RECLAMATION

Managing Water in the West

Park City and Snyderville Basin Water Supply Study Special Report

Prepared by: Bureau of Reclamation

Contributor:

State of Utah Division of Water Resources

U.S. Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Provo, Utah

February 2006

Executive Summary

Overview

Historically, water suppliers in Park City and Snyderville Basin have relied primarily on groundwater for their municipal and industrial (M&I) water. Because of the extensive development of the groundwater sources, there is concern that there may be limited potential for additional development of the groundwater as a reliable long-term water supply. The recent drought (1999-2004) has raised further questions regarding the quantity and reliability of the existing groundwater development within the Basin. This problem is being compounded by the continuous rapid growth in the Basin, which has become a highly desirable residential and recreational community.

There is significant local interest in determining the long-range water needs of the Basin and identifying feasible options to provide additional water for future needs. Over the past several years, government agencies and several private entities have explored various options to develop additional water supplies. However, a comprehensive evaluation of the overall water needs within the Basin had not been conducted, nor had a comparison between alternative plans been examined in an objective manner.

In 2001, the U.S. Army Corps of Engineers (COE) was funded and directed by Congress to conduct a feasibility study for Park City on water supply options, titled the "Park City Water Supply Infrastructure Study". The COE completed significant work prior to Reclamation's involvement. Page 120 of the FY 2004 Energy and Water Appropriations Conference report states: "The conference agreement includes $500,000 for the Bureau of Reclamation to continue a feasibility study of water supply infrastructure improvements in Park City, Utah." Reclamation received additional funding in FY 2005 and FY 2006. This study is being conducted pursuant to the authority and with the funding provided in these appropriations.

The purpose of this Park City and Snyderville Basin Water Supply Study is to evaluate the future water needs within the rapidly growing Park City and Snyderville Basin area and to formulate, compare, and prioritize options that could be pursued to provide for the M&I water needs expected through 2050. This report presents the findings and recommendations of the study.

Projected M&I Demands

The Park City and Snyderville Basin area is experiencing some of the fastest growth in Utah. This growth has included commercial, institutional, and residential development. The entire area is experiencing an accelerated change from a regional ski resort destination to a diversified year-round vacation and living community, as well as a bedroom community for the Salt Lake Metropolitan area.

Population within the study area is projected to increase from the present (2001) approximately 24,000 to about 64,000 in 2030 and 86,000 by the year 2050. If per-capita use rates were to continue as at present, this increased population would result in an M&I demand of approximately 25,000 acre-feet per year in 2030 and 32,000 acre-feet per year by 2050. However, assuming current water conservation goals are met, the projected demands would be about 23,000 acre-feet per year in 2030 and 27,000 acre-feet per year by 2050.

As explained in Chapter 4, additional demands have been placed on the system to meet in-stream flow and wastewater dilution requirements (1,100 acre-feet per year in 2030 and 1,600 acre-feet per year in 2050), and to replace susceptible mine tunnel flows which have been relied on by Park City (2,000 acre-feet per year for both 2030 and 2050). These additional demands increase the projected water needs to 26,100 acre-feet per year in 2030 and 30,600 acre-feet per year in 2050.

Reliable Water Supply

Table ES-1 shows, by water provider, estimated annual water supplies currently available to meet M&I demands within the study area. This current long-term reliable water supply is approximately 14,000 acre-feet per year. Total current use is approximately 9,800 acre-feet, leaving a current reserve of about 4,200 acre-feet to meet fire suppression and other emergency needs. Chapter 4 presents a detailed discussion of the reasons for and the importance of this reserve. Also explained in Chapter 4 is the rationale for increasing the "reserve" need from the current 4,200 acre-feet per year to 6,500 acre-feet per year in 2030 and 7,500 acre-feet per year in 2050.

TABLE ES-1
2003 Annual Water Production Estimate
(Units: Acre-Feet per Year)

Water Supplier	Total In-Basin (AF/Yr)	2001 Actual Use (AF/Yr)
Community Water Company	281	163
Gorgoza Mutual Water Company	1,424	583
High Valley Water Company	166	75
Mountain Regional SSD	2,467	1,697
Park City Municipal Corporation	5,716	4,728
Summit Water Distribution Co.	3,340	2,065
Summit Co. Service No. 3	203	80
Timberline Special Imp. District	59	16
Others	371	427
Totals (Rounded)	**14,000**	**9,800**
	Surplus/Reserve	**4,200**

Not included in the 14,000 acre-feet per year current supply are more recently developed water supplies and expected future in-Basin water development supplies. Those already developed include the 1,600 acre-feet per year supply provided by the recently completed Lost Creek

Canyon Pipeline project and the 1,000 acre-feet per year imported by Park City from the Jordanelle Special Service District. These supplies are discussed in greater detail in Chapter 4.

Additional in-Basin supplies, assumed to be developed annually by the year 2050, include 300 acre-feet additional groundwater and 500 acre-feet conversion of agricultural-use to municipal-use. Including these developed and anticipated future in-Basin supplies, and excluding the reserve need, the projected reliable water supplies of 9,800, 10,700, and 9,900 acre-feet per year for years 2001, 2030, and 2050, respectively, are required as shown in Table ES-2.

Projected M&I Needs

Projected M&I needs are computed by subtracting projected reliable supply from projected M&I demands. As shown in Table ES-2, the projected additional M&I needs (future development) are 15,400 acre-feet for the year 2030 and 20,700 acre-feet for 2050. A detailed discussion of the analysis behind these numbers is presented in Chapters 2 through 4.

TABLE ES-2
Snyderville Basin Projected Future M&I Needs
Units: Acre-Feet per Year

Existing and Projected M&I Needs	2001	2030	2050
Population	23,900	64,300	86,300
Calculated M&I Demand	**9,800**	**25,300**	**32,000**
Water conservation	0	(2,300)	(5,000)
Adjusted M&I Demand	**9,800**	**23,000**	**27,000**
Minimum instream flow/wastewater dilution required	0	1,100	1,600
Mine tunnel concerns – mine collapse, water quality	0	2,000	2,000
Projected Total M&I Demand	**9,800**	**26,100**	**30,600**
Calculated Current Supplies	**14,000**	**14,000**	**14,000**
Lost Creek Canyon Project	0	1,600	1,600
Jordanelle Special Service District imports	0	1,000	1,000
Increased groundwater development	0	200	300
Future agricultural conversions	0	400	500
Reserve Capacity	(4,200)	(6,500)	(7,500)
Projected Reliable Supply	**9,800**	**10,700**	**9,900**
Projected Additional M&I Needs (Future Development)	**0**	**15,400**	**20,700**

Future Development Options

Nine options were identified for developing water to meet future needs. The first three are in-Basin development options, while the remaining six are importation options. Four of the six importation options (6, 7, 8 and 9), develop the same Weber Basin Water Conservancy District (WBWCD) water supply. Therefore, only one of the four could be considered for future development.

Each of the nine Options was studied in detail to determine viability. A more detailed description of the analysis is presented in Chapter 5. Of the nine Options, six were considered viable for further evaluation as shown in bold type in Table ES-3. Also shown is the water supply that would be developed by each, for a total potential development of 20,000 acre feet per year by 2030 and 21,600 acre-feet per year by 2050.

TABLE ES-3
Development Options Summary
Units: Acre-Feet per Year

Development Options	2001	2030	2050
In-basin Development			
1 – Additional In-Basin Surface Water Storage			
2 – Conjunctive Management of Surface & Groundwater			
3 – Water Reuse	**0**	**2,000**	**3,600**
Importation			
4 – Provo River – JSSD	**0**	**500**	**500**
5 – East Canyon Pipeline	**0**	**12,500**[1]	**12,500**[1]
6 – Brown's Canyon Pipeline			
7 – Lost Creek Canyon Pipeline	**0**	**5,000**[2]	**5,000**[2]
8 – Weber River via Weber Provo Canal	**0**	***5,000***[2]	***5,000***[2]
9 – Lost Creek Canyon and Weber Provo Canal	**0**	***5,000***[2]	***5,000***[2]
Total Potential Development	**0**	**20,000**	**21,600**

[1]Additional water right approvals and potential acquisitions may be needed to yield the full 12,500 acre-foot supply.
[2]These options are dependent upon the same 5,000 acre-feet water supply as Option 7 – hence only one of the three can be developed.

Option Evaluation

Each of the six viable Options was evaluated against a set of criteria developed during the public involvement process of the study. Each criterion was generally applied on a per acre-foot basis. The study team divided the evaluation criteria into two separate categories: Economic Evaluation factors and Non-Economic Evaluation factors. Economic factors include capital cost and present value life cycle cost. Non-Economic factors include environmental, social, institutional, and system reliability.

Results of the economic factors evaluation are shown in Table ES-4, with a more detailed explanation presented in Chapter 6 (Section 6.3.2) and in the Appendix. Potential impacts were identified during the non-economic factors evaluation, however, none were considered sufficiently significant to prevent or limit development of any of the six Options.

TABLE ES-4
Economic Factors Evaluation Summary

Economic Factors	Option 3	Option 4	Option 5[1]	Option 7[1]	Option 8	Option 9
Capital Costs (new) [2] (Units 1,000)	$19,100	$2,700	$53,700 - $67,300	$25,500	$7,200	$14,400
Capital Costs (total) (Units: 1,000)	$19,850	$2,700	$69,300 - $82,900	$37,800	$7,200	$24,300
Capital Costs per acre-foot capacity[3]	$5,510	$5,400	$7,920 - $6,630	$7,560	$1,440	$2,880
Life Cycle Costs per acre-foot delivered	$179	$744	$418 - $376	$369	$460	$426

[1] Option 5 costs are shown as a range, consistent with a capacity between 8,750 acre-feet per year and 12,500 acre-feet per year, as explained in Sections 5.7.2 and 6.3.2. Also, costs for Options 5 and 7 are based on cost estimate Method 3 (see Table ES-5).
[2] Capital costs of new facilities only
[3] Based on capital costs (total) rather than capital costs (new).

Preferred Plan

Of the six options evaluated, only Options 5 and 7 are included in the preferred plan. Option 3 is not included because it is an in-Basin option, i.e. water reuse, which was assumed would be developed by local entities. Options 8 and 9 were eliminated because Option 7 is the highest ranking of the three and therefore becomes the preferred method for importing WBWCD water from Rockport Reservoir to the Snyderville Basin. Option 4 is eliminated because of high life cycle cost relative to the other options.

With the options narrowed to two, a more detailed comparison of the two was conducted from both an economic and non-economic perspective, in order to rank the options and make recommendations with regard to construction priority. This comparison is described in more detail in Chapter 6, Sections 6.3.2 and 6.3.3. A more detailed economic analysis showing four different methods of cost estimates is shown in Table ES-5.

The economic comparison shows that the life cycle cost per acre-foot delivered (See Table ES-4) is slightly lower for Option 7 than for Option 5, but are within the accuracy of the estimates. Because the cost differences between the two are considered within the margin of error of the analysis, other factors must be considered to determine a recommended priority.

TABLE ES-5
Option Cost Estimate Summary by Method

Options	Method 1[1] New Facilities Only	Method 2[2] All Facilities (USBR)	Method 3[3] All Facilities (Includes Sunk Costs)	Method 4[4] (New Facilities Contract Cost Only)
Option 5 - East Canyon Pipeline (8,750 AF capacity and water supply)				
Capital Costs				
Capital Cost (Units: 1,000)	$53,700	$76,000	$69,300	$39,900
Capital Cost per AF Capacity	$6,140	$8,690	$7,920	$4,560
Option 5 - East Canyon Pipeline (12,500 AF capacity and water supply)				
Capital Costs				
Capital Cost (Units: 1,000)	$67,300	$89,600	$82,900	$51,400
Capital Cost per AF Capacity	$5,380	$7,170	$6,630	$4,110
Option 7 - Lost Creek Canyon Pipeline (5,000 AF capacity and water supply)				
Capital Costs				
Capital Cost (Units: 1,000)	$25,500	$40,300	$37,800	$19,000
Capital Cost per AF Capacity	$5,100	$8,060	$7,560	$3,800

[1] Method 1 – Costs for new facilities only. Cost of existing facilities excluded (no sunk costs). Costs include 10% for unlisted items, 20% for contingencies, and 12% for engineering, design, and construction oversight.
[2] Method 2 – Cost of all facilities (new and existing) as if none have been constructed. Costs include 10% for unlisted items, 20% for contingencies, and 12% for engineering, design, and construction oversight.
[3] Method 3 – Cost of all facilities (new and existing). Existing facility sunk costs are added to cost of new facilities. Costs include 10% for unlisted items, 20% for contingencies, and 12% for engineering, design, and construction oversight.
[4] Method 4 – Method 1 (new facilities only) - contract of "field" costs only – which includes 10% for unlisted items but does not include 20% for contingencies, or 12% for engineering, design, and construction oversight.

As shown in Table ES-5, the capital cost for Option 7 is lower than the capital cost for Option 5. Also, Option 7 capital cost per acre-foot capacity for Methods 1 and 4 is less than costs for Option 5. However, Option 7 capital cost per acre-foot capacity for Methods 2 and 3 is inside the range of costs for Option 5. Cost differences between the two Options are so close that they are considered within the margin of error of the analysis, and therefore, do not indicate a conclusive preference of one over the other.

The non-economic comparison, as mentioned above, found no potential impact that would prevent or limit development of either of the two Options. However, some could have significant impact on the timing and risk of development.

Park City and other areas within the Snyderville Basin have an immediate need for additional water supplies, making timing of permanent water deliveries critically important. The available supplies are already behind the projected demand curve (Figures 4.1 and 6.1). Based on the information presented in Chapter 5, and the analysis presented in Chapter 6, the non-economic factors comparison of the two Options ranks Option 7 ahead of Option 5. Considering both the economic and non-economic factors, Option 7 is ranked first for the following reasons:

- A primary reason for the congressional legislation was to find a permanent solution to Park City's immediate and critical need for 2,500 acre feet of water per year. Option 7 is the least costly, would require only 2½ miles of additional pipeline, and would require the shortest time to implement for Park City's need.
- Option 7 is a smaller project and has a lower new facility project capital cost, i.e. $25,500,000 instead of $67,300,000, which makes obtaining funding easier and faster.
- Option 7 can be implemented in less time and with less risk.
- Option 7 has fewer easements, water rights, and land use permit issues to resolve.
- Option 7 has water delivery agreements in place.
- A majority of the infrastructure for Option 7 is already constructed.
- Environmental compliance is expected to take less time because Option 7 is a smaller project with fewer expected adverse impacts.
- Option 7 has a lower capital contract cost per acre-foot capacity, although both projects are relatively close and are considered within the margin of error of the cost estimates.

The East Canyon Pipeline Project, however, is also needed and should move forward immediately and as expeditiously as possible to meet the future, rapidly growing, water needs in the other areas of the Snyderville Basin.

Table ES-6 shows the priority ranking and the quantities of water recommended for development under each option.

