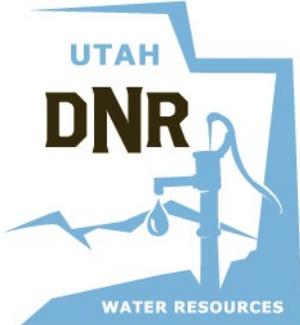




Water-Related
Land Use
Inventories

UTAH

**Jordan River Basin
2008 Inventory**



A Water-Related
Land Use Inventory Report
of the
Jordan River Basin



Prepared by:

Utah Department of Natural Resources
Division of Water Resources

Report Compiled:
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ACKNOWLEDGMENTS

This report was prepared by Eric Edgley, Technical Services Manager. The land use data summarized in this report were gathered under the direction of Todd Adams, Assistant Director, and supervised by Eric Edgley, Section Chief, Technical Services, Utah Division of Water Resources.

The Technical Services Staff was chiefly responsible for the collection, preparation and analyses of the data. The data were summarized by Barbara Perry, GIS Analyst. Additionally, select members of the Planning and Development Staffs assisted with the collection of the data.

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A handwritten signature in blue ink, appearing to read "Dennis J. Strong", is written over a horizontal line.

Dennis J. Strong, Director

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JORDAN RIVER BASIN

WATER-RELATED LAND USE INVENTORY

INTRODUCTION

Authority

In the 1963 general session, the Utah State Legislature charged the Division of Water Resources with the responsibility of developing a State Water Plan. This plan is to coordinate and direct the activities of state and federal agencies concerned with Utah's water resources. As a part of this objective, the Division of Water Resources collects water-related land use data for the entire state. This data includes the types and extent of irrigated crops as well as information concerning phreatophytes¹, wet/open water areas, dry land agriculture and residential/industrial areas.

The data produced by the water-related land use program are used for various planning purposes. Some of these include: determining cropland water use, evaluating irrigated land losses and conversion to urban uses, planning for new water development, estimating irrigated acreages for any area, and developing water budgets. Additionally, the data are utilized by many other state and federal agencies.

Previous Methods

The land use inventory methods used by the division in conducting water-related land use studies have varied with regard to the procedures used and the precision obtained. During the 1960s and 70s, inventories were prepared using large format vertical-aerial photographs supplemented with field surveys to label boundaries, vegetation types, and other water use information.

After identifying crops and labeling photographs, the information was transferred

onto a base map and then planimetered^{II} or "dot-counted" to determine the acreage. Tables for individual townships and ranges were prepared showing the amount of land in each land use category within each section. Data were then available for use in preparing water budgets.

In the early 1980s, the division began updating its methodology for collecting water-related land use data to take advantage of the rapidly growing fields of Remote Sensing and computerized Geographic Information Systems (GIS).

For several years during the early 1980's, the division contracted with the University of Utah Research Institute, Center for Remote Sensing and Cartography (CRSC), to prepare water-related land use inventories. During this period, water-related land use data was obtained by using high altitude color infrared photography and laboratory interpretation, with field checking.

In March 1984, several division staff members visited the California Department of Water Resources to observe its methodology for collecting water-related land use data for state water planning purposes.

Based on its review of the California methodology and its own experience, the division developed a water-related land use inventory program. This program included the use of 35mm slides, United States Geological Survey (USGS) 7-1/2 minute quadrangle maps, field-mapping using base maps produced from the 35mm photography and a computerized GIS to process, store and retrieve land use data.

Areas for survey were first identified from previous land use studies and any other available information. The identified areas

were then photographed using an aircraft carrying a high quality 35mm single lens reflex camera mounted to focus along a vertical axis to the earth. Photos were taken between 6,000 and 6,500 feet above the ground using a 24mm lens. This procedure allowed each slide to cover a little more than one square mile with approximately 30 percent overlap on the wide side of the slide and 5 percent on the slide's narrow side.

