | 9.44 | 7.32 | 5.46 | 3.16 | 2.57 | 78.28 |
| All American Canal* | 2.47 | 3.29 | 5.96 | 7.68 | 9.44 | 9.81 | 9.35 | 9.13 | 6.91 | 5.14 | 2.55 | 1.76 | 73.49 |

*Imperial to Morelos Kc data and Yuma area weather data used for these calculations

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# Appendix 3:  Exhibits 1 through 6

This appendix contains the following Exhibits:

1. Exhibit 1.  Index of water user boundaries.
2. Exhibit 2.  Water User Boundaries, IID and CVWD.
3. Exhibit 3.  Program area, Hoover Dam to Davis Dam.
4. Exhibit 4.  Program area, Davis Dam to Parker Dam.
5. Exhibit 5.  Program area, Parker Dam to Imperial Dam.
6. Exhibit 6.  Program area, Imperial Dam to Mexico.
7. Exhibit 7.  Program area near Salton Sea.

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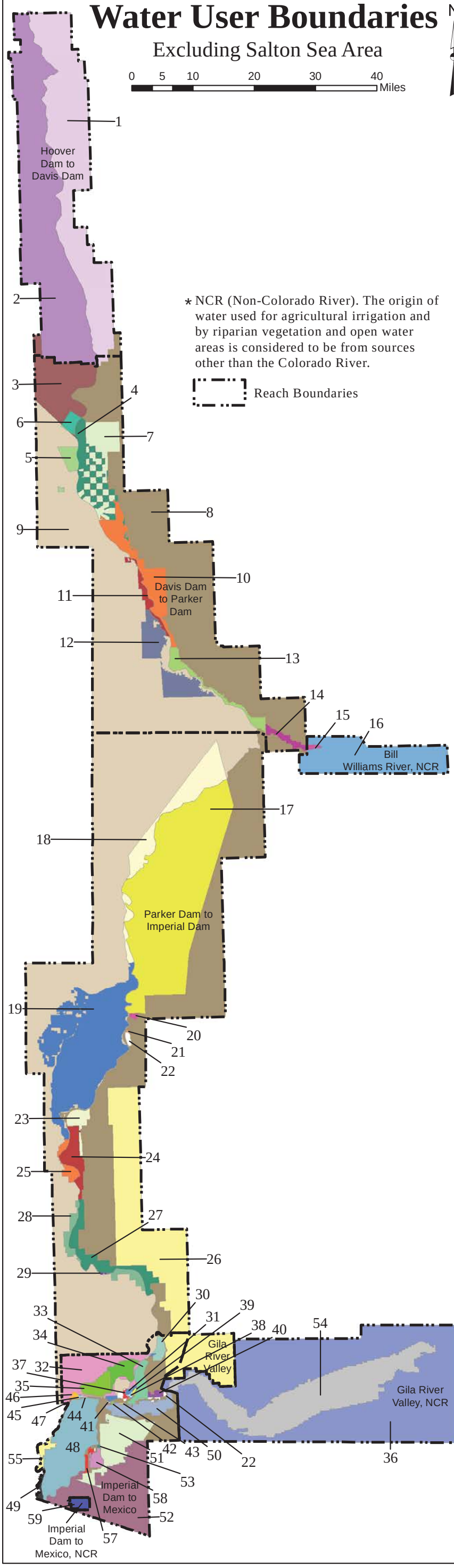
# Water User Boundaries

## Excluding Salton Sea Area

0 5 10 20 30 40 Miles

N




* NCR (Non-Colorado River). The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