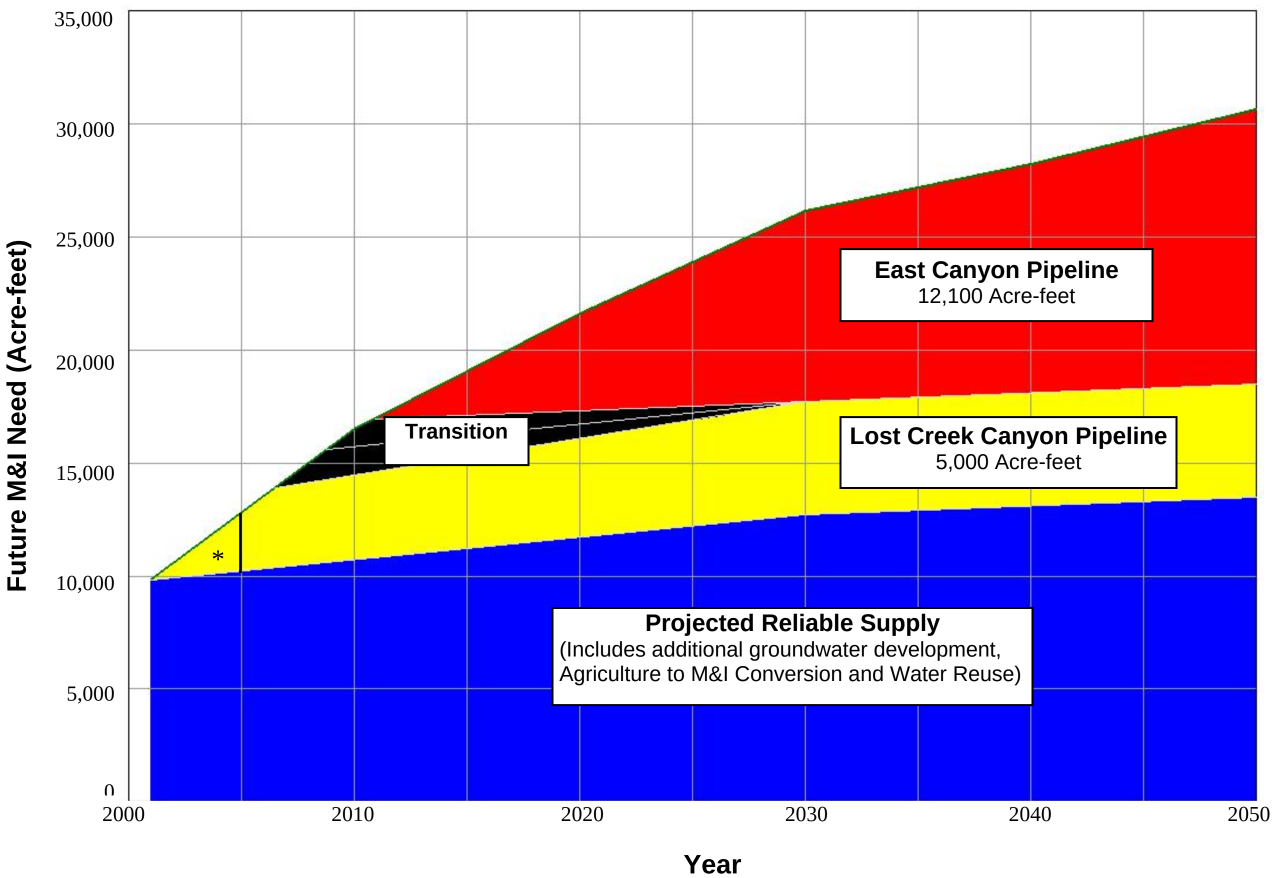
TABLE ES-6
Preferred Plan
Development Option Priority and Needs
Units: Acre-Feet per Year

		2030	2050
Priority	**Development Option**		
1	Option 7 - Lost Creek Canyon Pipeline	5,000	5,000
2	Option 5 - East Canyon Pipeline	8,400	12,100
	Total Developed	**13,400**	**17,100**

Figure ES-1 shows a recommended timeline for implementing the preferred plan. As shown in the figure, the Lost Creek Canyon Pipeline project would meet M&I needs in the immediate and near future with the East Canyon Pipeline project meeting later needs. The figure also shows a "transition" or "over-lap" period when both projects could meet growth needs in the Basin at the same time. This would likely occur as the Lost Creek Canyon Pipeline project water is near full utilization and the East Canyon Pipeline project has been constructed and is operational. Factors which could govern the size of the over-lap would include how quickly the East Canyon Pipeline project can be constructed, the location of need within the Basin, and which water supply is the most marketable in terms of cost of water, proximity to growth areas, customer service, etc.

Table ES-7 is a study summary which shows existing and projected needs, current water supply, and the preferred plan for meeting those projected needs.

Figure ES-1
Preferred Plan Implementation



*Area to the left of the vertical line (2005) indicates M&I demands in excess of projected reliable supply. In order to meet the M&I demands, reserve capacity is being used.

TABLE ES-7
Study Summary
Units: Acre-Feet per Year

Existing and Projected Needs	2001	2030	2050
Population	23,900	64,300	86,300
Calculated M&I Demand	**9,800**	**25,300**	**32,000**
Water conservation	0	(2,300)	(5,000)
Adjusted M&I Demand	**9,800**	**23,000**	**27,000**
Minimum in-stream flow/wastewater dilution requirement	0	1,100	1,600
Mine tunnel concerns – mine collapse, water quality	0	2,000	2,000
Projected M&I Demand	**9,800**	**26,100**	**30,600**
Calculated Current Supplies	**14,000**	**14,000**	**14,000**
Lost Creek Canyon project	0	1,600	1,600
Jordanelle Special Service District imports	0	1,000	1,000
Increased groundwater development	0	200	300
Future agricultural conversions	0	400	500
Reserve Capacity	(4,200)	(6,500)	(7,500)
Projected Reliable Supply	**9,800**	**10,700**	**9,900**
Projected Future M&I Needs (Future Development)	**0**	**15,400**	**20,700**
Future Water Reuse (Developed by Others)	0	2,000	3,600
Projected Additional M&I Needs (Preferred Plan)	**0**	**13,400**	**17,100**
Preferred Plan			
Lost Creek Canyon Pipeline	--	5,000	5,000
East Canyon Pipeline	--	8,400	12,100
Total Future Development	**--**	**13,400**	**17,100**

Contents

List of Tables

List of Figures

Standard Acronyms and Abbreviations

AF	acre-feet
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BC&A	Bowen, Collins & Associates
BOD	Biochemical Oxygen Demand
BOD_5	five-day biochemical oxygen demand
BMP	Best Management Practices
C	degrees Celsius (or centigrade)
CAD	computer aided design
cfm	cubic feet per minute
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm/sec	centimeters per second
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
cu yd	cubic yard
dia	diameter
DO	dissolved oxygen
D&WCCC	Davis and Weber Counties Canal Company
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERC	Equivalent Residential Connection
ESA	Endangered Species Act
F	degrees Fahrenheit
FONSI	Finding of No Significant Impact
ft	feet or foot
ft^2	square feet
ft/ft	feet per foot
ft/h	feet per hour
ft/min	feet per minute
ft/s	feet per second
FWS	US Fish and Wildlife Service
FY	Fiscal Year
g	gram
GIS	Geographical Information System
GOPB	Governor's Office of Planning and Budget

gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
gps	gallons per second
hp	horsepower
hvac	heating, ventilation, and air conditioning
JSSD	Jordanelle Special Service District
kg	kilogram
kv	kilovolt
kva	kilovolt-ampere
kw	kilowatt
kwh	kilowatt hour
l	liter
lb	pound
LF	lineal feet
LS	lump sum
mg	milligram
MG	million gallons
mgd	million gallons per day
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
M&I	Municipal and Industrial
MHZ	megahertz
MOU	Memorandum of Understanding
msl	mean sea level
MRWSSD	Mountain Regional Water Special Service District
MWH	Montgomery Watson Harza
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
OD	outside diameter
O&M	operation and maintenance
OM&R	operation, maintenance and replacement
OSHA	Occupational Safety and Health Administration
PE	Professional Engineer or Project Engineer
PIP	Public Involvement Plan
PM	Project Manager
POC	point of contact

POTW	publicly owned treatment works
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
PRWUA	Provo River Water Users Association
psf	pounds per square foot
psig	pounds per square inch gauge
pvc	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
Reclamation	Bureau of Reclamation
RFP	Request for Proposal
ROW	Right-of-Way
SBWRD	Snyderville Basin Water Reclamation District
SCSA3	Summit County Service Area No. 3
SDWA	Safe Drinking Water Act
SDWS	Safe Drinking Water Standard
SHPO	State Historic Preservation Office
SOW	Scope of Work
STP	Sewage Treatment Plant
SWDC	Summit Water Distribution Company
tbc	to be considered
TMDL	Total Maximum Daily Load
μg/g	micrograms per gram
μg/l	micrograms per liter
μg/kg	micrograms per kilogram
μm	micrometer
UDDW	Utah Division of Drinking Water
UDOT	Utah Department of Transportation
UDWQ	Utah Division of Water Quality
UDWLR	Utah Division of Wildlife Resources
UDWR	Utah Division of Water Resources
UGS	Utah Geological Survey
UPDES	Utah Pollutant Discharge Elimination System
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture

USGS	U.S. Geological Survey
UV	ultraviolet
WBWCD	Weber Basin Water Conservancy District
WRF	Waste Water Reclamation Facility
WTP	Water Treatment Plant
WWTP	Waste Water Treatment Plant

Definitions

Some water terms peculiar to the water industry are briefly defined here in order to better understand the information presented.

Water Supply Terms

Water is supplied by a variety of systems for many users. The general term “supply” is defined as the amount of water available. A public agency owns most water supply systems, but in some cases the owner/operator is a private company. Thus, a "public" water supply may be either publicly or privately owned. Also, systems may supply treated and/or untreated water.

***Concurrency* –** A process established by Summit County Ordinance to ensure adequate capacity for community water systems located in the Snyderville Basin.

***Community Water System* –** A public water system that serves at least 15 service connections used by year-round residents or regularly services at least 25 year-round residents.

***Equivalent Residential Connection (ERC)* –** A term used to evaluate service connections, other than typical residential domicile, and is an estimate of the equivalent volume or rate of flow to that of a typical residential connection.

***Maximum Water Supply Available Under Present Conditions* –** The annual volume of water that is the lesser of the hydrologic capacity of the water source, the physical capacity of the water system, or the use allowed by water rights.

Municipal Water Supply – A municipal supply is that which provides water for residential, commercial, and institutional uses. The terms municipal, community and city are often used interchangeably.

***Municipal and Industrial Water Supply* –** Includes all water (potable and non-potable) supplied for residential, commercial, institutional, light industry, and large self-supplied industries. This supply is available from community systems, non-community (transient and non-transient) systems, self-supplied industrial systems, and private wells.

***Non-Potable Water Supply* –** Non-potable water does not meet safe drinking water requirements. Secondary irrigation companies and self-supplied industries usually supply this water. Sometimes referred to as non-culinary water supply, but usually referred to as secondary water.

***Potable Water Supply* –** Potable water is that which meets all applicable federal and state safe drinking water requirements for residential, commercial, institutional and industrial uses. Potable is also referred to as culinary or drinking water supply.

Public Community Water Supply – This includes potable water supplied by either privately or publicly owned community systems which serve at least 15 service connections or 25 individuals with year round usage. Water from public community supplies may be used for residential, commercial, institutional, and industrial purposes. This can include both indoor and outdoor uses.

Public Non-Community Water Supply – Includes potable water supplied by either privately or publicly owned systems of two types: transient and non-transient. Transient systems are systems that do not serve 25 of the same non-resident persons per day for more than six months per year. Examples include campgrounds, RV parks, restaurants, convenience stores, etc. Non-transient systems are systems that regularly serve 25 of the same non-resident persons per day for more than six months per year. Examples include churches, schools and industries. This report combines transient and non-transient systems together and calls them all public non-community systems.

Reliable System Source Capacity – The portion of the annual water supply that is available to meet peak demands. When this number is divided by the average per capita usage, the result approximates the maximum population that the water system can serve.

Secondary Water Supply – This water is usually a pressurized or open ditch water supply system with untreated water for irrigation of privately and publicly owned lawns, gardens, parks, cemeteries, golf courses and other open areas. These systems, sometimes called "dual" water systems, are installed to provide an alternative to irrigating with culinary water for outdoor areas. Irrigation companies often provide this supply. Self-supplied industries can also use secondary water for industrial processes.

Self-supplied Industrial Supply – This category includes potable or non-potable water, usually from their own wells or springs, supplied by individual privately owned industries.

Chapter 1 – Introduction

1.1 Background

In recent years, the Park City and Snyderville Basin (Basin) area has experienced some of the fastest growth in Utah. This growth has included commercial, institutional, and residential development. The expansion of the ski resorts prior to and following the 2002 Winter Olympics has attracted not only seasonal resort developments, but also year-round residential communities. The entire area is experiencing an accelerated change from a regional ski resort destination to a diversified year-round vacation and living community, as well as a bedroom community for the Salt Lake Metropolitan area.

Historically, the municipal and industrial (M&I) water supply to the Snyderville Basin has been provided by a number of entities. Park City Municipal Corporation has provided water to city residents since the city was incorporated. As development began to spread into the unincorporated areas of the Snyderville Basin, a number of organizations were created to provide water. Most were formed by developers needing to provide a water system for their associated land development projects. Over the years, many of those systems evolved into private water companies, private mutually-owned companies, or special service districts formed by Summit County. There are also some developments that still rely on individual wells to provide residential water.

Most of these systems have relied on wells as the primary source of M&I water. Park City has developed a large portion of its water supply from tunnels formerly used for mineral extraction. A few small springs have been developed to supplement the wells. The Snyderville Basin has a unique groundwater system. The area is divided into a number of compartmentalized basins composed mostly of bedrock formation aquifers that are segregated from each other. Studies have shown that these aquifers are limited in storage capacity and are recharged primarily through precipitation, with relatively short recharge periods.

Because of the limited groundwater resource, there is a concern that there may be limited potential for additional development of the groundwater as a reliable long-term water source for the Snyderville Basin. The drought that has occurred in the past 5 to 6 years (1999-2004) has raised concerns about the amount and reliability of further groundwater development within the Basin. These concerns have been compounded by the rapid growth in the Basin.

Three water entities servicing the Basin have developed surface water sources and constructed treatment plants. Community Water Company operates the oldest surface water source using Willow Creek water located near The Canyons Resort. Summit Water Distribution Company (SWDC) and Mountain Regional Water Special Service District (MRWSSD), have each developed surface water treatment plants. The SWDC Plant treats water diverted from East Canyon Creek while the MRWSSD Plant in the Promontory Development recently began importing and treating water from the Weber River area just upstream of Rockport Reservoir.

With continued growth of residences and business interests in the Basin there is a great interest in determining the long-range water needs of the Basin and identifying feasible alternatives to provide additional water to meet future demand. Over the past several years, Government agencies and several private entities have explored various options to develop an additional water supply. Frequently, there has been competing views on water supply, infrastructure, and service areas. Several of these entities have proposed options for importing additional water into the Basin to meet their individual needs.

A number of investigations have been conducted since the early 1990's by various organizations, including the Weber Basin Water Conservancy District (WBWCD), Park City Municipal Corporation, MRWSSD, Summit County, SWDC, and the U.S. Army Corps of Engineers (COE). These studies are compiled and summarized as part of this study. An extensive literature search was conducted and a reference summary is included at the end of this report.

In 2001, the COE was funded and directed by Congress to conduct a feasibility study for Park City on water supply options, titled the "Park City Water Supply Infrastructure Study". The COE completed significant work prior to Reclamation's involvement. Page 120 of the FY 2004 Energy and Water Appropriations Conference report states: "The conference agreement includes $500,000 for the Bureau of Reclamation to continue a feasibility study of water supply infrastructure improvements in Park City, Utah. Reclamation received additional funding in FY 2005 and FY 2006. This study is being conducted pursuant to the authority and with the funding provided in these appropriations.

Park City and the Snyderville Basin lie within the boundaries of WBWCD. WBWCD has extended offers to water providers in the Basin to purchase unsubscribed-for M&I water to augment their supplies. WBWCD, Park City, Summit County, and MRWSSD (then known as Atkinson Special Service District), entered into a Memorandum of Understanding and Agreement dated November 18, 1996 (1996 MOU). The 1996 MOU set forth a framework for the development of a project to deliver water made available from WBWCD's sources to the service areas of Park City and MRWSSD, with possible future expansion into other areas of Summit County. That agreement expired in early 2004, and in May 2004, a new MOU was negotiated.

SWDC has entered into an agreement with the Davis and Weber Counties Canal Company (D&WCCC) to purchase 5,000 acre-feet of water in East Canyon Reservoir and pump it to its treatment plant in the Snyderville Basin to supply its customers. They have also offered to participate with WBWCD in any importation project from East Canyon Reservoir.

The purpose of this study is to evaluate the water needs within the rapidly growing Park City and Snyderville Basin area, quantify those needs, and develop and evaluate options or alternatives, that could be pursued to provide for the M&I water demands expected through 2050.