The slides were then indexed according to a flight-line number, slide number, latitude and longitude. All 35mm slides were stored in files at the division offices and cataloged according to township, range and section, and quadrangle map location.

Water-related land use areas were then transferred from the slide to USGS 7-1/2 minute quadrangle maps using a standard slide projector with a 100-200mm zoom lens. This step allowed the technician to project the slide onto the back of a quadrangle map. The image showing through the map was adjusted to the map scale with the zoom lens. Field boundaries and other water-use boundaries were then traced on the 7-1/2 minute quadrangle map.

Next, a team was sent to use the map in the field to check the boundaries and current year land use field data on the 7-1/2 minute quadrangles.

The final step was to digitize and process the field data using ARC/INFO software developed by Environmental Systems Research Institute (ESRI).

Present Methodology

Starting in 2000 with the land use survey of the Uintah Basin, the division further improved its land use program by using digital data for the purposes of outlining agricultural and other land cover boundaries. The division uses satellite data, USGS Digital Orthophoto Quadrangles (DOQs), National Agricultural Imagery Program (NAIP), and oth-

er digital images in a heads-up digitizing^{III} mode for this process. This allows the division to use multiple technicians for the digitizing process.

Digitizing is done as line and polygon files using ArcMap 9/10 or ArcView 3.2 with a satellite image or DOQ image as a background with other layers added for reference. Boundary files are created in logical groups so that the process of edge-matching along quad lines is eliminated and precision is increased. All boundaries of individual agricultural fields, urban areas, and significant riparian areas are precisely digitized.

Once the process of boundary digitizing is done, boundary line files are converted to polygons and loaded onto tablet PCs. Field crews are then sent to label and field check the boundary file as well as the crop or land cover type for each polygon. Each tablet PC is attached to a GPS unit for real-time tracking to continuously update the field crew's location during the field labeling process. This improved process has saved the division much time and money and even greater savings will be realized as the new statewide field boundaries are completed. When the time comes to re-inventory a basin, existing boundaries will be used and will only be modified in areas where they have actually changed.

Once processed and checked, the data is filed in the State Geographic Information Database (SGID) maintained by the State Automated Geographic Reference Center (AGRC). Once in the SGID, the data becomes available to the public. At this point, the data is also ready for use in preparing various planning studies.

In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Areas not inventoried are mainly desert, rangeland and forested areas.

Wet/open water areas and dry land agriculture areas are mapped if they are within or border irrigated lands. As a result, the numbers of acres of wet/open water areas and dry land agriculture reported by the division may not represent all such areas in a basin or county.

During land use inventories, the division uses 11 hydrologic basins as the basic collection units. County data is obtained from the basin data. The water-related land use data collected statewide covers more than 2,700,000 acres of dry and irrigated agricultural land. This represents about 5 percent of the total land area in the state.

JORDAN RIVER BASIN WATER-RELATED LAND USE DATA

Basin Description

The Jordan River Basin covers about 780 square miles and comprises nearly the entirety of Salt Lake county. The Wasatch Range to the east, Traverse Mountains to the south, Oquirrh Mountains to the west, and Great Salt Lake to the north generally define the boundary of the drainage.

Elevations within the Jordan River Basin range from 4,190 feet at the shores of Great Salt Lake to nearly 11,500 feet at points along the Wasatch Range. The Oquirrh Mountains on the west of the study area rise to more than 9,500 feet while the Traverse Mountains peak at about 6,700 feet.

Due to the wide range in elevation, a wide range of climates also exists within the study area. The climate of the basin has reached -30° F in the winter and more than 100° F in the summer. Precipitation in the study area ranges from 12 to 16 inches on the valley floors to 60 inches in the higher elevations of the Wasatch Range. It is one of

Utah's wettest Basins, receiving an average of 23 inches of precipitation annually¹. Most of the study area's precipitation falls on the Wasatch Range in the form of snow in the winter months.