Reach Boundaries

1- Lake Mead National Recreation Area, AZ
2- Lake Mead National Recreation Area, NV
3- State of Nevada
4- Fort Mojave Indian Reservation, AZ
5- Fort Mojave Indian Reservation, CA
6- Fort Mojave Indian Reservation, NV
7- Mohave Valley Irrigation and Drainage District, AZ
8- State of Arizona
9- State of California
10- Havasu National Wildlife Refuge, AZ
11- Havasu National Wildlife Refuge, CA
12- Chemehuevi Indian Reservation, CA
13- Lake Havasu State Park, AZ
14- Bill Williams River National Wildlife Refuge, AZ
15- Bill Williams River National Wildlife Refuge, AZ (NCR)*
16- State of Arizona, Alamo Dam to Bill Williams River NWR (NCR)*
17- Colorado River Indian Reservation, AZ
18- Colorado River Indian Reservation, CA
19- Palo Verde Irrigation District, CA
20- Rayner Ranches, AZ
21- North Baja Pipeline, LLC, AZ
22- Arizona State Land Department, AZ
23- Cibola Valley Irrigation and Drainage District, AZ
24- Cibola National Wildlife Refuge, AZ
25- Cibola National Wildlife Refuge, CA
26- Yuma Proving Ground, AZ
27- Imperial National Wildlife Refuge, AZ
28- Imperial National Wildlife Refuge, CA
29- Lake Enterprises of California, LLC, CA
30- Mittry Lake Management Area, AZ
31- Fort Yuma Indian Reservation, AZ
32- Fort Yuma Indian Reservation, CA
33- North Gila Valley Irrigation District, AZ
34- Yuma Project Reservation Division, Bard Unit, CA
35- Yuma Project Reservation Division, Indian Unit, CA
36- State of Arizona, Gila River Valley (NCR)*
37- Cha Cha, LLC, AZ
38- Beattie Farms Southwest, AZ
39- JRJ Partners, LLC, AZ
40- Gila Monster Farms, AZ
41- City of Yuma, AZ (Yuma East Wetlands)
42- Ogram Boys Enterprises Inc., AZ
43- Ogram, George, AZ
44- Curtis, Armon, AZ
45- Powers (Power, R.E. & P.), AZ
46- North Cocopah Indian Reservation, AZ
47- Pasquinelli, Gary and Barb, AZ
48- Yuma County Water Users Association, AZ
49- State of Arizona, Limitrophe Section
50- Yuma Irrigation District, AZ
51- Yuma Mesa Irrigation and Drainage District, AZ
52- State of Arizona, Down Gradient of YMIDD
53- University of Arizona, AZ
54- Wellton-Mohawk Irrigation and Drainage District, AZ
55- West Cocopah Indian Reservation, AZ
56- East Cocopah Indian Reservation, AZ
57- Unit B Irrigation and Drainage District, AZ
58- Hillander C, AZ (NCR)*