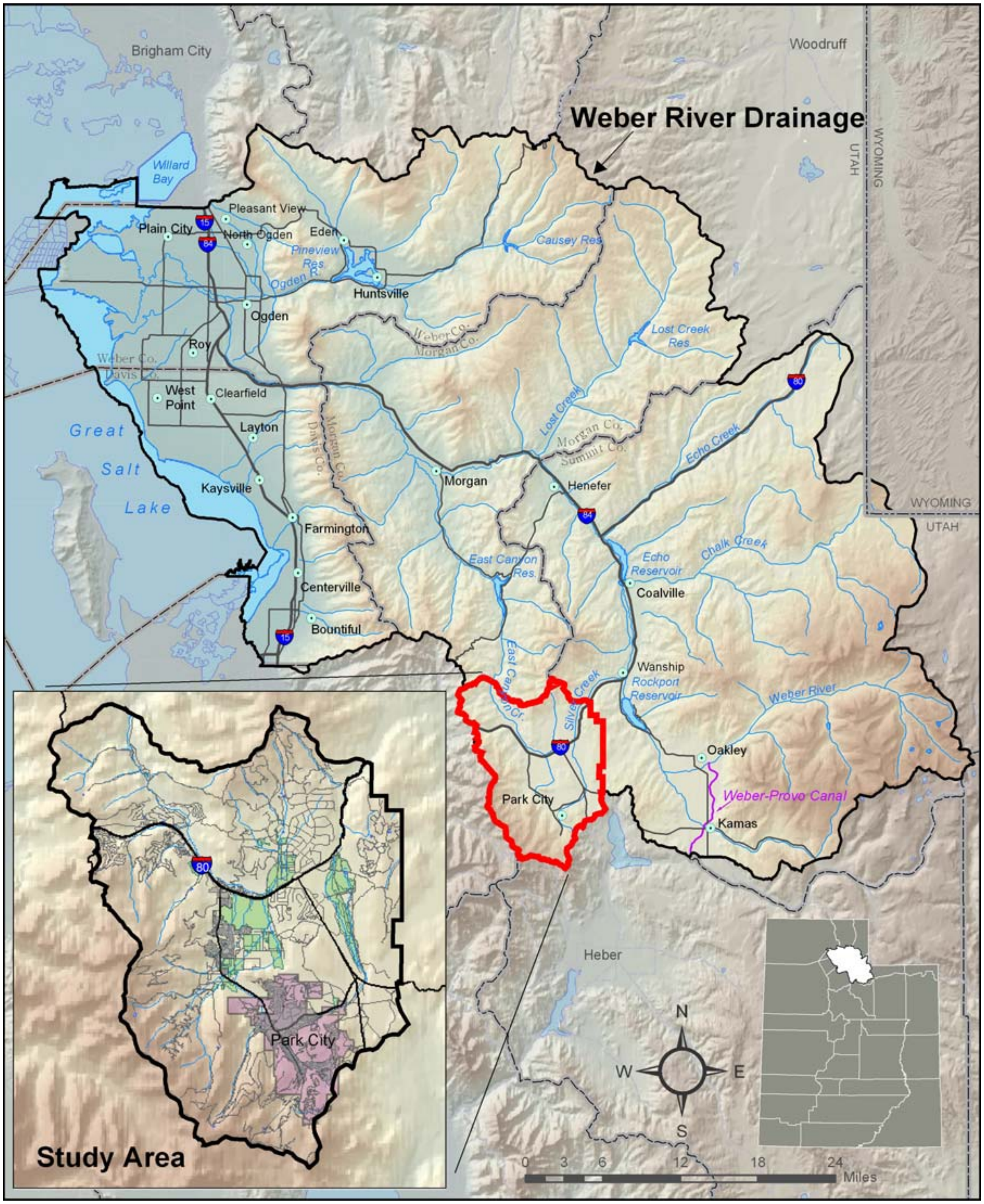
1.2 General Description of Study Area

The boundaries of the Snyderville Basin for the purposes of this study were determined by Reclamation with input from the State of Utah Division of Water Resources (UDWR) and water providers in the Basin. This study area encompasses the area from near the western Summit County boundary at mile marker 140 on Interstate 80 (I-80), east to I-80 mile marker 150, and north and south of I-80 to the enclosing mountain ridgelines on or near the Summit County boundaries. An illustration of the study area is provided in Figure 1-1.

The study area generally consists of higher elevation mountain valleys and resort developments on the slopes of the surrounding mountains.

FIGURE 1-1
VICINITY MAP

SNYDERVILLE BASIN WATER SUPPLY STUDY



Chapter 2 – Existing Conditions, Water Supplies and Infrastructure

2.1 Background

During the early settlement of the Snyderville Basin, population was concentrated within the boundaries of the mining town of Park City, with only a few scattered individual homes located within the rest of the Basin. In the late 1950's and early 1960's, a ski resort was developed on the mountains adjacent to Park City. Since then, the dynamics of the region have dramatically changed; initially to a winter vacation destination, and more recently to a year-round resort community.

With the increased recreational opportunities, residential developments expanded within Park City and into the surrounding unincorporated areas. Park City continued to expand its water supply system to meet the needs within its boundaries. Water development within the unincorporated portion of the Basin was initially a private enterprise. The earliest developments, Summit Park and Pinebrook, developed their own water companies and water systems. Most consisted of wells and small storage tanks. Some of these evolved into community systems and some eventually combined to serve more than one developed area. Summit Water Distribution Company was founded in 1979, to develop a Basin-wide water system that would supply numerous developments owned by the principles of the water company.

When a countywide wastewater system was developed in the 1970's, development within the unincorporated areas accelerated. Eventually, Summit County incorporated several service districts to take over ownership and operation of these smaller water systems. Several private water companies also emerged to own and operate systems. Some of these systems are operated as mutual water companies, where each user owns a portion of the system. Others remained as private companies governed by the Utah Public Service Commission.

In 2000, Summit County established MRWSSD. MRWSSD subsequently assumed ownership and/or operation of several smaller systems which were either privately owned or formerly in other special service districts. Several of these smaller systems had experienced difficulty in providing water to their customers for a variety of reasons. Some experienced problems with their supply wells, and their efforts to find new sources were unsuccessful. Others were under capitalized and unable to fund operation and maintenance needs.

2.2 Summit County Concurrency Requirements

In the Snyderville Basin, water has become a critical component in the ability to sustain growth. In addition to the State Engineer closing the area to new appropriations, Summit County has implemented a concurrency ordinance to all non-municipal public water supply providers in the Snyderville Basin, which requires them to demonstrate they have adequate water to meet current and approved growth demands within their boundaries. The ordinance requires that concurrency reports be submitted which provide the county with accurate data that is used to update the carrying or design capacity of an existing water system. The concurrency review focuses on the existing public water supplies, and the dependable peak-day source capacity. This new capacity value is used by the county to determine if sufficient water source production capacity is available and if infrastructure improvements are in place before development approvals and building permits are issued for new construction. Reported 2004 concurrency capacities are listed in Table 2-1. This table shows the maximum capacity of the water supply sources and an estimate of the annual production capacity of that source, and it also shows the rated capacity. Rated capacity is a term used in the concurrency process to discount the available supply for drought and operational problems that reduce the capabilities of the source to produce water. In estimating the volumes of water produced, it is assumed that spring and surface sources are constant year around. However, since SWDC's East Canyon Water Treatment Plant only operates from April to September, it was rated at one-half the yearly maximum capacity. In the future, SWDC may choose to operate the treatment plant during the winter months to reduce its dependence on groundwater and reserve use of its wells for peak periods of demand. Due to operational constraints commonly associated with wells, well sources are considered to be operational one-half of the year. The rated capacities are determined for each system by the Utah Division of Drinking Water (UDDW), based on pump tests after well completion. The UDDW rules require that the wells be pumped at 150 percent of the anticipated design capacity. The county generally subtracts an additional 15 percent from the UDDW rated capacity as a drought reserve. These criteria are reflected in the tables.

2.3 Existing Water Systems and Source Descriptions

In describing existing water systems and sources, two factors are important to consider: (1) maximum water supply available under present conditions, and (2) reliable system source capacity. The maximum water supply is defined as the total water resource that is presently developed. The ability to use this total resource is limited by mechanical constraints (such as pump capacity or pipe size), hydrologic constraints (such as reliable streamflow or groundwater safe yield), or legal constraints (such as a water right or contract). For purposes of this study, the least water supply available after considering these constraints is considered to be the reliable system source capacity. Determination of well pump capacities, spring flow estimates, treatment plant capacities, and water right information all aid in the calculation of this value.

Because most culinary water system storage tanks are designed to store only about 1 day's worth of water demand, and many systems only use the full capacity of their wells during the peak season, not all of the maximum water supply is available to meet future water needs. Therefore, the system source capacity is more useful in determining future water capacities of the particular community water system sources (wells, springs, etc.). See Section 2.4.1, for a more detailed definition of a reliable supply. When the system source capacity is divided by the average annual per capita water use for the system, the result represents the population that can be reliably served by the present system sources.

TABLE 2-1
Reported Concurrency Capacities

Water Supplier/ Source Name	Source Type	2004			
		Max Capacity (gpm)	Max. Annual Capacity (ac-ft/yr.)	Rated Capacity (gpm)	Annual Rated Capacity (ac-ft/yr.)
Community Water Company					
Ambush #1	Well	40	32	-[1]	-[1]
Ambush #2	Well	25	20	-[1]	-[1]
Wagon Trail #2	Well	16	13	16	13
Gulch	Well	105	85	95	77
Bushwacker	Well	15	12	-[1]	-[1]
Willow Creek Treatment Plant	Surface	200	323	180	290
Totals		**401**	**485**	**291**	**380**
Gorgoza Mutual Water Company					
Two Mile Springs	Spring	70	113	60	96
Well #1	Well	125	101	85	69
Dan's Well	Well	120	97	85	69
Well #P3	Well	100	81	100	81
Well #4B	Well	547	441	425	343
Well #4R	Well	500	403	340	274
South Ridge #1 Well	Well	43	35	43	35
Ankareh	Well	225	181	150	121
Summit Water Connection	Intercon	300	242	300	242
Totals		**2,030**	**1,694**	**1,588**	**1,328**
High Valley Water					
High Valley Old Well	Well	150	121	128	103
Atkinson Well #2	Well	86	69	73	59
Totals		**236**	**190**	**201**	**162**
Mountain Regional Water Special Service District[2]					
Atkinson Well #2	Well	194	156	165	133
Jailhouse Well #3	Well	120	97	102	82
Silver Creek Well #10	Well	306	247	260	210
Starpointe Well #15b	Well	1,225	988	1,041	840
Three Mile Well	Well	150	121	128	103
Blackhawk Well #2R	Well	123	99	105	85
Gorgoza Well #6	Well	188	152	160	129
Nugget Well	Well	200	161	170	137
Spring Creek Spring	Spring	125	202	125	202
Lake Well #1	Well	194	156	165	133
Sun Peak Well #2	Well	35	28	30	24
Winter Park Well #3	Well	76	61	65	52
Summit Park Well #2	Well	37	30	25	20
Summit Park Well #4	Well	20	16	17	14
Summit Park Well #5	Well	72	58	61	49
Summit Park Well #7	Well	120	97	87	70
Spring Creek Well #1	Well	252	203	213	172
SWDC Sports Park	Intercon	80	65	80	65
Totals		**3,517**	**2,937**	**2,999**	**2,520**
Park City Corporation					
Spiro Tunnel	Spring	2,350	3,791	2,350	3,791
Judge Tunnel	Spring	1,200	1,936	650	1,048
Thiriot Spring	Spring	1,600	2,581	628	1,013
Middle School Well	Well	1,000	807	1,000	807
Divide Well	Well	1,000	807	667	538
Park Meadows Well	Well	1,000	807	-[1]	-[1]
JSSD Interconnect	Intercon	1,000	1,000	1,000	1,000
Totals		**9,150**	**11,726**	**6,295**	**8,196**
Summit County Special Service Area No. 3					
Well #1	Well	145	234	128	206
Totals		**145**	**234**	**128**	**206**

TABLE 2-1
Reported Concurrency Capacities (cont.)

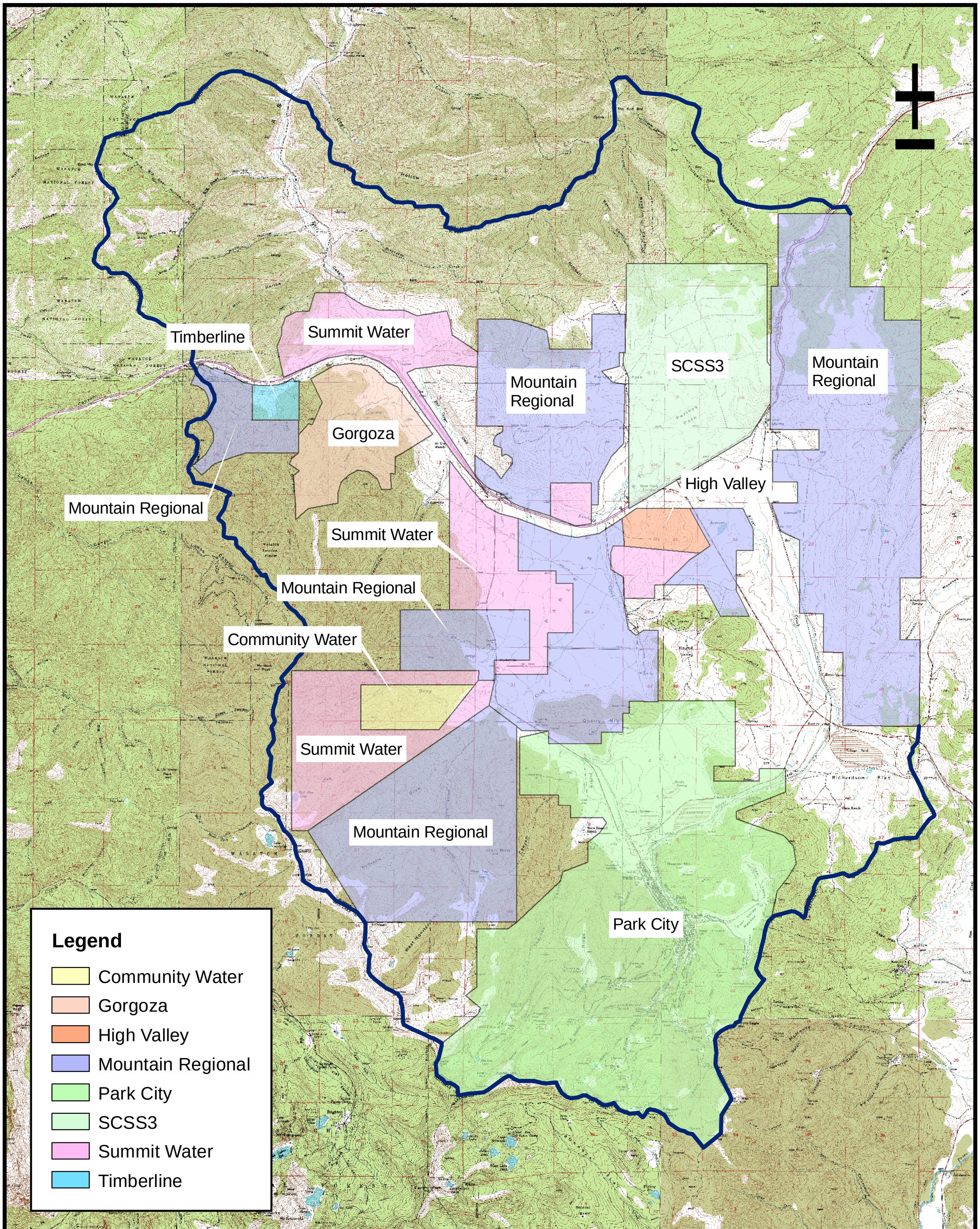
		2004			
Water Supplier/ Source Name	Source Type	Max Capacity (gpm)	Max. Annual Capacity (ac-ft/yr.)	Rated Capacity (gpm)	Annual Rated Capacity (ac-ft/yr.)
Summit Water Distribution Company					
Rest Stop Well	Well	1,200	968	800	645
Hiute Well	Well	150	121	128	103
Jeremy Well	Well	511	412	434	350
Knight Well	Well	71	57	60	48
White Pine Well	Well	20	16	17	14
Church Well	Well	95	77	81	65
Storage Well	Well	750	605	638	515
Old F-7 Well	Well	185	149	157	127
U224 Well	Well	250	202	167	135
New F-7 Well	Well	468	377	398	321
Spring Creek Springs	Spring	500	807	425	686
East Canyon Treatment Plant[3]	Surface	3,820	907	1,120	452
Totals		**8,020**	**4,698**	**4,425**	**3,460**
Timberline Special Service District					
Ponderosa Well	Well	22	18	19	15
Cedar Well	Well	14	11	12	10
Gorgoza Interconnect	Inteconnect	20	16	20	16
Summit Park Well #7	Well	26	21	22	18
MR Interconnect	Interconnect	2	2	2	2
Totals		**84**	**68**	**75**	**60**

[1] Incomplete data
[2] Mountain Regional Water Special Service District includes systems formerly known as Atkinson Special Service District, Summit Park, Silver Springs, Spring Creek, Pivotal Promontory, and Quarry Mountain.
Well capacity for volume calculations was assumed to operate 50 percent of the time.
[3] Summit Water Treatment Plant was assumed to operate only 1/4 of the year due to water availability in East Canyon Creek.
Annual Capacities are derived from converting capacity to annual use assuming full time availability of springs, 1/2 time for wells and 1/4 time for Summit Water's Treatment Plant.

The major water suppliers in the study area are composed of public water systems and privately controlled water systems. In addition, there are numerous individual systems that typically provide water to a single home or property using a well or spring. A description of each of the major water providers is presented in the following paragraphs to provide an understanding of the water supply system of the area. Figure 2-1 shows the present service area of each of the major water providers in the Basin. Summit County's Concurrency Officer, who oversees the reports and enforces the county's ordinance, has developed a definition of equivalent residential connections (ERC) with which the number of ERCs for each water system has been determined. The officer uses the ERC numbers to evaluate each water provider's capacity to meet expected peak day water demands. An ERC is defined to be 0.86 gallons per minute or 1,238 gallons per day.

Community Water Company

Community Water Company is a privately-owned water system serving an area of The Canyons Ski Resort and surrounding developments. Based on the 2004 Concurrency Report, submitted by Community Water Company, the system is currently servicing 286 ERCs, with an expectation of increasing to 439 ERCs at build-out. There are three connections to SWDC in Community Water Company's water system, and one connection to MRWSSD.



Snyderville Basin
Water Supply Study

Figure 2-1
Present Distribution Areas

Sources for Community Water Company includes: two wells (Wagon Trail No. 2 Well and Gulch Well) and one treated streamflow (Willow Creek Treatment Plant). UDDW rates the current total system source as 291 gallons per minute (gpm). In addition to the connections requiring service throughout the year, Community Water Company has a standby commitment to The Canyons Ski Resort to provide water for snowmaking.