In recent years, agricultural lands have dwindled due to the rapid population expansion and development of the area. As of 2008, the state of Utah population estimate reached 2,757,779. In that same year, about 37 percent of the state lived in the Jordan River Basin (1,030,519). The majority of that population resided at the base of the Wasatch Front between Salt Lake City and Draper. The basin's largest cities include Salt Lake City (pop. 178,858) West Valley City (pop. 119,841), and Sandy City (pop. 94,203).

Data Collection

The Division inventoried water-related land use in the Jordan River Basin

Annual
Precipitation
For 2008

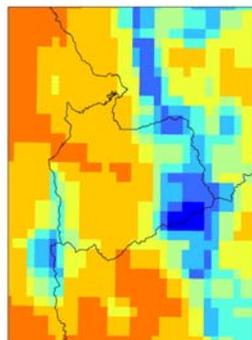
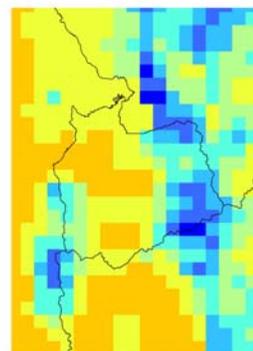
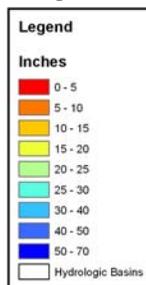
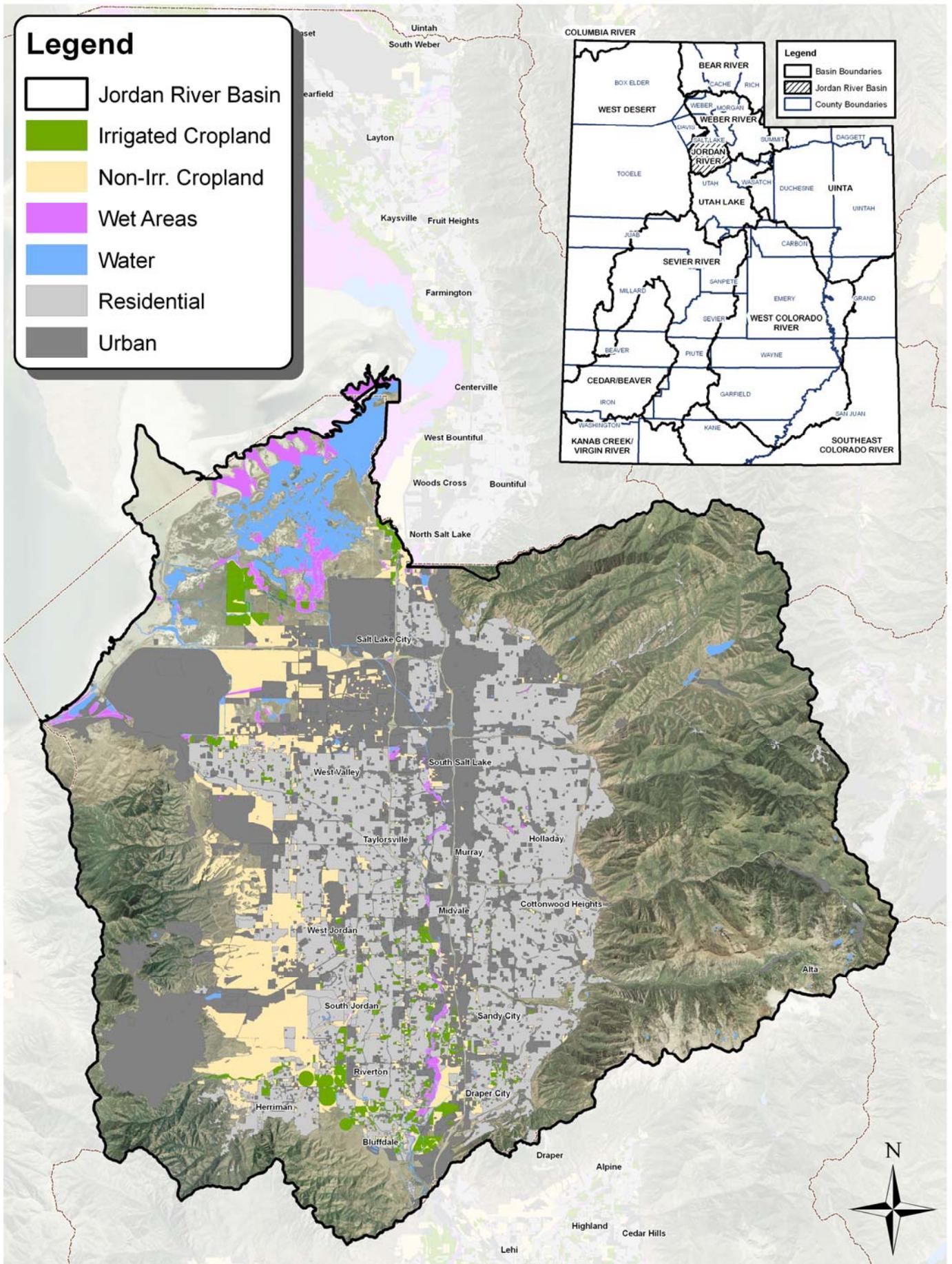


