

VIRGIN RIVER MANAGEMENT PLAN (VRMP)



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District

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Virgin Town

Springdale Town

Grand Canyon Trust

People for the USA

Dixie Soil Conservation District

Dated: June 1999

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VIRGIN RIVER MANAGEMENT PLAN (VRMP)

EXECUTIVE SUMMARY

Washington County is growing at an unprecedented rate. The population has tripled in the past 20 years. From 1990 to 1995 the population increased 28 percent or an average of 5.6 percent per year. This rapid growth presents many challenges to maintaining the region's desirable quality of life. Among the most challenging of issues is the provision of adequate water supplies to sustain domestic, industrial, agricultural and natural resource uses.

The Virgin River and its related flood plain are the lifeblood of the ecosystem within Washington County. The diversion of water for irrigation from the Virgin River and its tributaries preceded or paralleled the settlement of most communities in the county. The human and ecological needs are much the same today, as in the past. The future growth of the Virgin River Basin is dependent upon proper development of water from the Virgin River and its tributaries. The river areas are habitats for a large number of wildlife, including six native fish.

Diversions, dams, road construction, river channel changes, introduction or invasion of non-native plants and fish, recreation use, residential development along the river, and past livestock grazing have caused a loss of habitat for some native fish, mammals, birds and reptiles.

This plan is sponsored by the Washington County Water Conservancy District, Utah State Department of Natural Resources, Washington County, Shivwits Band Paiute Indian Tribe, St. George City, Washington City, Hurricane City, La Verkin City, Toquerville Town, Ivins Town, Rockville Town, Santa Clara City, Virgin Town, Springdale Town, Bureau of Land Management, Virgin River Land Preservation Association, Grand Canyon Trust, Irrigation Companies, People for the USA, the Utah Department of Environmental Quality and Dixie Soil Conservation District.

The VRMP does not take administrative authority from individual sponsors or mandate specific actions to be taken by anyone. Sponsorship of the plan involves a commitment to apply best efforts using available resources and legal authority to meet the goals of the plan.

This plan is prepared by the sponsors to develop an integrated approach to the sound development and management of the Virgin River and its tributaries. The goals will promote the following:

- ! Establish a cooperative, broad-based and consensus-driven process for resolving resource issues connected with Virgin River watershed.

- ! Improve communication, understanding and coordination of efforts on resource issues.
- ! Develop informational opportunities for the general public regarding the goals and actions of the VRMP.
- ! Seek to cooperate and collaborate with other persons or entities not a party to the VRMP who might have a stake in actions proposed to be taken.
- ! Provide sufficient water resources to meet Washington County's needs.
- ! Conserve, enhance, protect native species and their habitat.
- ! Assist in reducing the likelihood of additional species listings.
- ! Assist in the development and implementation of a trail plan with community and landowner participation.
- ! Maintain and improve water quality, including but not limited to addressing salinity and nitrate issues.
- ! Recommend and assist in implementation of improved agricultural and culinary water conservation strategies.
- ! Protect and enhance the 100-year flood plain and watersheds.
- ! Determine and establish appropriate instream flows for all stream reaches.
- ! Protect and respect private property and existing water rights.
- ! Address water reuse opportunities and issues.

This plan along with the Virgin River Resource Management and Recovery Program (VRRMRP), was prepared in conjunction with the U.S. Fish and Wildlife Service, will provide the necessary actions for improvement of the wildlife species listed under the Endangered Species Act and allow for water development. The VRRMRP develops base line conditions and mitigation banking for native species. The VRRMRP assigns responsibility and sets up a funding structure to carry out and meet the goals of the Program. The VRRMRP establishes minimum base line flows and conditions against which all projects must be evaluated.

The plan proposes a several pronged approach to reach the goals and objectives for management, development, and habitat conservation in the Virgin River drainage 100-year flood plain. Actions being considered include:

- A. Reduction of the Virgin River water flows during the winter period above the Washington Field diversion to meet plan objectives.
- B. Development of cooperative management strategies with private land owners. who are willing and interested in protecting river and flood plain values.
- C. Acquisition of protective easements with willing land owners to improve or protect river and flood plain values.
- D. Implementation of zoning to protect river and flood plain values.
- E. Completion of effective mapping of the 100-year flood plain on at least two foot contours, and encourage completion of meander corridor and stability studies.
- F. Restoration of native fish habitat by providing year-long instream flows in river
- G. Implementation of measures to reduce the impact of La Verkin Springs (Pah Tempe Springs) on the Virgin River's water quality.

- H. Potential construction of Sand Hollow Reservoir to provide an additional 30,000 acre-feet of water for human-use.
- I. Potential replacement of diversions downstream of Gunlock Reservoir on the Santa Clara River with a pipeline from Gunlock Reservoir to Ivins Reservoir to save water now lost to seepage.
- J. Potential piping of water on Ash Creek and tributaries to replace open ditches and reduce losses from seepage.
- K. Completion of a study to determine the relationship between ground water aquifers and the Hurricane fault and between the Santa Clara drainage and the surface water system.
- L. Discontinuing water diversions on lower La Verkin Creek with cooperation of property owners, to enhance spinedace habitat.
- M. Development and implementation of a water conservation plan to save an estimated 25% of present water use.
- N. Recycling of water from sewer treatment plants for irrigation of parks, golf courses, and other suitable uses.
- O. Completion of a water quality inventory and development of a plan to maintain or improve water quality.
- P. Completion of a watershed inventory and plan to maintain or improve watershed values.
- Q. Encourage and assist with the development of a trail corridor.

Summary

The VRMP charts a new and ambitious course for conducting planning and management activities within the Virgin River drainage. Where parties have traditionally collided, the VRMP establishes a process whereby innovative solutions may be created to meet the challenges and utilize the various opportunities that are present in the Virgin River drainage. Through cooperation, instead of confrontation, the stakeholders within the Virgin River drainage will be able to successfully plan and manage river-related resources.

VIRGIN RIVER MANAGEMENT PLAN (VRMP)

CHAPTER 1. INTRODUCTION & INFORMATION

A. PURPOSE

This plan is prepared by the sponsors to develop an integrated approach to the proper development and management of the Virgin River and its tributaries. In the past, successful resource management within the Virgin River watershed has been hindered by a lack of coordination between various planning and management entities. Quite often this resulted in piecemeal, fragmented management of the River. Where parties have traditionally collided, the VRMP establishes a neutral process whereby innovative solutions may be created to meet the challenges and utilize the various resources that are present in the Virgin River watershed.

The coordinated effort established by the VRMP will help ensure the continued prosperity and well-being of the citizens of Washington County and simultaneously advance wildlife and conservation values associated with the Virgin River. The VRMP charts a new and ambitious course for conducting planning and management activities within the Virgin River watershed. Through cooperation, instead of confrontation, the stakeholders within the Virgin River watershed will be able to successfully plan and manage river-related resources.

While the VRMP does not take administrative authority from individual sponsors or mandate specific actions to be taken by any one, sponsorship of the plan involves a commitment to apply best efforts using available resources and legal authorities to meet the goals of the plan.

This plan along with the Virgin River Resource Management and Recovery Program (VRRMRP), was prepared in conjunction with the US Fish and Wildlife Service and others, will provide the actions necessary for improvement of habitat for the wildlife species listed under the Endangered Species Act (ESA) and allow for sound water development. The VRRMRP develops base line conditions and mitigation banking for native species protection. It assigns responsibility and sets up a funding structure to carry out the program goals. Minimum base line flows and conditions against which all

projects must be evaluated will be established. Those actions which will be completed by the VRRMRP will be shown throughout the plan.

B. THE NEED FOR A MANAGEMENT PLAN

Population growth in Washington County over the past several years has been unprecedented. The growth averaged in excess of 6 percent annually since 1970 and resulted in the tripling of the region's population in the past 20 years (Five County Association of Governments 1990). A study completed in August 1994 by the WCWCD shows population projections ranging from 203,937 to 552,872 by the year 2040. From 1990 to 1995, the population increased 28 percent. This is an average of 5.6 percent per year. The population projections, shown in Table 1 (Reference 15), are as follows:

- ! Low Growth - Current growth rates will not be sustained and future rates will average 5.7 percent from 1990 to 1995, then decline to an average rate of 1.40 percent, from 2035 to 2040.
- ! Medium Growth - Current growth will continue to increase, to a peak averaging 6.70 percent between 1990 and 1995, then drop off to an average rate of 2.15 percent from 2035 to 2040.
- ! High Growth - Growth will continue to increase to a peak averaging 6.70 percent between 1995 and 2000, then drop off to an average rate of 2.50 percent from 2035 to 2040.

TABLE 1. Population Projections

POPULATION PROJECTIONS ADOPTED FOR STUDY				COMPARATIVE PROJECTIONS	
YEAR	LOW	MEDIUM	HIGH	UOPB* 1998	CONSTANT RATE OF GROWTH
1990**	48,560	48,560	48,560	48,560	48,560
1995	63,767	67,158	67,158	68,500	63,136
2000	80,229	90,298	92,880	86,215	82,087
2005	96,676	118,016	127,269	106,590	106,726
2010	112,074	150,621	171,119	130,521	138,761
2015	128,668	188,601	224,176	155,007	180,411
2020	144,867	227,812	283,398	177,558	234,564
2025	160,731	266,671	349,799	212,720	304,971
2030	175,727	304,669	419,480	254,827	396,511
2035	190,242	342,190	488,658	305,269	515,528
2040	203,937	380,592	552,872	365,697	670,269

*Utah Office of Planning and Budget (UOPB)

**1990 Census figures

While it is not likely that current rates of growth will be sustained indefinitely, there are no indications that growth will slow significantly in the near future. Las Vegas, Nevada, for example, has experienced growth rates of up to 12 percent annually for the past ten years. The Washington County Water Conservancy District has adopted the Medium Growth projection as the most reliable basis for planning actions.

Along with prosperity, rapid growth has brought many challenges to maintaining the region's desirable quality of life. Among the most significant of these challenges is providing adequate water supplies to sustain domestic, industrial, and agricultural uses while protecting and enhancing natural ecosystems.

The Virgin River and its related flood plain is a critical component of riparian ecosystems within Washington County. The river flood plain is habitat for a host of birds including the bald eagle, golden eagle, peregrine falcon, Southwest willow flycatcher, ducks, gulls, hawks, hummingbirds, owls, sandpipers, sparrows, etc. Other wildlife in the area include beaver, bobcats, cotton tails, deer, fox, marmot, raccoon, bighorn sheep, squirrels, lizards, snakes and six native fish including the woundfin minnow, the Virgin River chub, the Virgin spinedace, the speckled dace, and the desert sucker (See Appendix C). Some of these species have been listed under the ESA. The river also hosts a number of plant species including cottonwood, willow, ash, tamarisk, Russian olive, sedges, reeds, grasses and shrubs. Some of these species are currently being managed under

a special status designation due to factors compromising their prospects for survival. (See Appendix C).

Maintaining the quality of life and providing for future growth and prosperity within the Virgin River Basin is dependent upon water from the Virgin River. Because the riparian habitats contained within the flood plains of the Virgin River remain largely undeveloped, the sponsors recognize a unique opportunity to protect this resource for the many needs competing for its values as well as reducing the likelihood of additional species listings under the ESA.

C. VRMP GOALS

Through implementation of the plan, the sponsors will pool their collective resources to achieve synergies intended to promote the following goals:

- ! Establish a cooperative, broad-based and consensus-driven process for resolving resource issues connected with Virgin River watershed.
- ! Improve communication, understanding and coordination of efforts on resource issues.
- ! Develop informational opportunities for the general public regarding the goals and actions of the VRMP.
- ! Seek to cooperate and collaborate with other persons or entities not a party to the VRMP who might have a stake in actions proposed to be taken.
- ! Provide sufficient water resources for Washington County's needs.
- ! Conserve, enhance, protect and recover native species and their habitat.
- ! Assist in reducing the likelihood of additional species listings.
- ! Assist in the development and implementation of a trail plan with community and landowner participation.
- ! Maintain and improve water quality, including but not limited to addressing salinity and nitrate issues.
- ! Recommend and assist in implementation of improved agricultural and culinary water conservation strategies.
- ! Protect and enhance the 100-year flood plain and watersheds.
- ! Determine and establish appropriate instream flows for all river reaches.
- ! Recognize and respect private property and existing water rights.
- ! Address water recycling opportunities and issues.

Sponsorship of the VRMP entails a commitment to the goals stated above. These goals will be implemented through management actions, projects and other mechanisms for which proposals are described in succeeding sections of this document. These actions, projects and other mechanisms are subject to further refinement or amendment through the process set forth in Chapter 14. While all sponsors will participate in the integrated process outlined in Chapter 14, different sponsors may play differing roles in the implementation process and not all sponsors will necessarily be involved in implementation or be in agreement with each and every element of the plan.

D. PLANNING AREA DESCRIPTION AND LOCATION

The Virgin River's headwaters are in Washington, Kane and Iron Counties of Utah. The lower watershed includes portions of Mojave County, Arizona and Clark and Lincoln Counties, Nevada. The river eventually empties into Lake Mead in southeastern Nevada. The distance from the headwaters to Lake Mead is approximately 200 miles and the basin above Lake Mead includes approximately 5900 square miles. The river yields 130,000 acre feet (AF) of water per year on average, but has provided as much as 337,000 AF and as little as 69,000 AF.

Washington County is located in southwestern Utah, adjacent to both Nevada and Arizona. The county has a diverse topography and climate due to a wide range of elevations, but is generally arid and desert-like. Most of the people live in a fairly narrow corridor along the Virgin River at an elevation of about 2800 feet above sea level. Outlying communities also contribute to the population base.

The region is noted for its favorable climate, scenery, lifestyle, and physical and economic environment. Unsurpassed recreation opportunities are used by millions of visitors each year who visit public land facilities and reservoirs managed for recreation. Recreation and tourism had a local tax impact of \$3.3 million in Washington County in 1993.

Most of Washington County is in the Virgin River watershed. The elevation of the county ranges from 2500 feet above sea level near St. George to 10,000 feet in some parts of Zion National Park. Eighty-six percent of the land in the county is state and federal land managed by the Bureau of Land Management, National Park Service, Forest Service, and Utah School and Institutional Trust Lands Administration (SITLA). A recent population management study by the WCVCD identified the following constraints which would preclude development in significant portions of the county: Federal ownership, fault zones, topography, wetlands, flood plains, geologic hazards and endangered species habitat (Reference 14).

The diversion of water for irrigation from the Virgin River or its tributaries has preceded or paralleled the settlement of all the communities located along the Virgin River. Water from the river is needed by all the communities along the river for agricultural, municipal and industrial uses and for protection of ecosystems. Without water from the river the settlement and present development would not have occurred. The complete history of early settlement efforts to tame the river and put it to a beneficial use could fill volumes. The need for sound water development is as great today as it was in the past although water conservation is expected to play a larger role in the future.

The VRMP planning area includes all of the 100-year flood plains of the main stem Virgin River between Zion National Park and the Utah state line; the main stem Santa Clara River from the headwaters to Virgin River confluence; Ash Creek from Ash Creek Reservoir to Virgin River confluence; and La Verkin Creek from the headwaters to Virgin

River confluence. (Figures 1, 2, and 3) Land ownership in the planning area is shown in Table 2.

TABLE 2. Land Ownership in Virgin River Management Area (in acres)

Streams	Private and other	School Trust	Public	Paiute Indian Res.	Total
Virgin	5825	36	1186	0	7,047
Santa Clara	834	15	203	215	1,267
Ash Creek	239	29	215	0	483
La Verkin Creek	145	0	2	0	147
Total	7,043	80	1,606	215	8,944
Percentage	80%	1%	16½%	2½%	100%

E. HISTORY OF VIRGIN RIVER AND DIVERSIONS

Virgin River Basin prehistory indicates that diversion of water from the river for cultivation evolved from the earliest inhabitants of the area. The people who inhabited the area prior to 2000 years ago, the Paleo-Indian and the Archaic people, were mainly hunters and gathers. About 2000 years ago the basket makers evolved. They are credited with the introduction of horticulture. The basket makers over the next 900 years evolved into what we today call the Anasazi (the "ancient ones"). They were excellent agriculturists and used every type of water control device to bring water to their fields where they grew corn, beans, and squash. They developed an elaborate diversion and irrigation system. The Anasazi abandoned the area around 800 years ago. The Southern Paiute Indians were living in the area when the first white man came. The Paiutes cultivated crops in some areas, but were mainly gatherers and hunters.

Anglo settlement of the Virgin River Basin is a story of colonization by the Mormon Church. In 1854, missionaries were sent out under Jacob Hamblin to prepare the way for later settlers. In the fall of 1854, Hamblin and his associates, with the help of the Indians, set to work on a dam across Santa Clara Creek. In 1856, the first settlement of Santa Clara (about one-half mile above the present Santa Clara town) was established by a few farmers. In 1857, Washington was settled and the first water for irrigation was taken from the Virgin River. The area became known as "Utah's Dixie" after the first cotton harvest in 1855. In 1858, an experimental cotton farm was started at Hebersville, later called Price, a few miles below St. George (Reference 7).

By 1903 the settlements on the Virgin River, beginning with those highest in the drainage, were Springdale, Shunesburg, Rockville, Grafton, Virgin City, Hurricane Bench, La Verkin, Washington, St. George, Bloomington, Price, and Atkinville in Utah. There was also Littlefield in Arizona and Mesquite and Bunkerville in Nevada. In 1902 at

least 15 diversions existed on the river at these towns with 41 ditches irrigating 6,548 acres (Reference 6). Since the beginning of these settlements along the Virgin River, diversions and seasonal low flows caused the river to dry up in some sections during dry months of the year. According to the journals of early settlers, the Virgin River sometimes dried up below Bloomington for several miles and began to flow again at the springs near Littlefield. See Figures 2 and 3 for a map of towns and diversions on the Virgin River.

Table 3 shows the towns, diversions and dates of settlements on the Virgin River, Santa Clara River, La Verkin Creek and Ash Creek. A listing of Virgin River drainage diversions and their locations is included in Appendix A.

TABLE 3. Diversions and Settled Dates

Virgin River

<u>Name</u>	<u>Date Settled</u>	<u>Diversion Completed</u>
Behunin Farm	1863	1863
Springdale	1862	1862
Shunesburg	1862	1862*
Rockville	1860	1860
Grafton	1859	1859
Virgin (Pocketville)	1859	1859
Quail Creek Reservoir Diversion		1985
Hurricane	1906	1904**
La Verkin	1898	1891**
Atkinville	1860's	1860's*
Jarvis Field		1875*
Virgin Ditch - St. George Field	1861	1862*
Old Washington Fields	1857	1857*
Present Washington Fields		1893
Sheldon Johnson		1953

*no longer exist

**no longer exist; water is provided through the Quail Creek Reservoir pipeline

SANTA CLARA RIVER

<u>Name</u>	<u>Date Settled</u>	<u>Diversion Complete</u>
Santa Clara	1855	1855
Gunlock	1857	1857
Tonaquint	1856	1856
Veyo	—	—

ASH CREEK

<u>Name</u>	<u>Date Settled</u>	<u>Diversion Complete</u>
Pintura	1863	1863
Anderson Junction	—	—
Toquerville	1857	1857

The diversions have been factors in loss of habitat for some native fish, mammals, birds and reptiles, along with a myriad of other conditions such as past livestock grazing, road

construction, river channel changes, transplanting of non-native game and bait fish, introduction and invasion of non-native plant species, recreation use, and urban development.

F. WATER NEEDS, CONSERVATION AND WATER RIGHTS

1. Water Needs

Current and anticipated growth creates the need to provide sufficient water supplies for increased utilization of water for municipal and industrial uses. Projected total water demands are shown in Table 4. (WCWCD Purpose & Needs Study)

In estimating future water demands, current rates of water use were applied to the expanding population and concurrent land uses and modified to reflect realistic water conservation practices. The total future water demands for Washington County consists of three components:

- ! Municipal and Industrial (M&I) Demands—The water required to meet the residential, commercial, institutional, and industrial needs of the population of Washington County. The major portion of the M&I demand is supplied by treated water distributed by municipal water systems, but also includes private systems and individual residences. The M&I demand may also be referred to interchangeably as public water supply, culinary water supply, or domestic water supply.
- ! Secondary (Landscape) Water Demands—Untreated water used for irrigation of privately and publicly owned lawns, gardens, parks, cemeteries, golf courses and other areas associated with the populace. This is separate from, and in addition to, M&I supplies used to water residential and public lawns and landscaping. Secondary Water Systems may also be referred to as Dual Water Systems.
- ! Agricultural Irrigation Demands—The water applied to agricultural lands for the growing of crops or pasture.

This plan is designed to develop and manage the water resources of the Virgin and Santa Clara Rivers and Ash Creek and La Verkin Creek. Additional water needs will be met by conservation, ground water development, water recycling, and potentially the Lake Powell pipeline.

Table 5 shows total projected M & I water demands without conservation. Table 6 shows water M & I demands with conservation. Both tables show estimated shortages if additional waters are not developed, river management changes made, and distribution systems improved. It would require an additional 40,000 AF by 2020 and 66,000 AF by 2040, if conservation is not implemented.

TABLE 4. Projected Total Water Demands (AF/YR)^

A. Municipal and Industrial Demands				B. Landscape Water Demands			
YEAR	Low Growth	Medium Growth	High Growth	YEAR	Low Growth	Medium Growth	High Growth
1990*	19040	19040	19040	1990*	14711	14711	14711
1995	25003	26333	26333	1995	19317	20345	20345
2000	31458	35406	36418	2000	24304	27355	28137
2005	37907	46274	49902	2005	29287	35751	38554
2010	43944	59059	67096	2010	33951	45629	51838
2015	50451	73951	87900	2015	38978	57134	67911
2020	56802	89325	111120	2020	43886	69013	85852
2025	63022	104562	137156	2025	48691	80784	105967
2030	68902	119461	164478	2030	53234	92295	127076
2035	74594	134173	191603	2035	57631	103662	148032
2040	79964	149230	216781	2040	61780	115295	167485

C. Agricultural Irrigation				D. Total Annual Demands			
Year	Low	Medium	High	Year	low	Medium	high
1990*	87740	87740	87740	1990*	121491	121491	121491
1995	87740	85340	80020	1995	132061	132018	126698
2000	87740	82940	72290	2000	143502	145700	136845
2005	87740	80540	64570	2005	154933	162565	153026
2010	87740	78140	56850	2010	165635	182827	175784
2015	87740	75740	49130	2015	177169	206825	204941
2020	87740	73350	41410	2020	188428	231688	238382
2025	87740	70950	33690	2025	199454	256296	276813
2030	87740	68550	25960	2030	209876	280306	317514
2035	87740	66150	18240	2035	219965	303985	357875
2040	87740	63750	10520	2040	229484	328275	394786

*Estimated actual use

^Reference 15, *Purpose and Needs Study*

TABLE 5. Water Demands Without Conservation (AF/YR) ^

A. Municipal and Industrial Demands			
YEAR	Low Growth	Medium Growth	High Growth
1990	19,040	19,040	19,040
1995	25,003	26,333	26,333
2000	31,458	35,406	36,418
2005	37,907	46,274	49,902
2010	43,944	59,059	67,096
2015	50,451	73,951	87,900
2020	56,802	89,325	111,120
2025	63,022	104,562	137,156
2030	68,902	119,461	164,478
2035	74,594	134,173	191,603
2040	79,964	149,230	216,781

B. Secondary System Demands			
YEAR	Low Growth	Medium Growth	High Growth
1990	14,711	14,711	14,711
1995	19,317	20,345	20,345
2000	24,304	27,355	28,137
2005	29,287	35,751	38,554
2010	33,951	45,629	51,838
2015	38,978	57,134	67,911
2020	43,886	69,013	85,852
2025	48,691	80,784	105,967
2030	53,234	92,295	127,076
2035	57,631	103,662	148,032
2040	61,780	115,295	167,485

Total Annual M & I Demands			
Year	Low Growth	Medium Growth	High Growth
1990	33,751	33,751	33,751
1995	44,321	46,678	46,678
2000	55,762	62,760	64,555
2005	67,193	82,025	88,456
2010	77,895	104,687	118,934
2015	89,429	131,085	155,811
2020	100,688	158,338	196,972
2025	111,714	185,346	243,123
2030	122,136	211,756	291,554
2035	132,225	237,835	339,635
2040	141,744	264,525	384,266

Demand Shortage W/O Conservation			
YEAR	Low Growth	Medium Growth	High Growth
1990			
1995			
2000			
2005	-4,193	-19,025	-25,456
2010	-14,895	-41,687	-55,934
2015	-26,429	-68,085	-92,811
2020	-37,688	-95,338	-113,972
2025	-48,714	-122,346	-180,123
2030	-59,136	-148,756	-228,554
2035	-69,225	-174,835	-276,635
2040	-78,744	-201,525	-321,266

^Reference 15, *Purpose & Needs Study*

TABLE 6. Water Demands With Conservation (AF/YR) ^

A. Municipal and Industrial Demands				B. Secondary Systems Demands			
Year	Low Growth	Medium Growth	High Growth	Year	Low Growth	Medium Growth	High Growth
1990	19,040	19,040	19,040	1990	14,710	14,710	14,710
1995	24,290	25,582	25,582	1995	18,397	19,376	19,376
2000	29,662	33,384	34,339	2000	22,297	25,096	25,813
2005	33,576	40,988	44,201	2005	25,917	31,638	34,118
2010	36,413	48,937	55,597	2010	29,017	38,999	44,305
2015	38,921	57,051	67,812	2015	32,213	47,218	56,124
2020	42,199	66,360	82,551	2020	33,336	52,423	65,214
2025	46,819	77,679	101,893	2025	36,986	61,365	80,493
2030	51,188	88,747	122,191	2030	40,437	70,108	96,528
2035	55,416	99,677	142,342	2035	43,777	78,743	112,447
2040	59,405	110,863	161,047	2040	46,929	87,579	127,223

Total Annual M&I Demands				Demand Shortage W/ Conservation			
Year	Low Growth	Medium Growth	High Growth	Year	Low Growth	Medium Growth	High Growth
1990	33,750	33,750	33,750	1990			
1995	42,687	44,958	44,958	1995			
2000	51,959	58,480	60,152	2000			
2005	59,493	72,626	78,319	2005		-9,626	-15,319
2010	65,430	87,936	99,902	2010	-2,430	-24,936	-36,902
2015	71,134	104,269	123,936	2015	-8,134	-41,269	-60,936
2020	75,534	118,782	147,765	2020	-12,534	-55,782	-84,765
2025	83,806	139,044	182,387	2025	-20,806	-76,044	-119,387
2030	91,625	158,856	218,719	2030	-28,625	-95,856	-155,719
2035	99,193	178,420	254,789	2035	-36,193	-115,420	-191,789
2040	106,334	198,442	288,270	2040	-43,334	-135,442	-225,270

^ Reference 15, *Purpose and Needs Study*

2. Water Conservation

Water conservation must be initiated and succeed if the plan's goals are to be met. Estimates of potential reduced demands due to water conservation range from 15 percent to 25 percent.