RECLAMATION
*Managing Water in the West*

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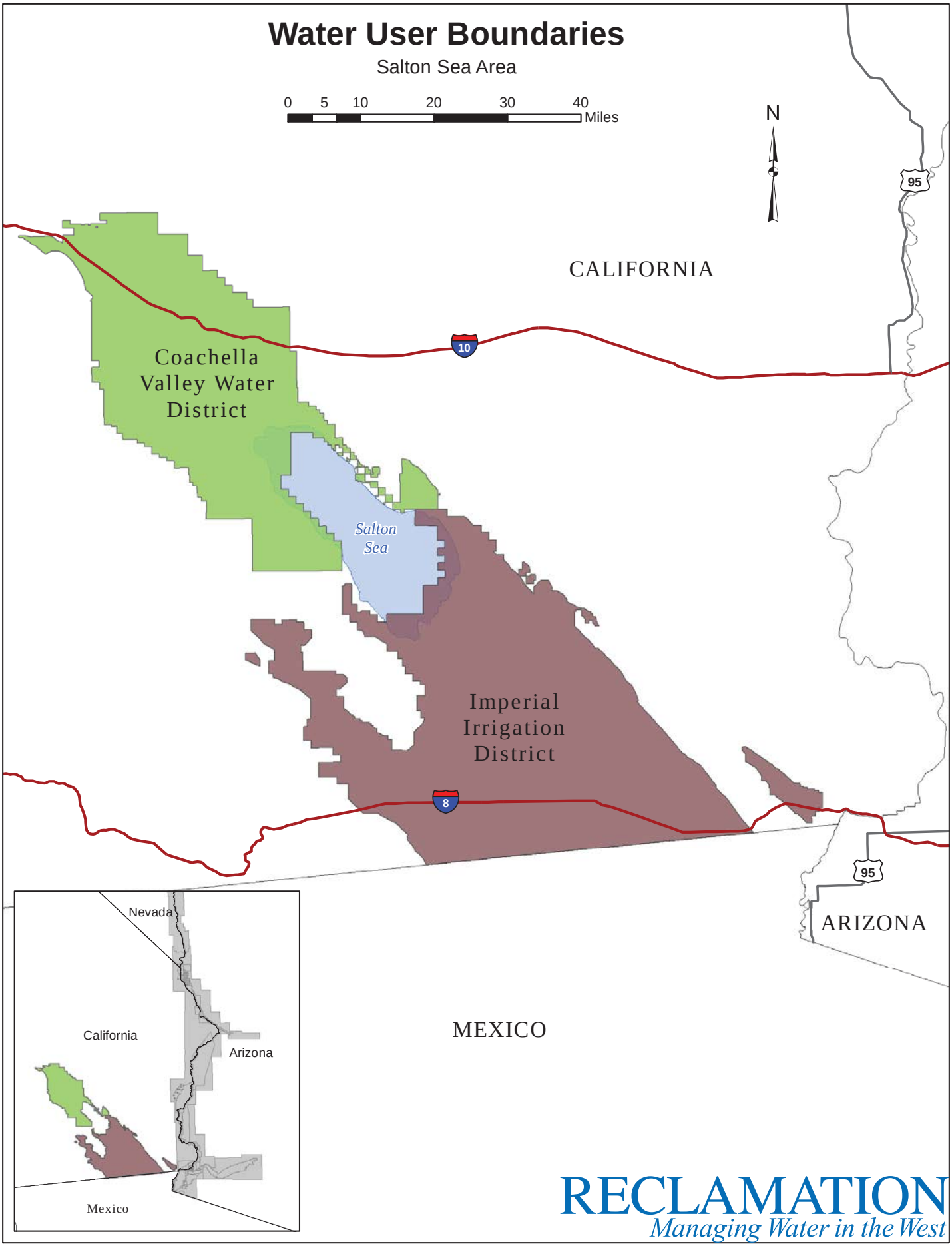
# EXHIBIT 2


Water User Boundaries
Salton Sea Area
0 5 10 20 30 40
Miles
N
95
CALIFORNIA
10
Coachella Valley Water District
Salton Sea
Imperial Irrigation District
8
95
ARIZONA
MEXICO
Nevada
California
Arizona
Mexico
RECLAMATION
Managing Water in the West