Figure 1



Average
Annual
Precipitation
1971 to 2000

Figure 2 Mapped Water-Related Land Use in 2008 and Basin Location



during the summer of 2008. Previous inventories were done in 1988, 1994, and 2002. In 2008, the division inventoried nearly 39,000 acres of agricultural land in the Jordan River Basin. This represents roughly 8 percent of the total land area in the entire basin. Figure 2 illustrates the water-related land use of the basin and shows that urban and agricultural land use is widespread throughout the basin.

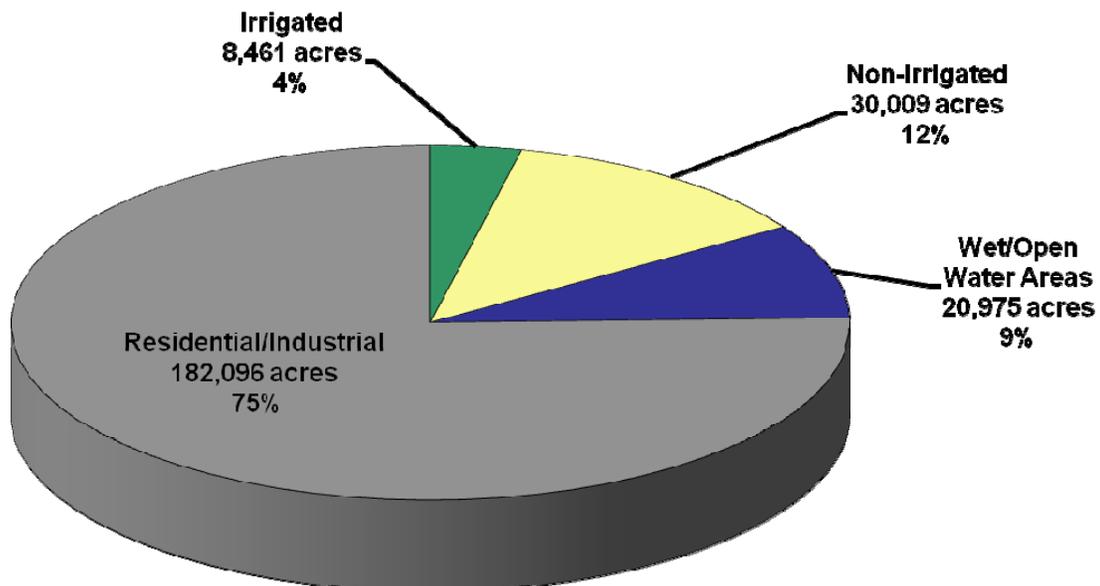
Data Summary

Figure 3 shows four categories of water-related land use by percentage and acreage. Of the 39,000 agricultural acres

inventoried in 2008, only 8,461 acres were irrigated lands (including land that was sub-irrigated), and 30,009 were non-irrigated (including land that was fallow and idle). Other categories that were inventoried include: 20,975 acres of wet/open water areas (including reservoirs and lakes), and a majority of the acres (182,096) were residential/industrial areas (including farmsteads and rural housing).