Gorgoza Mutual Water Company

Gorgoza Mutual Water Company is a mutually-owned water system originally developed to provide water to the Pinebrook development. Based on the 2004 Concurrency Report, submitted by Gorgoza, the system is currently servicing 1,399 ERCs with an expectation of increasing to 1,540 ERCs by 2009. No additional growth or development is anticipated beyond that point.

Sources for the Gorgoza system include seven wells and one spring, with a total rated capacity of 1,588 gpm (in 2004). Additionally, up to 300 gpm is available through interconnections with SWDC's system on an emergency basis. Gorgoza recently completed drilling a new well. Well tests documented a maximum capacity of 300 gpm, and the State of Utah has approved a rated capacity of 200 gpm. Gargoza may drill an addition well in the future for reserve capacity. Gorgoza also has an interconnection with MRWSSD through which they can receive or supply water as needed.

High Valley Water Company

High Valley Water Company is a mutually-owned water system serving customers located in the area southwest of I-80/U.S. Highway 40 Junction. Based on the 2004 Concurrency Report, submitted by High Valley, the system is currently servicing 211 ERCs with an expectation of increasing to 225 ERCs by 2009. High Valley has no plans to increase their service area or build new developments in the current service area.

Sources for the High Valley Water Company system include: two wells (High Valley Old Well and Atkinson Well No. 2), with a total UDDW rated capacity of 201 gpm. Atkinson Well No. 2, is jointly owned by High Valley and MRWSSD. Because of the wells water quality problems, MRWSSD voluntarily exchanges the poor quality water for higher quality water and supplies it to High Valley. A replacement well for Atkinson Well No. 2 was drilled but found to be unproductive. Since then, High Valley Water Company has contracted with SWDC to provide additional water when needed.

Mountain Regional Water Special Service District

MRWSSD is a county organized water district. It includes systems formerly known as Atkinson Special Service District, Summit Park, Silver Springs, Spring Creek, Pivotal Promontory, and Quarry Mountain. Based on the 2004 Concurrency Report, the system is currently servicing 2,700 ERCs with an expectation of increasing to 5,540 ERCs by 2009.

Sources for the MRWSSD system includes: 16 wells and 1 spring, with a total UDDW rated capacity of 2,999 gpm. MRWSSD recently completed a surface water treatment plant (Signal Hill) that treats water pumped from shallow wells located along the Weber River just upstream from Rockport Reservoir. The plant has been operational since October 2004 and has an initial capacity of 3.0 million gallons per day (MGD).

Park City Municipal Corporation

Park City Municipal Corporation operates a public water system. Because it is a publicly operated system, no concurrency report is required. Based on information provided by the city, it services approximately 4,700 connections. These connections consist of single and multi-family homes, hotels, golf courses, two ski resorts, restaurants, and a variety of other businesses. Park City has projected future water needs and developed a Master Plan that assumes a growth build-out by about 2030.

Sources for the Park City system includes: three wells, one spring, and two tunnels, with a total UDDW rated capacity of 6,295 gpm. Currently, one of the three wells has been taken off line due to water quality issues. Once adequate treatment can be provided, this well will add another 670 gpm to the total rated capacity. Additionally, the city currently imports 1,000 gpm, up to a maximum of 1,000 acre-feet per year, from Jordanelle Special Service District (JSSD). JSSD is a water district located in Wasatch County that serves water to the area surrounding Jordanelle Reservoir and is described below.

Summit County Service Area No. 3

Summit County Service Area No. 3 (SCSA3) is classified as a county authorized water system that provides water to the area north of the I-80/U.S. Highway 40 Junction. Based on the 2004 Concurrency Report, the system is currently servicing 149 ERCs with an expectation of increasing to 194 by 2009.

The source for the SCSA3 includes: Well No. 1, with a UDDW rated capacity of 128 gpm. It is important to note, that there are a significant number of individual wells serving homes in this area. As growth occurs in this area, it is probable that there will be a move to a greater dependence on the public water system and the numerous small existing wells will not be acceptable as a public water source. Thus, as existing individual well owners convert to the public system, even without growth, there will be a greater need for water supply in the public system serving this area. MRWSSD operates this system under an inter-local agreement.

Summit Water Distribution Company

SWDC is a user-owned exempt mutual water company. This means that the operation side of the company cannot make a profit, but can only charge the costs for operation, maintenance, repair, and replacement of the water distribution system. All costs and necessary actions associated with expansion of the SWDC system is the responsibility of the shareholder(s) proposing the expansion (Flitton 2005). The system serves a wide area of the Snyderville Basin, extending from Jeremy Ranch to U.S. Highway 40, and south to The Canyons Ski Resort area. Based on the 2004 Concurrency Report, the system is currently servicing 2,805 ERCs, with an expectation of increasing to 4,305 ERCs by 2009.

Sources for the SWDC system includes: a surface water treatment plant, 10 wells, and 1 spring, with a total rated peak capacity of 4,425 gpm. The water treatment plant currently receives source water from a diversion on East Canyon Creek. The long-range plan is to construct a water line and pump stations to withdraw water from East Canyon Reservoir to supply the treatment plant. This would increase the production from that plant to match the installed capacity and facilitate future expansion.

In an agreement dated May 26, 1998, by and between Utah Division of Wildlife Resources (UDWLR) and SWDC, SWDC agreed to a variety of stream enhancement measures, including a forbearance from diverting water from East Canyon Creek, unless its base flows exceeded 3.5 cubic feet per second (cfs), and an intent to continue cooperating to increase base flows above 3.5 cfs level. With respect to the flows of East Canyon Creek arising naturally above the project's water treatment plant at Jeremy Ranch, Summit Water agreed to not divert any water directly from East Canyon Creek, unless the creek's flow rate at the above-mentioned location is greater than 6.0 cfs, thereby establishing 6 cfs as the base flow rate at which Summit Water will stop its direct diversions from East Canyon Creek and begin taking water from East Canyon Reservoir (any diversion made when the flow is greater than 6 cfs will not reduce the flow to less than 6 cfs). As part of the mutual cooperation between the parties, there is a commitment to provide incremental augmentation from upstream sources to increase base flows above the 6 cfs base flows established by this agreement. Summit Water also agreed to recognize cumulative increases to the 6 cfs base flow, when such flows are made possible by quantifiable augmentation to upstream flows in East Canyon Creek or its tributaries. During low flow periods from droughts, etc. which extend into the identified winter months, the 6 cfs base flow will be respected. During low flows occurring at any other time of year, 3.5 cfs base flows will be respected (no diversion will reduce the base flow below 3.5 cfs). As a consequence of these commitments, SWDC will provide the UDWLR a right to use 2 cfs capacity of the proposed East Canyon Pipeline to deliver water for fish, and thereby receives credit toward the 6 cfs minimum streamflow.

Timberline Special Service District

Timberline Special Service District is a community water system that provides water to the Parleys Summit area. Based on the 2004 Concurrency Report, the system is currently servicing 87 ERCs with an expectation of increasing to 95 ERCs by 2009. Timberline has contracted with MRWSSD to provide management, service, and maintenance. They have also been approved for annexation into MRWSSD.

Sources for the Timberline system includes: two wells with a UDDW rating of 31 gpm. Timberline also receives 20 percent of the production from two wells jointly owned by Timberline and MRWSSD (formerly Summit Park Special Service District). Additionally, Timberline receives 20 gpm through a connection with Gorgoza Mutual Water Company. The total peak source capacity for Timberline is 75 gpm. MRWSSD operates this system under an inter-local agreement.

Weber Basin Water Conservancy District

The Weber Basin Water Conservancy District (WBWCD) was formed in 1950 to develop the water resources of the Weber River Drainage Basin. WBWCD provides primarily wholesale treated and untreated water to customers located in Summit, Morgan, Davis, Box Elder, and Weber Counties. WBWCD operates a number of reservoirs located on the Weber River and its tributaries, conveyance facilities, treatment plants and wells, to provide culinary and secondary water to its customers. Since its inception, WBWCD has intended to provide water to the

Snyderville Basin, but until recently it had not developed any systems to do so. With the completion of the Lost Creek Canyon Project, MRWSSD will provide about 1,600 acre-feet of WBWCD water to the Snyderville Basin. Recently, a diversion at Rockport Reservoir was examined to evaluate the feasibility of providing an additional 5,000 acre-feet of WBWCD water to the MRWSSD treatment plant for use in the Snyderville Basin. Weber Basin has contracted with both Park City and MRWSSD to deliver 2,500 acre-feet per year of Weber River water to each entity.

Jordanelle Special Service District (JSSD)

JSSD was established by Wasatch County to provide water to developments located around Jordanelle Reservoir. Although it is not located in the Snyderville Basin, JSSD has a treatment plant and distribution system with an existing connection that provides water to Park City through Deer Valley Resort. The source of JSSD's water is the Ontario Tunnel, and it is treated prior to use. In 2002, Park City and JSSD entered into a 20-year lease agreement to purchase 1,000 acre-feet per year of M&I water at a maximum rate of 1,000 gpm from JSSD through this connection. The city is currently in the third year of that agreement.

2.4 Existing Water Supply

2.4.1 Methodology

To estimate the annual water production capacity of the existing water sources in the Basin, several methods were used. The first method was to use the maximum installed capacity of the sources within each system. These values were derived by summing the capacity values shown in Table 2-1 under the column entitled maximum annual capacity. Table 2-2 lists the total maximum source capacity as reported in each water supplier's 2004 Concurrency Report, along with the 2001 actual water usage. The actual 2001 supply values were provided by UDWR based upon data collected from water providers.

The use of the 2001 data raises the question of why more recent data was not used. UDWR, the agency collecting this data, believes the 2001 data is more representative of the long-term water deliveries in the Basin than more recent data. While water use data for 2003 and 2002, was available and could have been used, the water use in both of these years was significantly impacted by drought conditions. Utilizing water use during a known drought year (2003 was one of the most severe on record) to project future water demands is undesirable because it would result in a significant underestimation of actual future water needs.

Given that the County Concurrency Officer has rated each source, a second method was used to estimate the annual water production capacities based on the rated capacity of the sources. Table 2-3 lists these capacities for each water supplier.

A third method was developed to estimate annual water production capacity using a peaking factor. Standard practice in water system planning and operation is to install sufficient capacity to meet expected peak demands of the system. This practice typically recognizes that peak capacity only needs to be available for short periods of time when peak demands occur. Peak demands are generally two to three times the average demand of the system. Given that each water provider has designed their system taking into account peaking factors, an approach that evaluates peaking factors was considered appropriate for this analysis.

Table 2-4 lists the adjusted peak capacities for each source. These capacities were adjusted by dividing the maximum annual production capacity (for spring and surface sources) in Table 2-1 by a peaking factor of 2.3. Well capacities were doubled to reflect year-round operation and then divided by the same peaking factor. This peaking factor was calculated in the Park City Municipal Corporation Water Supply and Water Demand Update, May 2000 using 1995 through 1999 water use data.

Peaking factors define the relationship between infrastructure flow rates and delivery volume – the greater the peaking factor, the lower the delivery volume, and visa-versa. Peaking factors are influenced by the demand distribution pattern (magnitude and timing of the peak use periods versus base flow), available storage volumes, and other factors. While it can be argued that different peaking factors should be used for the different areas and/or water companies, doing so is beyond the level of accuracy of this study. Importation volumes are provided generally to the entire Snyderville Basin and not to specific areas. Also, a primary objective of the study is to compare options to determine which best meets the projected water needs within the area. Therefore, one peaking factor rate was used in the study for the entire study area. This 2.3 peaking factor is considered to be representative of the demands in the Basin. Table 2-4 shows the capacities available to reliably serve the water demands in the Basin.

Interviews were also conducted with water providers in Snyderville Basin. Many of the major suppliers interviewed stated that their actual production volumes are approaching the capacity of their sources to produce water. Based upon this information, the third method's estimate (Table 2-4) for water production is considered to be a more reasonable estimate of the annual production capacities than the first two methods. Each of the other methods estimates the overall production capacity higher than experience with these systems would indicate. The peaking method appears to more closely estimate the reliable capacity of these systems. The estimate of existing production capacity for the Basin is approximately 14,000 acre-feet per year.

TABLE 2-2
2003 Annual Water Production Estimate Method One (Using Maximum Installed Capacities)

Water Supplier	Springs (Ac-Ft/Yr)	Wells (Ac-Ft/Yr)	Surface (Ac-Ft/Yr)	Import (Ac-Ft/Yr)	Total (Ac-Ft/Yr)	*Total In Basin* (Ac-Ft/Yr)	2001 Actual Usage (Ac-Ft/Yr)
Community Water Company		162	323		485	485	163
Gorgoza Mutual Water Co.	113	1,581			1,694	1,694	583
High Valley Water Co.		190			190	190	75
Mountain Regional SSD	202	2,736			2,937	2,937	1,697
Park City Municipal Corporation	8,307	2,420		1,000	11,726	10,726	4,728
Summit Water Distribution Co.	807	2,984	907		4,698	4,698	2,065
Summit Co. Service #3		234			234	234	80
Timberline Special Imp. Dist.		68			68	68	16
Others		427			427	427	427
Totals	**9,428**	**10,801**	**1,230**	**1,000**	**22,459**	**21,459**	**9,834**
						Surplus/(Deficit)	**11,625**

Assumptions: Use 1/2 well capacity and full spring and surface water capacities shown in Table 2-1.
Most of the flows shown under springs for Park City are actually tunnels.

TABLE 2-3
2003 Annual Water Production Estimate Method Two (Using Rated Capacities of Systems)

Water Supplier	Springs Ac-Ft/Yr)	Wells (Ac-Ft/Yr)	Surface (Ac-Ft/Yr)	Import (Ac-Ft/Yr)	Total (Ac-Ft/Yr)	*Total In Basin* (Ac-Ft/Yr)	2001 Actual Usage (Ac-Ft/Yr)
Community Water Company		90	290		380	380	163
Gorgoza Mutual Water Co.	96	1,232			1,328	1,328	583
High Valley Water Co.		162			162	162	75
Mountain Regional SSD	202	2,318			2,520	2,520	1,697
Park City Municipal Corporation	5,852	1,344		1,000	8,196	7,196	4,728
Summit Water Distribution Co.	686	2,323	452		3,460	3,460	2,065
Summit Co. Service #3		206			206	206	80
Timberline Special Imp. Dist.		60			60	60	16
Others		427			427	427	427
Totals	**6,835**	**8,162**	**742**	**1,000**	**16,739**	**15,739**	**9,834**
						Surplus/(Deficit)	**5,905**

Assumptions: Summit Water Treatment Plant is rated at 1/4 the annual production because it operates in summer months only.
Park City Import is contract water delivered by Jordanelle Special Service District under long-term contract.
Assumes wells at 1/2 installed capacity, springs at full capacity and surface water as shown in Table 2-1.
Most of the flows shown under springs for Park City are actually tunnels.

TABLE 2-4
2003 Annual Water Production Capacity Estimate Method Three (Using Peaking Factor Adjustment)

Water Supplier	Springs (Ac-Ft/Yr)	Wells (Ac-Ft/Yr)	Surface (Ac-Ft/Yr)	Import (Ac-Ft/Yr)	Total (Ac-Ft/Yr)	*Total In Basin* (Ac-Ft/Yr)	2001 Actual Usage (Ac-Ft/Yr)
Community Water Company		141	140		281	281	163
Gorgoza Mutual Water Co.	49	1,375			1,424	1,424	583
High Valley Water Co.		166			166	166	75
Mountain Regional SSD	88	2,379			2,467	2,467	1,697
Park City Municipal Corporation	3,612	2,104		1,000	6,716	5,716	4,728
Summit Water Distribution Co.	351	2,595	394		3,340	3,340	2,065
Summit Co. Service #3		203			203	203	80
Timberline Special Imp. Dist.		59			59	59	16
Others		371			371	371	427
Totals	**4,099**	**9,393**	**535**	**1,000**	**15,026**	**14,026**	**9,834**
						Surplus/(Deficit)	**4,192**

Assumptions: Use Installed or maximum flow rate shown in Table 2-1 and adjust for peak by dividing by the peaking factor of 2.3 (for springs and surface water (for wells, the maximum is doubled and then divided by 2.3).
Most of the flows shown under springs for Park City are actually tunnels.

2.4.2 Limiting Factors

The actual available water within the Snyderville Basin is somewhat lower than the Method 3 Estimate, due to several factors. The most significant limiting factor is the lack of long-term storage capacity available in the Basin. Typically, the storage is short-term in nature and designed to meet daily demands only. If large storage facilities were available, the surplus water currently available during the winter and spring months could be utilized to a greater extent than is currently possible.

Another limiting factor is that each system is operated independently from the others. When one system is experiencing its peak demand, it cannot be met using another system's resources. There are interconnections between some water systems to provide this capability, but they are not wide spread. The history of competition among water providers in the Snyderville Basin, limits the amount of cooperation achievable to meet each other's needs.