The annual future water demands for Washington County with water conservation are shown in Table 6 for M&I plus Secondary (Landscape) projected needs through the year 2040 (Reference 15). Agricultural demand is not included because as municipal development increases, agricultural uses will decrease. Agricultural water rights may become a source of future water supplies to meet the demands of other sectors (Purpose and Needs Study). A draft conservation plan has been prepared for Washington County to address these issues (Reference 24). The plan's "Executive Summary" is included as Appendix G. Chapter 8 contains the actions recommended by VRMP to conserve water.

3. Surface Water Rights

Water rights are an important concern of this plan. Present water rights are legally vested and thus must be honored by this plan. There was less conflict over water rights in the early days of settlement in the Virgin River Basin. Settlement of all the communities by members of the Mormon Church enabled the early settlers to divide the water without litigation. Where disagreements arose between individuals, the conflicts were settled by church authorities. The Territorial Legislature allowed county select men to serve as guardians of the streams. A farmer could appear before them and be given certificates for water. In 1865, a law authorizing irrigation districts was passed. This was not used except for Santa Clara River. The Revised Statutes of Utah (1898) allowed those desiring to appropriate water to file a notice of appropriation with the county clerk within twenty days after making the appropriation. In 1901, a law was passed which allowed County Commissioners to appoint Water Commissioners to distribute the water. Most of the water is now controlled and distributed by irrigation companies. The current water rights are shown in Appendix B. Many of the actions proposed in the plan will require resolving water rights issues before they can be completed.

4. Current Developed Water Rights and Supply

The water that is either currently being used for culinary purposes or which could readily and easily be converted to such a use is shown in Table 7. The information contained in Table 7 was compiled in 1991 by the Washington County Water Conservancy District from records of municipal water rights of record from the Utah Division of Water Rights. These records were distributed to the various municipalities for review and comment regarding the actual current availability of the water for municipal use.

TABLE 7. Summary of Developed Water Rights

Municipality	Quantity - (AF)	Municipality	Quantity - (AF)	Municipality	Quantity - (AF)
Hildale	440 ¹	New Harmony	920.27	Hurricane	4,648.52
La Verkin	714.45	Rockville	113.37	St. George	26,512.35

Leeds	252.61	Santa Clara	1,261.92	Toquerville	724.00
Virgin	83.00	Gunlock	59.33	Washington	8,797.59
Springdale	1,182.62	Central	21.00	Pine Valley	1,272.62
Pintura	3.252	Vevo	183.91	Enterprise	160.16

¹ Vested in "Twin Cities Water Works". Water Right No. 81-295 and 81-951, used in Hildale and Colorado City.

² Vested in Pintura Culinary Water Company. Water Right No. 81-794(U8388)

The total developed water shown in the above table is 46,907 acre-feet. An additional 16,000 acre-feet has been developed from the Quail Creek Reservoir. Therefore, the total current developed water supply for Washington County is assumed to be approximately 63,000 acre-feet (WCWCD Purpose and Needs Study, March 1995).

G. POTENTIAL WATER SUPPLY

Groundwater and surface water is considered fully appropriated in the Virgin River drainage area with the exception of one area west of Hurricane and south of the Virgin River and the area tributary to Beaver Dam Wash. Therefore, supplies to meet the future demands will need to come from conservation and developing existing surface and ground water rights that haven't yet been perfected. An additional M & I supply may come from conversion of agriculture water rights to municipal uses. Major approved applications that are yet to be developed totaled over 280,000 Acre Feet in 1989. Potential local sources of future water supplies include surface water development, water conservation, recycling of treated water, conversion of agricultural water to M&I use, and groundwater development (*Purpose and Needs Reference 15*).

An estimate of the potential water supply for the Virgin River Basin is summarized in Table 8 below:

TABLE 8. Potential M&I Water Supplies

Potential M&I Water Supplies		
Source	Quantity (A/F)	Cumulative (A/F)
Current developed supply ¹	63,000	63,000
New projects (Surface Water) ²	19,700	82,700
Reuse ³	22,000	104,700
Agricultural Conversion ⁴	40,000	144,700
Ground Water Development ⁵	16,000	160,700
Water Conservation ⁶	16,000	176,700

¹ From tabulation of developed municipal water rights provided by WCWCD plus 16,000 AF yield from Quail Creek (Table 7).

² Estimate based on project yields of 10,500 AF/YR identified with BESTM computer model of Virgin River with zero shortage, removal of Pah Tempe Springs from the river, meeting current irrigation and river flow demands, plus potential development of Beaver Dam Wash and Santa Clara River.

³ Maximum reuse of treated water on golf courses and parks in the year 2040.

⁴ Assumes conversion of approximately 50 percent of the Hurricane, La Verkin, Ash creek and Washington Fields average annual water diversions to M&I use.

⁵ Includes 5,000 AF of projected seepage loss proposed off-stream reservoir.

⁶ Based on 25% saving from the current 63,000 AF developed.

Groundwater will continue to be developed in Washington County. Available evidence suggests that substantial underground supply exists though it has not been quantified to date. When the current USGS study is completed (3-4 years) a more accurate evaluation of the extent and reliability of this resource can be made.

The projects are listed below according to their ability to meet the forecasted water supply needs of Washington County. The demand shortage with conservation is shown in Table 6. Table 9 below shows the potential project implementation schedule based on medium growth with conservation.

The goals of the plan may be met with completion of these projects along with conservation of 16,000 AF, reuse of 22,000 AF and 8,100 AF from reduced winter flows. The total potential water yield from the plan is shown in Table 10.

TABLE 9. Potential Project Implementation Schedule[^]
(Based on Medium Growth w/Conservation)

YEAR	Required New Supply AF/YR			Potential Supply Source		
	Low Growth	Medium Growth	High Growth	Project	Yield (AF/YR)	Total (AF/YR)
2000				Santa Clara River	3,600	3,600
2005		7,626	13,319	Sand Hollow Reservoir	15,000	18,600
2010	430	22,936	34,902	Pah Tempe Springs	31,000	49,600
2015	6,134	39,269	58,936	Ash Creek	7,000	56,600
2020	10,534	53,782	82,765	Ground Water	11,000	67,600
2025	18,806	74,044	117,387	Lake Powell Pipeline	60,000	127,600
2030	26,625	93,856	153,719			
2035	34,193	113,420	189,789			
2040	41,334	133,422	223,270			

[^]Reference 15 *Purpose and Need Study* March 1995

TABLE 10. Total Potential Additional Water From Plan

Project	Yield AF	Annual Cost AF	Total Annual Cost
Sand Hollow Reservoir	15,000 ¹	\$79	\$1,185,000
Pah Tempe Removal	31,000 ²	\$21	\$651,000
Ash Creek	7,000 ⁴	\$213	\$1,491,000
Gunlock/Ivins Reservoir Pipeline	3,600 ⁴	\$63	\$226,800
Reduction Winter Flows	8,100 ⁵	\$0	\$0
Water conservation	16,000 ³	\$40	\$640,000
Water Reuse	22,000 ⁴	\$50	\$1,100,000
Wells	11,000 ⁴	\$86	\$946,000
Total	114,700		\$6,239,800
	Average Annual Cost AF		\$54

i Total water needed for M&I by 2020 is 118,782 AF and by 2040 is 198,442 AF with medium growth. (Reference 15 *Purpose and Needs Study*)

i There is currently 63,000 AF of developed M&I water. (Reference 15 *Purpose and Needs Study*)

¹ Includes 5,000 AF from wells.

² Yield from reduction in agriculture needs and conversion from agriculture. (Purpose and Needs Study)

³ 25% savings from current 63,000 AF developed.

⁴ Purpose and Needs Study (Reference 15)

⁵ Utah Division of Water Resources, simulation model.

CHAPTER 2. CURRENT CONDITIONS AND MANAGEMENT ACTIONS

The streams and associated flood plains of the basin are divided into several reaches for study and identification. Numerous animal species occur throughout the flood plains. Among others, these include Virgin spinedace, Gambel's quail, water fowl , mule deer, beaver, and non-game migratory birds (neo-tropical). A variety of raptors concentrate around agricultural areas. The flood plain is host to a variety of plant species. Those shown below are those species which represent culturally, economically and socially important species.

A. VIRGIN RIVER (See Figures 2 and 3 for maps)

1. Zion National Park to Quail Creek Reservoir Pipeline Diversion (Reach 1)

a. Description

The Virgin River reach goes from Zion National Park's boundary, just east of Springdale, to the Quail Creek Reservoir pipeline diversion. This reach is approximately 22 miles long and is privately owned except for about 1/4 mile of state land and an estimated 2 miles of public land (Figure 1). This reach contains some of the oldest diversions and settlements on the river. Water was first diverted from the following towns adjacent to the river: Virgin and Grafton in 1859, followed by Rockville in 1860 and Springdale in 1862 (see Figure 2). River flows are impacted by diversions within these communities. However, historic flows in this reach have been sufficient to keep the diversions from dry damming the river.

Viable populations of Virgin spinedace inhabit all sections of this reach. The reach has characteristics of good habitat for Southwest willow flycatcher. Individual birds have been observed, but nesting hasn't been confirmed. Table 11 details the land ownership in this reach.

TABLE 11. Land Ownership, Reach 1

OWNERSHIP	ACRES
Private *	1,108
Public	212
State Trust	14
Indian	0

*Private includes WCWCD lands

b. Diversions

i. Springdale

This diversion is located in Zion National Park. The water is piped to Springdale. The Springdale Consolidated Irrigation Company manages the diversion under a dual system for culinary and irrigation water. They have a water right for 3.97 cfs.

Photo 1 Springdale Diversion
SE 1/4 SW 1/4, Sec 15, T41S, R10W

ii. Rockville-Grafton Diversion (Figure 1 and 2)

This diversion is a common diversion for both Rockville and Grafton. Water is diverted by a cement diversion into a pipe. Rockville has a water right for 3.84 cfs, which is managed by the Rockville Town Ditch Company. Grafton has a water right for 2.72 cfs which is managed by the Hall and Grafton Irrigation Company.

Photo 2 Rockville-Grafton Diversion
SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 32, T41S, R10W

iii. Virgin Diversion, South-side (Figure 1 and 2)

Water is diverted to irrigate lands on the south side of the river at this diversion. This diversion is an earthen wing which diverts water into the ditch. There is a water right for 5 cfs owned by Bud D. Lee.

Photo 3 Virgin diversion south-side
NW ¼ NE ¼, Sec. 31, T41S, R11W

iv. Virgin Diversion, North-side (Figure 1 and 2)

This is the diversion for the town of Virgin. A water right for 2.64 cfs is owned by the Virgin Irrigation Company. The diversion is a concrete headgate on an outside curve of the river. The amount of water diverted in this reach is quite small compared to the river flow. The river flow measured at the Virgin gage from 1941 to 1993 has varied from a monthly mean of 95.7 to 387 cfs, with an annual mean of 182.3 cfs. (Virgin River Simulation Model, Utah Division of Water Resources 9-6-94)

Photo 4 Virgin diversion north-side
SW 1/4 SW 1/4, Sec. 30, T41S, R11W

c. Management Actions

- ! Map the flood plain.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values; and, as appropriate, purchase property or acquire protective easements.
- ! Washington County, Springdale, Rockville and Virgin develop and enforce zoning to prevent improper development in the 100-year flood plain.
- ! Develop a recreation trail system if desired by communities.
- ! Encourage preservation of heritage and historical values such as ghost towns, cemeteries, historical sites, etc.
- ! Protect scenery, recreation, wildlife, water quality and fishery values.

2. Quail Creek Pipeline Diversion to Hurricane, La Verkin Bridge (Reach 2) Figure 2

a. Description

This reach begins at and includes the Quail Creek pipeline diversion and goes to the Hurricane/La Verkin bridge. The reach has been affected by diversions since 1891 when the La Verkin diversion was completed. The Hurricane diversion was completed in 1904 and since that time, this reach of river has been dry dammed during low flow periods of the year. Native fish have been eliminated from this reach since that time. The present Quail Creek diversion, built in 1985, dry dams the stream during some parts of the year and is located a short distance upstream from the old Hurricane diversion. As part of the spinedace conservation agreement, a constant flow of at least 3 cfs now passes the Quail Creek diversion year long. Since the Quail Creek pipeline began operation in 1985, the old La Verkin and Hurricane diversions have been abandoned. These historical canals can be seen on the sheer canyon walls. La Verkin and Hurricane now get their water from the Quail Creek diversion and pipeline during the summer when no water is diverted to Quail Creek Reservoir.

Upstream a short distance from the Hurricane and La Verkin bridge is La Verkin (Pah Tempe) hot springs. These springs presently contribute an average of 12 cfs of highly mineralized water into the river (Appendix D). The high mineral content and temperature of this water renders the entire river unsuitable for culinary use below this point.

The Quail Creek pipeline is buried in the bank or under the stream in this reach. A road traverses the stream channel for the entire length of the reach. The pipeline leaves the river at La Verkin hot springs. A power plant which operates off the pipeline is located just upstream from the bridge. This power plant releases between 5 to 35 cfs of water to the river to meet stream flow requirements down stream.

Virgin spinedace have re-colonized this reach since 1995. Due to the narrow width and frequent floods in this 3-mile reach, the plant communities and streamside habitats are sparse. Tamarisk dominates the vegetation types and practically no cottonwood trees occur here. Bald eagle and peregrine falcon are known to frequent this reach which is entirely under private ownership (see Figure 2 and Table 12).

TABLE 12. Land Ownership, Reach 2

Ownership	Acres
Private	91
State Trust	0
Public	0

While this reach supports some riparian habitats, wetlands are non-existent.

b. Diversions

i. Quail Creek Pipeline Diversion

This diverts water into the Quail Creek pipeline which carries the water to the Quail Creek Reservoir and provides irrigation water for Hurricane and La Verkin. A maximum of 250 cfs can be diverted because of the size of the pipe.

Photo 5 Quail Creek Pipeline Diversion

NE ¼ NW ¼, Sec. 29, T41S, R12W

c. Management Actions

- ! Protect the scenic, recreation, wildlife and fishery values.
- ! Return flows of water to the river at the Quail Creek diversion year long. This will return water to the reach and allow the reintroduction of native fish below the diversion.
- ! Implement measures to reduce or remove the impact of La Verkin (Pah Tempe) hot springs on the Virgin River's water quality
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values; and, as appropriate, purchase property or acquire protective easements.
- ! Develop the old Hurricane Canal as a recreation/historical trail and limit access in the canyon to the canal.
- ! Protect, restore and enhance wetlands which occur on acquired lands or those with conservation easements where appropriate.

3. Hurricane, La Verkin Bridge to Quail Creek Reservoir Dam (Reach 3)

a. Description

. The reach is estimated to be eight miles long containing about 4 miles of public land, ¼ mile of state trust land, and 3 ¾ miles of private land (Figure 2). Table 13 details the land ownership in this reach. Ash Creek and La Verkin Creek enter the river west of La Verkin

TABLE 13. Land Ownership, Reach 3

OWNERSHIP	ACRES
Private	283
Public	208
State Trust	1
Indian	0

This reach occurs in a narrow sandstone or lava-capped canyon and is relatively inaccessible to humans. Having been left reasonably undisturbed, this reach holds high biological significance since native fish, including the endangered Virgin River chub and woundfin minnow, maintain stable populations here, the vegetative community has not been severely impacted, and desert tortoise occur on south-facing talus slopes. The reach also supports important habitats for the endangered Southwest willow flycatcher.

This habitat is regionally important to a variety of raptors, particularly golden eagles. This is due to the close proximity of the cliffs and the riverine habitat. Bald eagles and Peregrine falcons use this area during the winter months.

Riparian habitats are somewhat constricted by the canyon walls, but wetlands do occur here. Potential for restored or constructed wetlands exist in this reach. Most of the public land in this reach falls within the borders of the Red Cliffs Desert Reserve.

b. Diversions

Although water rights are shown for 5M Corporation and Melvin Fawcett, there are no present diversions within this reach of the Virgin River..

c. Management Actions

- ! Protect the scenic, recreation, wildlife and fishery values
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property.
- ! Develop a recreation plan and trail along the complete distance of the reach.
- ! Develop an interpretive plan to educate users of river, wetlands and flood plain values in conjunction with the trail and recreation development.
- ! Protect, restore, and enhance wetlands which occur on acquired lands or with conservation easements where appropriate.

4. Quail Creek Reservoir Dam to Washington Field Diversion (WFD)

a. Description

This 6-mile reach is the best remaining habitat for the endangered Virgin River chub and roundfin minnow. It constitutes important habitat for raptors, water fowl, the Southwestern willow flycatcher, and non-game migratory birds due to close proximity to man-made reservoirs and agricultural areas. Water flows are enhanced in this reach by release from Quail Creek Reservoir to meet the required 86 cfs of flow at the WFD. The Biological Opinion issued for development of the Quail Creek Reservoir requires 86 cfs at the diversion or natural flow. This is also the water right of the St. George/Washington water users. The reach contains about 4.5 miles of private land and 1.5 miles of public land.

TABLE 14. Land Ownership, Reach 4

OWNERSHIP	ACRES
Private	350
Public	56
State Trust	0

The flood plain is relatively wide through this reach. Tamarisk and willow are the dominant plant types in the wide flats. Wetlands occur in this reach and potential for restoration and/or created wetlands are noteworthy.

b. Diversions

i. Washington Fields

This is one of the largest and most important diversion on the Virgin River. All of the water for the Washington/St. George Fields, Cunningham Field, Price Bench and Price Field are diverted here. There is a priority water right for 85.895 cfs owned and controlled by the St. George/Washington Canal Company.

Photo 6 Washington Field Diversion
SW ¼ SW ¼, Sec. 21, T42S, R14W

c. Management Actions

- ! Protect the scenic, recreation, cultural, wildlife and fishery values.
- ! Evaluate reduction of winter water flows below 86 cfs in the Virgin River, from November through April. This water could be stored in the Quail Creek Reservoir, stored in the proposed Sand Hollow Reservoir, or used for return flows (after evaluation in the VRRMRP).
- ! Maintain the river flow after spring runoff measured at the WFD, without augmentation, at 86 cfs, or natural flow, to meet the existing agricultural water rights and the biological opinion for Quail Creek Reservoir.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and as appropriate, purchase property or acquire protective easements.
- ! Develop a recreation plan and trail along the complete distance of the reach.
- ! Protect, restore and enhance wetlands which occur on acquired lands or with conservation easements, where appropriate.
- ! Reduce winter water use in the Washington Fields.
- ! Interpret historical areas such as Lorenzo's Place.
- ! Study development of a wetland with water from La Verkin (Pah Tempe) Hot Springs in the event the mineralized water is removed from the river.

5. Washington Fields Diversion to Johnson Diversion (Reach 5)

a. Description

This reach provides important habitat for raptors (peregrine falcon, bald eagle), southwestern willow flycatcher, game species (deer & quail), waterfowl, and non-game migratory birds. This is partially due to the close proximity of the large agricultural nearby. The river is often dry dammed at the WFD. Return flows restore the river flow below the diversion. Native plants are a part of the plant community here, although tamarisk and Russian olive are the dominant type. A few key wetlands occur in this reach. Early pioneer journals indicate that Washington County's largest wetland occurred where the Virgin River now passes the Washington Fields. The potential for restored or constructed wetlands is high in this reach, but complicated by encroaching housing developments. Beavers are a problem in this reach as they damage ditches and waterways. This reach is about six miles long and is privately owned except for three-quarters of a mile of public land (see Figure 3). Table 15 details the land ownership in this reach.

TABLE 15. Land Ownership, Reach 5

OWNERSHIP	ACRES
Private	1,116
Public	85
State Trust	0
Indian	0

The Johnson diversion serves as a fish barrier to prevent non-native fish from moving upstream. This has been effective in the past. However, red shiners (a non-native fish) have now been identified in this reach. This reach was treated to remove non-native fish in 1995 and results appear to be successful.

b. Diversions

i. Johnson Diversion

Johnson diversion was rebuilt after the Quail Creek dike failure in 1988. This large str divers only a small amount of water. Water is diverted to a ditch, then is pumped to a po on top of the stream bank. The water then is used on farms down stream. The wat is for 3.7 cfs and is owned by Sheldon Johnson.

Photo 7 Johnson Diversion

NE ¼, Section 27, T42S, R15W

c. **Management Actions**

- ! Protect riverine, wildlife and fish values.
- ! Restore native fish habitat by providing year-long instream flows below Wash Field Diversion.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Develop a recreation and trail plan along the complete distance of the reach.
- ! Map the 100-year flood plain

6. Johnson Diversion to St. George Sewer Plant (Reach 6)

a. Description

This reach receives return flows from the agricultural areas and provides good habitat for both Virgin River chub and woundfin. The close proximity to the agricultural fields provides a large food base for several special status species such as bald eagles, peregrine falcons and Southwest willow flycatcher (confirmed flycatcher nest site). Some of the highest concentrations in the county of waterfowl and raptors occur in this reach. This area provides important habitat for most migratory birds (shore birds, neo-tropical migrants). The river receives impacts from urban development from St. George and Bloomington. This reach is about eight miles long and is privately owned except for one mile of State Trust land (Figure 3). Table 16 details the land ownership in this reach.

TABLE 16. Land Ownership, Reach 6

OWNERSHIP	ACRES
Private	1,129.3
Public	0
State Trust	85

Native fish species have been heavily impacted by the introduction of non-native fish species to the river. The red shiner is the dominant fish in much of this reach (Figure 3). Although this reach was treated in 1993 to remove the non-native fish, the effort was unsuccessful and this reach is still dominated by non-native fish species. The treatment greatly reduced the native fish species which have not fully recovered from its effects. A major flaw in the failed treatment was the inability to treat side drainage. It is planned to treat the river again in 1998. Beavers are still a problem in this reach where they dam ditches and waterways.

b. Diversions

There are no diversions in this reach.

c. **Management Actions**

- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Develop a recreation and trail plan for lands between the Bloomington-St. George trail and the Johnson diversion.