The division has further classified the water-related land use within the basin. Figure 4 represents data from the surface irrigated and sub-irrigated cropland categories. The data are broken down into 10 different subcategories.

Figure 3 Delineation of Water-Related Land Use Categories within the Jordan River Basin in 2008.



Total basin acreage for irrigated lands, non-irrigated lands, wet/open water areas, and residential/industrial are presented in Table 1. Table 2 provides a comparison of acreage totals by survey year.

Due to changes in methodology, improvements in imagery, and upgrades in software and hardware, increasingly more refined inventories have been made in each succeeding year of the Water-Related Land Use Inventory. While this improves the data we report, it also makes comparisons to past years difficult. Making comparisons between datasets is still useful; however, **increases or decreases in acres reported should not be construed to represent**

definite trends or total amounts of change up or down. To estimate such trends or change, more analysis is required.

Figure 4 Breakdown of Irrigated Cropland within the Jordan River Basin in 2008.

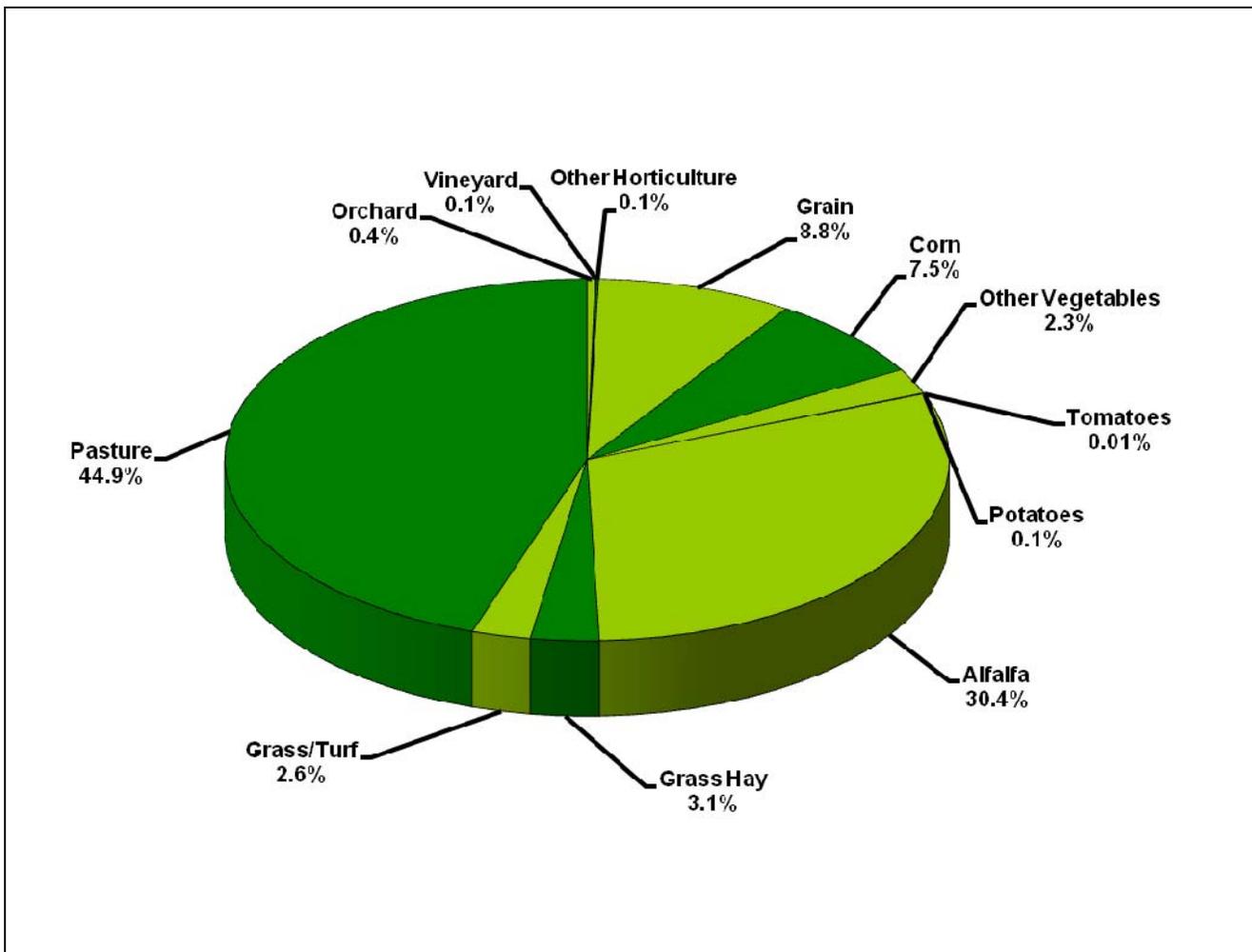


Table 1 Jordan River Basin Land Use Summary of Land Cover by County for 2008