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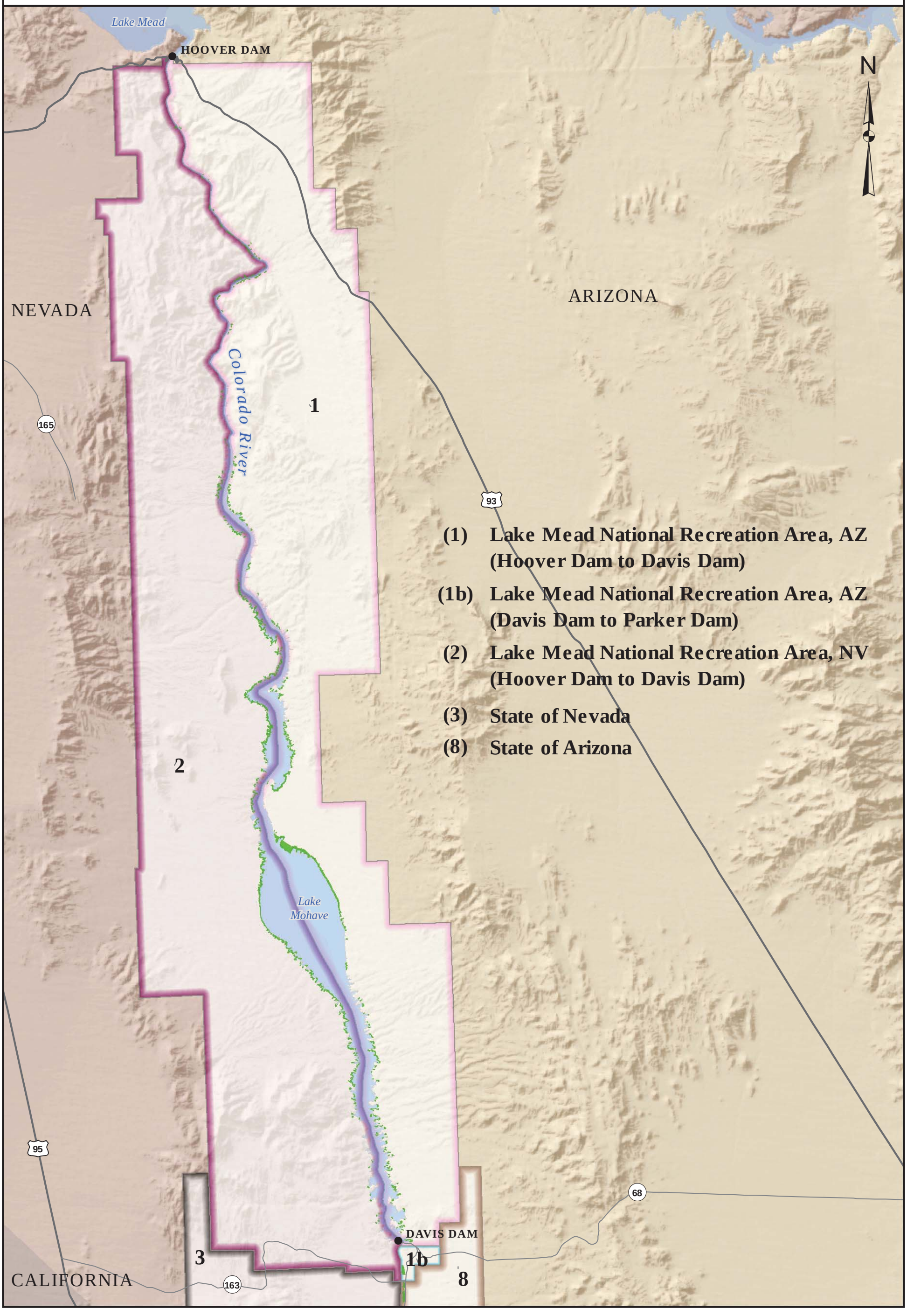
# PROGRAM AREA ALONG THE COLORADO RIVER

## Hoover Dam to Davis Dam

Riparian vegetation in the program

Agricultural fields in the program

0 3 6 9 12 Miles




(1) Lake Mead National Recreation Area, AZ (Hoover Dam to Davis Dam)

(1b) Lake Mead National Recreation Area, AZ (Davis Dam to Parker Dam)

(2) Lake Mead National Recreation Area, NV (Hoover Dam to Davis Dam)