- ! Map the 100-year flood plain.
- ! Work with willing landowners to protect and enhance the existing wetlands in reach to assist with flood control and water quality maintenance. Pursue options to create or enhance existing wetlands to assist with retaining and cleaning urban runoff.

7. St. George Sewer Plant-Arizona State Line (Reach 7)

a. Description

This reach starts at the St. George regional sewer treatment plant. At the beginning of the reach, six million gallons of water per day is discharged into the river. This reach is an important habitat for Virgin River chub and woundfin. This reach is heavily impacted by the introduction of non-native fish species. The red shiner is the dominant fish in much of the reach. A fish barrier constructed by the WCWCD is located at the start of the narrow reach above the Arizona State line. After the barrier was constructed, this reach was treated to remove the non-native fish. The effort was not successful and the reach is dominated by red shiner. The treatment greatly reduced the native fish species and numbers remain relatively low. Vegetation in this reach is dominated by tamarisk and willow with very few cottonwoods. Infrequent use of this area by peregrine falcons, bald eagles and Song Sparrow willow flycatcher occurs. Use of this area by waterfowl is highest during the hunting season when birds use this area to evade hunters. This area provides an important habitat for all migratory birds (raptors, waterfowl, neo-tropical migrants). There are plans to restore this reach of river again to remove red shiners and other non-native fish.

This reach is estimated to be seven miles long. The reach contains ¼ mile of State land, 1 mile of private land, and 5 ¾ miles of solidly blocked public land (Figure 3). Table 17 details the land ownership in this reach.

TABLE 17. Land Ownership, Reach 7

OWNERSHIP	ACRES
Private	206
Public	617
State Trust	15

b. Diversions

There is no diversion in this reach. There is a fish barrier near the end of the reach where the river enters Arizona.

Photo 8 Fish Barrier

(to keep Red Shiner fish from going upstream)

NE 1/4 NE 1/4 SE 1/4, Section 30 T43S, R16W

c. Management Actions

- ! Protect the scenic, recreation, cultural, wildlife and fishery values.
- ! Protect the 100-year flood plain from encroachment or destruction of riparian riverine values by zoning, management decisions, purchase or protective ease

B. SANTA CLARA RIVER (See Figure 4)

1. Headwater - Gunlock Reservoir Dam (Reach 1)

a. Description

This reach covers the river and 100-year flood plain from the headwaters to Gunloc Reservoir Dam. The reach is estimated to be over 25 miles long. The reach contain estimated 6 miles of National Forest, 2.5 miles of public land (BLM), and 16.5 miles private land (Figure 4). Table 18 details the land ownership in this reach from Veyo Gunlock Dam. Information is not available on the upper stream.

TABLE 18. Land Ownership, Reach 1

<i>OWNERSHIP</i>	<i>ACRES</i>
Private	203
Public	29
State	0
Indian	0

The river is historic habitat for Virgin spinedace below Veyo. Spinedace are impact non-native trout species downstream to Gunlock Reservoir. The biological conditions in this reach are among the least disturbed in the watershed. No major threats have been identified in this reach. The vegetation and river bed are in fairly good condition in reach with native vegetation species dominating.

The streambed immediately north of Gunlock Reservoir is filling with cobble and gravel from the upstream watershed. The source of material is not completely understood. The channel is filling from Gunlock Reservoir up stream through the community of Gunlock. The continued deposition of material will likely cause flooding in Gunlock in the future. Much of the material deposited in the channel is good quality sand and gravel.

This reach provides important habitat for migratory raptors (peregrine falcon & bald eagle), game species (deer and quail), waterfowl, and non-game migratory birds. This is partly due to the close proximity of Baker, Sand Cove and Gunlock Reservoirs.

b. Diversions or Reservoirs

i. Pine Valley Reservoir

This reservoir is located in the National Forest. It is a small recreation reservoir and does not divert water from the river.

ii. Pine Valley Diversion

Water is diverted for irrigation at Pine Valley.

iii. Central Diversion

A diversion located in the National Forest, diverts water for irrigation at Central.

iv. Hydroelectric Diversion

Above Baker Reservoir water is diverted for a power plant.

v. Baker Dam and Reservoir

This reservoir has a small BLM recreation site located east of the dam.

vi. Power Plant Diversion

A diversion 2.7 miles below Baker Dam diverts water to Upper and Lower Sand Cove Reservoirs. The water is returned to the river at Gunlock through a power plant.

vii. Irrigation Diversion

Five miles below Baker Dam, an irrigation diversion diverts two cfs.

viii. Gunlock Diversion

One mile above Gunlock is a diversion for agricultural and other uses at Gunlock.

ix. Gunlock Reservoir and Dam

Water is stored for downstream irrigation use.

Photo 9 Gunlock Reservoir

SW ¼ NW ¼, Sec. 22, T40S, R17W

c. Management Actions

- ! Map 100-year flood plain
- ! Allow appropriate managed sand and gravel operations to remove sand and gravel from the river channel above Gunlock Reservoir.
- ! Limit access to existing roads.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Prevent any actions which could effect water quality, such as mill sites which contaminate ground water.
- ! Complete a watershed study to determine sources of sedimentation above Gunlock Reservoir.
- ! In cooperation with landowners and land managers, implement actions to improve watershed conditions above Gunlock Reservoir.

2. Gunlock Reservoir Dam to Winsor Diversion (Reach 2)

a. Description

This 5-mile reach covers the Santa Clara River from the Gunlock Reservoir dam to the Winsor diversion. The reach hosts eagle, beaver, hawks, osprey and ducks. The reach consists of 3 miles of public land, 1/4 mile of private land, and 2 3/4 miles Indian land (See Figure 4). Table 19 details the land ownership.

TABLE 19. Land Ownership, Reach 2

Ownership	Acres
Private	14
Public	105
State Trust	0
Indian	69

The river below the Gunlock dam is generally dry except during the irrigation season when the reservoir overflows during the spring. There is water along this reach during summer due to irrigation releases. Heavy recreation and camping use occurs along the river during the winter and spring which adversely impacts stream banks. Some of the oldest cottonwood trees occupy the banks of this reach, but very few young trees are found. The BLM is studying effects of grazing and recreation on reproduction of trees. There is one small diversion above the Paiute Indian Reservation (See Figure 4).

The Virgin spinedace conservation agreement has a provision to return a minimum flow of 3 cfs to river year long below Gunlock Reservoir.

b. Diversions

i. Bowler Diversion

This is a small diversion above the Paiute Indian Reservation.

c. Management Actions

- ! BLM - develop and implement a grazing management program for the public land on this reach. This will allow riparian vegetation to improve and reduce stream bank damage.

- ! Restore native fish habitat by providing year-long water flows below Gunlock Reservoir.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming or acquire protective easements.
- ! BLM - establish a Special Recreation Management Area which would include rotation recreation along the flood plain and reduction of impacts from off-road activity.
- ! Discourage any actions such as mill sites which could contaminate ground water
- ! Work with Shivwits Band members and tribal leaders to protect riparian and aesthetic values in the this reach

3. Winsor Diversion - Seep Ditch (Reach 3)

a. Description

This reach contains all of the Santa Clara River from Winsor diversion to Seep Ditch diversion. This reach is estimated to be over 13 miles long. The reach contains 4 miles Shivwits Band Paiute Indian Reservation, 2 miles public land, and 7 miles of private (See Figure 4). Table 20 details the land ownership in this reach.

TABLE 20. Land Ownership, Reach 3

Ownership	Acres
Private	479
Public	68
State Trust	15
Indian (Shivwits)	146

This reach starts at the Winsor Dam diversion where four to six cfs is diverted during 210 day irrigation season (See Figure 4). The diversion is a tall rock and concrete structure which is a barrier to fish movement upstream. Virgin spinedace are not present in this reach because it is currently dewatered in some sections for part of the year.

This reach provides important habitat for migratory raptors (peregrine falcon & bald eagle game species, water fowl, and non-game migratory birds (including neotropical migrants). This is partially due to the close proximity of Gunlock Reservoir and numerous wetlands along the river.

This reach is affected by recreation use as evidenced by several sites where dispers camp sites and fire circles exist next the stream. The livestock grazing on public land under a good management system and riparian values are improving. The road which parallels the stream crosses river fords at two locations. The road is poorly maintained and is causing erosion into the stream. There are some excellent panels of rock art along this reach. A cooperative management agreement has been developed between BLM, the Town of Santa Clara, and the Town of Ivins to protect archaeological values, to eliminate vandalism and to preserve riparian systems and recreation opportunities along portions of this reach. The potential for protecting, enhancing or creating wetlands in this reach is high.

b. Diversions

i. Winsor Diversion (Shem Dam)

This is located at the start of the reach. This diversion serves both the Shivwits Band of Paiute Indians and Ivins Water Users.

ii. Three Mile Diversion

iii. Santa Clara South Ditch

iv. St. George Fields Diversion

Photo 10 Winsor Diversion

SW 1/4 Section 20, T41S, R17W.

c. Management Actions

- ! Potential replacement of water diversions at the Winsor diversion, Three Mile diversion, Santa Clara South Ditch diversion and St. George Fields diversion with a pipeline from Gunlock Reservoir to Ivins Reservoir. A large water saving would be achieved.
- ! Develop pooling agreements of water rights downstream for better utilization of water.
- ! Resolve the Shivwits Band of Paiute Indians water rights issues.
- ! Interpret and protect archeological values.
- ! Limit access to existing roads.
- ! Establish a recreation plan to manage recreation use.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Work with the Shivwits Band members and tribal leaders to protect riparian and aquatic values.

4. Seep Ditch Diversion- Virgin River Confluence (Reach 4)

a. Description

This 2-mile reach includes the Santa Clara River from the Seep Ditch diversion to the Virgin River confluence. It goes through the South Gate subdivision and golf courses above the confluence with the Virgin River. This reach hosts many wildlife species, including water fowl, neo-tropical migrants and spinedace. It is all private land (See Figure 4). Table 21 details the land ownership in this reach.

TABLE 21. Land Ownership, Reach 4

Ownership	Acres
Private	138
Public	0
State Trust	0
Indian	0

b. Diversions

i. Seep Ditch Diversion (Figure 4)

ii. Bloomington Diversion (Figure 4)

c. Management Actions

! Acquire conservation easements to protect riparian and aquatic values. Because of high property values it may not be possible to purchase property.

! Develop and enforce zoning preventing unsound development in the flood plain.

C. ASH CREEK (See Figure 5)

1. Ash Creek Reservoir to Toquerville Springs (Reach 1)

a. Description

This reach runs along the western edge of the Hurricane fault, also known as the Bluff Ridge. This reach supports abundant wildlife: deer, quail, water fowl, bald eagle and nontropical migrant birds.

At the present time North Ash Creek is impounded by the Ash Creek Reservoir at the end of the reach. Impounded water leaks out within a short time. The Ash Creek drainage is dry most of the time below Ash Creek Reservoir to Toquerville. During the spring period, or as long as water is available, water is diverted from Leap Creek, South Ash Creek and Wet Sandy which are tributaries to Ash Creek. This water is normally diverted and used before it reaches the Ash Creek drainage. These diversions all empty into ditches and much water is lost to seepage. Because the drainage is dry most of the time there is little riparian vegetation. This reach does not contain fish species. This reach is 12 miles long (Figure 5). It contains 3 ¾ miles of private land, 6 ½ miles of public land and 1 ¾ miles state trust land. The land ownership is shown in Table 22.

TABLE 22. Land Ownership, Reach 1

OWNERSHIP	ACRES
Private	94
Public	72
State Trust	29
Indian	0

b. Diversions

There are no diversions in this reach on the main Ash Creek drainage. There are diversions on the following tributaries to Ash Creek.

i Leap Creek (Figure 5)

There are two diversions on Leap Creek, one on the Dixie National Forest and one at the mouth of Leap Creek. Both diversions divert water into unlined ditches. The lower one stores water in a small reservoir. Water rarely reaches Ash Creek.

ii South Ash (Figure 5)

Water is diverted near the Dixie National Forest Boundary into an unlined open ditch. Water is used at Pintura for irrigation. Water rarely reaches Ash Creek.

iii. Wet Sandy (Figure 5)

Water is diverted on the Dixie National Forest and by a long open ditch provides water for irrigation at Anderson Junction. Water rarely reaches Ash Creek.

c. Management Actions

- ! Potential exists to pipe water from Ash Creek Reservoir down Ash Creek to the proposed Sandstone Mountain Reservoir (Figure 6). Replace open ditches with pipelines from the present diversions on Leap Creek, South Ash Creek, and Wet Sandy to join up with the Ash Creek Reservoir pipeline. Present water rights at Pintura and Anderson Junction would be delivered from the pipeline. This water could be redistributed by a pipeline to Toquerville and La Verkin to replace irrigation water now supplied from Toquerville springs. The Toquerville springs water could then be used for culinary use.
- ! Evaluate effects of water piping on Toquerville springs.

2. Toquerville Springs to Ash Spring (Reach 2)

a. Description

A large amount of water enters Ash Creek at Toquerville springs, which is within the boundaries of the Town of Toquerville. The average flow is estimated at 14 cfs during summer and fall and ranges from 4 to 23 cfs. Water is gathered at the springs and diverted at the West Field/Wallace diversion and the East Side diversion. During low flow periods in the four miles between Toquerville springs and Ash springs, the stream is less than two miles until it reaches Ash springs. This reach is historic habitat for spinedace, but presently no populations appear to exist. This reach supports bald eagle, water fowl, and neo-tropical migrants. The land is all private.

TABLE 23. Land Ownership, Reach 2

Ownership	Acres
Private	40
Public	0
State	0

b. Diversions

i. West Field/Wallace

ii East side

c. Management Actions

- ! Change the use of Toquerville springs from agriculture to culinary use.
- ! Resolve water rights issues.
- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Map the 100-year flood plain.

3. Ash Springs to Virgin River (Reach 3)

a. Description

Perennial flows occur in Ash Creek from Ash springs to the Virgin River. Culinary water is pumped at Ash springs for Hurricane and La Verkin. There are four irrigation diversions downstream to the Virgin River. The water flow varies considerably in different parts of the stream because of the diversions. Some water, however, remains in the channel nearly the entire distance to the river.

Spinedace occupy this segment of stream. This reach also supports raptors and nontropical migratory birds. Because of narrow canyons, little potential exists for wetlands development.

TABLE 24. Land Ownership, Reach 3

Ownership	Acres
Private	106
Public	0
State	0

b. Diversion (Figure 3)

i. Getman

ii Woods

ii Goodwin

iv Krom

c. Management Actions

! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.

! Map the 100-year flood plain.

D. LA VERKIN CREEK (See Figure 3)

1. Headwaters to Chute Falls (Reach 1)

a. Description

This reach starts at the headwaters of La Verkin Creek above Zion National Park and extends downstream through the park and public lands to Chute Falls. None of this has been identified as historic native fish habitat. The immediate area supports many populations. There is a diversion and reservoir near the headwaters which diverted La Verkin Creek water into the Spring Creek drainage. The WCWCD purchased this right and has returned it to the drainage. The drainage provides hiking access to Karch Arch. A water fall called Twin Falls is located in the reach. The upper Jones diversion is located above the Falls area. This reach is estimated to be 20 miles long. It contains 10 miles of private land, 9 miles public land, and 6.25 miles of Zion National Park. (Figure 3)

The acres of flood plains have not been identified in this reach.

b. Diversions

i. Headwater Diversions

Above Zion National Park, there were diversions from Willow Creek, Meadow Hollow, Elisha and Myron springs which diverted the water out of La Verkin Creek and put it in Spring Creek. The WCWCD has purchased this water right and returned it to La Verkin Creek.

ii. Upper Jones Diversion (Figure 3)

There is no diversion in the stream at the present time. Some water may be pumped into the stream to use at the diversion location.

c. Management Actions

- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Protect the scenic, recreational and hydrologic values.

2. Chute Falls to Wilson Diversion (Reach 2)

a. Description

This reach starts at Chute Falls and goes to the Wilson diversion. Chute Falls is a natural barrier to prevent movement of fish up stream. La Verkin Creek up to Chute Falls has been identified as Virgin spinedace habitat. The lower Jones diversion is located in this reach. From the Jones diversion down stream, there are good stands of cottonwoods. The reach supports raptors and nontropical bird species.

A major subdivision, Cholla Creek, is being developed below the Jones diversion, and it appears to be partly in the flood plain. This reach is 4 ½ miles long. It contains 2 miles of private land and 2 ½ miles of public land (Figure 5). The land ownership within the year flood plain is shown in Table 25.

TABLE 25. Land Ownership, Reach 2

Ownership	Acres
Private	54
Public	10

b. Diversions

- i. Jones — This is the major diversion on La Verkin Creek. The WCWCD has purchased most of the water rights at this diversion.

Photo 11 Jones Diversion
SE ¼ NW ¼, Sec. 12, T41S, R13W

Photo 12 Wilson Diversion

NE ¼ SE ¼, Sec. 14, T41S, R13W

c. Management Actions

- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Where agreements can be reached, discontinue diversion of water at lower diversions and supply water from the La Verkin branch of the Quail Creek pipe to meet water needs.
- ! Map the 100-year flood plain.
- ! Study feasibility of removing existing diversions or modifying them to allow fish passage.

3. Wilson Diversion to Virgin River Confluence (Reach 3)

a. Description

This reach starts at and includes the Wilson diversion and goes to the Virgin River. It provides habitat for Virgin spinedace. The Terry West diversion is located in this reach. This reach also supports deer, raptors, waterfowl, non-game birds, and nontropical species. The reach is two miles long and is nearly all private land. Land ownership is shown in Table 26.

TABLE 26. Land Ownership, Reach 3

Ownership	Acres
Private	80
Public	2

b. Diversions

i. West Diversion

c. Management Actions

- ! Work with and assist private property owners to protect the river, wetlands and flood plain from activities and development harming riparian and aquatic values and, as appropriate, purchase property or acquire protective easements.
- ! Discontinue water diversion of West diversion and supply water from the La V branch of the Quail Creek Pipeline to meet water right needs.
- ! Map 100-year flood plain.

TABLE 27. TABLE of Present Conditions and Conditions with Plan

Virgin River	Present Conditions		Conditions With Plan	
	Low Flow cfs	Miles Dry	Minimum Target Flows with Program	Miles Water Restored/ Restored Habitat
#1 Zion National Park/Quail Lake Diversion	no change	0	no change	0
#2 Quail Lake Diversion/Hurricane Bridge	0 Dry	3 miles	3 cfs	3 miles
#3 Hurricane Bridge/Quail Lake Dam	50 cfs-summer 80 cfs-winter	0	no change	0
#4 Quail Lake Dam/Washington Field Diversion	86 cfs-summer 86 cfs-winter	0	no change Less than 86 cfs-winter if biological opinion changed	0
#5 Washington Field Diversion/Johnson Diversion	0 Dry	3 miles	5 cfs from La Verkin Springs	3 miles
#6 Johnson Diversion/St. George Sewer Plant	no change	0	0	no change
#7 St. George Sewer Plant/Arizona State Line	no change	0	Reduced Flow Water reuse	no change
Santa Clara River				
#1 Headwaters/Gunlock Dam	no change	0	no change	0
#2 Gunlock Dam/Windsor Diversion	0 dry	5 miles	3 cfs	5 miles
#3 Windsor Diversion/Seep Ditch Diversion	0 dry	15 miles	3 cfs	15 miles
#4 Seep Ditch/Virgin River	no change	no change	no change	0
Ash Creek Reach				
#1 Ash Creek Reservoir/Toquerville Springs	Dry	12 miles	no change	no change
#2 Toquerville Springs/Ash Springs	Dry	2 miles	no change	no change
#3 Ash Springs/Virgin River	1 cfs	0	no change	no change
La Verkin Creek				
#1 Headwaters/Chute Falls	5 cfs	0	10 cfs	0
#2 Chute Falls/Jones Diversion	5 cfs	0	10 cfs	0
#3 Jones Diversion/Virgin River	Low flow	0 poor habitat	5 cfs no water diversion	2 miles good habitat

CHAPTER 3. POTENTIAL WATER DEVELOPMENT AND MANAGEMENT

Potential projects and river management changes summarized below could provide an additional 114,700 acre-feet (AF) of water for municipal use. The VRMP proposes a several pronged approach for management, development and habitat conservation in the Virgin River drainage 100-year flood plain. The biological effects of these actions will be analyzed in accordance with the review process set up in the Virgin River Resource Management and Recovery Program (VRRMRP). After adequate evaluation, some projects may be dropped and others may be added. Potential projects are those identified in the 1995 Purpose and Needs Study to meet human water needs in Washington County. Inclusion of a project in the VRMP does not imply approval by all VRMP sponsors.

A. LA VERKIN SPRINGS (PAH TEMPE) SALINITY CONTROL

(See Figure 6 for map)

1. Project Proposal (Purpose and Needs, March 1995)

The WCWCD's present preferred alternative would be to remove La Verkin (Pah Tempe) springs from the Virgin River, cool the water, and return it to the river below Washington Field diversion. This project consists of two parts. First, build diversion dams upstream and downstream of the springs to divert river flow around the springs and allow for separate collection of the spring water. Second, transport the water by a 12 mile pipeline to below Washington Fields diversion for discharge back into the Virgin River. The benefits of this project will reestablish fish habitat below the diversion dam, where the river is dry during portions of the year. A wetland could be developed with this water, if found feasible, before the water is returned to the river below the Washington Field diversion. A power plant could be operated on the pipeline.

2. Alternatives

There are alternatives for collection of the springs, routes for the pipeline and use of the water after it is removed from the river. An alternative also exists to treat the water at the Washington Field diversion for culinary use. The alternatives for each phase are as follows:

a. Collection of Springs/Cut-off Trench

This proposal consists of a small diversion structure above the spring to divert the river flows below 500 cfs around the spring area. A small diversion dam below the spring will allow bypass of the high flows and during no flow will allow for the surface collection of the springs. This alternative would allow the cultural and historical values of the spring to stay intact.

b. Well Points

A series of wells could be drilled which would lower the water table and remove the springs from the river. This alternative would dry up the springs.

c. Pipeline Routes

There are two routes being considered for the pipeline and removal of water from the river. One route is a graded pipeline to gravity flow along the river downstream. Another route is to pump it and follow the Quail Creek pipeline alignment and existing roadways to below the Washington Fields diversion dam. Another route would follow the existing Quail Creek pipeline alignment a short distance downstream to the La Verkin Creek confluence area where a constructed wetland could partially remove the spring's heat and salt. Part of the pumping costs could be recovered through power generation revenue. Analysis of environmental impacts and costs will determine which alternative is used if carried out.

d. Alternatives for Use of High Mineralized Water

The water can be 1) piped to below the Washington Fields diversion and returned to the river; 2) it can be discharged into evaporation ponds for disposal; or 3) it can be treated to remove minerals, and be used for irrigation, instream, or culinary use.

e. Discussion of Alternatives

The WCWCD favored alternative is to pipe the water to below the Washington Fields diversion and return it to the river. This is preferred because it wouldn't waste the water and provides instream water flows to the river below the diversion. The effects of highly mineralized water on native fish species after it has been cooled and returned to the river will be determined by studies. The development of a wetland using this water would also be studied.

The treatment of La Verkin Springs for municipal use is not preferred because of excessive costs and problems associated with disposal of the removed minerals.

The alternative of water disposal in evaporation ponds is not preferred because it wastes valuable water and because of the problem of disposing of the minerals from the ponds.

The following additional measures might be required:

- ! Replacement of flow to the Virgin River above the Washington Fields diversion to replace La Verkin Springs flow.
- ! Construction of holding ponds for La Verkin Springs water to lower the water temperature prior to discharging water back into the Virgin River.

B. REDUCE WINTER WATER FLOWS

1. Proposal

This proposal is to change winter water flows in the reach above the Washington Field diversion (WFD) to less than 86 cfs. The flows would be reduced from November 1 to April 30. Flows would stay at 86 cfs or natural flow during the remainder of the year. The saved water can be stored in Quail Creek Reservoir and the proposed Sand Hollow Reservoir. This saved water can then be used for irrigation, culinary use and provide year-long instream flows during drought periods for fish and aquatic values. This could increase the yield of Quail Creek Reservoir and Sand Hollow Reservoir.