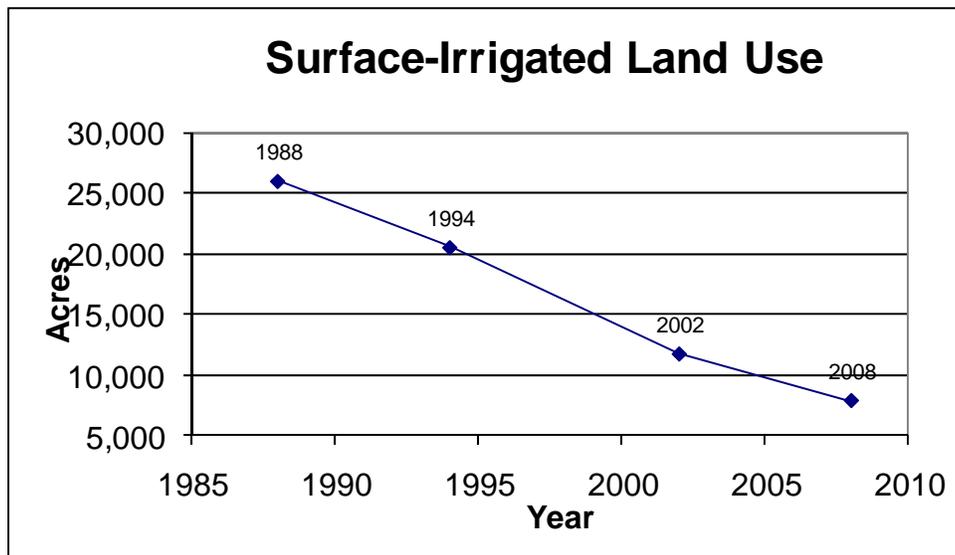
JORDAN RIVER BASIN LAND USE 2008 (Acres)			
Category	Cover	Salt Lake	Total
		County	
Surface-Irrigated			
	Orchard	29	29
	Vineyard	4	4
	Other Horticulture	8	8
	Grain	692	692
	Corn	589	589
	Sorghum	0	0
	Other Vegetables	179	179
	Potatoes	5	5
	Onions	0	0
	Beans	0	0
	Tomatoes	1	1
	Alfalfa	2,402	2,402
	Grass Hay	241	241
	Grass/Turf	207	207
	Pasture	3,546	3,546
	Irrigation Method		
	<i>Flood</i>	5,201	5,201
	<i>Sprinkle</i>	2,703	2,703
	Subtotal	7,904	7,904
Sub-Irrigated			
	Pasture-subirrigated	553	553
	Grass Hay-subirrigated	4	4
	Subtotal	557	557
	Total Irr. (Surface & Sub)		8,461
Non-Irrigated			
	Fallow	1,220	1,220
	Idle	5,879	5,879
	Dry Grain/Seeds	10,015	10,015
	Dry Alfalfa	104	104
	Dry Pasture	5,966	5,966
	Dry Idle	6,821	6,821
	Subtotal	30,005	30,005
Other Non-Irrigated			
	Range Pasture	3	3
Wet/Open Water Areas			
	Wet Flats	12	12
	Riparian	6,547	6,547
	Streams	1,384	1,384
	Reservoirs	838	838
	Ponds & Lakes	11,588	11,588
	Sewage Lagoon	61	61
	Evaporation Pond	549	549
	Subtotal	20,978	20,978
Residential/Industrial			
	Farmsteads	673	673
	Residential	92,783	92,783
	Urban Turf Areas	9,395	9,395
	Commercial/Industrial	79,246	79,246
	Subtotal	182,097	182,097
Total Land Use/Land Cover		241,544	241,544