(3) State of Nevada

(8) State of Arizona

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EXHIBIT 4

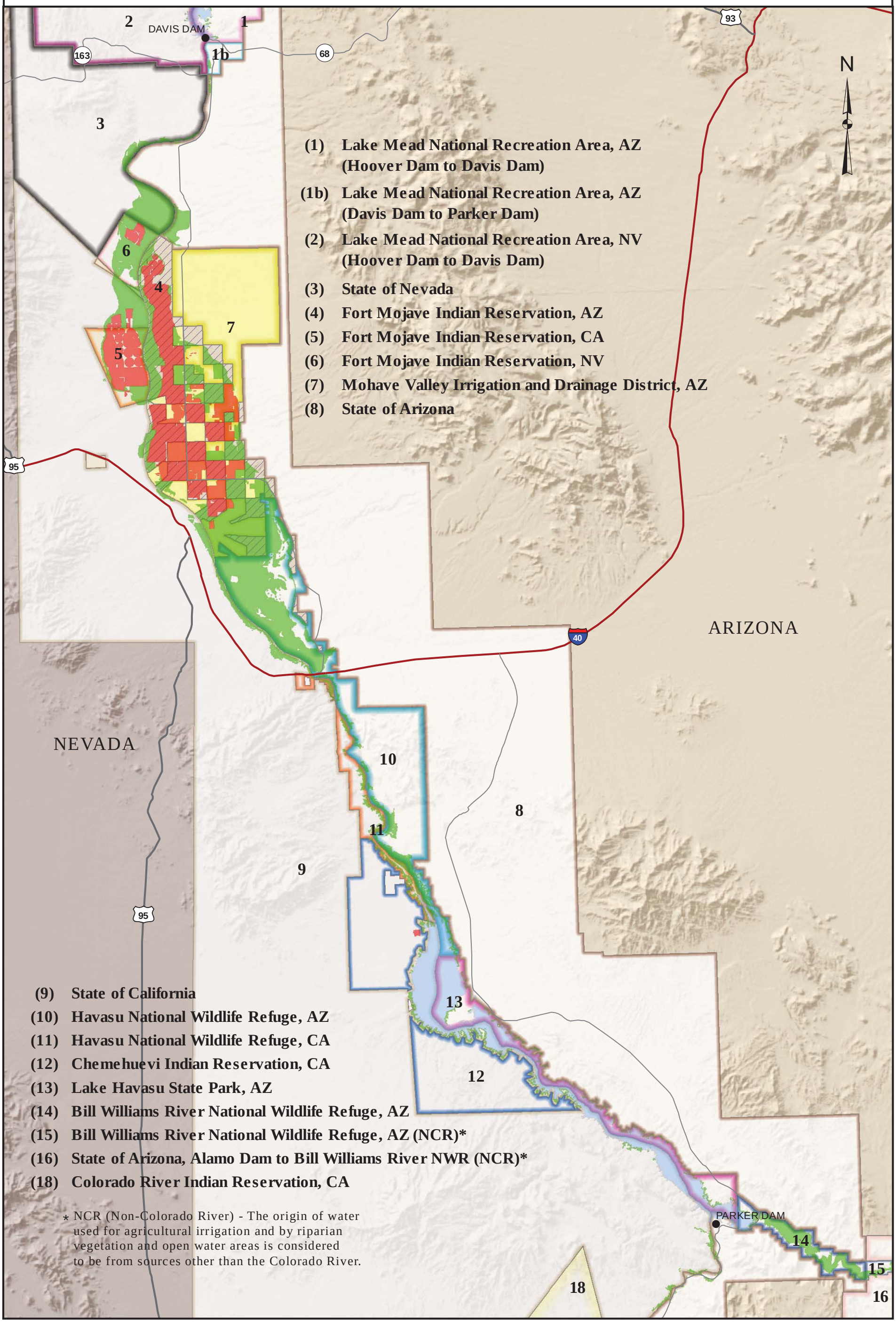
# PROGRAM AREA ALONG THE COLORADO RIVER
## Davis Dam to Parker Dam

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Riparian vegetation in the program

Agricultural fields in the program

0 3 6 9 12 Miles




(1) Lake Mead National Recreation Area, AZ (Hoover Dam to Davis Dam)

(1b) Lake Mead National Recreation Area, AZ (Davis Dam to Parker Dam)

(2) Lake Mead National Recreation Area, NV (Hoover Dam to Davis Dam)

(3) State of Nevada

(4) Fort Mojave Indian Reservation, AZ

(5) Fort Mojave Indian Reservation, CA

(6) Fort Mojave Indian Reservation, NV

(7) Mohave Valley Irrigation and Drainage District, AZ

(8) State of Arizona

(9) State of California

(10) Havasu National Wildlife Refuge, AZ

(11) Havasu National Wildlife Refuge, CA

(12) Chemehuevi Indian Reservation, CA

(13) Lake Havasu State Park, AZ

(14) Bill Williams River National Wildlife Refuge, AZ

(15) Bill Williams River National Wildlife Refuge, AZ (NCR)*

(16) State of Arizona, Alamo Dam to Bill Williams River NWR (NCR)*

(18) Colorado River Indian Reservation, CA

* NCR (Non-Colorado River) - The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