A study and report "Evaluating Alternative Flow Strategies in the Virgin River" by Dr. Thomas B. Hardy of March 3, 1994 (Reference 5) evaluates the effects of different stream flows on fish species and their habitats. This study was completed by use of the daily flow simulation model for the Virgin River developed by the Utah Division of Water Resources (UDWR 1994). River channel characteristics were compared using field measurements and the PHAB SIM hydraulic simulation routines. In addition, multi-spectral video imagery at several flow rates was utilized to compare total surface areas within the stream channel to predict total surface areas from the PHAB SIM model results. Video was used to measure differences in instream habitat features at different measured flows. The results of this study are quite complex, but are summarized in the report as follows:

- Impacts to woundfin, Virgin River chub and other native species habitat associated with the reduction of winter flows from the 86 cfs to 50 cfs in Hardy et al. (1989) suggest that this trade-off of lower winter flows for flow augmentation below Washington Fields diversion during summer and early fall may be feasible without significant impacts to fisheries habitat.
- It is evident that based on long term data, all species show small net positive gains in habitat in terms of both the median and average percent changes in available habitat. In general, with the exception of two larger size classes of roundtail chub and largest size class of flannel mouth sucker, all species and life stages show net monthly positive gains in terms of the median and average percent change in available habitat.
- System wide segment weighted results for all species show improved habitat conditions under the 50 cfs flow scenario based on the long term 50 year period of record using daily flows.
- Long term monthly average and median percent changes in habitat were restricted to the largest life stages of roundtail chub and flannel mouth suckers and were generally less than -10 to -12 percent. Other species and life stages showed positive percent changes in habitat which ranged from 1 to 8 percent (Hardy, March 3, 1994). The results of this study will need to be verified by additional evaluations or studies.

2. Alternatives

Other alternatives regarding different flows and time periods will be analyzed in the Resource Management and Recovery Program (VRRMRP).

3. Mitigation or Benefits

The yield of Sand Hollow Reservoir and Quail Creek Reservoir could be increased.

C. SAND HOLLOW RESERVOIR

(See Figure 6 for map)

1. Project Proposal (Purpose and Needs, March 1995)

The proposed Sand Hollow Reservoir is located approximately 5.5 miles southwest of Hurricane, Utah (see Figure 6). It will have a proposed capacity of 30,000 acre-feet. The site is off stream of the Virgin River and water will be delivered to the reservoir basin by a 66-inch pipeline connected to the Quail Creek Pipeline System. This project has an estimated groundwater recharge from the reservoir of 4,500 to 11,000 acre-feet per year. Wells developed down gradient of the basin would recover this water. The potential yield from the reservoir is estimated at 9,200 acre-feet per year. Part of the water saved by reducing winter water flow at the Washington Field diversion would be stored in this reservoir. The reservoir will recharge water aquifers and could increase instream flows downstream from the reservoir. It will also help meet water needs for anticipated growth in Washington County. Sand Hollow will provide water for instream flows to the river during drought periods. The annual cost of this project is approximately \$79 per acre foot. If the Lake Powell pipeline is built, the reservoir will be at the end of the pipeline.

2. Alternatives

Alternatives to this project have been evaluated such as a dam site on Fort Pierce Wash. It would require a much longer pipeline and construction of a new diversion. The geologic structures are not good for holding water. The cost per acre foot of yield would be \$3,775. Another alternative is the old Dixie Springs project which consists of a dam on the Virgin River near the Washington Fields diversion. Because of environmental concerns, sedimentation, and negative effects to listed and unlisted native fish species, this proposal is not feasible at this time.

3. Mitigation or Benefits

a. Native Fish Habitat, Riparian and Aquatic Values

The following actions could mitigate effects, if any, from the construction of the Sand Hollow Reservoir project on native fish habitat, riparian and aquatic values. Year-long stream flows could be provided below the Quail Creek diversion and year-long water flows restored below

the Washington Fields diversion. Also the protection of the 100-year flood plain will enhance riparian values and fish habitat.

b. Recreation

Sand Hollow will positively contribute to the demand for more water based recreation opportunities, especially as they relate to reservoirs available to boating and developed recreation. Floating the river could be affected by reduced flows.

D. PIPELINE GUNLOCK RESERVOIR TO IVINS RESERVOIR

(See Figure 7 for map)

1. Project Proposal

This project involves piping water from Gunlock Reservoir to Ivins Reservoir, in a 24-inch pipeline. A pipeline would replace the current open ditch and diversions down stream . It is estimated that 13 cfs of flow which is currently lost to infiltration in the river channel and ditch can be recovered for downstream use. Water delivered from this pipeline will replace diversions downstream to the Seep Ditch diversion. Part of this saved water could be used for restoring water to the river below Gunlock Reservoir. Flow restoration would allow Virgin spinedace and other native fish to reestablish in this section of the Santa Clara River. It is estimated that the project can yield 3,600 acre-feet of water. The estimated annual cost of this project is \$63 per acre foot. After the pipeline is in place it may be possible to remove existing diversion structures.

2. Alternatives

The only alternative is to continue delivering water from diversions on the river and from the open ditch. Water loss to infiltration would continue to occur. Winter flows would not be restored below Gunlock Reservoir.

3. Mitigation or Benefits

This project by itself will not affect listed and unlisted native fish. If water can be restored to the stream channel below Gunlock Reservoir, it will restore historical spinedace habitat which now periodically goes dry during the winter season. It will also replace diversions down stream and allow free flows.

E. ASH CREEK PROJECT

(See Figures 5 and 6 for map)

1. Project Proposal (Purpose & Needs, March 1995)

This project consists of gathering the waters of Ash Creek, Leap Creek, South Ash Creek, and Wet Sandy at their present diversions and piping them to the proposed Sandstone Mountain Reservoir, southeast of Anderson Junction. The water would then be distributed to Pintura, Anderson Jct., La Verkin, and Toquerville by pipeline for irrigation. The high quality water at Toquerville Spring could then be used for culinary use. The pipeline would drop 814 feet creating the potential for hydro power development. The annual yield of this project is estimated to be 6,600 acre-feet. The planned reservoir would have an active storage capacity of 3,000 acre-feet. The annual cost of delivered water is estimated at \$213 per acre foot. If there is more water delivered during non-use periods than Sandstone Mountain Reservoir's capacity, the water can be piped to Quail Creek or Sand Hollow Reservoirs.

2. Alternatives

The only alternative is to continue with the present diversions. There are alternatives for location of the Sandstone Mountain reservoir.

3. Mitigation or Benefits

If there are any changes in base level water flows below Toquerville Springs, water will be needed to replace it. This project will be beneficial because it could provide high quality water from Toquerville Springs for culinary use, and would conserve a considerable amount of water now being lost to infiltration and evaporation. This could effect the recharge of the aquifer which feeds the springs.

F. LA VERKIN CREEK WATER REPLACEMENT

1. Proposed Project

This project consists of extending the La Verkin pipeline to provide water to the lower La Verkin Creek water users. Water diversion on lower La Verkin Creek would then be discontinued and the water users would receive their water from the La Verkin pipeline which is part of the Quail Creek Pipeline system. There is a major diversion on La Verkin Creek above Zion National Park which diverts water to Spring Creek Canyon. This water right has been purchased by WCWCD and returned to La Verkin Creek. This has returned La Verkin Creek to a natural free flowing stream for most of its distance. This water could be used to replace water taken from the Virgin River if Pah Tempe Springs is removed.

2. Alternatives

The only alternative is no action which would continue to rely upon present diversions.

3. Mitigation or Benefits

No negative impacts have been identified for this project. A major benefit derives from returning the stream to a natural free flowing condition throughout most of the drainage. This project could increase the flow of La Verkin Creek to the Virgin River by an estimated 5 cfs. It could restore 2 ½ miles of historic Virgin spinedace habitat. Moreover, it could restore 1/4 mile of historic woundfin habitat and provide an opportunity to establish at least 2 ½ miles of new woundfin habitat. If diversions are left in place, fish passages should be provided. The removal of existing diversions could also have effects on the stream.

G. REUSE OF TREATED EFFLUENT

1. Proposed Action

The Regional Water Reclamation Facility which serves the cities of St. George, Ivins, Santa Clara and Washington, currently discharges six million gallons of effluent per day into the Virgin River. The proposal is to treat the effluent and use it for secondary water use to irrigate golf courses, parks, etc. It is estimated this will provide or yield of 22,000 AF per year. (*Purpose and Needs Study*) This proposal could be implemented on any new treatment plants constructed.

2. Alternatives

The only alternative is to continue to discharge effluent into the Virgin River.

3. Mitigation or benefits

This proposal's major benefit will be to provide a yield of 22,000 AF of water per year to help meet the water needs of the county at a reasonable cost estimated to be \$50 per AF per year.

This proposed action will reduce river flows below the treatment plant. This could effect native fish species. During low flow periods the effluent provides major water flows in the Virgin River.

CHAPTER 4. PRIVATE PROPERTY MANAGEMENT STRATEGIES

Private property owners are the key to success of the VRMP. With 80% of the property in the 100-year flood plain privately owned, little success can be achieved without the owners' involvement and cooperation. No actions will be carried out without close coordination with private property owners.

This chapter details the cooperative management strategies, and if opportunities become available, the acquisition of properties in the 100-year flood plain and protection of water rights. Every effort will be made to protect private property rights while trying to carry out the goals of the plan.

If the plan is going to be successful, lands in the 100-year flood plain must be managed to protect or enhance its values. These lands are valuable for:

- ! Wildlife Habitat
- ! Fishery Habitat
- ! Water Quality
- ! Riparian Areas and Wetlands
- ! Open Space
- ! Scenery
- ! Recreation
- ! Agriculture
- ! Human water
- ! Flood Control

A. COOPERATIVE MANAGEMENT

Most of the land in the flood plain is private property. As a result, the first approach will be to develop cooperative management strategies with private land owners, who are willing and interested in protecting river and flood plain values. These strategies can include providing information and implementing or continuing land uses and management practices which improve or maintain flood plain values.

B. ZONING STRATEGY

Zoning ordinances will be developed by individual communities and the county with participation from the public and land owners to protect river and flood plain values. These ordinances should contain provisions to prohibit inappropriate uses which intrude into the flood plain or effect the values which have been identified for the flood plain. What is contained in the ordinances will be determined by each governing entity. A sample zoning ordinance is included in Appendix F.

C. PROTECTIVE EASEMENTS

Protective easements can be negotiated with willing land owners to protect the river and flood plain values. These easements could include such things as:

- ! Providing access
- ! Limiting access
- ! Providing tax relief
- ! Long term land use planning
- ! Restricting types of use
- ! Maintaining present land use
- ! Providing land owner monetary reimbursement for enhancing or limiting uses in the flood plain

The entity acquiring the easements will hold the easement and be responsible for arranging the purchase.

D. ACQUISITION STRATEGY

Lands offered on a willing seller, willing buyer basis and at fair market value may be purchased to protect flood plain values. Land titles will be held by the party acquiring the property and contain protective covenants to assure protection of the flood plain values.

E. WATER RIGHTS PROTECTION

Water rights within the Virgin River Basin are held by individuals, businesses, irrigation companies, Indian tribes, municipalities, and other government entities (Appendix B). Water rights are an important concern of this plan and a principal goal is to protect them.

The actions described above to protect and improve the flood plain and protect water rights will be carried out simultaneously by all sponsors of the plan. These actions should begin immediately upon completion of this plan, but will require a considerable amount of time for full implementation.

CHAPTER 5. WILDLIFE INFORMATION

A. INTRODUCTION

The purpose of the VRMP along with the VRRMRP is to provide, to the maximum extent practical, the perpetual presence of woundfin, Virgin River chub, other native fish, and the Southwest willow flycatcher while providing water for present and future water dependent needs in the Virgin River basin. Enhancement of the habitat for these species will occur as an integral part of the proposed conservation and water management projects. This plan also benefits many other plant and animal species by preserving the riparian and aquatic values within the 100-year flood plain. The VRRMRP will direct the actions necessary for the maintenance and recovery of these species.

Preservation of existing ecological values is an objective of the VRMP. The ecological values to be preserved include the aquatic and riparian features of the basin. These values include the threatened, endangered, and candidate species of concern and the riparian vegetation which provides food and cover for these and many other species along the drainages. Some stream and bank areas have been affected by diversions, dams and other developments in the past. The ecological value of the area has been changed from its ancestral or "pristine" condition. Since it is extremely difficult to reconstruct what this ancestral condition would have been, and virtually impossible to recreate it, a realistic and more workable goal is to attempt to preserve the known values of the present day Virgin River drainage and flood plain.

A second guiding principle is to preserve existing biodiversity. Part of the ecological value lies in the multitude of species of animals, birds, fishes and plants making the river their home. Nine species have been listed. One species was proposed for listing. Table 28 summarizes the status of these species. Appendix C is a listing of all species which may use the flood plain.

TABLE 28. Endangered Species in Washington County

Federally Listed & Proposed Threatened & Endangered Species in Washington County		
Common Name	Scientific Name	Category
Mojave Desert Tortoise	<i>Gopherus agassizi</i>	Threatened
Peregrine Falcon	<i>Falco peregrines</i>	Endangered
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Endangered
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	Threatened
Southwest Willow Flycatcher	<i>Empidonax trailii extimis</i>	Endangered
Woundfin Minnow	<i>Plagopterus argentissimus</i>	Endangered
Virgin River Chub	<i>Gila robusta seminuda</i>	Endangered
*Virgin Spinedace	<i>Lepidomeda mollispinis mollispinis</i>	Proposed listing withdrawn
Dwarf Bear-Claw Poppy	<i>Arctomecon humilis</i>	Endangered
Siler Pincushion	<i>Pediocactus sileri</i>	Threatened
*Federal Register notice May 18, 1994 proposed listing as threatened		

B. BIOLOGICAL INFORMATION

For complete biological information refer to reference 8, 11 and the VRRMRP.

1. Species of Concern

a. Woundfin (*Plagopterus argenitissimus*)

The woundfin was listed as endangered on October 13, 1970 (35 FR 16047). A recovery plan combined with recovery actions for the Virgin River chub has been developed and is being implemented by the Virgin River Fishes Recovery Team (Reference 11). Critical habitat has not been determined.

b. Virgin River Chub (*Gila robusta seminuda*)

The Virgin River chub was listed as endangered on August 24, 1990 (54 FR 35305). A recovery plan combined with recovery actions for woundfin, has been developed by the Virgin River Fishes Recovery Team (Reference 11). Critical habitat has not yet been determined.

c. Virgin Spinedace (*Lepidomeda mollinspinis mollinspinis*)

The Virgin spinedace was, by proposed rule (590 FR. 25875) dated May 18, 1994, proposed for listing as a threatened species under the ESA (16 U.S.C. 1531). This proposed rule was withdrawn as a result of the Virgin spinedace conservation agreement and strategy dated April 11, 1995. There are two recent reports which assess the status of spinedace in the Virgin River Basin: "Status of the Virgin Spinedace in the Virgin River Drainage, Utah" by Richard A.

Valdez, et al. dated January 1991 (Reference 10) and "The Current Distribution and Status of Spinedace in the Virgin River Basin" by R. Craig Addley and Thomas B. Hardy dated December 1, 1993 (Reference 1). The Valdez report was used as the basis for the petition to list the spinedace. This report was also used as the basic documentation for the proposed rule for listing by the U.S. Fish and Wildlife Service. The Addley/Hardy report is more accurate and current, and incorporates data from the Valdez report.

d. Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is currently listed by the USFWS as an endangered species. Most observations of bald eagles in Washington County are along the Virgin River, Santa Clara River, and the bodies of water associated with these rivers. These are non-resident eagles that are moving south or wintering in the area. Other use areas include Quail Creek Reservoir, Hurricane sewer ponds, Baker Dam Reservoir, Sand Cove Reservoir, Gunlock Reservoir, Ivins Reservoir and Ash Creek Reservoir (BLM 1990; DWR 1991).

e. Southwest Willow Flycatcher (*Empidonax traillii extimus*)

This bird is listed as endangered and occurs at the extreme northern limit of its range in Utah. It is an insectivore and neotropical migrant which breeds in the spring/summer period of the southwest. Typical breeding habitat includes thickets of willow, buttonbush, seepwillow, tamarisk, or other large shrubs and small trees, possibly with an over story of cottonwood, box elder or other larger trees. In terms of standing water, surface water, boggy or swampy conditions are prevalent (Tibbitts et al. 1994).

f. Candidate Species

Over 40 species occurring in Washington County are considered candidates for the federal endangered species list and many others are state-listed. Of these, one species is currently proposed for listing: the Virgin spinedace. Five more species are likely to be considered for listing in the near future. These include the spotted bat, gumbo milk-vetch, Holmgren milk-vetch, Bonneville cutthroat, and wet rock physa (also known as the Zion Canyon snail).

C. HABITAT IMPROVEMENT, MAINTENANCE AND PROTECTION

1. Woundfin (*Plagopterus argentissimus*), Virgin River Chub (*Gila robusta seminuda*)

These two species are considered together due to the similarity of habitat and impacts.

a. Woundfin and Virgin Chub Habitat Maintenance, Enhancement and Protection

! Substantial water flows, year long will allow fish to maintain themselves in all parts of their habitat.

! Controlled use of the flood plain will allow for maintenance of stream banks and reduce erosion.

i. Habitat Enhancement

- ! Water will be restored year long below the Washington Field diversion, which is presently dewatered many times during the year. Restored flows will allow the fish to re-establish in this historic habitat.
- ! Stream banks and river channels will improve over time from measures designed to protect flood plain values and improve fish habitat.

ii. Protection of Habitat

- ! The purchase or lease of the 100-year flood plains will provide protection to important wetlands and riparian areas.
- ! Plan implementation will protect the rivers and associated habitats by eliminating reaches of dry channel during some parts of the year.

2. Virgin Spinedace (*Lepidomeda mollispinis mollispinis*)

a. Spinedace Habitat Maintenance, Enhancement and Protection

i. Habitat Maintenance

- ! Water flows, year long will allow fish to maintain themselves over a greater range of their historic habitat.
- ! Controlled use of the flood plain will allow for maintenance of stream banks and reduce erosion.

ii. Habitat Enhancement

- ! The restoration of water year long to the Virgin River, from Quail Creek Pipeline diversion to La Verkin Springs, will allow spinedace to reoccupy 2.8 miles of historical habitat.
- ! The restoration of water year long to the Santa Clara River, from Gunlock Dam downstream, will allow the reintroduction of spinedace to 20 miles of historical habitat, where they presently do not exist.
- ! Stream banks and river channels will improve from protection and improved management.
- ! The removal of some diversions from La Verkin creek could improve 3.8 miles of habitat.

iii. Protection of Habitat

- ! The purchase or lease of the 100-year flood plains will provide protection to important wetlands and riparian areas.
- ! The plan will protect the rivers and associated habitats by eliminating reaches of dry channel during parts of the year.

3. Bald Eagle (*Haliaeetus Leucocephalus*)

a. Bald Eagle Habitat Maintenance, Enhancement, and Protection

This plan will be beneficial to the bald eagle. Riparian areas and wetlands will be protected along the streams. Two additional reservoirs will create new habitat for bald eagles.

4. Southwest Willow Flycatcher (*Empidonax trailii extimus*)

a. Habitat Enhancement and Protection

This plan should have a positive effect on flycatcher habitat. The protection and management of the 100-year flood plain should improve habitat and provide reliable cover and nesting areas. Intrusions and habitat disturbances should also be reduced.

D. IMPACTS MITIGATION AND CREDIT BANKING

The impacts of program implementation, mitigation, credit banking, and alternatives will be developed in the Virgin River Resource Management and Recovery Program, which is currently being developed (Appendix E).

CHAPTER 6. RECREATION

A. INTRODUCTION

The development and implementation of the Virgin River Management Plan provides a unique and timely opportunity to simultaneously study and analyze recreation opportunities adjacent to and within the river corridor. If feasible, the development of recreation facilities which are compatible with and complement the goals and objectives of the VRMP would address identified community needs and desires for increased recreation opportunities. Land owner participation will be required for any plans and development completed.

A brief evaluation of recreational resources within the project area, and a discussion of issues and conceptual opportunities are included in Reference 24, titled *Virgin River Habitat Conservation and Management Plan; Recreation component*. The resources, issues, and opportunities explored in this document compiled by the Utah Division of Parks and Recreation provide a starting point from which to thoroughly study the integration of recreation with the VRMP.

In summary, it appears that broad community needs and desires could be served by a recreation plan and facilities developed in conjunction with the implementation of the VRMP, the related protection of the 100-year flood plain for critical riparian habitat, and the development of addition water based recreation opportunities such as those provided by the development of the proposed Sand Hollow Reservoir.

Any development of recreation facilities will require close cooperation with and support from private property owners to be successful.

Developments will need to carefully consider impacts to riparian and wildlife values, so as to not harm these values.

B. PRESENT CONDITIONS

There is no formal mechanism for coordinating planning and funding recreation for the entire river corridors. St. George has a developed system, but other communities do not.

1. Recreation Opportunities

Recreation opportunities along the corridors vary from primitive dispersed camping to crowded boating experience at the managed reservoirs. The recreation activities include kayaking, hiking, photography, waterskiing, power boating, fishing, camping, picnicking, swimming, sunbathing, biking, golf, nature study, hunting and horseback riding, etc.

The Statewide Comprehensive Outdoor Recreation Plan (SCORP)(ref 20) lists the top ten recreation activities in Washington County, for families and individuals. These are shown in Tables 29 and Table 30.

TABLE 29. Favorite Family Activities in Washington County

Favorite Family Activities Washington County	
1. Picnicking	11. Tennis
2. Golf	12. Hiking
3. Walking	13. ATV Activities
4. Fishing	14. 4-Wheeling
5. Developed Camping	15. Powerboating
6. Baseball/Softball	16. Waterplay/Sunning
7. Driving/Sightseeing	17. Field Sports
8. Waterskiing	18. Basketball
9. Pool Swimming	19. Volleyball
10. Primitive Camping	20. Attend Events

TABLE 30. Favorite Individual Activities



Formal trails are quite limited except for Zion National Park. St. George has 2.5 miles of trail completed with over 22 more miles planned. The 8.5 mile Pa'rus trail connects Zion National Park with Springdale. No other trails exist in the corridor area. Santa Clara, Ivins, and other communities are in the early stages of trail planning and coordination, however.

2. Water Based Recreation

There is an enormous demand for water-base recreation. Failure to plan adequately for recreation uses at water development projects will lower visitor experiences. There are currently 350,000 visitor days use occurring at Quail Creek Reservoir. The planned Sand Hollow Reservoir is expected to generate similar use levels.

3. Present Recreation Programs

The present recreation providers are shown in Table 31.

TABLE 31. Recreation Management Programs

RECREATION MANAGEMENT IN THE PROJECT AREA	
Corridor communities/agencies	Recreation program status
St. George	Full recreation program with trails
Washington County	No programs - Communities handle
Washington City	Established Program - Would like trails but need funding.
Hurricane	Small program - Ball fields
Santa Clara	Citizen committee formed - Planning stage for a system
Ivins	None currently - support trails and future programs
La Verkin	Support recreation - Has sports program
Virgin	Small city park and river facility - No programs
Rockville	No programs
Springdale	Trails planning in place
Bureau of Land Management	Recreation provider throughout county, Limited developed recreation - Red Cliffs Campground, Baker Reservoir
National Park Service	Major recreation provider - Zion National Park
Utah Division of Parks and Recreation	Major recreation provider - Three areas in county

4. Trail Needs and Corridor Recreation

One goal of the VRMP is to assist sponsors and others to develop a trail and natural parkway plan for the 100-year flood plain. Table 32, a 1995 draft "Utah Statewide Trails Assessment" identifies the top 10 statewide trails issues. The Three Rivers Parks and Trails Committee is developing a community-based trail plan.

TABLE 32. Top Ten Statewide Trails Issues

TOP TEN STATEWIDE TRAILS ISSUES*	
Rank	Issue
1	Develop more new trails
2	Provide more information about trails
3	Maintain and provide additional public access to public lands
4	Develop trail user education programs
5	Additional resources are needed to maintain existing trails
6	Improve coordination between trail users, local, state and federal agencies
7	Improve bicycle facilities
8	Develop regional/local comprehensive trail plans
9	Create a stable continuous funding source for trail development
10	Develop more trail opportunities for the elderly and trail users with disabilities - universal access

* = Taken from 1995 Draft Utah Statewide Trails Assessment

C. RECOMMENDATIONS OF PLANS

The VRMP integrates water development, economics and recreation. The recommendations from the Plan are as follows.

1. Private Property Protection

Consider private property concerns with recreation development.

2. Organize a Separate Recreation Committee

The VRMP Coordinating Committee will establish a separate committee to plan and develop recreation proposals.