Table 2 Comparison of Land Cover Totals by Inventory Year*

JORDAN RIVER BASIN LAND USE (Acres)	
	Basin Total
1988 Land Use Summary	
Surface-Irrigated	26,009
Sub-Irrigated	950
Non-Irrigated	25,958
Other Non-Irrigated	0
Wet/Open Water Areas	43,976
Residential/Industrial	125,253
Total land use/Land Cover	222,146
1994 Land Use Summary	
Surface-Irrigated	20,535
Sub-Irrigated	77
Non-Irrigated	27,982
Other Non-Irrigated	0
Wet/Open Water Areas	43,094
Residential/Industrial	131,589
Total land use/Land Cover	223,277
2002 Land Use Summary	
Surface-Irrigated	11,748
Sub-Irrigated	611
Non-Irrigated	28,635
Other Non-Irrigated	0
Wet/Open Water Areas	36,900
Residential/Industrial	171,866
Total land use/Land Cover	249,761
2008 Land Use Summary	
Surface-Irrigated	7,904
Sub-Irrigated	557
Non-Irrigated	30,005
Other Non-Irrigated	3
Wet/Open Water Areas	20,978
Residential/Industrial	182,097
Total land use/Land Cover	241,544

* Please refer to the word of caution on page 6 regarding comparisons between datasets.

Figure 5 Surface Irrigated Land Use Comparison Graph



Data Access

GIS data used in this summary may be downloaded from the Utah AGRC. Current land use datasets are available as a statewide layer or by county and are offered in shapefile and geodatabase formats. To download the most recent dataset, Go to:

<http://www.water.utah.gov/Planning/landuse/index.htm>

For past GIS datasets, Please contact Technical Services at the Division of Water Resources

Past Land Use Reports for this area and a PDF of this report can be found at

<http://www.water.utah.gov/planning/landuse/publ.htm>

Metadata is available at

<http://www.water.utah.gov/planning/landuse/gisdata.htm>

Additional Jordan River Basin reports as well as many other reports can be found at

<http://www.water.utah.gov/planning>

REFERENCES

1. Utah State Water Plan, Jordan River Basin, Utah Division of Water Resources, June 2010.
2. Prism Group, Oregon State University, <http://prism.oregonstate.edu/>
Maximum and Minimum precipitation calculated using Zonal Statistics tool with ESRI ArcInfo license
ftp://prism.oregonstate.edu/pub/prism/us_30s/grids/ppt/Normals/us_ppt_1971_2000.14.gz
ftp://prism.oregonstate.edu/pub/prism/us/grids/ppt/2000-2009/us_ppt_2008.14.gz

GLOSSARY

- I. Phreatophyte - A deep-rooted plant that obtains water from a permanent ground supply or from the water table.
- II. Planimetered or dot-counted - process to determine acreage by assigning an acreage value to a “dot” based on map scale and then counting the number of “dots” within a specific boundary.
- III. Heads-up digitizing - Manual digitization by tracing a mouse over features displayed on a computer monitor, used as a method of vectorizing raster data.