2.4.3 Water Rights and Groundwater Systems

A review of the water rights in the Snyderville Basin, indicates that there are significantly more paper water rights than physical water. The 2004 Water Use Plans submitted to the State Engineer by the various public water suppliers, indicate that they have asserted water rights in the Snyderville Basin totaling just over 28,000 acre-feet. However, during the recent series of dry years, these entities have only been able to withdraw approximately 10,000 acre-feet per year. In addition to the water rights held by the public water supply agencies, there are many private water rights for which water use plans are not submitted.

The U.S. Geological Survey (USGS) performed a surface and groundwater budget study of the Snyderville Basin in 1998, (USGS, Tech. Pub. No. 115) and concluded that surface and groundwater systems are closely connected. The USGS divided the Snyderville Basin into six sub-basins and estimated the movement of surface and groundwater between the subbasins. The USGS further concluded that, "The rapid increase in discharge to streams and springs that results from the recharge effects of snowmelt is indicative of a groundwater system with little storage." This leads to the conclusion that an increase in groundwater pumping will quickly reduce surface water discharge. Conversely, increased surface water usage will decrease groundwater infiltration in adjacent areas.

2.4.4 Surface Water Sources

There are currently three sources of surface water supplying public water systems within the Snyderville Basin. The first is Willow Creek. The Willow Creek supply is treated in one of the oldest treatment plants in the area. This plant is operated by Community Water Company and is located in Willow Draw just north of The Canyons Ski Resort. This plant was constructed in the early 1980's, and is a traditional filter plant that has a maximum capacity of 0.29 MGD (200 gpm) and is rated by the county at 0.26 MGD (180 gpm). This plant provides water to the Community Water Company and The Canyons Ski Resort.

The second water supply is diverted from East Canyon Creek, under water rights owned by SWDC. The diversion point is located just south of SWDC's treatment plant. However, SWDC has agreed to not divert to its treatment plant during periods when the stream flow is less than 3.5 cfs (2.3 MGD/1,570 gpm). To treat this water, SWDC constructed a water treatment plant along East Canyon Creek, just upstream from the Snyderville Basin Wastewater Reclamation Facility, in 2002. This plant is a pressure membrane plant that has an installed capacity of 5.5 MGD (3,820 gpm). Due to the limited water supply to the plant the County has rated the capacity of the plant at 1.6 MGD (1,120 gpm). It operates primarily in the spring and summer months when there is sufficient water flowing in East Canyon Creek.

Plans have been developed to further develop this water supply by construction of pump stations and a pipeline from East Canyon Reservoir to the treatment plant site. A portion of the pipeline has been installed in the Jeremy Ranch Development with the balance of the system awaiting development. With the construction of the pipeline and pump stations, it is anticipated that the full 5.5 MGD (3,820 gpm) existing capacity would be utilized. Space is provided in the treatment plant to increase the capacity of the plant to 22 MGD (15,500 gpm) by adding additional treatment equipment. Initial plans are to import up to 5,000 acre-feet of water from East Canyon Reservoir each year, with an ultimate capacity of up to 12,500 acre-feet per year. These plans are further discussed in Chapter 5 as a part of future development options.

The third surface water source is water imported from the Weber River through the new Lost Creek Canyon Pipeline to MRWSSD's new Signal Hill Water Treatment Plant, located in The Promontory Point Development, east of Highway U.S. Highway 40. The facilities to pump 1,600 acre-feet per year have been operational since October 2004. This plant is a pressure membrane plant with an initial capacity of 3.0 MGD (2,080 gpm). The source of the water supply is the Weber River above Rockport Reservoir. MRWSSD has constructed a series of infiltration wells near the banks of the river where water is pumped to a booster pump station then transmitted up the mountainside to Promontory Point Treatment Plant. The plant is expandable to 6.0 MGD (4,200 gpm) within the treatment building. Water is purchased from WBWCD to supply the system. WBWCD and MRWSSD have been investigating ways to increase the water supply to this system from either Rockport Reservoir or from the Weber River just upstream of the reservoir. A study was conducted by Reclamation to examine the possible diversion options. The preferred option from that study is incorporated into the list of potential options presented in Chapter 5 of this report.

2.4.5 State Engineer's Interim Groundwater Management Plan

To determine available in-Basin water supplies, the State Engineer used modeling software to extend the stream gauging data for East Canyon Creek and Silver Creek and develop 50 years of synthetic record. From this data, annual discharge from the Basin was determined for each creek. The State Engineer then selected the driest year at each gauge (the dry years were not the same for both gauges), summed the two total annual values, and came up with 23,700 acre-feet of total "dry year" or "safe" yield of the Basin. The State Engineer further determined that public water supply agencies should only depend on this 23,700 acre-feet of dry year supply. In the analysis, the State Engineer determined that this is the amount that can be depleted, not just diverted. However, if this amount were to be fully depleted, discharge from the Basin would be reduced to zero in the driest year.

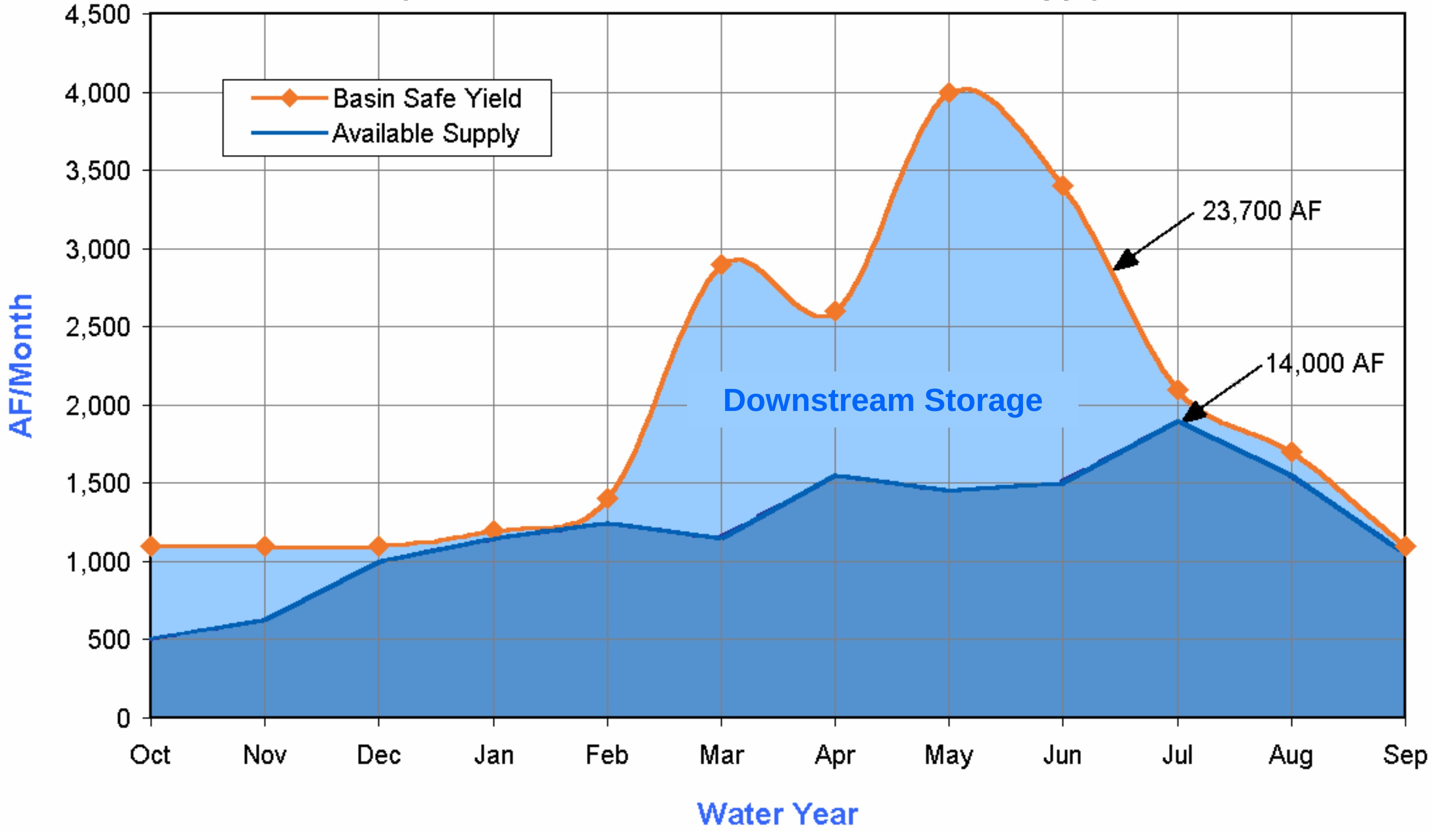
In order to determine the distribution of the 23,700 acre-feet per year, the State Engineer proportionately distributed this volume between the six subbasins found in the USGS study. The State Engineer then estimated using a standard methodology, the amount of current depletion in the Basin based on approved uses. That effort resulted in an estimate of between 11,000 and 12,000 acre-feet of existing approved annual depletion. The State Engineer then found that in two of the six subbasins, all of the allocated depletion has been committed under existing rights. In reviewing future change applications to move water rights, the State Engineer will use these totals to determine if additional water can be developed in each subbasin. Using the single driest year in each basin to calculate the safe yield is a very conservative method. In the absence of better data, this was considered a reasonable approach. However, the water needs to be physically available when needed in order to be a legitimate source.

The 23,700 acre-feet of safe or dry year yield from the Snyderville Basin is sufficient to supply the present and most future needs of the Basin residents if the supply matched the demand or if there was significant storage. However, the water that is available in the high runoff period as shown in Figure 2-2, does not correspond with the same time period as peak demands. Further, much of this high flow or runoff water discharges from the Basin and cannot be used because of downstream water rights that require the runoff water to be stored in East Canyon or Echo Reservoirs.

2.4.6 Comparison of Available Supplies with Basin Safe Yield

Figure 2-2 below depicts two hydrographs charted over the water year of October 1 to September 30. The area under the top hydrograph represents the 23,700 acre-feet of safe yield of the Basin, including the East Canyon Creek and Silver Creek drainages. The shape of this graph was patterned after the hydrograph of the data from the streamflow gage on East Canyon Creek for the years 1990-1995. Using this pattern, the graph was developed for the total volume of 23,700 acre-feet. The area under the lower hydrograph represents the 2003 Adjusted Peak Water Supply Production Capacity of the Basin water supply systems, which is estimated at approximately 14,000 acre-feet as shown in Table 2-4. This graph is represented on the figure as Available Supply.

FIGURE 2-2
Snyderville Basin Safe Yield vs. Available Supply



Chapter 3 – Current M&I Demands

3.1 Introduction

This chapter presents current M&I water use information for the study area (including water for parks, golf courses, etc.). Agricultural water use is discussed in Chapter 4 as a part of the section on Projected Future Supplies. The data collected for the most recent update of the M&I Water Supplies Study (M&I Study) for the Weber River Basin has been used as a basis for this report. Some of the information considered includes data from related investigations recently completed by UDWR and the Utah Division of Water Rights.

3.2 Data Collection and Methodology

Each year, UDWR targets particular hydrologic basins or study areas for M&I water supply and use analysis. The Division of Water Right's water use data form sent to UDWR by the community water systems of the state is the primary tool for these analyses.

UDWR contacts the manager and/or operator(s) of each public community water system (as defined by UDDW) to schedule a data analysis meeting. During such meetings, UDWR attempts to retrieve any missing data as well as obtain an overall feeling of the supplies and demands of the water system, in case estimates are necessary. All of the community water systems for the various basins studied have cooperated and provided the necessary M&I water supply and use data.

An important part of the data collection process is to determine the present water use for each community water system. Present water use, as defined herein, includes the developed water that is actually diverted into the distribution system from surface or subsurface sources.

The most recent M&I study for the Weber River Basin was started in May 2002 by UDWR. Data from the 2001 Municipal and Industrial Water Use Forms, distributed by the Division of Water Rights in cooperation with UDWR and UDDW, were used as a basis for the study. The data for the Snyderville Basin that is shown in this chapter was presented to local water providers in the fall of 2004 to identify significant discrepancies and ensure its accuracy.

3.3 M&I Water Use Classifications

M&I water use is divided into four categories: residential, commercial, institutional, and industrial. The residential category includes water used in residential homes for inside and outside uses. The commercial category includes water use for retail establishments and businesses. The institutional category includes water use for Government facilities, military facilities, schools, hospitals, churches, parks, cemeteries, golf courses, etc. The industrial category includes industrial and mining with a wide variety of water uses associated with businesses that produce a specific product.

3.3.1 Residential Use

This use is associated with residential cooking, drinking water, clothes washing, personal grooming and sanitation, irrigation of lawns, gardens and landscapes, and miscellaneous inside and outside cleaning. Single family homes, apartments, duplexes, and condominiums are some examples of buildings with residential water use.

UDWR collects data from the system operator about the number of residential connections and the amount of water used by those connections. Water use in this category is divided into three subcategories: culinary-outside, culinary-inside, and secondary-outside use. The first step in calculating the amount of water used in each of these subcategories is determining the amount of indoor water use. When individual water meter readings are available, indoor water use can be estimated by looking at several individual homes' winter meter readings, totaling the water use, and dividing it by the number of households and/or residents. If this method yields an unreasonable value, then UDWR will use information from their December 2000 report of Identifying Residential Water Use. The report contains a graph that indicates the relationship of persons per household and the appropriate indoor water use in gallons per capita per day (GPCD). The person per household data is obtained from the Utah State Governor's Office of Planning and Budget. This data is retrieved for each county and used with the above-mentioned graph to obtain a GPCD value. This value is then multiplied by the community water system's customer population to yield the water system's total indoor water use.

Once indoor water use has been determined for the year, it is then subtracted from the total year's residential water use given by the system's operator. The result represents the amount of water used during the summer months for outdoor applications. This amount is then checked with the value calculated by using the average lot size within the water system's service area, percentage that is irrigated, the irrigation efficiency, and the consumptive water use for the type of landscaping in the area.

3.3.2 Commercial Use

Commercial water uses are normally associated with small business operations that may include drinking water, food preparation, personal sanitation, facility cleaning and maintenance, and irrigation of facility landscapes. Retail businesses, restaurants, and hotels are some examples where commercial water use occurs.

For most systems, the system operator can separate metered commercial water use data from the total water use. In cases where this data is not available or is extremely difficult to obtain, UDWR attempts to estimate commercial water use by inventorying commercial businesses in the area and using published commercial water use estimates. These publications come from the UDDW and from reports published by the Utah State Water Laboratory. In some rural communities where there are a relatively small number of commercial connections, the businesses are individually visited by UDWR and asked about their water use.

3.3.3 Institutional Use

Institutional water uses are normally associated with the general operation of various public agencies and institutions. Examples include water used for city, county, state and Federal Government facilities, parks, golf courses, schools, hospitals, churches, military facilities, fire hydrant testing, and other municipal losses in the water system. Because this water use is rarely metered in total, the process to acquire this data is difficult. Again, the system operator is asked to provide information about city facilities such as number and size of parks, schools, churches, and golf courses. Water right duty rates for the area are used to calculate the amount of water these areas use. Also, the estimates made of leakage and testing of water system facilities is included in this category.

3.3.4 Industrial Use

Industrial water use is associated with the manufacturing or production of products. The volume of water used by industrial businesses can be considerably greater than water used by commercial businesses. Manufacturing plants, oil and gas producers, mining companies, and dairies are some examples where industrial water use occurs. Industrial water use within community water systems is acquired with the same process used to obtain commercial water use data discussed earlier.

3.3.5 Private-Domestic Use

Private domestic use includes water from private wells or springs for use in individual homes, usually in rural areas not accessible to public water supply systems. Due to the lack of records associated with this type of water use, quantities are usually estimated. Generally, a population assumed to be served by private wells is determined by taking the difference between the total population of a county or other jurisdiction and the number of people served by the public community water system(s) within the jurisdictional boundaries. Calculated gallons per capita water use rates for the area are then used to determine a total use for this category. A record of the number of active private well water rights is another method of determining private domestic water use. Each active water right is assumed to be a "typical" family, using approximately 1 acre-foot of water annually.

3.4 M&I Water Use Data

By definition, municipal and industrial (M&I) water use is a combination of all residential, commercial, institutional, and industrial uses. It includes the total water (potable and non potable) supplied by public water systems (community and non community), self-supplied industries, private domestic systems, and secondary irrigation companies.

Within the study area are the following public community water systems: Community Water System, Gorgoza Mutual Water Company, High Valley Water Company, Mountain Regional Special Service District, Park City Water, Summit County Service Area No. 3, Summit Water Distribution Company, and Timberline Special Improvement District. Also included in the study area are the self-supplied industries Duke Energy Field Services and United Park City Mines Company, along with the Summit County Public Works facility.

3.4.1 Current Use Estimates

Table 3-4 summarizes the 2001 total M&I water use for the study area which is further broken down by system and category of use in Tables 3-1 through 3-3 as explained below.

Table 3-1 shows a breakdown of the potable water use for each public community system for the base data year of 2001. This table shows that for the study area, the total current annual potable water use is 8,182 acre-feet. Given a service population of 23,065 people, the per capita daily potable water use of public community water systems in the study area is 317 gpcd.