3. Evaluate Plan for Future

Organize professional and community leaders to evaluate and plan for the future of recreation in Washington County, especially as it relates to corridor and parkway management.

4. Funding

Secure a method of funding to provide recreation for the greater geographic areas of the county (The City of St. George has a well established system).

5. Trails Feasibility Plan

Complete a trails feasibility plan.

6. Corridor Interpretive Plan

Initiate a corridor interpretive plan with emphasis on identifying visitor education opportunities for endangered species recovery and heritage resources.

7. Development

Develop recreation opportunities and facilities in concert with water and species conservation efforts.

8. Cooperate

Work cooperatively to reduce riparian associated recreation impacts on the Santa Clara and Virgin River.

9. Support Sand Hollow Reservoir

Support Sand Hollow Reservoir from the perspective that it addresses the demand for reservoir based recreation.

10. Pursue Partnerships

Actively pursue partnerships with other resource interests and private interests to build program and funding support.

D. CONCEPTUAL ALTERNATIVES

Opportunities for the Virgin River are endless. Some of these are as follows:

1. Santa Clara River Reserve

This reserve could have connecting trails, recreation management and an Indian museum. A trail system between Ivins and Santa Clara could link to it.

2. Grafton Renovation

Renovation of the historical town of Grafton which could be accessed by footbridge from Highway 9 and the proposed information center for Zion National Park.

3. Interpretive Trail

Building of an interpretive trail highlighting endangered species, off Highway 9, funded with Section 6 Endangered Species Act monies.

4. Linking Trails

Building trails in Virgin which link with trails from Springdale.

5. Quail Creek to St. George Trail

Construct a trail from Quail Creek Reservoir to St. George with several access points.

6. Zoning

Consider special land use or resource protection zones along streams in the drainage to protect these precious waterways for the future.

Alternatives such as these are only the beginning. Opportunity boundaries will be set only by a lack of concern or focus. This component of the VRMP helps to bring about that focus.

CHAPTER 7. FLOOD PLAIN MANAGEMENT

A. INTRODUCTION

The major goal of the VRMP is to protect and improve the 100-year flood plains and protect them from intrusions and uses which could harm their values. The flood plains provide important and critical habitat for many wildlife species. They are an important part of the watershed and have a major role in maintaining and improving water quality. Flood plains are the location of most wetlands and riparian areas in Washington County. A properly functioning flood plain has a major role in protecting adjacent areas from damage during flood events. Riparian vegetation in the flood plain is a critical element of the human and natural environment and requires protection. The flood plains in the Virgin River Basin remain largely undeveloped and thus provide a unique opportunity to improve and protect riparian resources essential to the health and ecological well-being of the basin and to human safety and enjoyment.

B. PRESENT CONDITIONS

Private property owners own at least 80 percent of the flood plain. They are doing and have done a good job of protecting and managing flood plain areas. Much of this land is in agriculture which provides good protection of flood plains, but population growth is putting pressure on these lands for development which has effected land values. No organized plan for protecting flood plains has been developed for use throughout the county.

Good flood plain mapping has not been completed throughout the basin. Much of the flood plain has limited quality mapping done by the Federal Emergency Management Agency (FEMA) for flood insurance. These maps are not adequate to identify flood plain boundaries by local government agencies. St. George City and some other communities have good mapping, but the county and most towns do not. Planning for flood plain protection is greatly impeded where the flood plains cannot be identified on the ground.

All government entities in the basin have some kind of ordinances to protect flood plains, usually through zoning ordinances or regulations. Current ordinances are not uniform in their requirements or effectiveness. Some allow building in the flood plain with special stipulations. Some allow filling to take place to facilitate construction above the 100-year flood zone. Such filling can redirect flood waters to areas outside the current flood plain and result in unintended damage to other land and property.

C. RECOMMENDATIONS

1. Encourage and assist government entities in completing accurate flood plain mapping on at least two foot contours.
2. Work with and assist private property owners to protect the river and flood plains from activities and development harming riparian and aquatic values or acquire protective easements.

3. If private property owners desire to sell, purchase lands within the 100-year flood plain, where appropriate.
4. Assist and encourage governing entities to adopt zoning ordinances which fully protect flood plains from inappropriate intrusions. (A sample ordinance is included in Appendix F.)

CHAPTER 8. WATER CONSERVATION

A. INTRODUCTION

If the plan is going to be successful, water conservation must be implemented. As shown in Table 5 and 6 in Chapter 1, an additional 39,556 AF/YR by 2220 and 66,083 AF/YR by 2040 will be required to meet anticipated demands with moderate growth if water conservation is not implemented. The State Water Plan defines water conservation a “wise-use” which includes strategies for reducing water demand, and for increasing water supply (Reference 9). The VRMP will propose the use of both methods of conservation. The State plan suggests three elements which should be present in an effective water conservation plan. These include efficiently designed operating systems, water saving devices, and practices and programs to encourage people to use water wisely. All of these are included in the VRMP.

B. PRESENT CONDITIONS

The present per capita water use is estimated in excess of 300 gallons per person per day. This is a very high water use compared to other areas of the southwest. Comparisons are shown in Table 33.

TABLE 33. Per Capita Water Use

County	1990	1995
Imperial, CA (Yuma)	283	188
Iron, UT (Cedar City)	329	282
Los Angeles, CA	185	158
Maricopa, AZ (Phoenix)	229	249
Salt Lake, UT	306	241
San Diego, CA	260	154
Washington, UT	357	341
Clark, NV	218	222
Lincoln, NV	328	492

It is clear there is a need and opportunity for Washington County to do better in implementing water conservation. In order to address this need for water conservation, a county-wide committee was organized under the direction of the WCWCD. The Washington County Water Management and Conservation Plan was prepared. The conservation plan was approved by the Board of Directors of the WCWCD on May 21, 1996.

The plan includes all of the elements discussed above. The goals of the plan are:

1. General Supply Management

The focus is to improve water quality, improve design and efficiency of water storage projects, reduce water loss through seepage and evaporation, encourage drought management, and enhance watersheds.

2. Agricultural

The goal is to provide information on improved irrigation practices to farmers and other irrigators. It is hoped to increase efficiency, prevent erosion and ground water contamination, and conserve water.

3. Interior Residential, Commercial/Industrial and Landscape

The goal is to reduce outside landscape watering by 20% in the next 20 years. This alone would reduce per capita use to 250 gallons per day.

Although the conservation plan has been completed, it has not been adopted or implemented by all water using entities.

C. RECOMMENDATIONS

- Encourage and assist governing entities, irrigation companies or other water managing entities to adopt the developed water conservation plan or help develop their own plan.
- Implement a public information program regarding water management and conservation.
- Encourage water pricing structures which encourage conservation.
- Support and encourage the recycling of water from water treatment facilities.
- Support and encourage activities and projects which reduce water loss from seepage and more efficient use of irrigation of yards and farms.
- Develop demonstration projects to demonstrate more efficient irrigation methods.

CHAPTER 9. OPEN SPACE MAINTENANCE AND CONSERVATION OF AGRICULTURAL LAND

A. INTRODUCTION

Essential goals of the VRMP address the need to conserve, enhance, protect and recover native species and their habitat and to assist in the reduction of the likelihood of additional species requiring federal or state protection. Important objectives central to the achievement of these goals are the maintenance of open space and the conservation of agricultural lands within the river's 100 year flood plain. Open space – including privately owned natural areas and public parks – and productive agricultural are essential for maintaining healthy wildlife habitat. Other important functions of open space and agricultural land include improving water quality, reducing surface water runoff, accommodating floodwaters, and contributing to our community's quality of life through recreation and the protection of the community's scenic and historical character.

In addition to its importance to wildlife, agricultural land conservation makes it possible for a local economy to continue to produce and sell agricultural products. It also provides future generations with the opportunity to participate in this traditional and desirable lifestyle, whether through the private keeping of livestock and pasturage or the commercial production of feed, fruit, meat and other agricultural goods.

For the purposes of this plan, the term "open space" means specifically largely undeveloped areas of land within the 100 year flood plain where natural vegetation dominates or is enhanced and wildlife are able to reside with adequate cover and a tolerable level of disturbance. Open space may be privately or publicly owned. The conservation of agricultural land will be treated separately.

B. PRESENT CONDITIONS

As previously noted in this plan, approximately 80% of the area within the 100-year flood plains of the Santa Clara and Virgin Rivers is privately owned and utilized for private benefit. Except for a few new subdivisions adjacent to the Virgin River, much of this land remains in larger lot ownership. Along the Santa Clara River, private ownership is more fragmented but larger agriculturally zoned parcels still exist.

The *Coordination Plan for Washington County's Urbanizing Region*, July 1997, a compilation and comparison of the general plans of the numerous cities and towns throughout the county, reports that "nearly every community expressed a goal or policy regarding the preservation of local natural areas as open space." Specifically identified areas considered desirable to be preserved as permanent local open space for Washington County include "areas that are important for the functioning of natural systems, such as the riparian areas and flood plains of the Virgin River, Santa Clara River, Mill Creek [and] wetland areas."

The county has adopted several open space policies including 1) encourage the permanent preservation of land designated as Open Space in the general plans of each community and 2) endorse the Virgin River Management Plan and encourage each community to aid in its implementation.

Although the regional plan recognizes the uncertain future of agriculture in Washington County due to development pressure, the county nevertheless has adopted policies in support of agricultural preservation including: 1) productive agricultural land is a limited resource of both environmental and economic value and should be conserved and preserved; and 2) preservation and enhancement of a rural lifestyle is an important component of the cultural, social and aesthetic well-being of the region.

Open space preservation efforts in Washington County are also supported by private organizations and public agencies.

Private organizations with offices in Washington County which support the maintenance of open space and the conservation of agricultural lands include People For the USA, a coalition of individuals and groups dedicated to the protection and use of both public and private lands for natural resource production; the Virgin River Land Preservation Association, a community based land trust; and the Grand Canyon Trust, a conservation organization.

Supportive public agencies include the State of Utah Department of Natural Resources (DNR) and its Division of Wildlife Resources (DWR), Division of Parks and Recreation, and Division of Forestry, Fire and State Lands; the State of Utah Department of Agriculture; the Governor's office of the State of Utah; the Natural Resources Conservation Service (NRCS); the Bureau of Land Management, and the U.S. Fish and Wildlife Service.

C. RECOMMENDATIONS

- Map the existing land uses in the 100-year flood plains.
- Encourage and support the preservation and maintenance of larger areas of privately-owned space within the 100-year flood plain wherever possible.
- Purchase land on a willing seller-willing buyer basis within the 100-year flood plain or obtain protective easements to protect riparian areas, wetlands, native animals, fish, and aquatic values.
- Encourage each community, county or agency to develop protective zoning and enforcement for the 100 year flood plain and agricultural lands under their jurisdiction.

CHAPTER 10. WATERSHED/WATER QUALITY

A. INTRODUCTION

As water resources become increasingly scarce in the Virgin River Basin, concerns have increased about the quality of the River's water. This chapter is a watershed and water quality management plan for the area in the Virgin River drainage in Washington County, Utah. Objectives of the plan are:

1. To serve as a tool for local officials to improve or protect water quality;
2. To provide a mechanism for implementing water quality improvement projects;
3. To develop a long-term monitoring plan to determine the effectiveness of the plan;
4. To serve as a model in using a watershed based approach to water quality plan;

B. PROJECT AREA

The East Fork of the Virgin River originates in the mountains in western Kane County and travels through parts of Zion National Park before entering Washington County. The North Fork of the Virgin River also originates in the mountains of western Kane County and travels through parts of Zion National Park. The basin area encompasses 1,831,000 acres, to include the Santa Clara River, Ash Creek, and La Verkin Creek.

About 23.7 percent of the Virgin River drainage is privately held with 0.8 percent of that land classified as agricultural under irrigation with the remainder of the area under public ownership.

Water quality studies on the Virgin River date as far back as 1964 with more recent studies conducted in the 1980's and 1990's. The Utah Division of Water Quality has monitored sites in the basin on a continual basis since the mid 1970's. Work in the 1970s concentrated on municipal and industrial effluent entering the river. More recently studies have concentrated on non-point pollutants, particularly nutrients, bacteria and sediments.

Impoundments in the basin include Pine Valley, Baker Dam, Gunlock, and Quail Creek Reservoirs. None of these reservoirs have been thoroughly evaluated for water quality.

Macro-invertebrates in rivers and streams provide information on long-term conditions in those water bodies. Samples collected in the Virgin River since the 1960s have had poor macro invertebrate diversity and were dominated by sediment and organic tolerant species.

C. CURRENT WATER QUALITY STATUS

Water quality monitoring in the Virgin River has been conducted since 1975 to determine the current water quality status in the Virgin River Basin to include lakes and reservoirs. Over 29 stream sites or permitted discharge points in the Virgin River Basin were monitored during that same time frame. Some sites were sampled routinely and analyzed for nutrients, bacterial contamination, field oxygen, temperature and pH. Information from other sites vary with the site and the program it has been associated with.

D. BENEFICIAL USES, STANDARDS AND THE TMDL PROCESS

The beneficial uses supported by lakes, reservoirs and rivers in Utah include domestic water supplies, recreation and aesthetics, wildlife habitat, and irrigation and other agricultural use. Low dissolved oxygen, high ammonia concentrations and excessive sediments impact fisheries. Nutrients (phosphorus and nitrate) cause increased plant growth, creating aesthetic problems, low dissolved oxygen and taste and odor problems. Bacterial contamination is a human health concern. Instream standards for various water quality parameters and an anti-degradation policy have been established by the State to protect these beneficial uses.

Total Maximum Daily Loads (TMDLs) are a means of evaluating and protecting waters based on mass loads of pollutants to the water bodies, rather than just concentrations of pollutants. Using this approach, all point and non-point sources can be compared according to their relative contributions, and impacts throughout the entire watershed can be estimated. Similarly, improvements in water quality can be evaluated in terms of their impacts throughout the drainage.

E. RECOMMENDATIONS

1. Organize a watershed technical committee under the VRMP Coordinating committee. This committee should be made up of technical experts which could be from water departments conservation districts, fish and game department, universities, teachers, conservation groups, natural resource agencies, realtors, agricultural users, soil conservation districts, and private property owners, etc.
2. This committee should complete a watershed plan in the following stages:
 - a. Identify problem areas

It will be necessary to identify and address concerns about the water and other natural resource systems, local economy and social structure.

All concerns will need to be explored to see if there is in fact a real problem. When developing this list of concerns, everyone with a stake in the watershed from the beginning will be involved.

It will be necessary to consider major economic forces. Who are major employers? Where are they located? What are the trends? How can the plan impact the economic future of the watershed? How do the economic, social and natural resources impact each other? What is the role of education now and in the future?

All concerns will be considered and documented at this stage.

b. Seek and Analyze Data

Concerns will be consolidated and analyzed, using any and all existing data available to the working committee(s). This will provide a baseline for later comparison.

c. Prioritize Challenges/Opportunities

There will not be enough funds or time to address all potential watershed management needs. Priorities will be set that target efforts to the most critical problems and opportunities.

Consensus will be sought on which problems or opportunities to pursue. Options will be analyzed for addressing each issue in terms of timeliness and cost/benefit.

d. Determine Critical Areas

Critical areas within a watershed are those with the greatest impact. These might include water supply locations, recreational use areas, or fragile wildlife habitats.

Water quality in critical areas may be affected by "point source" and/or "non-point source" discharges. These will be identified.

The goal of determining critical areas is to match resource needs with targeted efforts.

e. Establishing Objectives

When establishing objectives the following points should be considered:

- All views of those with a stake in the watershed should be considered
- Existing legal constraints need to be considered
- The objective must be measurable
- Objectives may change later as more information becomes available
- Objectives must be acceptable and achievable

3. Continue working with existing local agencies and extension services to encourage best management practices (BMPs) in all agricultural and non agricultural lands in the basin. In addition, increase awareness on urban contributions to water pollution and educate the public on measures that can be taken to reduce this problem. There is need for a coordinator to oversee the existing and planned efforts in the Virgin River Basin. The

existing VRMP Coordination Committee will continue to function in an advisory capacity.

CHAPTER 11. WETLANDS AND RIPARIAN AREAS

A. INTRODUCTION

An important step in achieving essential VRMP goals is to protect and improve existing wetlands and riparian areas. Riparian lands are areas along streams, rivers, and desert washes where the vegetation reflects the permanent influence of surface or subsurface water. In the Virgin River flood plain, typical riparian vegetation consists of trees or shrubs such as cottonwood, willow, salt cedar, and Russian olive, herbaceous plants including grasses, forbs, rushes, and sedges, and aquatic plants such as watercress and cattails.

Riparian communities in good condition exhibit an abundant and diverse assortment of plants. Healthy communities show good age distribution and provide for most of the soils to be covered by vegetation. This vegetation provides soil and bank stability. Water seeking roots bind the soil together, and the above ground vegetative growth slows down flood waters and reduces stream siltation.

Wetlands are areas inundated by water with frequency sufficient to support vegetation and aquatic life that require saturated soils for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, wet meadows, natural ponds, and some reservoirs. Besides providing essential wildlife habitats, wetlands can contribute to better water quality, retard flooding, and promote ground water recharge by naturally impounding water that infiltrates into deeper soils.

The Virgin River riparian and wetland areas play an important role for resident and migratory game and non-game birds as well as numerous mammals, reptiles, and insects. Wetlands and riparian areas are especially important due to their relative scarcity. There are a number of threatened, endangered or other important species which are dependent on these habitats.

B. PRESENT CONDITIONS

Numerous areas within the Virgin River flood plain remain relatively undisturbed from below Zion National Park to the Arizona state line and contain healthy stands of riparian vegetation. However, introduced species, urban growth, certain agricultural practices, flow alterations, ground water depletions, and indiscriminate use from growing numbers of recreationists are placing increased stress on the riparian resources. Among other things, impacts include habitat loss, habitat fragmentation, and impaired water quality. In some cases, agricultural returns, urban runoff, and water storage facilities have created wetland conditions that could be managed to sustain healthy, productive systems. Other opportunities exist to improve plant composition and habitats in selected areas by replacing invasive, introduced species with desirable vegetation. Runoff and agricultural returns could also be captured and used to create or maintain wetlands and riparian areas. A substantial portion of these areas occur on privately-owned lands. Landowner consent and cooperation will be necessary in designing and completing projects associated with management opportunities.

C. RECOMMENDATIONS

1. Promote public understanding of the importance of wetlands and riparian areas and opportunities for protection.
2. Inventory and map existing wetlands and riparian areas and identify management opportunities in cooperation with private land owners.
3. Work with communities and landowners to manage urban runoff and agricultural returns so as to improve water quality and wildlife habitats.
4. Develop cooperative management strategies with private property owners to maintain, develop, and protect riparian and wetland values.
5. Encourage landowners and land management agencies to develop alternatives to disruptive activities in riparian habitats so as to reduce impacts from wood cutting, inappropriate developments, and heavy recreation or vehicle use.
6. Establish protective conservation easements with interested private property owners, where appropriate, in the flood plain.
7. Assist in purchasing wetlands or riparian areas where willing sellers and buyers exist.
8. Help local, state, and federal agencies to identify and improve areas where invasive, introduced species can be replaced with desirable vegetation to achieve goals for riparian improvement. Also assist local authorities in controlling undesirable insect populations.

CHAPTER 12. PUBLIC AFFAIRS AND EDUCATION

A. INTRODUCTION

If the plan is going to be successful and be implemented, it will require support of landowners and the public. It will be necessary to develop and carry out a public affairs program to inform and educate the public of the value and necessity of implementing the plan. It will require the use of all media to be successful.

B. PRESENT CONDITIONS

There are representatives of all major stakeholders on the coordinating committee. This level of participation provides a good base from which to educate and inform private property owners and the public. There have been VRMP presentations given to all city councils and the county. Numerous presentations have been given to civic clubs and other groups in the county. A video has been prepared explaining the management plan. A water conservation plan has been prepared by a broad-based county group, but needs to be adopted by the various government entities. A water fair is sponsored by the WCWCD for all 5th grade students in the county.

Much has already been done to educate the public, but a coordinated effort involving all participating plan sponsors is needed to achieve the goals of the VRMP.

C. RECOMMENDATIONS

1. Organize a publicity committee to develop and implement a public affairs program to educate and promote the VRMP.
2. Hold workshops to explain and promote the VRMP.
3. Prepare a brochure to be sent to all households in the county explaining the VRMP.
4. Keep the public informed of successful implementation actions as they are completed.

CHAPTER 13. ECONOMIC IMPACTS

A. INTRODUCTION.

Assessing the economic impact of the Virgin River Management Plan (VRMP or the plan) requires that the plan be broken into parts, and each part will be evaluated separately. There are five parts of the plan that will cause potential economic impacts. These are: 1) the La Verkin Spring project; 2) the Sand Hollow Reservoir project; 3) the Gunlock-Ivins Pipeline project; 4) the Ash Creek project; and 5) flood plain acquisition and green space development. Each of these projects was analyzed using IMPLAN, an input-output model of Washington County, Utah. (Groesbeck, 1995)(Ref. 16)

B. DISCUSSION OF VARIABLES EFFECTING ALL PROJECTS.

Two of the primary variables that will effect the economic impact of most of the projects are the rate of population growth in the county, and the timing sequence in which the projects are completed. These two variables determine the demand for, and supply of water, respectively. If the supply of water increases at a rate faster than the demand, the economic value of water falls in real (inflation-adjusted) terms, or vice versa.

Given the present supply of and demand for water, the probability of eliminating water reserves is approximately 16 percent. This probability is derived using the flow data from the Virgin River for the period 1910-1991, wherein the probability of flows less than or equal to the flows during the drought of 1989-1991. During that period, reservoirs were drained, and water rationing was discussed. As the demand for water increases due to the rapidly increasing population in the county, the probability of eliminating water reserves increases, as long as the supply is held constant, and current internal allocations of water (agricultural, culinary, etc.) remain unchanged.

An appropriate goal for policy makers is to hold the probability of eliminating water reserves constant. This means that as the population grows, water resources should grow, so that reserves as a percentage of demand is held roughly constant. The problem with this goal, however, is that population grows in a continuous exponential manner as average water resources grow in fairly large steps because of the capital intensity of water projects. (Groesbeck, 1995)

C. ANALYSIS OF PROJECTS.

The following section provides an analysis of the economic impact of each project. Each analysis is subject to the assumptions made, and is generated using an input-output model of Washington County, Utah. One-time impacts (construction and development) as well as ongoing impacts (consumer spending, tourism, agricultural production, etc.) are presented for each project. One-time impacts should be interpreted as the 1996 present value of construction and development activity that will be supported by the additional water supplies. On going impacts should be interpreted as the annual contribution to the economy by on going

activities supported by the additional water supplies, expressed in 1996 dollars. The "Population Supported" column is relevant only for on going activities. It is not applicable to the one-time impacts because it assumes that all construction is completed simultaneously, which is far too unrealistic. It is further assumed that of all municipal waters created, two-thirds of them will be allocated to residential uses. (Groesbeck, 1995)

1. La Verkin Spring Project.

The La Verkin Spring project diverts waters with high content of salts to a point downstream, making it possible to maintain instream flows through critical areas while increasing potential diversions of higher-quality waters. A portion of the increased diversions will be stored in the proposed Sand Hollow Reservoir, and this portion of new water supplies is analyzed within the framework of that project. The remaining portion of new water supplies of 50,678 acre-feet annually can eventually be used to provide municipal water. However, it is assumed that over the next ten years 80 percent of the water will be allocated to agricultural uses, and 20 percent to municipal water supplies. The probability-adjusted water supply for residential use is assumed to be 1,137 acre-feet, and the probability-adjusted agricultural water supply is assumed to be 6,892 acre-feet annually.

The remaining economic impacts of the La Verkin Spring Project are primarily related to the construction of the pipeline, which has an estimated cost of \$16,370,000. While hydroelectric generation may be possible due to the pipeline, no benefits associated with generation are assumed in this analysis. An additional impact will be caused by the fact that there will be year-round instream flows below the Washington Fields diversion, which will likely increase the use of recreational areas in and around Bloomington. It is assumed that recreational use will increase by 5,000 visitor days annually, with \$10 worth of expenditures each.

TABLE 34. Economic Impact Due to Construction of La Verkin Spring Project.