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EXHIBIT 5

# PROGRAM AREA ALONG THE COLORADO RIVER

## Parker Dam to Imperial Dam

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Riparian vegetation in the program

Agricultural fields in the program

0 6 12 18 24 Miles

N

PARKER DAM

IMPERIAL DAM

(8) State of Arizona
(9) State of California
(13) Lake Havasu State Park, AZ
(14) Bill Williams River National Wildlife Refuge, AZ
(15) Bill Williams River National Wildlife Refuge, AZ (NCR)*
(16) State of Arizona, Alamo Dam to Bill Williams River NWR (NCR)*
(17) Colorado River Indian Reservation, AZ
(18) Colorado River Indian Reservation, CA
(19) Palo Verde Irrigation District, CA
(20) Rayner Ranches, AZ
(21) North Baja Pipeline, LLC, AZ
(22) Arizona State Land Department, AZ
(23) Cibola Valley Irrigation and Drainage District, AZ
(24) Cibola National Wildlife Refuge, AZ
(25) Cibola National Wildlife Refuge, CA
(26) Yuma Proving Ground, AZ
(27) Imperial National Wildlife Refuge, AZ
(28) Imperial National Wildlife Refuge, CA
(29) Lake Enterprises of California, LLC, CA
(30) Mittry Lake Management Area, AZ
(31) Fort Yuma Indian Reservation, AZ
(32) Fort Yuma Indian Reservation, CA
(33) North Gila Valley Irrigation District, AZ
(34) Yuma Project Reservation Division, Bard Unit, CA
(36) State of Arizona, Gila River Valley (NCR)*
(54) Wellton-Mohawk Irrigation and Drainage District, AZ

* NCR (Non-Colorado River) - The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

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U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Riparian vegetation in the program
Agricultural fields in the program

N

# PROGRAM AREA ALONG THE COLORADO RIVER
## Imperial Dam to Mexico

0 3 6 9 12 Miles

CALIFORNIA
ARIZONA
MEXICO
IMPERIAL DAM
Northerly International Boundary
Southerly International Boundary

9 30 26 32 34 8 33 36 35 37 39 54 46 45 44 22 38 40 47 31 41 42 43 50 95 51 48 53 55 57 56 52 49 58 8

* NCR (Non-Colorado River) - The origin of water used for agricultural irrigation and by riparian vegetation and open water areas is considered to be from sources other than the Colorado River.

(8) State of Arizona
(9) State of California
(22) Arizona State Land Department, AZ
(26) Yuma Proving Ground, AZ
(30) Mittry Lake Management Area, AZ
(31) Fort Yuma Indian Reservation, AZ
(32) Fort Yuma Indian Reservation, CA
(33) North Gila Valley Irrigation District, AZ
(34) Yuma Project Reservation Division, Bard Unit, CA
(35) Yuma Project Reservation Division, Indian Unit, CA
(36) State of Arizona, Gila River Valley (NCR)
(37) Cha Cha, LLC, AZ
(38) Beattie Farms Southwest, AZ
(39) JRJ Partners, LLC, AZ
(40) Gila Monster Farms, AZ
(41) City of Yuma, AZ
(42) Ogram Boys Enterprises Inc., AZ
(43) Ogram, George, AZ
(44) Curtis, Armon, AZ
(45) Powers (Power, R.E. & P.), AZ
(46) North Cocopah Indian Reservation, AZ
(47) Pasquinelli, Gary and Barbara, AZ
(48) Yuma County Water Users Association, AZ
(49) State of Arizona, Limitrophe
(50) Yuma Irrigation District, AZ
(51) Yuma Mesa Irrigation and Drainage District, AZ
(52) State of Arizona, Down Gradient of YMIDD
(53) University of Arizona, AZ
(54) Wellton-Mohawk Irrigation and Drainage District, AZ
(55) West Cocopah Indian Reservation, AZ
(56) East Cocopah Indian Reservation, AZ
(57) Unit B Irrigation and Drainage District, AZ
(58) Hillander C, AZ (NCR)*