Secondary water is another important aspect of total M&I water use. Table 3-2 shows the amount of secondary water use for public community systems. In the study area, secondary water is supplied for some residential uses, but mostly for commercial and institutional purposes, for a total use of 1,225 acre-feet.

Table 3-3 gives the estimated water use for public non-community systems and private domestic systems. Summit County Public Works is one of the three non-community systems within the study area. There are two self-supplied industries in the study area. Combined, these uses amount to 153 acre-feet of potable water and 274 acre-feet of non-potable water for the year 2001.

Total potable M&I water use in the study area for 2001 is 8,335 acre-feet, while non-potable water use is 1,499 acre-feet, giving a total M&I water use of 9,834 acre-feet.

TABLE 3-1
2001 Potable Water Use for Public Community Water Systems

Summit County Water Supplier	POTABLE USAGE (Acre-Feet/Year)						Service Population	Gallons Per Capita Per Day
	Residential Indoor	Residential Outdoor	Commercial Total	Institutional Total	Industrial Total	TOTAL M&I		
Community Water Co.	77	44	42	0	0	**163**	200	727
Gorgoza Mutual Water Co.	305	239	0	40	0	**583**	3,340	156
High Valley Water Co.	30	45	0	0	0	**75**	450	149
Mountain Regional SSD	576	1,021	60	15	5	**1,677**	5,760	260
Park City Culinary Water	630	1,822	1,146	150	0	**3,748**	8,050	416
Summit Co Service #3	34	46	0	0	0	**80**	420	170
Summit Water Distribution	437	1,253	135	15	0	**1,840**	4,660	352
Timberline Special Imp. Dist.	13	3	0	0	0	**16**	185	78
STUDY AREA TOTALS	**2,102**	**4,472**	**1,384**	**220**	**5**	**8,182**	**23,065**	**317**

TABLE 3-2
2001 Secondary Water Use in Public Community Systems

Summit County Water Supplier	Residential Use (Ac-Ft/Yr)	Commercial Use (Ac-Ft/Yr)	Institutional Use (Ac-Ft/Yr)	Industrial/ Stockwater Use (Ac-Ft/Yr)	Total Secondary Use (Ac-Ft/Yr)
Community Water Company	0	0	0	0	**0**
Gorgoza Mutual Water Co.	0	0	0	0	**0**
High Valley Water Company	0	0	0	0	**0**
Mountain Regional SSD	20	0	0	0	**20**
Park City Culinary Water	100	650	230	0	**980**
Summit Co Service No.3	0	0	0	0	**0**
Summit Water Distribution	0	225	0	0	**225**
Timberline Special Service Dist.	0	0	0	0	**0**
STUDY AREA TOTALS	**120**	**875**	**230**	**0**	**1,225**

TABLE 3-3
2001 Water Use for Public Non-Community Water Systems,
Self-Supplied Industries and Private Domestic Systems

	POTABLE USAGE					
	Residential Use (Ac-Ft/Yr)	Commercial Use (Ac-Ft/Yr)	Institutional Use (Ac-Ft/Yr)	Industrial/ Stockwater Use (Ac-Ft/Yr)	Total Potable Use (Ac-Ft/Yr)	Total Secondary Water Use (Ac-Ft/Yr)
County Facilities:						
Summit County Public Works	0	0	2	0	2	0
Subtotals	**0**	**0**	**2**	**0**	**2**	**0**
Self-Supplied Industries[1]	0	0	0	1	1	274
Private Domestic Systems	150	0	0	0	150	0
STUDY AREA TOTALS	**150**	**0**	**2**	**1**	**153**	**274**

[1]Duke Energy Field Services, United Park City Mines Co.
Note: The estimated population served by private domestic systems is 500 persons.

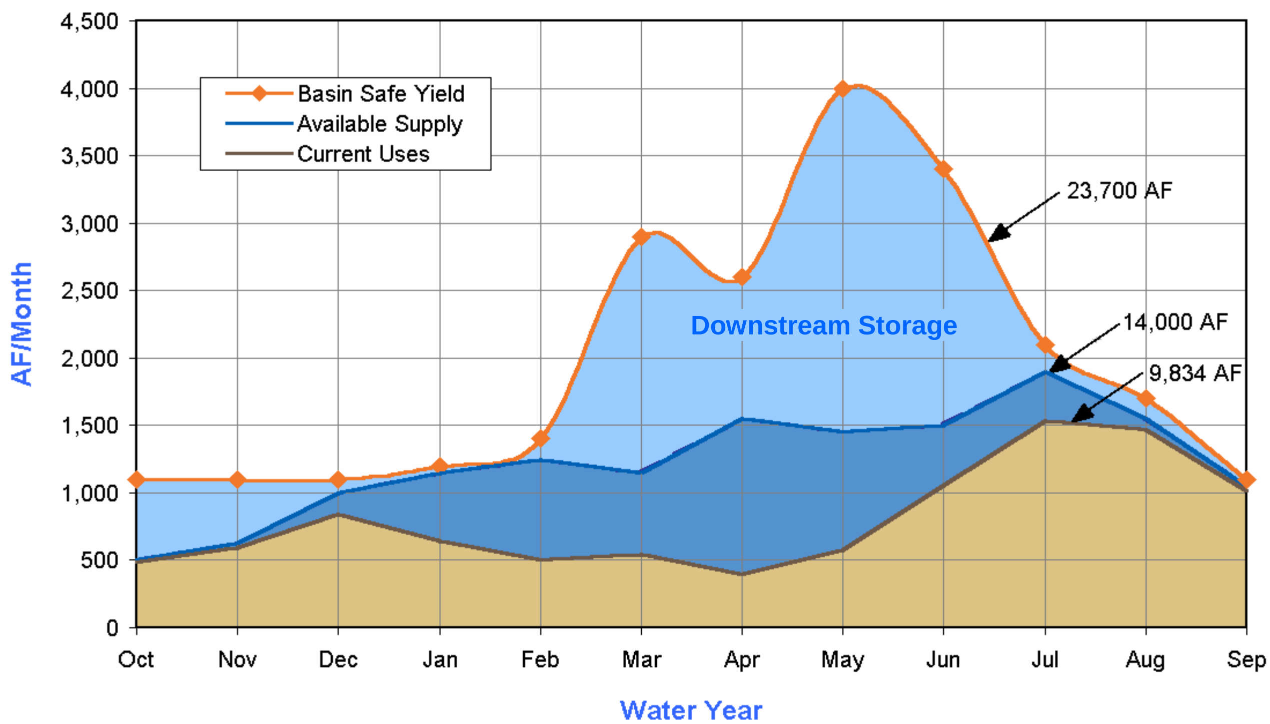
TABLE 3-4
2001 M&I Water Use Summary

Uses	Potable (Acre-Ft/Yr)	Secondary (Acre-Ft/Yr)	Total Use (Acre-Ft/Yr)
Water Use for Public Community Water Systems	8,182	1,225	9,407
Water Use for Non-Community, Self-Supplied Industries and Private Domestic Systems	153	274	427
Total Water Use	**8,335**	**1,499**	**9,834**

3.4.2 Comparison of Current Use with Available Water Supply

Figure 3-1 compares the current M&I water use in the study area with the basin safe yield and available water supply identified in Chapter 2. The area under the lower hydrograph is labeled as Current Uses and depicts the demand pattern of Park City (MWH, May 2002) multiplied by 2.3 to adjust it to the total water supply volume of 9,834 acre-feet (UDWR) delivered by all entities in the Basin during 2001. From this figure, it can be seen that the Available Supply exceeds the Current Uses during much of the year. However without significant storage, this excess supply cannot be used to meet the peak period requirements. The supply is limited by the connections it can serve during peak demand periods. The figure shows that the current uses nearly match the presently available supply from August through November.

FIGURE 3-1
Snyderville Basin Current M&I Use vs. Available Supply and Basin Safe



Chapter 4 – Future Supply & Demand and Projected Needs

4.1 Introduction

This chapter presents the process used to determine future water demands and projected needs within the study area. It includes a discussion of population projections, determination of future demands, and calculation of future supplies which are assumed to be available without implementing any of the supply components described in Chapter 5. From this data, conclusions were drawn about projected water needs for 2030 and 2050.

4.2 Population Projections

Two different methodologies for projecting future population were considered: The Governor's Office of Planning and Budget (GOPB), in conjunction with local Area of Governments (AOG), is the agency responsible for preparing population and other demographic projections for the State of Utah. In May 2005, the Mountainland AOG broke down the latest Governor's Office of Planning and Budget population projections for Summit County by incorporated cities and towns with the remainder as the balance of county. The city projections include Park City's estimated population for each decade from 2010 through 2050. Using this data and the 2000 Census tract data as a guide to future population distribution, the population of the study area in 2030 was estimated to be 64,300. For 2050, the projected population was estimated to be 86,300. Table 4-1 contains the GOPB population estimates for the study area.

The other approach taken to forecast population for the study area was to consider the maximum potential development within the Basin. Summit County has adopted a land use plan (Snyderville Basin General Plan) that identifies where development will be permitted and how densely it will be allowed to develop. Park City also has a similar land use plan that establishes the projected densities within the city limits. Using the densities associated with each land use, populations at build out were estimated for the various land use categories.

Comparatively, the two methods produced somewhat different results. While the GOPB projections estimate a study area population of approximately 86,300 by 2050, the build out method estimated the ultimate population within the study area to be only 75,600. Although the build-out method is often useful for planning purposes, this method assumes that current zoning laws and associated population densities will remain unchanged for the next 45 years. As experience in other communities demonstrates, zoning laws can and do change when property values increase and pressures mount to accommodate growth. Therefore, the higher GOPB population estimates were not considered unreasonable and are used for the purposes of this study.

TABLE 4-1
Snyderville Basin Population Projections

City/Area	Population					
	2001	2010	2020	2030	2040*	2050*
Park City	7,647	10,987	15,339	19,776	19,325	20,904
Balance of Snyderville Basin**	16,212	23,002	34,320	44,541	55,303	65,423
TOTAL	**23,859**	**33,989**	**49,659**	**64,317**	**75,603**	**86,327**

Source: Governor's Office of Planning and Budget, "2005 Baseline City Projections," June 2005.
* The Governor's Office of Planning and Budget (GOPB) models projections to 2030, all projections beyond this date are estimated using other methods and are provided by GOPB for scenario analysis.
** Estimated based on 2000 Census population distribution.

4.3 Projected Future Demands

4.3.1 Demand Modeling

UDWR has developed the Utah Water Demand/Supply model to project the future water demands. UDWR's base water use data for the year 2001 and the GOPB population projections were used to estimate water demands within the study area for each 10-year period from 2010 to 2050. These demands were projected both with and without water conservation. Figure 4-1 shows the projected demands with and without conservation.

FIGURE 4-1
Projected Future Water Demands

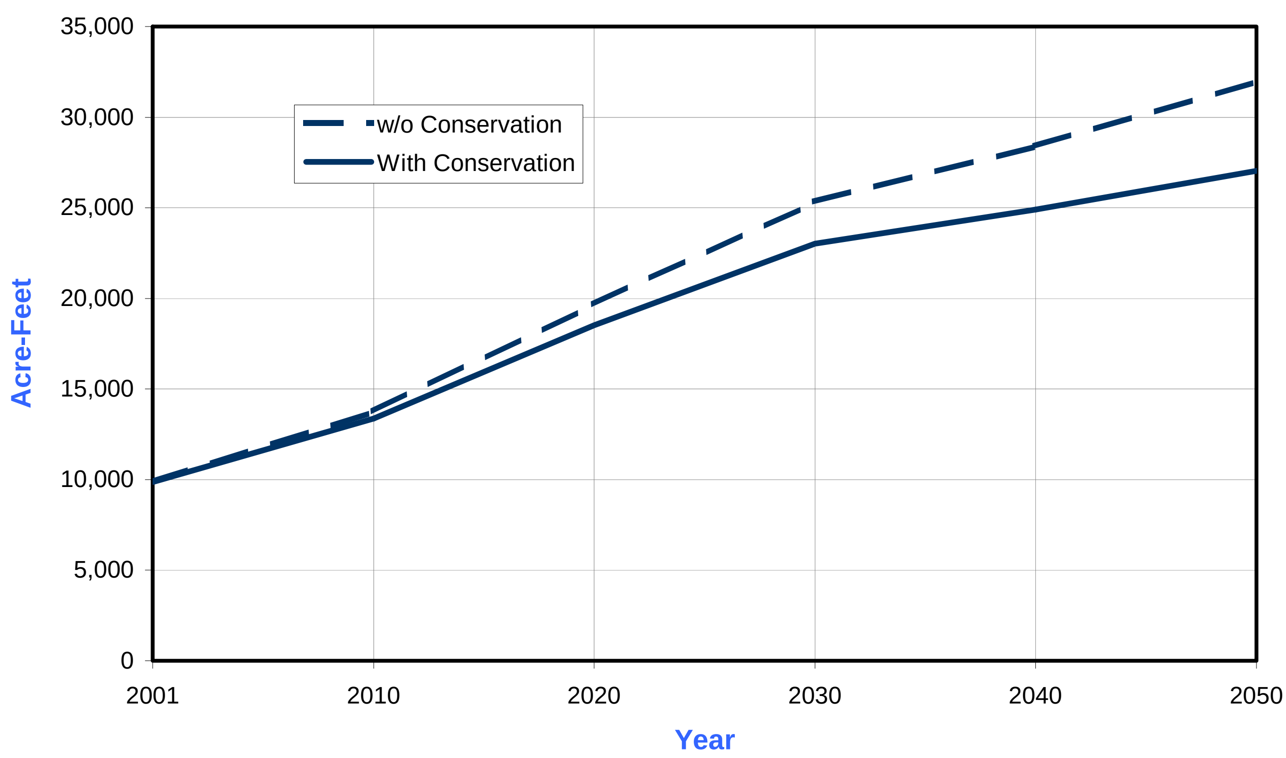


Table 4-2 shows the projected demands for Park City and the rest of the Snyderville Basin for each 10-year increment without water conservation. Table 4-3 shows the projected demands for Park City and the rest of the Snyderville Basin for each 10-year increment with water conservation. The total water demand in 2030 without conservation is projected to be 25,300 acre-feet. With conservation, the 2030 demand decreases by about 2,300 acre-feet to 23,000 acre-feet per year. Projections for the year 2050 are similarly calculated. The total water demand in 2050 without conservation is projected to be 32,000 acre-feet. With conservation, the 2050 demand is projected to decrease by about 5,000 acre-feet to 27,000 acre-feet per year. Figure 4-2 compares the 2030 and 2050 demands (with conservation) to the current demand, basin safe yield, and available supply as estimated in Chapters 2 and 3.

TABLE 4-2
Projected Future M&I Demands (Without Conservation)

City/Area	M&I Water Demand* (acre-feet)				
	2010	2020	2030	2040	2050
Park City	6,794	9,485	12,228	11,949	12,926
Balance of Snyderville Basin	6,975	10,198	13,108	16,449	19,052
TOTAL	**13,769**	**19,683**	**25,336**	**28,398**	**31,978**

* Includes 427 acre-feet of public non-community system use. See Table 3-3.

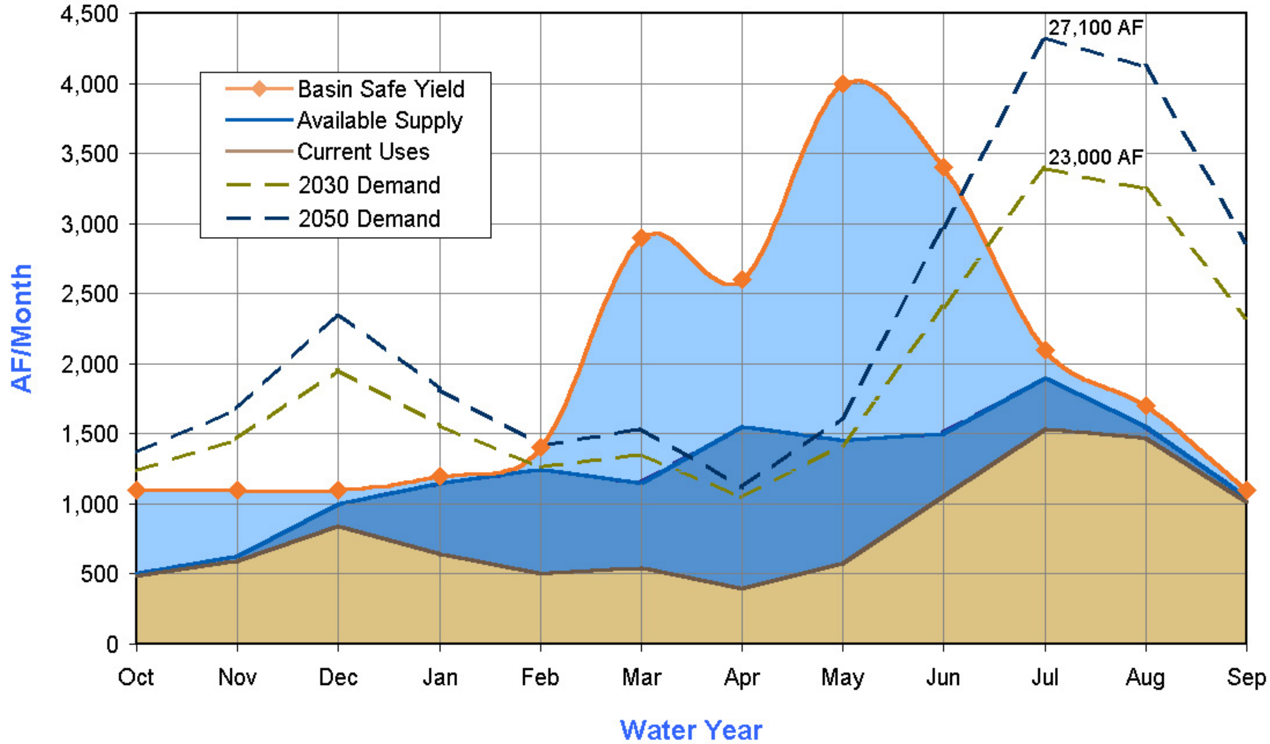
Several water suppliers within the study area have indicated that using population-based demand projections to project future demands is problematic. Many have suggested that an equivalent residential connection method would be more appropriate. One reason for these concerns is the fact that a large segment of the water use in the area comes from a non-permanent or transient population (tourists, second homeowners, etc.). Another concern is that large landscape water use such as golf courses cannot be properly reflected in population-based units (such as gallons per capita per day). After carefully considering each of these concerns, UDWR determined that the methodology employed by the Utah Water Demand/Supply model adequately addresses these issues and there is little risk that the resulting water use projections underestimate actual future demands.