Time Frame	1996 MM\$ Total Industry Output	Jobs Supported	Population Supported
1996 Present Value of Total Construction and Development	\$223.4549	NA	NA
Annual Ongoing Impact	\$28.1912	726.78	1809

The annual ongoing impact of approximately \$28.1912 million can be used to calculate a modified simple payback period, from a social point of view. The simple payback is equal to the cost of the project divided by the annual social returns associated with the project. The simple pay back is modified because the annual benefits do not include any construction or development values, as discussed earlier. It is further modified in the sense that the payback period is assumed to begin after the potential uses for the additional waters are fully developed. No assumption is made about how long it will take to develop the potential uses for

these additional waters. In this case the modified simple payback is 0.58 years (\$16.370 / \$28.1912). This implies that the project will rapidly contribute social benefits in excess of the cost of the project, and is, therefore, a prudent investment of public funds. (Groesbeck, 1995)

2. Sand Hollow Reservoir Project

In analyzing the Sand Hollow reservoir project, it is important to recognize that the reservoir will provide recreation opportunities, in addition to municipal water. It is anticipated that this reservoir will have sandy beaches, as well as developed recreational use areas. To that end, it is assumed that there will be 250,000 visitor days associated with the reservoir, with an average expenditure of \$10 per visitor day. This assumed rate is likely conservative, as the visitor days associated with Quail Creek Reservoir in Washington County is approaching 400,000 per year. It is also assumed that ongoing park support will be \$25,000 annually.

Given that the reservoir has an estimated annual yield of 9,200 acre-feet, the full-use probability-adjusted yield is 1,564. This value is adjusted still further by assuming that two-thirds of this water will be used to support residential uses. This implies that the remaining one-third will be used in the public domain and commercial sectors.

TABLE 35. Economic Impact Sand Hollow Reservoir.

Economic Impact Due to Construction of Sand Hollow Reservoir Project.			
Time Frame	1996 MM\$ Total Industry Output	Jobs Supported	Population Supported
1996 Present Value of Total Construction and Development	\$205.2310	NA	NA
Annual Ongoing Impact	28.7875	770-79	1915

The annual ongoing impact of approximately \$28.7875 million can be used to calculate a modified simple pay back period, from a social point of view. The simple payback is equal to the cost of the project divided by the annual social returns associated with the project. The simple payback is modified because the annual benefits do not include any construction or development values, as discussed earlier. It is further modified in the sense that the payback period is assumed to begin after the potential uses for the additional waters are fully developed. No assumption is made about how long it will take to develop the potential uses for these additional waters. In this case the modified simple payback is 0.57 years (\$16.4 / \$28.7875). This implies that the project will rapidly contribute social benefits in excess of the cost of the project, and is therefore a prudent social investment. (Groesbeck, 1995).

3. Gunlock-Ivins Pipeline Project.

It is estimated that the Gunlock-Ivins Pipeline Project will yield new water supplies (Full-use probability-adjusted) of 433.5 acre-feet annually. It is anticipated that all of these waters will be

allocated to agricultural use. Primary economic impacts of the project relate to its construction and the purchase of water rights.

An additional economic impact of the project will be that it maintains year-round instream flows in the Santa Clara River, which will also increase the recreational use rate of the flood plain park project. It is assumed in this analysis that flowing waters will contribute 20,000 visitor days to the flood plain park area annually, each spending \$10.

TABLE 36. Economic Impact of Gunlock-Ivins Pipeline.

Economic Impact Due to Construction of Gunlock-Ivins Pipeline Project			
Time Frame	1996 MM\$ Total Industry Output	Jobs Supported	Population Supported
1996 Present Value of Total Construction and Development	\$7.2742	NA	NA
Annual Ongoing Impact	0.3956	11.43	28

The annual ongoing impact of approximately \$.3956 million can be used to calculate a modified simple payback period, from a social point of view. The simple payback is modified because the annual benefits do not include any construction or development values, as discussed earlier. It is further modified in the sense that the payback period is assumed to begin after the potential uses for the additional waters are fully developed. No assumption is made about how long it will take to develop the potential uses for these additional waters. The simple payback is equal to the cost of the project divided by the annual social returns associated with the project. In this case the modified simple payback is 14.84 years (\$5.871/\$.3956). This implies that the project will not contribute significant net financial benefits to the economy for quite some time. However, as the intent of building the pipeline is to maintain instream flows in the Santa Clara River to protect endangered species, financial benefits are only part of the overall value of social benefits of the project. If this project is approved it implies that policy makers believe the overall social benefits of the project are enough offset the financial costs of the project. (Groesbeck, 1995)

4. Ash Creek Project

The Ash Creek Project creates new water supplies via surface and ground sources. Annual Full-use probability-adjusted water supplies are assumed to be 2,397 acre-feet. It is further assumed that the water will be divided between agricultural and municipal uses in proportions reflecting the current use pattern of water in the county, although with slightly higher municipal use (20 percent municipal, 80 percent agricultural/secondary systems).

Given that this project has associated with it the Sand Mountain Reservoir, it is anticipated that there will be some tourism benefit associated with the project. Specifically, it is assumed that the reservoir will attract 50,000 visitor-days, with an expenditure of \$10 each.

TABLE 37. Economic Impact of Ash Creek.

Economic Impact Due to Construction of Ash Creek Project			
Time Frame	Total Industry Output	Jobs Supported	Population Supported
1996 Present Value of Total Construction and Development	\$101.7189	NA	NA
Annual Ongoing Impact	8.633	226.68	563

The annual ongoing impact of approximately \$8.633 million can be used to calculate a modified simple payback period, from a social point of view. The simple payback is equal to the cost of the project divided by the annual social returns associated with the project. The simple payback is modified because the annual benefits do not include any construction or development benefits associated with new water supplies, as discussed earlier in this document. It is further modified in the sense that the payback period is assumed to begin after the potential uses for the additional waters are fully developed. No assumption is made about how long it will take to develop the potential uses for these additional waters. In this case the modified simple payback is 3.52 years ($\$30.359/\8.633). This implies that the project will contribute significant net financial benefits to the economy in a relatively short period of time, and is, therefore, a prudent social investment. (Groesbeck, 1995)

5. Flood Plain Management and Development

In estimating the economic impact associated with cooperative management of flood plain and the development of park and trail facilities in the flood plain, it is assumed that the development cost per acre will be \$100. Further, it is assumed that there will be 30,000 visitor days annually due to the development of trails and other facilities (excluding running water), with expenditures of \$10 each.

Additional impacts that are not quantified in this analysis include the increase in values of property adjacent to the flood plain as a result of the development of trails and other facilities. These values were not included because of the difficulty in assessing what the impacts per acre might be, but in areas where flood plains have been developed into green space, recreational use rises, and property values around the green space also rise.

TABLE 38. Economic Impact of Flood Plain.

Economic Impact Due to Flood plain Acquisition and Development

Time Frame	1996 MM\$ Total Industry Output	Jobs Supported	Population Supported
1996 Present Value of Activity Associated With Land Purchase and Development	\$7.8328	NA	NA
Annual Ongoing Impact	\$.5388	16.81	42

The annual ongoing impact of approximately \$.5388 million can be used to calculate a modified simple payback period, from a social point of view. The simple payback is modified because the annual benefits do not include any construction or development values, as discussed earlier. It is further modified in the sense that the payback period is assumed to begin after the potential uses for the additional waters are fully developed. No assumption is made about how long it will take to develop the potential uses for these additional waters. The simple payback is equal to the cost of the project divided by the annual social returns associated with the project. In this case the simple payback is 3.46 years (\$1.865/\$.5388). This implies that the project will contribute significant net financial benefits to the economy in a relatively short period of time. Therefore, this project is a prudent social investment, based on the assumptions listed.

D. SUMMARY

"The Virgin River Management Plan provides high-quality opportunities for the investment of public funds, at the same time preserving endangered species. In this light, the plan is exceptional, and should be pursued vigorously by all interested parties." (Groesbeck, 1995)

E. DATA SOURCE

All information presented in this plan is from (Final Draft: The Economic Impact of the Virgin River Habitat and Conservation Management plan by John D. Groesbeck, April 19, 1995. Reference 16).

The spreadsheets the printouts from the IMPLAN model for each of the projects are in the original report. This report is available at the Washington County Water Conservancy District Office.

CHAPTER 14. COORDINATION WITH OTHER PLANS AND PLAN ADMINISTRATION

A. COORDINATION WITH OTHER PLANS

This plan, along with the Recovery Plan for roundtail and Virgin River chub, the Virgin Spinedace Conservation Agreement, and the Resource Management and Recovery Program (VRRMRP) now being developed, will be the basis for actions necessary for management, recovery, restoration of lost habitat and mitigation for the proposed water management and project development.

This plan was developed originally to combine all of the plans and agreements into one document. A coordinating committee and technical committee was established and based on the committees' recommendations, it was decided to develop a separate program document which will address recovery of listed species. The program will provide for mitigation banking for native species protection. The program will provide a method for completing biological assessments for the water development projects and other actions which could impact river values. The purpose and scope of the program document is covered in a Memorandum of Understanding to Develop and Implement the Virgin River Resource Management and Recovery Program in Appendix E. This plan will direct management of the river corridor. The program will direct the management and recovery of wildlife species and develop mitigation and banking credits and debits.

The Washington County Habitat Conservation Plan (HCP) deals primarily with upland desert areas in the county and has little overlap with the VRMP. Although a 5-6 mile stretch of the Virgin River travels through the properties encompassed by the HCP north of Hurricane, it does not specifically target aquatic species, but rather the tortoise and other terrestrial species (reptilian, mammalian and avian). Consequently, the VRMP and the VRRMRP will ecologically complement the county plan by addressing species and riparian habitats not previously addressed in this region. The VRRMRP will address concerns expressed in the HCP in regard to endangered species in riverine areas. Land acquisition efforts in support of the HCP will further the goals of the VRMP to the extent that river and flood plain properties are involved.

The management of public lands administered by the Bureau of Land Management is directed by the St. George Field Office (Dixie) Resource Management Plan dated March 15, 1999. The part of the Virgin River gorge in the Beaver Dam Wilderness Area and Upper La Verkin Creek were determined to be suitable for Wild and Scenic River designation. The plan addresses watersheds, riparian values, and water quality and recognizes the VRMP as an important tool in managing the river corridors. The VRMP is in compliance with decisions in the plan and enhances them.

The Three Rivers Trail initiative is a cooperative effort linking people with places in Washington County by creating and maintaining a system of parks and trails through scenic lands, along waterways, between historic sites, and other places of interest. Trail supporters recognize that while the existing recreational opportunities in the county are important, residents' demand for

more recreation would be most appropriately done in a well-thought out, rather than haphazard way. Public land managers and private property owners alike are noting increased recreation use and impacts on their lands. In a positive light, many community leaders see this increasing demand for recreation as a opportunity to capture visitor dollars, develop additional quality of life amenities for residents, and provide educational experiences for the county's children. The VRMP is designed to support the efforts of the Three Rivers Trail.

The Washington County General Plan, dated May 13, 1999, (Ref. 27) contains the following planning direction on page 18. *Flood plains*, it states: "This plan recommends that lands identified in the county as lying in potential flood basins or drainage systems, or those lands, the development of which would cause uncontrollable pollution of streams and waters in the county, should be placed in the open space zone classification in order to protect them from urbanization", on page 10, Agricultural Land states: "The purpose of this plan regarding agricultural land is to protect, insofar as possible, the fertile lands of the county for the growing of crop."

And on page 11, the plan says a watershed plan should be prepared. It states: "In order to develop a firm water supply in terms of quantity and quality for a growing population of the county, a comprehensive watershed management and protection program should be undertaken." The VRMP is in compliance with and addresses each of the above sections of the county plan.

The State of Utah Division of Water Quality asked the coordinating committee of the VRMP to serve as a steering committee to complete a watershed plan for the entire Virgin River watershed. The coordinating committee accepted this request and assigned the administrative committee (AC) to oversee and complete a plan. The administrative committee determined the scope of the watershed plan was much broader than the VRMP, which only included the 100 year flood plain, and that other entities needed to be added to the AC. In addition, to the existing AC members, the following representatives were added: the Dixie National Forest, Zion Nation Park, Dixie Soil Conservation District, Kane County, and the National Resource Conservation Service. It was decided this would be a new committee called the Virgin River Watershed Advisory Committee. This committee is organized and has started development of the Virgin River Watershed Management Plan.

B. PLAN ADMINISTRATION AND DEVELOPMENT

The Virgin River Management Plan (VRMP) is being developed under the leadership of the Washington County Water Conservancy District. (WCWCD). It will be prepared and administered under the direction of two committees: 1) Coordinating Committee (CC); 2) Administration Committee (AC). The Coordinating Committee will be made up of the sponsors of the plan, plus other appropriate entities (as agreed to by the sponsors). The Administration Committee will be made up of nine (9) people elected by members of the Coordinating Committee. Both committees will be chaired by the WCWCD.

Monies and/or labor will be provided by all parties who participate in the plan. An Annual Work Plan (AWP) will be developed each year. The AWP will be developed under direction of the

Administration Committee and approved by sponsors of the plan. The planned actions will be carried out by the sponsors in their individual jurisdictions. The planning period is indefinite from the date of approval with review and modification every five years to adjust to changing conditions.

1. Coordinating Committee

This committee will be composed of plan sponsors and others appointed by the sponsors. This committee will meet at least twice a year. The committee will be chaired by the WCWCD. The Coordinating Committee will be as follows if the entity agrees to be a sponsor. Each sponsor will have one vote.

<u>ORGANIZATION</u>	<u>REPRESENTATIVE</u>
WCWCD - Chair	1
Utah Department of Natural Resources	1
Washington County	1
St. George City	1
Santa Clara City	1
Ivins Town	1
Washington City	1
Hurricane City	1
La Verkin City	1
Toquerville Town	1
Virgin Town	1
Rockville Town	1
Springdale Town	1
Bureau of Land Management	1
Irrigation Companies	
Santa Clara River	2
Virgin River	3
Virgin River Land Preservation Assoc.	1
Paiute Indian Tribe	1
Grand Canyon Trust	1
People for the USA (private property representative)	1
Utah State Department of Environmental Quality	1
Dixie Soil Conservation District	1

a. Responsibilities are as follows:

- ! Assist in development and implementation of the plan.
- ! Approve annual work plans.
- ! Provide members to serve as the local coordinating committee called for in the VRRMRP.
- ! Review the plan and amend if necessary.

- ! Elect members of the Administration Committee.
- ! Develop and carry out public education programs.
- ! Approve annual report.
- ! Oversee VRMP funding and budget.

The CC shall meet at least twice a year in St. George, Utah. One meeting each year shall be designated as its "annual meeting" to elect members of the AC and to ensure that all activities required to be conducted annually have been performed. A majority of members shall be required to make up a quorum of the CC. All decisions of the CC shall be made by consensus. The chair shall be entitled to vote.

2. Administration Committee

a. Membership

The AC will be composed of nine (9) people, the WCWCD representative and eight (8) others chosen by the CC. The WCWCD will serve as chair; provided, however, that meetings of the AC may be conducted by other members on a revolving and voluntary basis. Representation on the AC shall include the state, the federal government, municipal government, Washington County, the irrigation companies, the Shivwits Band, private property interests and conservation/environmental interests.

b. Duties

The AC will perform such duties as may be delegated to it from time to time by the CC and in addition will perform the following activities:

- , Prepare annual report of progress.
- , Develop annual work plans.
- , Prepare budgets.
- , Assist in public affairs.
- , Undertake actions to implement the VRMP.
- , Coordinate with those members of the CC which they represent.
- , Prepare agendas for meetings.

In addition, all members of the AC will serve on the Local Coordinating Committee of the VRRMRP.

c. Meetings

The AC will meet as necessary to carry out its duties. A majority of the members shall be required to make up a quorum of the AC. All decisions of the AC shall be made by consensus. Upon the request of any member, votes of the AC shall be taken by roll call. The chair shall be entitled to vote.

C. OBLIGATIONS OF EACH PARTY

In addition to sponsoring the VRMP and participating in the Committees as set forth above, the parties will use and exercise the rights and authority available to them in furthering the goals of the VRMP and assuring compliance with the terms of this Agreement. It is currently anticipated that each party will also undertake the actions specified for it below.

1. VRMP Development and Implementation

a. Washington County and Cities

- i. Work with and assist private property owners to protect the river and flood plains from activities and development harming riparian and aquatic values; and, as appropriate, purchase property, acquire protective easements or implement and maintain protective zoning.
- ii. Participate in the development of a recreation and trail plan with landowners where agreed to.
- iii. Develop, adopt and implement effective potable and secondary water conservation plans and water use practices.
- iv. Complete flood plain mapping of 100-year flood plains.
- v. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.

b. Washington County Water Conservancy District (WCWCD)

- i. Provide a representative to serve as chairman of the AC and CC. This will involve scheduling meetings, keeping minutes and overseeing implementation of the VRMP.
- ii. Work with and assist private property owners to protect the river and flood plains from activities and development harming riparian and aquatic values; and, as appropriate, purchase property and assist in acquiring protective easements.
- iii. Maintain and monitor instream flows as deemed appropriate within its authority as these flows may be determined from time to time.
- iv. Facilitate improvement and maintenance of water quality in the area covered by the VRMP.
- v. Plan and facilitate water projects identified through the VRMP process.
- vi. Assist in and encourage completion of flood plain mapping of the 100-year flood plains.
- vii. Create and implement programs to facilitate municipal and agricultural water conservation practices and to provide education on water conservation practices.
- viii. Facilitate the implementation of other actions, projects and mechanisms as refined or amended through the VRMP process.

c. Bureau of Land Management

- i. Make land use decisions, with public input, consistent with VRMP goals which will protect and enhance fishery, aquatic, riparian and recreation values, as well as water quality.
- ii. Facilitate the implementation of other actions, projects and mechanisms as refined or amended through the VRMP process.
- iii. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.

d. Utah State Department of Natural Resources

- i. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
- ii. Serve as chairman to develop the VRRMRP.
- iii. Provide assistance for the various Divisions of state government as follows:
 - (a) Wildlife Resources (UDWR) will be responsible for providing the chairman of the Technical Committee in development of the Virgin River Resource Management and Recovery Program (VRBIRMP).
 - (b) Parks and Recreation has completed a general recreation and conceptual plan for the entire river system which is included in the VRMP. It will assist individual parties in developing recreation plans if requested.
 - (c) Water Resources will
 - (i) complete channel flow analysis and
 - (ii) assist in identifying the 100-year flood plain.
 - (d) Water Rights will
 - (i) where requested, assist in clarifying water rights and related issues;
 - (ii) assist Water Resources in identifying the 100-year flood plain, and
 - (iii) take the lead in permitting and administering or distributing instream flows when it is determined what these flows should be.

e. Virgin River Land Preservation Association

- i. Work with private property owners to help find solutions for protecting lands they own, which may include assistance in purchasing or acquiring protective easements in the 100-year flood plain.
- ii. Apply for grants to assist in development and implementation of a recreational trail plan.
- iii. Assist in publicity for the VRMP as it pertains to the conservation of the flood plain and the development and implementation of a recreational trail plan.
- iv. Acquire and hold property and easements in the 100-year flood plain.
- v. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
- vi. Assist in enforcement of land use stipulations or protective easements.

f. Grand Canyon Trust

- i. Apply for grants to assist in development and implementation of those elements of the VRMP which are consistent with the goals of the Trust.
- ii. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
- iii. Help acquire easements and purchase property.

- iv. Work with private property owners to help find solutions for protecting lands they own, which may include assistance in purchasing or acquiring protective easements in the 100-year flood plain.
 - v. Assist in the creation and implementation of programs to provide education and preservation of riparian and aquatic habitat and in the facilitation of municipal and agricultural water conservation practices.
- g. Irrigation Companies
- i. Implement water management and conservation practices.
 - ii. Assist in demonstrating water saving water conservation practices.
 - iii. Assist in confirming, protecting, and adjusting water rights as necessary to implement the VRMP.
 - iv. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
- h. Shivwits Band of Paiutes
- i. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
 - ii. Implement water conservation on tribal lands and developments.
 - iii. Protect 100-year flood plains from activities determined to be detrimental to the band-established riparian and aquatic values.
 - iv. Work to resolve Indian water claims.
- i. Private Landowners Representative
- i. Carry out a public affairs information program with affected property owners.
 - ii. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
 - iii. Work with relevant entities to help find solutions for protecting lands they own.
 - iv. Assist in the creation and implementation of programs to provide education on water conservation and in the facilitation of municipal and agricultural water conservation practices.
 - v. Encourage private property input to city and county flood plain, recreation and trail master plans.
- j. Utah State Department of Environmental Quality
- i. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
 - ii. Provide assessments on water quality for those water bodies within the Lower Colorado River watershed planning area.
 - iii. Assist in the development of tools, graphic overlays or present in the watershed.
 - iv. Coordinate with other members to assure that water quality related issues are addressed in all areas of focus defined by the CC or AC through review or input into these areas or issues.
 - v. Serve as a liaison with DEQ for all related programs managed by DEQ.

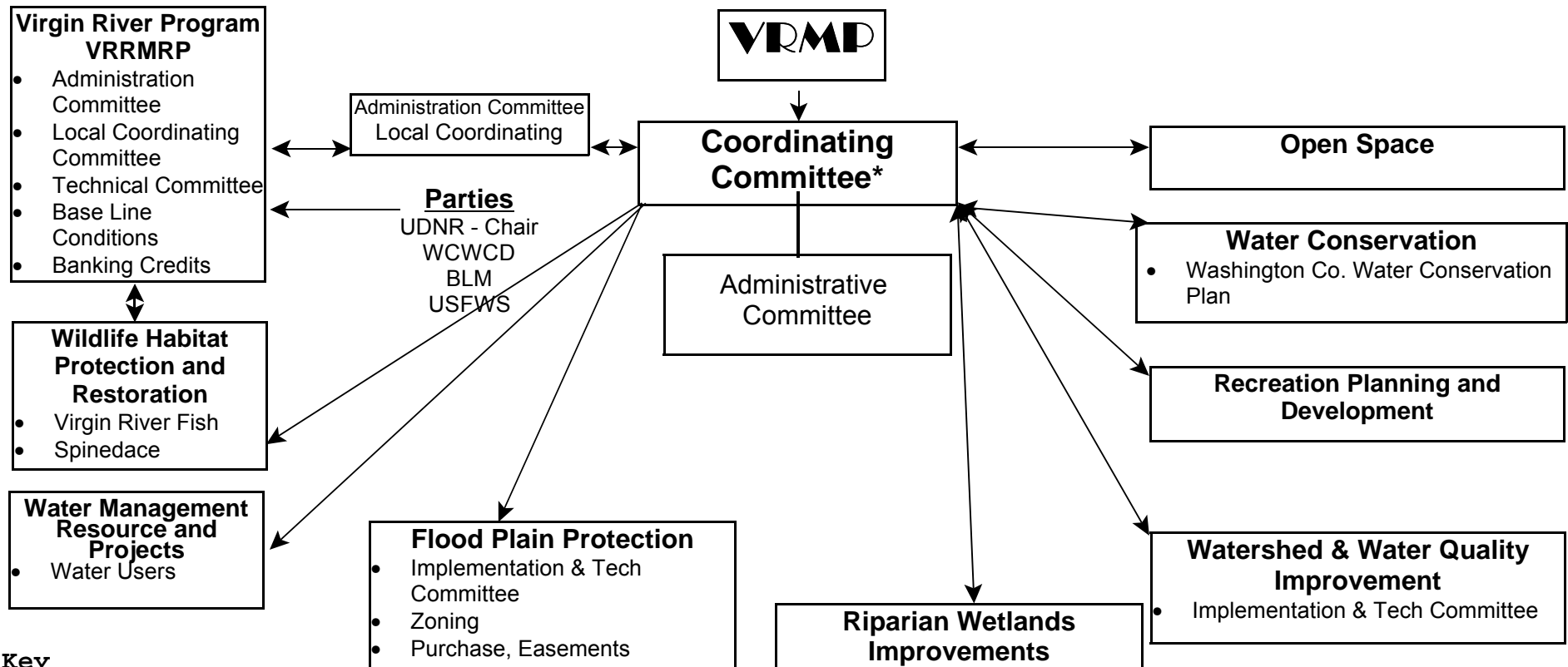
- vi. Assist in the further understanding of programs and issues administered by Utah DEQ and provide or present materials as needed for this task.
 - vii. Assist in the maintenance and acquisition of a water quality data base for the assessment of waters within the watershed.
 - viii. Encourage the local input into various policy making decisions at the state level that effect local entities.
- k. Dixie Soil Conservation District
- i. Provide a representative to serve on the CC, and to serve on the AC if chosen to such.
 - ii. Work with the private property owners to educate them about the VRMP and its goals.
 - iii. Work with private property owners to encourage better farming and water use practices.
 - iv. Assist private property owners in acquiring financial grants to implement better practices.
2. Budget

Each party shall, to extent authorized by law, include in their budgets adequate funding for studies, implementation and monitoring of the VRMP.