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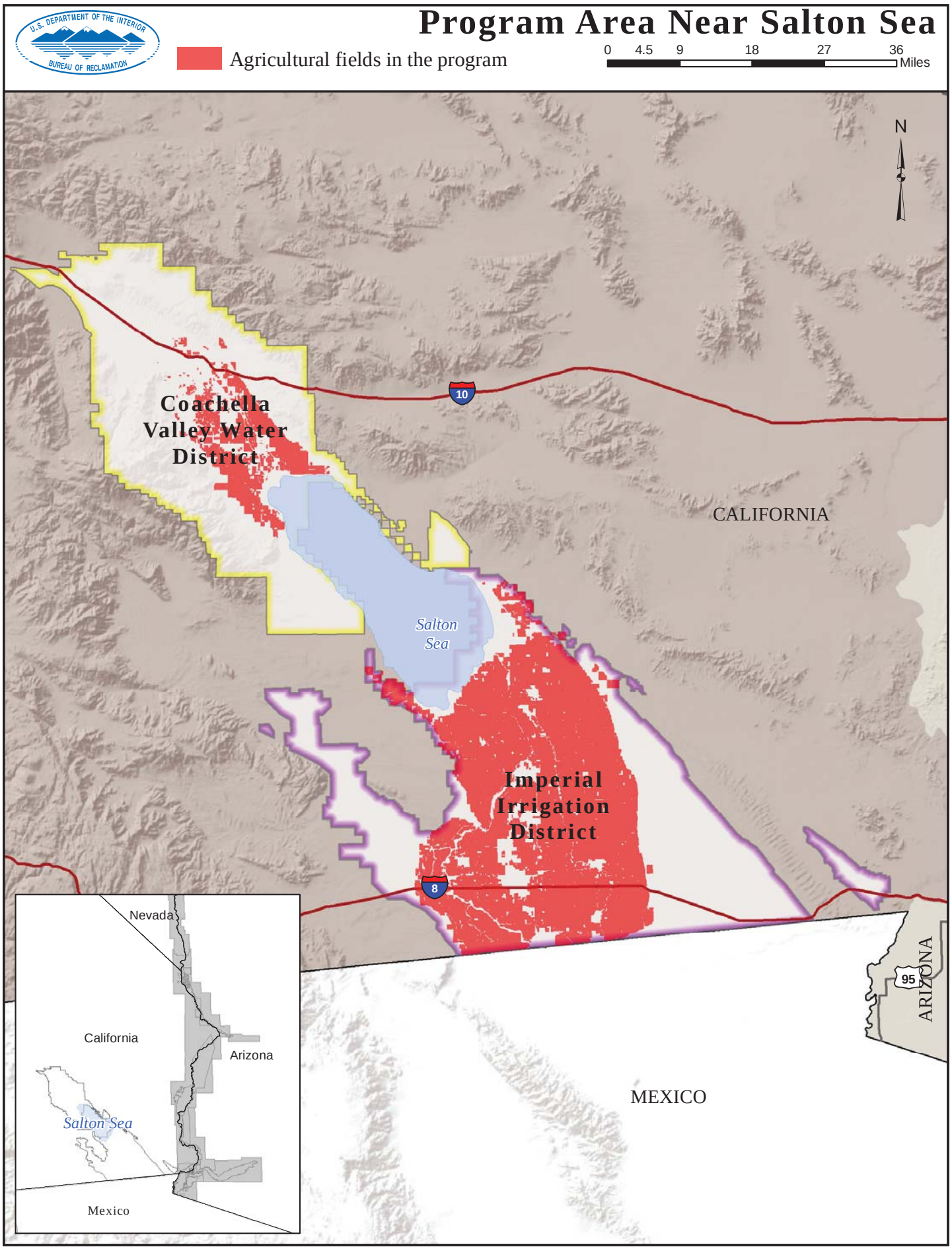
EXHIBIT 7


Program Area Near Salton Sea
Agricultural fields in the program
0 4.5 9 18 27 36
Miles
N
Coachella Valley Water District
Imperial Irrigation District
Salton Sea
CALIFORNIA
ARIZONA
MEXICO
10
8
95
Nevada
California
Arizona
Salton Sea
Mexico

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