TABLE 4-3
Projected Future M&I Demands (With Conservation)

City/Area	M&I Water Demand* (acre-feet)				
	2010	2020	2030	2040	2050
Park City	6,598	8,908	11,094	10,458	10,899
Balance of Snyderville Basin	6,787	9,603	11,930	14,450	16,132
TOTAL	**13,385**	**18,511**	**23,024**	**24,908**	**27,031**

* Includes 427 acre-feet of public non-community system use. See Table 3-3.

FIGURE 4-2
Comparison of 2030 and 2050 Demands (with Conservation) to Current Demand and Available Supply



4.3.2 Water Conservation

As demonstrated above, water conservation will play a significant role in helping water suppliers in the area to meet future needs. In addition to this important benefit, water conservation may also:

- Conserve energy as less water needs to be treated, pumped and distributed.
- Lessen the leaching of chemicals and other pollutants into streams and aquifers as water is applied more efficiently to urban landscapes and agricultural crops.
- Reduce future stream diversions and groundwater withdrawals that would otherwise occur, thereby enhancing water quality, environmental and recreational functions of natural waterways (UDWR, 2003b).

The State of Utah has developed a specific goal to conserve water use directly linked to M&I needs. This goal is to reduce per capita water demand from public community systems by at least 25 percent from 1995 to 2050. In the Snyderville Basin and Park City area, the accomplishment of this goal is estimated to be equivalent to a total decrease in demand of approximately 5,000 acre-feet per year by 2050. This reduction would account for a significant portion of the area's anticipated future water needs. This goal is based on modeling and research that indicates indoor and outdoor water use can be reduced by 25 percent or more with little change in lifestyle. (UDWR, 2003b).

Recognizing the importance of water conservation to Utah's future, the Utah Legislature passed the Water Conservation Plan Act in 1999. This act requires each water retailer with more than 500 connections, and all water conservancy districts, to prepare water conservation plans and submit them to UDWR. Water conservation plans are to be updated and resubmitted every 5 years from the original submittal date. In addition to this legislative requirement, the state's water funding boards require any entity requesting funds for water projects to have a water conservation plan in place, regardless of its size. Only five of the eight systems in the study area are required by law to prepare a water conservation plan. Of the three that are not required to do so, only High Valley Water has submitted a plan.

Although the Water Conservation Plan Act has helped elevate the importance of water conservation planning in the Snyderville Basin area, water providers in the area must set strong water conservation goals and ensure they are met by implementing appropriate measures. If a significant effort to achieve water conservation goals is not made, it may be difficult to justify large investments in new water development projects by state and Federal Governments.

Many western mountain resort communities have implemented stricter watering ordinances, such as no outside watering or using only native plants requiring no additional water on all new construction. If Government entities in the study area were to implement similar ordinances for all new construction, the conservation goals discussed above could be more easily met. The current per capita use for indoor residential, commercial, and institutional categories amounts to about 150 gpcd. With a current total water use of 317 gpcd, there is a significant potential for reduction of outdoor water use in the study area.

Water conservation efforts within the Snyderville Basin have yielded significant results in recent years. All three of the major water suppliers within the Study area (Park City, Mountain Regional Water Special Service District, and Summit Water Distribution Company) have realized declines in total demand in the neighborhood of 25 percent in just a few years. While drought-related responses certainly played a significant role in these reductions, it is likely that residents within the Basin will maintain at least a portion of these gains into the future. In order to help this to happen, the conservation message will need to continue to be emphasized during years of normal and above normal precipitation.

4.3.3 Wastewater Dilution Requirements

For the Snyderville Basin Water Reclamation District (SBWRD) to meet its State Discharge Permit requirements for discharging its treated M&I wastewater to East Canyon Creek, it has to rely on a minimum stream flow for dilution of the effluent to meet the designated beneficial uses for East Canyon Creek. The SBWRD is considering an upgrade to its treatment facility from the existing "Type 1" effluent treatment to reverse osmosis in order to comply with phosphorus limits. The current limit for phosphorus is 100 ppb, but the state is looking at reducing the limit to 50 ppb. SBWRD recently completed a very costly upgrade of its treatment system to meet the 100 ppb limit, and if this additional upgrade is necessary, it may be cheaper to purchase water for instream dilution flows, or to reduce its discharge volume by reuse.

Under a contract with SBWRD, Kleinfelder, Inc., recently completed a flow augmentation study on East Canyon Creek to determine the quantity of water that would be required to maintain minimum instream flows to allow achievement of beneficial uses designated for East Canyon Creek ("East Canyon Creek Flow Augmentation Feasibility Study: Summit and Morgan Counties, Utah, February 2005"). That study concluded that the maximum amount of augmentation to meet the instream flow goals is calculated to be approximately 1,095 acre-feet, which would provide a minimum 6 cfs for instream flow from July through September. This requirement is shown in the study for the year 2030, since 2030 is the planning time frame of the SBWRD. As the population increases, however, an additional 500 acre-feet would be needed by the year 2050 for a total need of about 1,600 acre-feet in 2050. SBWRD is interested in planning this future demand as part of the overall long-term demand addressed by this current study. Including this industrial water requirement of 1,100 acre-feet for 2030 and 1,600 acre-feet for 2050 as a part of the projected demand leaves water reuse as a potential development option that may be used to meet future needs.

4.3.4 Susceptible Mine Tunnel Flows

A large portion (approximately 50 percent) of the water used by Park City comes from old mine tunnels. The mining operations have ceased and the tunnels used for water supply are being maintained by Park City for water supply purposes. Because the tunnels are old and the maintenance being performed is only sufficient to keep the water flowing, if a tunnel collapse were to occur, the city's ability to meet peak demands would be at least temporarily reduced until repairs could be made or replacement sources developed. The city is also concerned that maintenance of the tunnels will become increasingly more difficult and expensive as the tunnels age and as the availability of qualified miners continues to decline.

The tunnels also have unique water quality issues associated with their use for drinking water purposes. The mines are former lead and silver mines and they contain heavy metals, arsenic, antimony, and other potential contaminants. The city has to carefully operate the tunnel systems so as to limit the amount of contaminants in the water supply. It also has to treat some of the water from the tunnels to remove contaminants. Concern over the long-term effects of potential contaminants on the water supply raises issues with the reliability of these sources. For these reasons, the city is interested in developing 2,000 acre-feet of additional supply to provide backup in case of emergencies even though they are expected to continue using the mine tunnel water as long as it is available and of acceptable quality.

4.3.5 Adjusted M&I Demand

Adding the effluent dilution requirement (1,100 to 1,600 acre-feet per year) and susceptible mine tunnel volume (2,000 acre-feet per year) to the total demand projected with conservation as shown previously in Table 4-3 yields an adjusted total M&I demand for the study area as shown in Table 4-4. For purposes of this study, the 2030 demand of 23,000 acre-feet per year (with conservation) and 2050 demand of 27,000 acre-feet per year (with conservation) are the demands that will need to be met by a combination of the projected reliable supplies discussed below and the water supply development options presented in Chapter 5.

TABLE 4-4
Adjusted M&I Demands

	Population or Volume (acre-feet)	
	2030*	**2050***
Population	64,300	86,300
Calculated M&I Demand	**25,300**	**32,000**
Water Conservation	(2,300)	(5,000)
Net M&I Demand	**23,000**	**27,000**
Minimum Instream Flow / Effluent Dilution Requirement	1,100	1,600
Susceptible Mine Tunnel Flows	2,000	2,000
Adjusted M&I Demand	**26,100**	**30,600**

* Rounded to nearest 100 acre-feet.

4.4 Projected Reliable Supplies

There are a number of water supply resources in the study area which were not included in the existing supplies discussed in Chapter 2 but which, for purposes of this report, are assumed to be available supplies for 2030 and 2050. These include the Lost Creek Canyon Pipeline Project, the Jordanelle Special Service District import, additional groundwater supplies, and agricultural water conversions. Also, the need for continued system surplus/reserve will continue into the future. Following is a discussion of each, including the amount by which they are expected to affect future available supplies. It is important to note that this study assumes that these water supply resources are developed concurrently with the growing population and are utilized to become part of the projected reliable supplies.

4.4.1 Lost Creek Canyon Pipeline

The Lost Creek Canyon Pipeline Project was completed and dedicated in October 2004. The current capacity of this project is 1,600 acre-feet per year. The source water comes from shallow wells near the Weber River above Rockport Reservoir. The existing infrastructure included in this importation project consists of the following: a shallow groundwater well system on the Weber River; a booster pump station; approximately 27,000 linear feet of 24-inch water transmission line to convey water from the well system to the Signal Hill Water Treatment Plant; a 3 MGD (2,080 gpm), expandable to 6 MGD (4,200 gpm), membrane water treatment plant located on the ridgeline above Three Mile Canyon; and two open reservoirs totaling approximately 15 acre-feet of raw water storage (Aqua Engineering, 2003). Current agreements contemplate that the pipeline may potentially convey up to 6,600 acre-feet per year to the Snyderville Basin. Although an expansion of the water importation capability of this system is presented as a potential water supply system component in Chapter 5, for purposes of determining projected future needs, this infrastructure is assumed to contribute 1,600 acre-feet per year to the reliable supplies for 2030 and 2050.

4.4.2 Jordanelle Special Service District Import

Park City currently receives water from Jordanelle Special Service District (JSSD) under a 20-year lease. This water comes from the Ontario Drain Tunnel. The current delivered flow capacity is approximately 1.4 MGD (1,000 gpm) and up to 1,000 acre-feet per year. The facilities for this delivery have already been constructed and are in operation. They consist of a filtration water treatment plant located at the mouth of the Ontario Drain Tunnel on the northwest side of Jordanelle Reservoir and approximately 15,400 linear feet of 12-inch treated water transmission pipeline. Even though the 1,000 acre-feet per year delivery contract expires in 2022, both Park City and JSSD expect deliveries will continue in perpetuity.

4.4.3 Additional Groundwater Development

In its study of the Basin, the Utah Geological Survey (UGS) found the groundwater system in the Snyderville Basin to be highly compartmentalized. Pumping of groundwater in one compartment does not appear to directly affect groundwater levels in other compartments. While it is possible that the majority of the best groundwater sources have already been developed by the existing water suppliers in the Basin, it is still very likely that additional groundwater development will occur. While the three largest water suppliers in the area (Park City, Mountain Regional Special Service District, and Summit Water Distribution Company), do not intend to develop any substantial amount of additional groundwater, other smaller entities and individuals with approved groundwater rights will likely continue to develop small quantities of groundwater. For purposes of the projected needs calculations in this chapter, it is assumed that these groundwater developments will add 200 acre-feet per year to the 2030 reliable supplies and 300 acre-feet per year to the 2050 reliable supplies.

4.4.4 Agricultural Water Conversions

As with other urbanizing areas of the state, lands historically used for agriculture in the Snyderville Basin are being developed into homes and businesses. Based on the State Engineer's calculations of depletion, a portion of the water once used on irrigated lands becomes available to meet the needs of the new M&I uses. The depletion allowed for the new use can be no greater than the depletion allowed for the agricultural use, and there may be limitations on the new use if there would be adverse effects to other water right holders in the area.

UDWR inventories water related land use for the entire state on a rotating basis. In 2003, surface irrigated acreage within the study area was estimated to be 1,100 acres. At the current development rate, and realizing that some of the lands are currently protected under conservation easements as open space and others will likely be protected, it is estimated that in 2050 the irrigated acreage will decline to less than a few hundred acres.

By 2050, UDWR estimates that 300 acres of irrigated lands have associated water rights that could be converted. The water associated with these lands that should become available for M&I uses would be between 400 and 500 acre-feet per year. For purposes of the projected needs calculations in this chapter, it is assumed that these conversions will add 400 acre-feet per year to the 2030 reliable supplies and 500 acre-feet to the 2050 reliable supplies.

4.4.5 System Surplus/Reserve Capacity Needs

As discussed in Chapter 2, the actual reliable water supply within the Snyderville Basin may be somewhat lower than the estimate of 14,000 acre-feet per year of available supply (see Table 2-4 and Section 2.4.2). Subtracting the actual 2001 use of 9,800 (rounded) acre-feet from 14,000 acre-feet leaves a difference of 4,200 acre-feet per year. There are a number of factors which currently prevent the use of much of this surplus supply. One of the major limiting factors is that each system is operated independently from the others. When one system is experiencing its peak demand, it cannot be met using another system's resources. There are some interconnections between water systems to provide this capability, but they are not widespread. The history of competition among water providers in the Snyderville Basin has also limited the amount of cooperation achievable to meet each other's needs. In addition to these concerns, much of this surplus or reserve capacity, does not correspond to peak demand times, and without additional surface storage in the Basin, is not available when needed.

Furthermore, local water suppliers and prudent water planning standards stress the importance of providing a sufficient amount of reserve capacity to prevent shortages during emergencies, when some water sources may not be available. As a result, for purposes of this study, this surplus or reserve capacity of 4,200 acre-feet per year has been subtracted from projected reliable supplies.

This volume of water needed for reserve capacity is expected to increase in the future as the M&I demand grows and greater stress is placed on existing water systems. The ability to share water supplies among water providers is also expected to improve, as more interconnects are constructed and the area becomes more densely populated bringing systems closer together. For purposes of this study, the projected percentages of total available supplies needed for reserve capacity will reduce from the current 30 percent to 20 percent for years 2030 and 2050. This reserve capacity is therefore computed to be 6,500 acre-feet in the year 2030 and 7,500 acre-feet in 2050. Table 4-5 summarizes the projected reliable supplies as discussed in this section and as used for the calculation of projected needs.

4.5 Projected Future Needs

In order to calculate the projected future additional M&I water needs within the Snyderville Basin, the projected reliable supplies are subtracted from the adjusted M&I demands as shown in Table 4-5. As shown from this calculation, an additional water supply of approximately 15,400 acre-feet will be needed in 2030 and 20,700 acre-feet will be needed in 2050. These numbers represent the future supply deficits that need to be satisfied by the various water supply options presented in Chapter 5.

TABLE 4-5
Projected M&I Needs

	Volume (acre-feet)		
	2001	2030	2050
Adjusted M&I Demand	**9,800**	**23,000**	**27,000**
In-stream Flow & Dilution Req.	**0**	**1,100**	**1,600**
Mine tunnel replacement water	**0**	**2,000**	**2,000**
Projected M&I Demand	**9,800**	**26,100**	**30,600**
Existing Supplies*	**14,000**	**14,000**	**14,000**
Lost Creek Canyon Pipeline Project	0	1,600	1,600
Jordanelle Special Service District Import	0	1,000	1,000
Additional Groundwater	0	200	300
Agricultural Conversions	0	400	500
Reserve Capacity	(4,200)	(6,500)	(7,500)
Projected Reliable Supply	**9,800**	**10,700**	**9,900**
Projected Additional M&I Needs**	**0**	**15,400**	**20,700**

*   Available supply from Chapter 2 (rounded to nearest 100 acre-feet).
** Projected M&I Demand minus Projected Reliable Supply.

Chapter 5 – Future Development

5.1 Introduction

This chapter presents the potential development options which have been identified to meet projected future water needs of Park City and the remainder of the Snyderville Basin. These projected needs for 2030 and 2050, as described in Chapter 4, are 15,400 acre-feet per year and 20,700 acre-feet per year, respectively. A combination of the options discussed below will be needed to meet these future demands.