Table 39 is a flow chart showing the correlation of the various committees.

TABLE 39. Flow Chart

VIRGIN RIVER MANAGEMENT PLAN



Key

VRRMRP-Virgin River Resource Mgt. & Recovery Program_____

WCWCD - Washington County Water Conservancy District

WC - Washington County

UDNR - Utah Department of Natural Resource

VRLPA - Virgin River Land Protection Association

BLM - Bureau of Land Management

USFWS - U.S. Fish and Wildlife Service

UDWR - Utah Division of Wildlife Management

UDEQ - Utah Department of Environmental Quality

DSCD - Dixie Soil Conservation District

*Sponsors

WCWCD - Chair	WC
UDNR	BLM
Cities & Towns	Grand Canyon Trust
VRLPA	Paiute Tribe
Irrigation Companies	UDEQ
Private Property	DSCD
Owners (People for the USA)	

SECTION 4.0 PRIORITY, ACTION PLAN, AND TIME FRAME

TABLE 40. Priority, Action Plan and Time Frame

Priority	Planned Actions	Time Frame
1	Restoration of 3 cfs of water to the Virgin River Channel below Quail Creek Pipeline diversion.	1995
2	Begin a study to determine the relationship of the groundwater aquifer from the Hurricane Fault to the Santa Clara drainage and its relationship to the surface water system.	1995-1996
3	Complete county wide water conservation plan.	1996
4	Start mapping flood plains	1998
5	Begin developing a watershed plan.	1999
6	Construct Sand Hollow Reservoir	2000
7	Purchase water rights or appropriate "saved water" for restoring year-long water flows to Santa Clara River below Gunlock Reservoir	2000
8	Construct Ivins Pipeline.	2000*
9	Complete water reuse project.	2002
10	Develop Virgin River Trail and natural parkway plan	2000
11	Reduce water at the Washington Diversion during the winter period	2000
12	Remove diversions on La Verkin Creek	2000
13	Work out agreements with Ash Creek Water Users	2005
14	Construct the Ash Creek Pipe line	2005*
15	Construct Sandstone Mountain Reservoir	2006
16	La Verkin Springs collection and pipeline to Washington Fields Diversion	2010*

* Will require analysis by VRRMP.

The purchase of land in the 100-year flood plain will begin as soon as the plan is approved. It will be implemented on a willing seller basis. Easements will be obtained or zoning implemented if land cannot be purchased.

SECTION 5.0 REPORTS

5.1 Annual Work Plan

An annual work plan will be prepared each year. The annual work plan will include details of the work to be accomplished, the target dates for completion, who will do the work, and how it will be funded. The work will be tied to the priorities and the financial budget. The work plan will be prepared by the WCWCD and administration committee then reviewed and approved by the other sponsors. The plan will be prepared by October 1 of the preceding year. The plan will then be reviewed and approved by November 15 by the sponsors of the plan.

5.2 Annual Report

In February of each year the administration committee will prepare an annual report detailing the accomplishments of the previous year and how well the goals of the previous years work plan were met. The report will: 1) detail how well budget targets were met; 2) detail any particular problems encountered; 3) and will make recommendations for changes. The report will be filed with sponsoring parties and must be approved by the Coordinating Committee.

SECTION 6.0 FUNDING

Funding is an individual responsibility of each sponsor. Each sponsor should program or request funding to meet their obligations for development, maintenance, and implementation of the plan. Projects or implementation actions within the individual jurisdictions will generally be funded by them. Each year funding should be identified by each sponsor so it can be included in development of the Annual Work Plan (AWP). Cost share actions would be planned so they can be included in the AWP as well.

SECTION 7.0 PLAN AMENDMENTS

Plan amendments can take several forms including boundary adjustments, changes in funding or mitigation, and/or changes necessary for successful plan implementation. Amendments can be proposed by any of the parties to the plan. All parties in the plan must agree to any amendments.

In response to unforeseen circumstances, any party to the VRMP plan may request appropriate amendments to the plan. These requests will be sent to the AC, who will set up appropriate meetings with the coordinating committee for discussion and consideration of proposed changes by all parties to the plan. The details are covered in the implementation agreement.

REFERENCES

1. Addley, R. Craig and Hardy, Thomas B. *The Current Distribution and Status of Spinedace in the Virgin River Basin*. December 1, 1993.
2. Five County Association of Governments. *Southwest Utah Economic and Demographic Profile*, 1990.
3. Hafen, Lyman. 1993. "The Question of Growth." *St. George Magazine*. July/August 1993.
4. Hardy/Hickman Studies
5. Hardy, Dr. Thomas B. "Evaluating Alternative Flow Strategies in the Virgin River (Draft)." March 3, 1994.
6. U.S. Department of Agriculture Bulletin No. 124. "Irrigation Investigation in Utah: The Virgin River Basin, 1903 Report."
7. Larson, Andrew Karl (1899-1983). *I Was Called to Dixie*. St. George, Utah, 1961.
8. Utah Division of Wildlife Resources. "Virgin Spinedace Draft Conservation Agreement." et.al. April 11, 1995.
9. *Utah State Water Plan: Kanab Creek/Virgin River Basin*. August 1993.
10. Valdez, Richard A. et al. "Status of Virgin River Spinedace in the Virgin River Drainage, Utah." January 1991.
11. Virgin River Fishes Recovery Team. "Recovery Plan for Woundfin and Virgin River Chub." March 1, 1985
12. Washington County. *Utah Habitat Conservation Plan*. March 17, 1993.
13. Washington County Water Conservancy District. "Draft Concept, Virgin River Management Plan." March 1994.
14. Ken D. Theis, Keith J. Maas "Population Management." May 17, 1994.
15. Boyle Engineering Corporation. "Purpose and Need Study." March 1995.
16. Groesbeck, John D., PH.d.
"Final Draft - The Economic Impact of the Virgin River Habitat and Conservation Management. Plan "April 10, 1995.
17. Utah Parks and Recreation Virgin River Habitat Conservation and Management Plan, Recreation Component July 3, 1995.
18. USDA Soil Conservation Service, Utah Department of Natural Resources, Division of Water Resources, 1990 Virgin River Basin - Utah Cooperative Study.
19. Institute of Outdoor Recreation and Tourism, Utah State University. 1995. Final Report; Utah Division of Parks and Recreation Telephone Survey.
20. Utah Department of Natural Resource, Division of Parks and Recreation. 1992. State Comprehensive Outdoor Recreation Plan (SCORP).
21. City of St. George. 1994. Parks Master Plan.
22. Utah Department of Natural Resources, Division of Parks and Recreation, Rivers Trails and Conservation Assistance Program, National Park Service. 1995. Utah Statewide Trails Assessment.
23. Utah Travel Council. 1994. 1993 Economic and Tourism Profiles for Utah Counties.
24. Washington County Water Conservancy District, "Washington County Water Management and Conservation Plan" Draft, May 21, 1966.
25. Frank Williams, BYU Horticulture Department. Continuing water quality study.
26. Utah State Geological Survey. 1993. Estimated use of water in the United States in 1990 and verbal update for 1995.
27. Washington County General Plan. May 13, 1999.

APPENDIX A

Present Diversions or Dams

DIVERSIONS ON THE VIRGIN RIVER	
Name	Location
1-Springdale Diversion	SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 15, T41S, R10W
2-Zion National Park Diversion	SW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 22, T41S, R10W
3-Rockville/Grafton Diversion	SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 32, T41S, R10W
4-Virgin Diversion, South Side	NW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 31, T41S, R11W
5-Virgin Diversion, North Side	SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 30, T41S, R11W
6-Quail Lake Pipeline Diversion	NE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 29, T41S, R12W
7-Washington/St. George Fields Diversion	SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 21, T42S, R14W
8-Sheldon Johnson Diversion	NE $\frac{1}{4}$, Sec. 27, T42S, R15W
9-Fish Barrier	NW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 30, T43S, R16W
DIVERSIONS ON THE SANTA CLARA RIVER (See Figure 4 for a map)	
Name	Location
10-Pine valley Reservoir	SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 19, T39S, R14W
11-Pine Valley Diversion	NW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 24, T39S, R15W
12-Central Diversion	SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 12, T39S, R16W
13-Hydro Diversion	SE $\frac{1}{4}$, Sec. 15, T39S, R16W
14-Baker Dam	SW $\frac{1}{4}$ Sw $\frac{1}{4}$, Sec 22, T39S, R16W
15-Sand Cove Reservoir Hydro Diversion	NE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 5, T40S, R16W
16-Irrigation Diversion	SE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 11, T40S, R17W
17-Gunlock Diversion	SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 22, T40S, R17W
18-Diversion	SE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 28, T40S, R17W
19-Gunlock Dam	SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 5, T41S, R17W
20-Diversion (Bowler)	NW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 36, T42S, R16W
21-Winsor Diversion (Shem Dam)	SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 28, T41S, R17W
22-Three Mile Diversion	SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 28, T41S, R17W

DIVERSIONS ON THE SANTA CLARA RIVER (See Figure 4 for a map)	
23-Santa Clara South Ditch Diversion	SW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 17, T42S, R16W
24-St. George Clara Fields Diversion	SE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 17, T42S, R16W
25-Seep Ditch	SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 36, T42S, R16W
26-Bloomington Diversion	NW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 6, T43S, R15W
DIVERSIONS ON ASH CREEK (See Figure 3 for a map)	
Name	Location
27-Leap Creek Diversion	NE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 22, T39S, R13W
28-Wet Sandy Diversion	SE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 7, T40S, R14W
29-South Ash Creek Diversion	SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 3, T40S, R13W
30-Toquerville Springs Diversion	NW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 35, T41S, R13W
31-West Field/Wallace Diversion	NE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 35, T41S, R13W
32- East Side Diversion	NE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 35, T41, R13W
33-Ash Springs Hurricane/La Verkin Culinary	NE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 11, T41S, R13W
34-Getman Diversion	SE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 14, T41S, R13W
35-Wood Diversion	NE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 14, T41S, R13W
36-Goodwin Diversion	SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 14, T41S, R13W
37-Krom Diversion	SW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 23, T41S, R13W
DIVERSION ON La Verkin CREEK (See Figure 3)	
Name	Location
38-Headwaters Diversions	NE $\frac{1}{4}$, Sec. 16, T38S, R11W
39-Upper Jones	S $\frac{1}{2}$ SE $\frac{1}{4}$, Sec. 7, T40S, R12W
40-Lower Jones	SE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec 12, T41S, R13W
41-Wilson	NE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec 14, T41S, R13W
42-Terry West	SW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec 14, T41S, R13W

APPENDIX B

Water Rights

Virgin River, Santa Clara River, Ash and La Verkin Creeks

Surface Water Rights on the Virgin River

WR No.	OWNER/ADDRESS	SOURCE/LOCATION PRIORITY DATE	QUANTITY
ZION NATIONAL PARK			
81-3608	USA National Park Service (Zion NP)	North Fork of Virgin River T41S R10W Sec. 22 00/00/1880	1.38 cfs
SPRINGDALE			
81-3392	Springdale Town Corp. Springdale, UT 84767	North Fork of Virgin River R41S R10W Sec. 22 00/00/1870	1.33 cfs
81-1142	Springdale Town Corp. Springdale, UT 84767	North Fork of Virgin River T41S R10W Sec. 22 00/00/1870	2.64 cfs
ROCKVILLE			
81-1135	Ardell DeMille, et.al	North Fork of Virgin River T41S R10W Sec. 32 00/00/1862	.27 cfs 73.5 AF
81-1120	Rockville Town Ditch Co. Rockville, UT 84763 (held by BWR)	North Fork of Virgin River T41S R10W Sec. 32 00/00/1862	3.84 cfs
GRAFTON			
81-1174	Hall and Grafton Irrigation Co. Rockville, UT 84763 (held by BWR)	North Fork of Virgin River T41S R10W Sec. 32 00/00/1865	1.42 cfs 391.0 AF
81-1146	Hall and Grafton Irrigation Co. Rockville, UT 84763	North Fork of Virgin River T41S R10W Sec. 32 00/00/1863	1.3 cfs 358.5 AF
81-260	Stout's River View Ranch St. George, UT 84770	Virgin River T42S R11W Sec. 3 03/20/1950	2.0 cfs
VIRGIN			
81-2401	Virgin Irrigation Co. Virgin, Utah 84779	Virgin River T41S R11W Sec. 30 00/00/1865	2.92 cfs

WR No.	OWNER/ADDRESS	SOURCE/LOCATION PRIORITY DATE	QUANTITY
81-265	Bud D. Lee Virgin, Utah 84779	Virgin River T42S R11W Sec. 4 08/07/1950	5.0 cfs
81-344	Gary C. & Mona Wilcox Virgin, UT 84779 Linda Collett	Virgin River T41S R12W Sec. 23 12/27/1957	1.25 cfs .25
QUAIL PIPELINE DIVERSION			
81-2478	WCWCD St. George, UT 84770	Quail Creek T41S R12W Sec. 29 00/00/1880	.275cfs 95.85 AF
81-3996	WCWCD St. George, UT 84770	Virgin River T41S R12W Sec. 29 01/15/1962	5,109 AF
81-2273	WCWCD St. George, UT 84770	Virgin River T41S R12W Sec. 29 01/15/1962	28,881 AF
81-143	WCWCD St. George, UT 84770	Virgin River T41S R12W Sec. 29 12/06/1937	4,000 AF
81-2318	WCWCD St. George, UT 84770	Virgin River T41S R12W Sec. 29 06/23/1983 Application	250.0 cfs
11174 81-124	WCWCD St. George, UT 84770	Virgin River T41S R12W Sec. 29 11/06/1931 Hydro Power non-consumption	65.0 cfs
81-1381	WCWCD St. George, UT 84770	Virgin River & Quail Creek T41S R12W Sec. 29 08/08/1922	37.5 cfs
81-1602	La Verkin Town	Virgin River T41S R12W Section 29 1890	1 cfs
81-2476	WCWCD St. George, UT	Virgin River T41S R12W Section 29	1 cfs
10379 81-110	WCWCD St. George, UT 84770	Virgin River T41S R12W Sec. 29 07/05/1928 Hydro Power non-consumptive	35.0 cfs
81-3107	WCWCD St. George, UT 84770	Virgin River T41S R13W Sec. 24 1893	2.0 cfs
81-507	State of Utah Board of Water Resources Salt Lake City, UT 84116	Virgin River T41S R12W Sec. 29 01/15/1962	147,600 AF

WR No.	OWNER/ADDRESS	SOURCE/LOCATION PRIORITY DATE	QUANTITY
81-2475	Hurricane Canal Co. Hurricane, UT 84737	Virgin River T41S R12W Sec. 29 00/00/1893	31.7354 cfs
81-157	Hurricane Canal Co. Hurricane, UT 84737	Virgin River T41S R12W Sec. 29 03/29/1940	63.0 cfs
81-2477	La Verkin Bench Canal Co. La Verkin, UT 84745	Virgin River T41S R12W Sec. 29 00/00/1900	7.9703 cfs
WEST OF HURRICANE			
81-328	5M Incorporated Hurricane, UT 84737	Virgin River T41S R13W Sec. 30 08/27/1956	4.9367 cfs
81-391	Melvin C. Fawcett, et. al Washington, UT 84780	Virgin River T42S R14W Sec. 10 05/26/1959	.65 cfs 205.5 AF
81-1468 81-3819 81-40	Melvin C. Fawcett, et. al Washington, UT 84780	Virgin River T42S R14W Sec. 15 05/26/1959	3 cfs 953.9 AF
81-410	Kenneth R. Anderson Hurricane, UT 84737	Virgin River T41S R13W Sec. 26 12/01/1971	2.0 cfs
ST. GEORGE AND WASHINGTON CANAL DIVERSION			
81-3542 81-1127	St. George Washington Canal Co. St. George, UT 84770 (held by BWR)	Virgin River T42S R14W Sec. 21 00/00/1890	1.07 cfs .44 cfs
81-3543	Karl Stucki St. George, UT 84770	Virgin River T42S R14W Sec. 21 00/00/1890	29.8513 cfs
81-3548	St. George Washington Canal Co. St. George, UT 84770 (held by BWR)	Virgin River T42S R14W Sec. 21 00/00/1900	56.0 cfs
81-174	St. George Washington Canal Co. St. George, UT 84770 (held by BWR)	Virgin River T42S R14W Sec. 21 06/05/1943	9.0 cfs
81-182	Lee C. & Cleo R. Atkin St. George, UT 84770	Virgin River T42S R14W Sec. 21 05/05/1944	2.4 cfs
SHELDON JOHNSON DIVERSION			
81-285	Sheldon B. Johnson J & S Farms St. George, UT 84770	Virgin River T42S R15W Sec. 27, 33 03/21/1953	3.7 cfs
BLOOMINGTON			

WR No.	OWNER/ADDRESS	SOURCE/LOCATION PRIORITY DATE	QUANTITY
81-3506 unapproved	Bloomington Country Club St. George, UT 84770	Virgin River T43S R15W Sec. 16 10/10/1989 (Application)	5.0 cfs
ATKINVILLE AREA			
81-183	John P. Atkin	Virgin River T43S R16W Sec. 23 5/18/1944	3.0 cfs

Surface Water Rights on the Santa Clara River

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION PRIORITY DATE	QUANTITY
81-4	Central Canal and Irrigation Co. Central, UT	Santa Clara River T39S, R16W, Sec. 12 11/2/1907	10 cfs 426.40 AF
81-27	Veyo Irrigation Co. Veyo, UT	Santa Clara River T39S, R17W, Sec. 32 3/20/1911	3.21 cfs 78.3 AF
81-66	Pacific Corp. 1407 West North Temple Salt Lake City, UT	Santa Clara River T39S, R16W, Sec. 32 6/23/1916	15 cfs Hydro Electric
81-80	Pacific Corp. 1407 West North Temple Salt Lake City, UT	Santa Clara River T39S, R16W, Sec. 15 5/2/1919	20.1 cfs Hydro Electric
81-133	State of Utah Board of Water Resources Salt Lake City, UT	Santa Clara T40S, R16W 6/24/1936	58854.2 AF
81-134	Central Canal and Irrigation Co., et.al. Central, UT	Santa Clara T39S, R16W, Sec. 22 6/24/1936	1145.8 AF Central 500 AF Veyo 350 AF Gunlock 250 AF Hirschi 45.8 AF
81-153	Sproul et.al.	Santa Clara T39S, R16W, Sec. 15 3/17/1950	3 cfs
81-1154	Gunlock Water Users Association Gunlock, UT	Santa Clara SW¼ SW¼, Sec. 22 T40S, R17W 00/00/1890	3.54 cfs
81-1765 <u>UNAP</u>	Dixie-Escalante Rural Electric Association Beryl, UT	Santa Clara SW¼ NE¼, Sec. 5, T41S, R17W 05/30/1979	40 cfs

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION PRIORITY DATE	QUANTITY
81-1771 <u>UNAP</u>	Dixie-Escalante Rural Electric Association Beryl, UT	Santa Clara T39S, R15W, Sec. 10 07/02/1979	.033 cfs
81-2253	Veyo Irrigation Co. Veyo, UT	Santa Clara SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 22, T39S, R16W 00/00/1890	.34 cfs
81-2254	Veyo Irrigation Co. Veyo, UT	Santa Clara T39S, R16W Sec. 22, 28, 32 00/00/1890	.8 cfs
81-2256	Central Canal and Irrigation Co. (held by UBW)	Santa Clara SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 12 T39S, R16W 00/00/1890	2.25 cfs
81-2279	Veyo Irrigation Co. Veyo, UT	Santa Clara T39S, R16W, Sec. 32 00/00/1890	.245 cfs
81-2298	Smith, Hyrum St. George, UT	SE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 11, T40S, R17W 00/00/1890	.06 cfs 25 AF
81-2407	Bowler, Randy West Jordan, UT	Santa Clara NW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec 36, T42S, R16W 00/00/1890	.093 cfs
81-2408	Leavitt, Lloyd Veyo, UT	Santa Clara NW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 36, T42S, R16W 00/00/1890	.042 cfs
81-2425	Shivwits Band Paiute Indians Cedar City, UT	Santa Clara SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 28, T41S, R17W	.138 cfs
81-3159	Santa Clara Seep Ditch Company St. George, UT	Santa Clara SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 36, T42S, R16W 00/00/1890	.44 cfs
81-3606	Pine Valley Pine Valley, UT (held by BWR)	Varies sources in Pine Valley Santa Clara and tributaries 00/00/1890	90.45 AF
81-3895	Lower Gunlock Reservoir Corp. St. George, UT	Santa Clara SW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 5, T41S, R17W 06/24/1936	1172 AF
81-1148	New Santa Clara Field Canal Company Santa Clara, UT 84765	Santa Clara River T41S R17W Sec. 5 00/00/1890 DEC	8.7 cfs

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION PRIORITY DATE	QUANTITY
81-1149	St. George Clara Field Canal Company St. George, UT 84770	Santa Clara River T41S R17W Sec. 5 00/00/1890 DEC	13.33 cfs
81-1597	Santa Clara Seep Ditch Company St. George, UT 84770	Santa Clara River T42S R16W Sec. 36 00/00/1890 DEC	3.54 cfs
81-2257	Gunlock Irrigation Company Gunlock, UT 84733	Santa Clara River T40S R17W Sec. 11 00/00/1890 DEC	2.906 cfs
81-2313	USA In trust for the Shivwits Band of Paiute Indians Cedar City, UT 84720	Santa Clara River T41S R17W Sec. 28 00/00/1890 DEC	1.242 cfs
81-2429	Bloomington Canal Company St. George, UT 84770	Santa Clara River T43S R15W Sec. 6 00/00/1890 DEC	3.28 cfs
81-77 A7838	State of Utah Board of Water Resources Salt Lake City, UT 84116	Santa Clara River T41S R17W Sec. 28 08/21/1918 CERT	1000.00 AF
81-7 A2368	State of Utah Board of Water Resources Salt Lake City, UT 84116	Santa Clara Creek T41S R17W Sec. 28 11/15/1930 WUCS	14.9 cfs
81-1101 A11929b	Lower Gunlock Reservoir Corp. St. George, UT 84770	Santa Clara River T41S R17W Sec. 5 06/24/1936 WUCS	15300.0 AF
81-2252 A58214 Hydropower plant	Lower Gunlock Reservoir Cop. St. George, UT 84770	Santa Clara River T41S R17W Sec. 5 10/05/1982 CERT	70.0 cfs non-consumptive

Surface Water Rights on the Ash Creek

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-14	Pintura Irrigation Co. Pintura, UT	South Ash Creek T40S, R13W, Sec. 3 03/19/1910	100%	1.86 cfs
81-3047	Pintura Irrigation Co. Pintura, UT	South Ash Creek T40S, R13W, Sec. 3 00/00/1860	100%	.87 cfs
81-3048	Pintura Irrigation Co. Pintura, UT	South Ash Creek T40S, R13W, Sec. 3 00/00/1870	100%	.13 cfs
81-3049	Pintura Irrigation Co. Pintura, UT	South Ash Creek T40S, R13W, Sec. 3 00/00/1870	100%	.64 cfs

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-3833 <u>Application no.</u> <u>A66956</u>	Washington County Water Conservancy District St. George, UT	South Ash Creek T39S, R13W, Sec. 29 06/14/1993	100%	10,000 AF
81-75	Payton Avon M. St. George, UT Hansen, Tessie B. St. George, UT Dixie Properties St. George, UT Blackburn, Terry D. Mary Ann D. Washington County Water Conservancy District St. George, UT	Peter's Leap Creek T39S, R13W, Sec. 22 08/04/1917 "" "" "" "" "" "" "" "" "" ""	4/160 th 10/64 th 66.1/160 th 1/64 th 41.15/160 th	1.5 cfs
81-75	Simar, Teresa St. George Blackburn, Lester P. and Joy Tanner, Mary Alice Sandy, UT Carter, Lloyd C. St. George, UT Sampson Family Trust St. George, UT	Peter's Leap Creek T39S, R13W, Sec. 22 08/04/1917 "" "" "" "" "" "" "" ""	1/160 th 1.5/160 th 17.75/160 th 7.595/160 th 1.28/160 th	
81-26	Payton, Harold T and Teresa Springville, UT	Peter's Leap Creek T39S, R13W, Sec.36 02/18/1911	100%	1 cfs
81-1975	Payton, Harold T and Teresa Springville, UT	Leap Creek T39S, R13W, Sec.36 00/00/1900	100%	.31 cfs
81-2849	Payton, Harold T. and Teresa Springville, UT	Leap Creek T39S, R13W, Sec.36 00/00/1860	100%	.12 cfs
81-3832 <u>Application no.</u> <u>A66955</u>	Washington County Water Conservancy District St. George, UT	Leap Creek T39S, R13W, Sec.36 06/14/1993	100%	10,000 AF

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-2400 <u>Application no.</u> <u>A59398</u>	Heideman, Orin D. Toquerville, UT	Wet Sandy Creek T40S, R14W, Sec. 2 10/13/1983	100%	4 cfs
81-3179	Webb, Vicky Box 582 Leeds, UT 84746	Sand Hollow Creek (West Sandy) T40S, R13W, Sec. 7 00/00/1885	3.00	10.1358 AF
	Fechser, Kay & Sherri Kay 2960 Industrial Road Las Vegas, NV 89109		2.94	9.9331 AF
	Kersh, Robert D. & Lucille H. 1610 W. Lovely Road Taylorville, UT 84123		6.66	22.5015 AF
	Jensen, W. M. Box 543 Hurricane, UT		6.20	20.9473 AF
	Hunsaker Ranch c/o Glen V. Hunsaker Box 35 Toquerville, UT		57.95	195.7912 AF
	Eveleth, Thomas E. & Sarah B. 4733 Fiddleneck Drive Redding, CA 96002	Leased to Glen Hunsaker	13.33	45.0367 AF
	Crane, Stanley R. & Jamise R. 1995 West Seven "C's" Lane Toquerville, UT		2.625	8.8688 AF
	Carhart, C. R. & Beverly 1901 W. Seven "C's" Lane Toquerville, UT		1.375	4.6456 AF
	Watters, Roger Dean & Rose Marie 373 West 2700 South Salt Lake City, UT		5.92	20.000 AF
	Total			1.13 cfs 337.86 AF
81-3834 <u>Application no.</u> <u>A66957</u>	Washington County Water Conservancy District St. George, UT	Wet Sandy Creek T40S, R13W, Sec. 7 06/14/1993	100%	6,000 AF

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-3837 <u>Application no</u> <u>A66991</u>	Hunsaker, Glen Murray, UT	Wet Sandy T40S, R13W, Sec. 7 06/28/1993	100%	10 cfs
81-37	Wallace High Line Irrigation Co. St. George, UT	Ash Creek T40S, R13W, Sec.35 09/05/1912		3 cfs
81-38	Robertson, Dennis M. and Donna H. La Verkin, UT	Ash Creek T41S, R13W, Sec.14 & 23 09/05/1912	8.33%	.75 cfs
	Anderson, Kenneth R. Hurricane, UT	"" ""	50.68%	
	Simpson, Martha St. George, UT	"" ""	18.75%	
	Krom, John and Charlotte Toquerville, UT	"" ""	15.99%	
	Lichfield, Robert B. and Patricia La Verkin, UT	"" ""	6.25%	
81-51	Washington Co. Water Conservancy District St. George, UT	Ash Creek T40S, R13W, Sec.23 04/07/1914	100%	8 cfs
81-503	Getman, Omerh. & Francis K. Huntington Beach, CA	Ash Creek T41S, R13W, Sec.14 11/22/1961	100%	.5 cfs
81-687	La Verkin Town Corp. La Verkin, UT	Upper Ash Creek Springs T41S, R13W, Sec.11 00/00/1890	100%	.491 cfs
81-1143	Hurricane City Hurricane, UT	Ash Creek Springs T41S, R13W, Sec.11 00/00/1880	100%	.3 cfs
81-1144	Hurricane Canal Co. Hurricane, UT	Upper Ash Creek Spring T41S, R13W, Sec.11 00/00/1883	100%	1.114 cfs
81-1602	La Verkin Town Corp. La Verkin, UT	Upper Ash Creek Springs T41S, R13W, Sec.11 00/00/1890	100%	1 cfs

W.R. NO.	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-2487	Wood Ltd., Blaine D. St. George	Ash Creek T40S, R13W, Sec.35 09/05/1912	100%	.25 cfs
81-2739 81-2743 81-2744 81-2745	Jones, Wayne H. & Elma W. Hurricane, UT Chamberlain, Sylvia Hurricane, UT Jones, Lloyd Grant & Rose J. Hurricane, UT	Ash Creek T41S, R13W, Sec.23 00/00/1880 "" "" "" ""	33.33% 33.33% 33.33%	.47 cfs
81-2801	Lundberg, Elese B., Lynne Jay, Don Charles, Gary B. Chatsworth, CA	Ash Creek T41S, R13W, Sec.14 11/22/1961	25% 25% 25% 25%	.5 cfs

Surface Water Rights on the La Verkin Creek

W.R. NO	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-2816	Kanarra Partnership Las Vegas, NV	Willow Creek T38S, R11W, Sec. 15 00/00/1898	100%	2.64 cfs
81-180	Kanarra Partnership Las Vegas, NV	Willow Creek T38S, R11W, Sec. 10 01/06/1947	100%	204.68 AF 5 cfs
81-179	Kanarra Partnership Las Vegas, NV	Meadow Hollow T38S, R11W, Sec. 16 10/28/1949	100%	204.68 AF
81-283	Kanarra Partnership Las Vegas, NV	Elisha & Myron Spring T38S, R11W, Sec. 16 7/16/1952	100%	204.68 AF
81-68	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T40S, R12W, Sec. 18 12/06/1916	undiv.	90.25 AF 2.0 cfs
81-615	Wilson, Dale 5217 Homby Ave. Las Vegas, NV	La Verkin Creek T41S, R13W, Sec. 14 03/31/1964	100%	81.75 AF 1.0 cfs
81-2233	Shady Acres Inc. PO Box 387 La Verkin, UT	La Verkin Creek T41S, R13W, Sec. 14 00/00/1880		165.00 AF 0.5 cfs
81-3434	Hunter, David et al. PO Box 66 Toquerville, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1880	undiv 1/3 int.	37.2 AF .155 cfs

W.R. NO	OWNER ADDRESS	SOURCE LOCATION/ PRIORITY DATE	INTEREST	QUANTITY
81-3445	Hunter, David et al. PO Box 66 Toquerville, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1902	undiv.	6.00 AF .025 cfs
81-3561	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 14 00/00/1880	undiv 1/3 int.	88.20 AF .3675 cfs
81-3562	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 14 00/00/1902	undiv 1/3 int	55.80 AF .2325 cfs
81-3576	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1880	undiv 1/3 int	63.00 AF .265 cfs
81-3577	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1902	undiv 1/3 int	27.00 AF .1125 cfs
81-3578	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1880	undiv 1/3 int	18.60 AF .0775 cfs
81-3579	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1902	undiv 1/3 int	8.40 AF .035 cfs
81-3580	Bruggeman, Robert Toquerville, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1880	100%	24.00 AF .0975 cfs
81-3581	Bruggeman, Robert Toquerville, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1902	100%	24.00 AF .015 cfs
81-3589	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1880	undiv 1/3 int.	52.20 AF .2175 cfs
81-3590	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 12 00/00/1902	undiv 1/3 int.	37.80 AF .1575 cfs
81-3931	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 14 00/00/1880	undiv 1/3 int.	6.00 AF .025 cfs
81-3932	Jones, Lloyd et al. 252 East 100 North Hurricane, UT	La Verkin Creek T41S, R13W, Sec 14 00/00/1902	undiv 1/3 int.	54.00 AF .225 cfs

APPENDIX C

Native Species of the Virgin River

APPENDIX D

WATER QUALITY INFORMATION ON THE VIRGIN RIVER

APPENDIX E

MEMORANDUM OF UNDERSTANDING

TO

DEVELOP AND IMPLEMENT

THE

VIRGIN RIVER RESOURCE MANAGEMENT

AND RECOVERY PROGRAM

APPENDIX F

SAMPLE FLOOD PLAIN AND FLOOD DAMAGE ORDINANCE

SECTION 1.0 STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE AND OBJECTIVES

1.1 STATUTORY AUTHORIZATION

The legislature of the State of Utah has in Section 10-8-84 delegated the responsibility to local governmental units to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry.

1.2 FINDINGS OF FACT

- (1) The flood plain areas of the Virgin River drainage in Washington County are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption and relief, and impairment of the tax base, all of which adversely affects the public health, safety and general welfare.
- (2) These flood losses are caused by the cumulative effect of obstructions in the flood plain which increase flood heights and velocities, and when inadequately anchored, damage uses in other areas. Uses that are inadequately flood proofed, elevated, or otherwise protected from flood damage also contribute to the flood loss.
- (3) In order to better provide for the protection and proper use of the river flood plains and channels for storm drainage, flood control, recreation use, wildlife habitat and open space it is necessary and desirable to adopt a flood plain ordinance.

1.3 STATEMENT OF PURPOSE

It is the purpose of this ordinance to protect the flood plain, to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by provisions designed:

- (1) To protect human life and health;
- (2) To minimize expenditure of public money for costly flood control projects;
- (3) To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- (4) To minimize prolonged business interruptions;
- (5) To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets, and bridges located in the flood plains;
- (6) To help maintain a stable tax base by providing for the sound use and development of the flood plain so as to minimize future flood blight areas;
- (7) To insure that potential buyers are notified that property is in the 100-year flood plain and,
- (8) To insure that those who occupy the 100-year flood plains assume responsibility for their actions.
- (9) Establish the boundaries of the 100-year flood plains within the statutory jurisdiction of the _____
__ for purposes of flood control, protection and management to be covered by this ordinance.
- (10) To improve water quality, by protection of riparian values wetlands and riverine habitats.

1.4 METHODS OF REDUCING FLOOD LOSSES AND PROTECTION OF FLOOD PLAINS

In order to accomplish its purpose, this ordinance includes methods and provisions for:

- (1) Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;
- (2) Requiring that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
- (3) Controlling the alteration of natural flood plains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;

- (4) Controlling filling, grading, dredging, and other development which may increase flood damage; and,
- (5) Preventing or regulating the construction of flood barriers which may increase flood hazards in other areas.
- (6) Restricting home or industrial construction in the flood plain.

SECTION 2.0 DEFINITIONS

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application.

"100-year Flood Plain" means land which would be flooded by a flood which would occur once in 100-years.

"Base Flood" means the flood having a one percent chance of being equaled or exceeded in any given year.

"Development" means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling grading, paving, excavation or drilling operations located within the area of the 100-year flood plain.

"Flood" or "Flooding" means a general and temporary condition of partial or complete inundation of normally dry land areas from:

- (1) The overflow of inland and/or
- (2) The unusual and rapid accumulation or runoff of surface waters from any source.

"Flood Insurance Rate Map" (FIRM) means the official map issued by the Federal Emergency Management Agency where the areas of special flood hazard have been designated Zone A.

"Structure" means a walled and roofed building or mobile home that is principally above ground.

"Substantial Improvement" means any repair, reconstruction, or exceeds 50% of the market value of the structure either:

- (1) before the improvement or repair is started, or
- (2) if the structure has been damaged and is being restored, before the damage occurred. For the purpose of this definition "substantial improvement" is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure.

The term does not, however, include either;

- (1) Any project for improvement of a structure to comply with existing state or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions, or
- (2) Any alteration of a structure listed on the National Register or Historic Places or a State Inventory of Historic Places.

SECTION 3.0 GENERAL PROVISIONS

3.1 LANDS TO WHICH THIS ORDINANCE APPLIES

This ordinance shall apply to all areas within the 100-year flood plain within the jurisdiction of _____.

3.2 BASIS FOR 100-YEAR FLOOD PLAIN

Maps prepared of the 100-year flood plain on at least 3 foot contours. The FIRM maps will be used until mapping is completed on 3 foot contours. These maps are located at the _____.

3.3 COMPLIANCE

No structure or land shall hereafter be constructed, located, extended, or altered without full compliance with the terms of this ordinance other applicable regulations.

3.4 ABROGATION AND GREATER RESTRICTIONS

This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and another ordinance, easement, covenant or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

3.5 INTERPRETATION

In the interpretation and application of this ordinance, all provisions shall be:

- (1) Considered as minimum requirements;
- (2) Liberally construed in favor of the governing body, and,

- (3) Deemed neither to limit nor repeal any other powers granted under state statutes.

3.6 WARNING AND DISCLAIMER OF LIABILITY

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This ordinance does not imply that land outside the 100-year flood plain and/or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of any officer or employee thereof, for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

SECTION 4.0 ADMINISTRATION

4.1 ESTABLISHMENT OF DEVELOPMENT PERMIT

A Development Permit shall be obtained before construction or development begins within any area of the 100-year flood plain established in Section 3.2. Application for Development Permit shall be made on forms furnished by the _____ and may include, but not be limited to; plans in duplicate drawn to scale showing the nature, location, dimensions, and elevations of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing. Specifically, the following information is required:

- (1) Elevation in relation to mean sea level, of the lowest floor (including basement) of all structures;
- (2) Elevation in relation to mean sea level to which any structure has been flood proofed;
- (3) Certification by a registered professional engineer or architect that the flood proofing methods for any non-residential structure meet the flood proofing criteria.
- (4) Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.

4.2 DESIGNATION OF INSPECTOR

The Inspector is hereby appointed to administer and implement this ordinance by granting to denying development permit applications in accordance with its provisions.

4.3 DUTIES AND RESPONSIBILITIES OF THE INSPECTOR

Duties of the Inspector shall include, but not be limited to:

4.3.1 Permit Review

- (1) Review all development permits to determine that the permit requirements of this ordinance have been satisfied.
- (2) Review all development permits to determine that all necessary permits have been obtained from those Federal, State or local governmental agencies from which prior approval is required.
- (3) Review all development permits to determine if the proposed development adversely affects the flood carrying capacity of the area of 100-year flood plain. For the purposes of this ordinance, "adversely affects" means damage to adjacent properties because of rises in flood stages attributed to physical changes of the channel and the adjacent over bank areas.
 - (a) If it is determined that there is no adverse affect and the development is not a building, then the permit shall be granted without further consideration.
 - (b) If it is determined that there is an adverse effect, then technical justification (i.e., a registered professional engineer's certification) for the proposed development shall be required.
 - (c) If the proposed development is a building, then the provisions of this ordinance shall apply.

4.3.2 Use of Other base Flood Data

When base flood elevation data has not been provided in accordance with section 3.2, BASIS ESTABLISHING THE 100-YEAR FLOOD PLAIN. Inspector shall obtain, review, and reasonably utilize any base flood elevation and flood way data available from a Federal, State or other source.

4.3.3 Information to be obtained and Maintained

- (1) Obtain and record the actual elevation (in relation to mean sea level) of the lowest floor (including basement) of all new or substantially improved structures, and whether or not the contains a basement.

- (2) Require that maintenance is provided within the altered or relocation portion of said watercourse so that the flood carrying capacity is not diminished.

4.3.4 Interpretation of 100-year Flood Plain Boundaries

Make interpretations where needed, as to the exact location of the boundaries of the 100-year flood plain (for example, where there appears to be a conflict between a mapped boundary and actual field conditions).

4.4 DISPUTES OVER BOUNDARIES OR MAPPED HAZARDS

The boundary lines of the flood channels as shown on the corridor maps shall be determined by use of the scale appearing on the maps and through photo identification. Where there is a conflict between the boundary lines illustrated on the maps and actual field conditions. The dispute shall be settled as follows:

- (1) The person or entity disputing the boundary or the hazard(s) present within a particular area shall submit technical and geologic evidence to support such claim to the _____ in the form of a site-specific report.
- (2) The _____ may request various experts from federal, state, or local agencies to review the evidence and make recommendations prior to making a decision concerning the dispute.
- (3) The _____ may allow deviations from the mapped boundary line only if the evidence clearly and conclusively establishes that the flood plain map boundary location is incorrect.
- (4) Any decision of the _____ relating to either the location of the flood plain boundary line or the hazard (s) present within a particular area may be appealed to the _____.

SECTION 5.0 FLOOD PLAIN USES

5.1 PERMITTED USES

The following uses having a low flood damage potential and not obstructing flood flows shall be permitted within the 100-year flood plain to the extent that they are not prohibited by any other ordinance and provided they do not require structures, fill or storage of materials or equipment. But no use shall adversely affect the capacity of the channels or flood way of any tributary to the main stream, drainage ditch, or any other drainage facility or system.

- 5.1.1 Agricultural uses such as general farming, pasture, grazing, outdoor plant nurseries, horticulture, viticulture, truck farming, forestry, sod farming, and wild crop harvesting.
- 5.1.2 Industrial-commercial uses such as loading areas, parking areas, airport landing strips.
- 5.1.3 Private and public recreational uses such as golf courses, tennis courts, driving ranges, archery ranges, picnic grounds, boat launching ramps, swimming areas, parks, wildlife and nature preserves, game farms, fish hatcheries, shooting preserves, target ranges, trap and skeet ranges, hunting and fishing areas, hiking and horseback riding trails.
- 5.1.4 Residential uses such as lawns, gardens, parking areas and play areas.

5.2 SPECIAL EXCEPTION USES

The following uses which involve structures (temporary or permanent), fill or storage of materials or equipment may be permitted only upon application to the _____ and the issuance of a Special Exception permit.

- 5.2.1 Uses or structures accessory to open space or Special Exception uses.
- 5.2.2 Circuses, carnivals, and similar transient amusement enterprises.
- 5.2.3 Drive-in theaters, new and used car lots, roadside stands, signs, and billboards.
- 5.2.4 Extraction of sand, gravel, and other materials.
- 5.2.5 Marinas, boat rentals, docks, piers, wharves.
- 5.2.6 Railroads, streets bridges, utility transmission lines, and pipelines.

5.2.7 Storage yards for equipment, machinery, or materials.

5.2.8 Kennels and stables.

5.2.9 Other uses similar in nature to uses described in Section 5.1 or 5.2 which are consistent with the provisions of this ordinance.

5.3 STANDARDS FOR FLOOD WAY SPECIAL EXCEPTION USES

5.3.1 *All uses.*—No structure (temporary or permanent), fill (including fill for roads and levees), deposit, obstruction, storage of materials or equipment, or other use may be allowed as a Special Exception use which, acting alone or in combination with existing or future uses, unduly affects the capacity of the flood way or unduly increases flood heights. Consideration of the effects of a proposed use shall be based on a reasonable assumption that there will be a equal degree of encroachment extending for a significant reach on both sides of the stream.

5.3.2 *Fill.*—

- (1) Any fill proposed to be deposited in the flood way must be shown to have some beneficial purpose and the amount thereof not greater than is necessary to achieve that purpose, demonstrated by a plan submitted by the owner showing the uses to which the filled land will be put and the final dimensions of the proposed fill or other materials.
- (2) Such fill or other materials shall be protected against erosion by rip-rap, vegetative cover or bulkheading.

5.3.3 *Structures (temporary or permanent).*—

- (1) Structures shall not be designed for human habitation.
- (2) Structures shall have a low flood damage potential.
- (3) The structure or structures, if permitted, shall be constructed and placed on the building site so as to offer the minimum obstruction to the flow of flood waters.
 - (a) Whenever possible, structures shall be constructed with the longitudinal axis parallel to the direction of flood flow, and
 - (b) So far as practicable, structures shall be placed approximately on the same flood flow lines as those of adjoining structures.
- (4) Structures shall be firmly anchored to prevent flotation which may result in damage to other structures, restriction of bridge openings and other narrow sections of the stream or river; and
- (5) Service facilities such as electrical and heating equipment shall be constructed at or above the regulatory flood protection elevation for the particular area or flood proofed.

5.3.4 *Storage of Material and Equipment.*—

- (1) The storage or processing of materials that are in time of flooding buoyant, flammable, explosive or could be injurious to human, animal or plant life is prohibited.
- (2) Storage of other material or equipment may be allowed if not subject to major damage by floods and firmly anchored to prevent flotation or readily removable from the area within the time available after flood warning.

SECTION 6.0 NONCONFORMING USES

6.1

A structure or the use of a structure or premises which was lawful before the passage or amendment of the ordinance but which is not in conformity with the provisions of this ordinance may be continued subject to the following conditions:

6.1.1 No such use shall be expanded, changed, enlarged, or altered in a way which increases its nonconformity.

6.1.2 No structural alteration, addition, or repair to any nonconforming structure over the life of the structure shall exceed _____ percent of its value at the time of its becoming a nonconforming use, unless the structure is permanently changed to a conforming use.

- 6.1.3 If such use is discontinued for _____ consecutive months, any future use of the building premises shall conform to this ordinance.
- 6.1.4 If any nonconforming use or structure is destroyed by any means, including floods, to an extent of _____ percent or more of its _____ value, it shall not be reconstructed except in conformity with the provisions of this ordinance.
- 6.1.5 Uses or adjuncts thereof which are or become nuisances shall not be entitled to continue as nonconforming uses.
- 6.1.6 Except as provided in Section 6.1.5, any use which has been permitted as a Special exception use shall be considered a conforming use.

SECTION 7.0 PENALTIES FOR VIOLATION

Violation of the provisions of this ordinance or failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with grants of Variances or Special exceptions) shall constitute a misdemeanor. Any person who violates this ordinance or fails to comply with any of its requirements shall upon conviction thereof be fined not more than \$_____ or imprisoned for not more than _____ days, or both, and in addition, shall pay all costs and expenses involved in the case. Each day such violation continues shall be considered a separate offense. Nothing herein contained shall prevent the _____ from taking such other lawful action as is necessary to prevent or remedy any violation.

SECTION 8.0 AMENDMENTS

The regulations, restrictions, and boundaries set forth in this ordinance may from time to time be amended, supplemented, changed, or repealed. However, no such action may be taken until a public hearing in relation thereto has been held at which parties in interest and citizens shall have an opportunity to be heard. At least _____ days' notice of the time and place of such hearing shall be published in a newspaper of general circulation in the _____.

SECTION 9.0 PROVIDING FOR ADVERTISING AND EFFECTIVE DATE

This ordinance shall be published in at least one newspaper having general circulation within the County. This ordinance shall become effective upon fifteen (15) days after its passage and publication as herein stated.

APPENDIX G

Washington County Water Management and Conservation Plan

EXECUTIVE SUMMARY

In April 1877, John Wesley Powell said, "In the whole region [the West], mere land is of no value. What is really valuable is the water privilege." Over the years as the area has been settled and developed, that statement has proven true. In the face of overwhelming growth and continued depletion of existing surface water and groundwater sources, the Washington County Water Conservancy District (WCWCD) has developed this Water Conservation and Drought Management Plan to provide for the future water needs of the county.

The plan divides water conservation in Washington County into three categories: General Supply Management; Agricultural; and Interior Residential, Commercial/Industrial, & Landscape. These three areas are based on the sub-committees that were formed from the original Water Conservation and Drought Management Committee which was created by the WCWCD in August 1993. Each section of the plan is sub-divided by area and explained in the context of its particular conservation aspects. Although each of the areas are interrelated, the divisions simplify the plan as well as its implementation.

The plan's goals are to conserve water by improving the quality of surface water, reducing seepage and evaporation, managing drought, enhancing the watershed, improving irrigation practices, educating the public, and passing conservation ordinances. The committee recommends that the plan be fully implemented over the next 20 years. The total amount of water conserved will depend on the success of water projects, public education, and the efforts of individual irrigators, businesses, and citizens. If the committee's projections are correct, the estimated annual water savings in general supply management and landscaping under full implementation are approximately 66,640 Acre Feet (AF). Savings from agricultural conservation are difficult to determine because the amount of water used for agriculture is decreasing rapidly, and because individual farmers determine the amount they will conserve by the practices they employ.

Specific conservation projects practices are outlined in the plan under each specific area. Different groups will take responsibility for implementing some parts of the plan, but the WCWCD will spearhead the effort. The main component of general supply management conservation will be projects which improve the water resources available for agricultural, municipal, and industrial use. Agricultural conservation will focus on individual farmers and other irrigators such as golf courses. The effort will be aimed at education through demonstrations and by showing the benefits of improved irrigation practices. Public and developer/landscaper education is the means by which water can be conserved in the interior residential, commercial/industrial, and landscape area.

Once the plan is approved, implementation will begin as soon as possible with full implementation set for 2015. This will, of course, depend on the cooperation of individual cities, irrigators, and county residents without whose help the plan will be rendered useless.

APPENDIX H

VIRGIN RIVER RESOURCE MANAGEMENT AND RECOVERY PROGRAM

March 10, 1999