5.2 Potential Future Development Options

Nine options have been identified for developing water to meet future needs. The first three, listed below, are in-Basin development options, while the remaining six are importation options that bring water from outside the Snyderville Basin Study Area. Importation options consider opportunities from each of the three adjacent drainage basins; Provo River (Option 4), East Canyon Creek (Option 5), and the Weber River (Options 6, 7, 8 and 9). Each of the Weber River Options (6, 7, 8 and 9) are separate methods/alignments for delivering the same 5,000 acre-feet of Weber Basin water to the Snyderville Basin, and are therefore not additive. Only one of the four can be recommended for development. These nine options, as shown on the map in Figure 5-1, are as follows:

In-Basin Development

1. Additional In-Basin Surface Water Storage
2. Conjunctive Management of Surface and Groundwater
3. Water Reuse

Provo River Importation

4. Provo River - JSSD

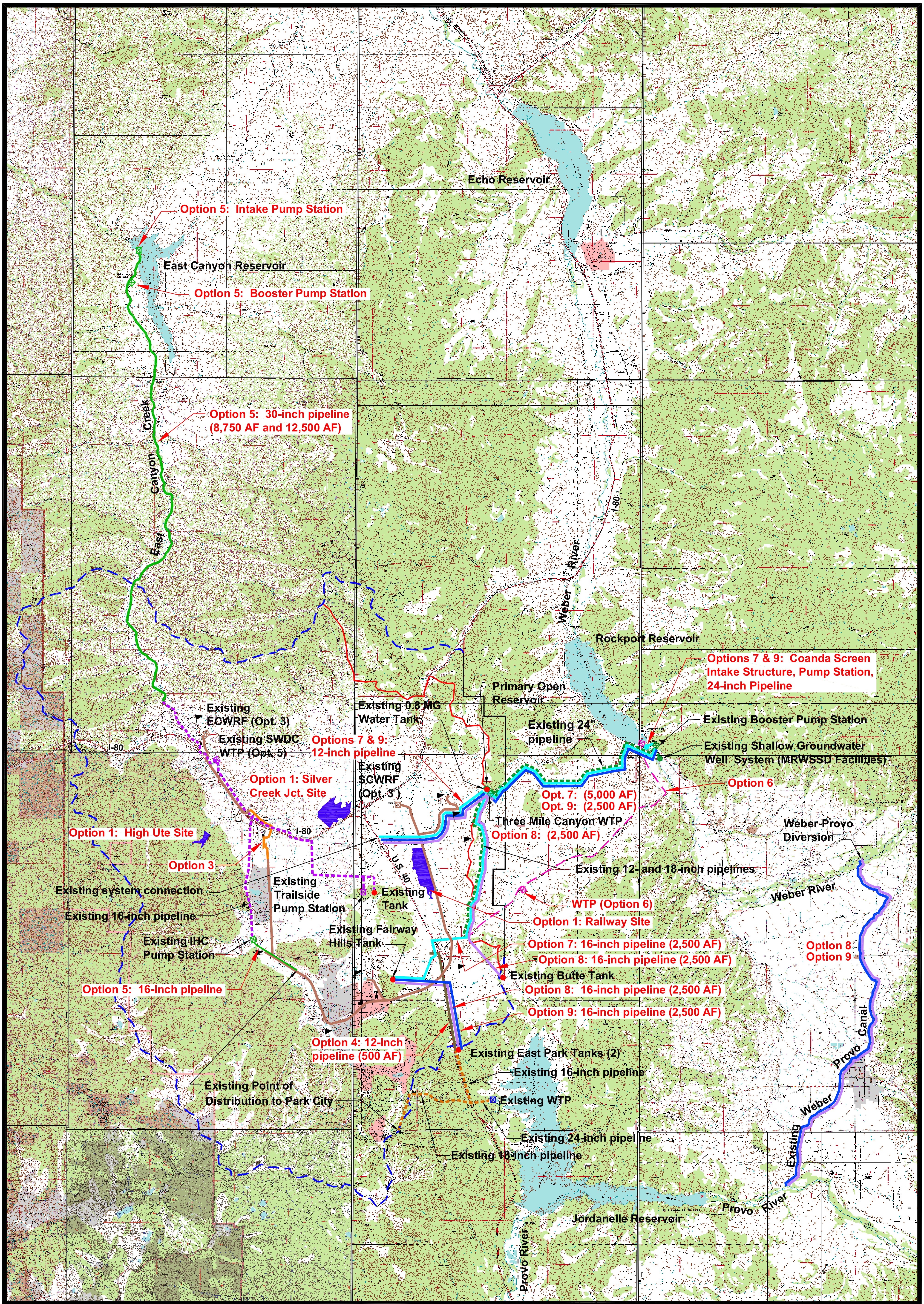
East Canyon Creek Importation

5. East Canyon Pipeline

Weber River Importation

6. Brown’s Canyon Pipeline
7. Lost Creek Canyon Pipeline
8. Weber River via Weber-Provo Canal
9. Lost Creek Canyon Pipeline and Weber-Provo Canal

This section describes each of the options, and presents the background and data used by the study team in reaching the study recommendations.



Legend

- Snyderville Basin Hydrologic Boundary
- Moratorium Area Boundary for the Snyderville Basin
- Mountain Region WSSD District Boundary
- Golf Course
- Existing Water Tank

Existing Facilities

- MRWSSD Existing Facilities
- JSSD Existing Facilities
- SWDC Existing Facilities
- ECWRF Facilities Under Construction

Options

- Option 1: Additional In-Basin Surface Water Storage
- Option 3: Water Reuse
- Option 4: Provo River - JSSD
- Option 5: East Canyon Reservoir Pipeline
- Option 6: Rockport Browns Canyon Pipeline (No further action)
- Option 7: Lost Creek Canyon Pipeline
- Option 8: Weber River via Weber-Provo Canal
- Option 9: Lost Creek Canyon and Weber-Provo Canal

N

2750 0 5500 11000

SCALE IN FEET

Figure 5-1
Options Map
Park City and Snyderville
Basin Water Supply
Study Special Report

5.3 Additional In-Basin Surface Water Storage (Option 1)

The availability of in-Basin surface water is greatest in the high runoff period and would require the development of surface water storage facilities to capture and hold the water for release later in the year when demand for the water is greatest. As noted in Chapter 3, the State Engineer estimates the "safe yield" of the Basin to be approximately 23,700 acre-feet annually, and the currently-developed available supply is about 14,000 acre-feet, leaving a potential storable supply of 9,700 acre-feet per year.

However, most, if not all, of the 9,700 acre-feet per year of potentially storable water in the Basin is currently owned and used by downstream water users. Therefore, exchanges or purchase of downstream rights would need to occur in order to store this water in the Basin. The advantage of capturing the high stream flows from East Canyon Creek or Silver Creek prior to leaving the Basin, is that pumping water from within the Basin would be less costly than pumping a like amount of water from outside the Basin.

5.3.1 Summary of Investigation

An appraisal level survey of potential dam sites was conducted. Several potential sites were located as shown on Figure 5-2. None of the sites identified, however, would accommodate a dam and reservoir large enough to meet any significant portion of the future needs of the area. The investigation was therefore focused on meeting a projected in-stream flow dilution requirement in a range of 1,100 to 1,600 acre-feet per year needed to enable the Snyderville Basin Water Reclamation District to meet their wastewater discharge requirements to East Canyon Creek (See Section 5.5).

To allow other water development options to occur, a minimum of 1,100 acre-feet of reservoir yield would be required to maintain in-stream flows. Based on historic data of stream flows, the in-stream flow requirement would not be required each year. The majority of the reservoir yield would be needed to meet these in-stream flows during the later summer months of moderate to dry years. The following sections describe the sites that were investigated.

5.3.1.1 Hi-Ute Site

The Hi-Ute site is situated in Threemile Canyon, about one mile above the Hi-Ute ranch house, also described as the NW quarter of Section 24, T 1 S, R 3 E, SLBM. The proposed dam would be approximately 80 feet high, and impound a lake of approximately 30 surface acres and 1,200 acre-feet volume. It would have a relatively high cost per acre-foot of storage, and the small drainage basin and low stream inflow would make the available water volume questionable.

A dam at this site would be classified as high hazard due to the ranch and associated structures, roads, utilities, and interstate highway located downstream. A number of local businesses are located within the probable dam break inundation area.

The site is used by the local population as a wildlife "viewing" area, and is situated adjacent to the 2002 Winter Olympics Sports Park. Impounded water would inundate the only road up Threemile Canyon.

Additionally, in the summer of 2004, Utah Open Lands, a land trust advocate, obtained a 200 acre conservation easement on the Hi-Ute ranch. The easement contains jurisdictional wetlands and historic structures. Furthermore, the reservoir site contains densely forested alpine slopes.

Provided the above-mentioned issues could be overcome, in order to consider a reservoir at this location, geotechnical testing of the site would be required to determine the feasibility of the dam.

5.3.1.2 Silver Creek Junction Site

The Silver Creek Junction site is situated on the north (east) fork of Kimball Creek (also called, Silver Creek) about 1,000 feet upstream of the confluence, just north of the Interstate 80 Silver Creek Junction rest area, also described as the SE quarter of Section 17, T 1 S, R 4 E, SLBM. The proposed dam would be approximately 18 feet high and impound a reservoir of approximately 90 surface acres and 1,100 acre-feet volume. It would have a reasonable cost per acre-foot of storage, but would have a low stream inflow, and has a moderately large but highly developed drainage basin down stream. The large surface area and shallow depth would make this lake susceptible to high evaporation losses.

The dam would be classified as high hazard, due to structures, roads, utilities, and an interstate highway located downstream. A number of local businesses, a fire station, a highway rest area, and residences are located within the probable dam break inundation area.

The site is situated adjacent to a number of residential developments and a golf course. The impounded water would inundate a number of existing roads. The reservoir would sit immediately adjacent to Interstate 80 and would be highly visible from the roadway. The impounded water may need an auxiliary dike near the freeway to prevent encroachment on the road fill.

Provided the above-mentioned issues could be resolved, in order to consider a reservoir at this location, geotechnical testing of the site would be required to determine the feasibility of a dam.

5.3.1.3 Railroad Site

The Railroad site is situated on Silver Creek, about 2 miles north of the Keetley Junction interchange of State Highway 40, also described as the NW quarter of Section 26, T 1 S, R 4 E, SLBM. The proposed dam would be approximately 34 feet high and impound a reservoir of approximately 60 surface acres and 1,300 acre-feet volume. It would have a reasonable cost per acre-foot of storage, but would have a low stream inflow and a moderately large and moderately developed drainage basin down stream. The large surface area and relatively shallow depth would make this lake susceptible to high evaporation losses.

The dam would be classified as high hazard due to structures, roads, utilities, and an interstate highway located downstream. A number of local businesses, a sewage treatment plant, an interstate highway, and local residences, are located within the probable dam break inundation area.

The site is situated adjacent to a number of proposed residential developments and golf courses. The impounded water would inundate a portion of the Union Pacific Rail Trail, an existing road, an existing wastewater treatment collection pipeline, and upland and/or riparian habitat. The upper edge of the reservoir would reach almost to an existing power substation.

The reservoir would sit immediately adjacent to State Highway 40, and would be highly visible from the roadway. It would also sit immediately downstream of the Richardson Flat Mine Tailings Site that is known to have contaminated groundwater present.

Provided the above-mentioned issues could be resolved, in order to consider a reservoir at this location, geotechnical testing of the site would be required to determine the feasibility of a dam.

5.3.2 Potential Impacts

Siting and construction of a new reservoir would be expected to result in significant impacts (both negative and positive) to the environment for fish and wildlife, land use, recreation, cultural resources, and other resources. Assuming that Federal involvement would be required in construction of new water storage, preparation of an environmental impact statement to fulfill NEPA requirements, and concurrent compliance with the Endangered Species Act, the Fish and Wildlife Coordination Act, and the Clean Water Act, among others, would be expected to take several years and have a relatively high cost.

5.3.3 Recommendations

As noted above, any development of surface water storage within the Basin would require overcoming a number of major obstacles. In addition, any reservoir would be small, with limited water supply and relatively high costs for little storage. These obstacles were considered by the management team to be sufficiently significant to eliminate surface storage as a viable option for water development in the Basin. This option was therefore dropped from further consideration in the study.

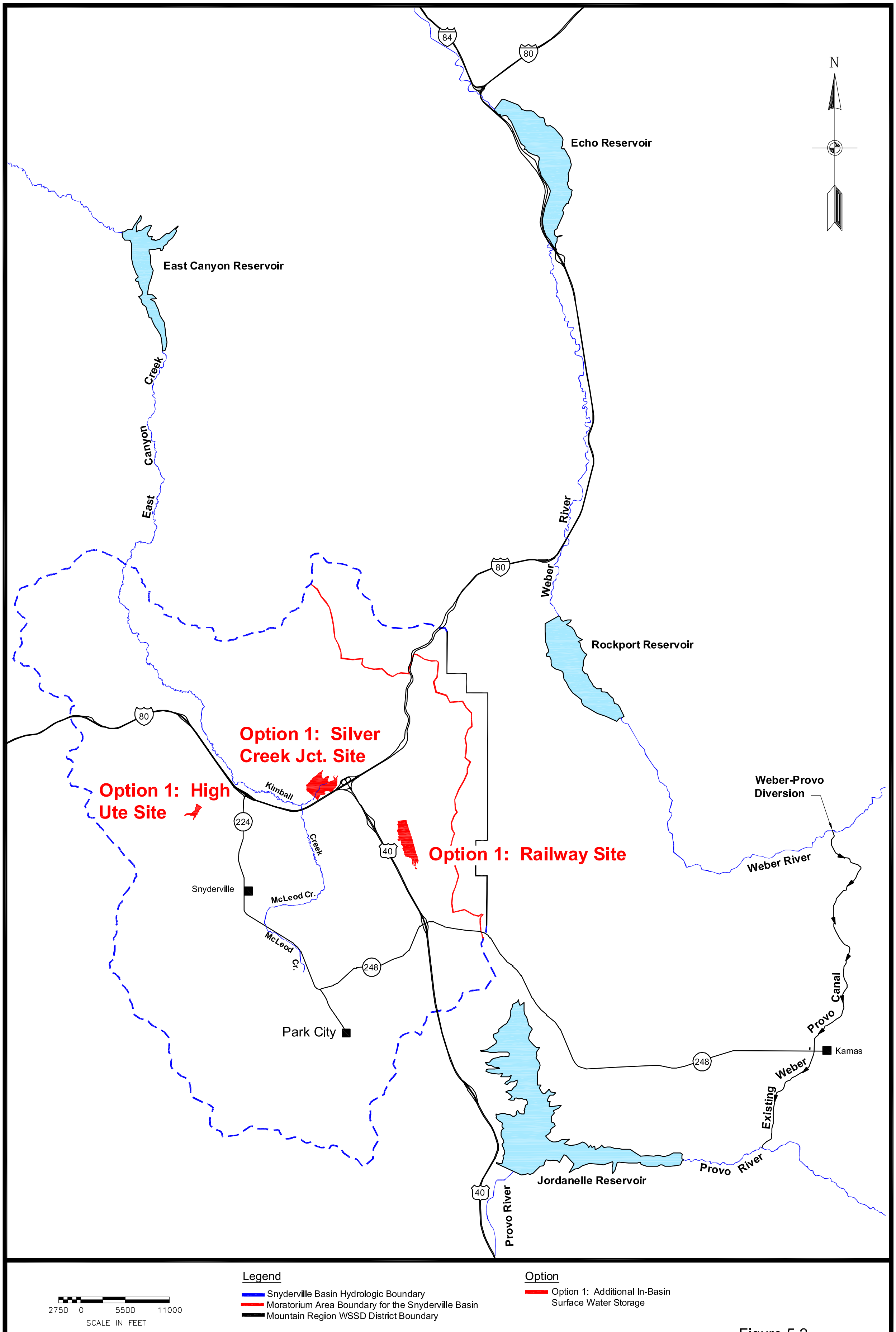


Figure 5-2
Option 1 Map
Park City and Snyderville Basin Water Supply Study Special Report

5.4 Conjunctive Management of Surface and Groundwater (Option 2)

Conjunctive management of the surface and groundwater resources in the Snyderville Basin and Park City area may help meet some of the projected future water needs. In its broadest definition, conjunctive management is the coordinated and combined use of surface water and groundwater to increase the available water supply of a region and improve the reliability of that supply.

Conjunctive management could be implemented to meet other objectives as well. These include: reducing groundwater overdraft, protecting water quality, and improving environmental conditions. Properly implemented, conjunctive management can change the timing and location of water so it can be used more efficiently. It encompasses full utilization of all water sources in creative ways that are unique to the location where the water is needed (UDWR, 2004).

5.4.1 Option Description

Water suppliers in the study area do not have a coordinated approach to managing surface water and groundwater as one resource. For the most part, they have used surface water and groundwater independently. Groundwater and surface water sources within the study area are closely connected. At some locations or at certain times of the year, water infiltrates the beds of the area's streams and recharges the groundwater. At other times or places, groundwater surfaces in seeps or springs and contributes to the base flow of local streams. Changes in either the surface or groundwater systems of the area affect the other. Therefore, effective management requires consideration of both resources.

There are several components common to most conjunctive management projects (all of which typically require extensive cooperation between water suppliers):

- Use more surface water and less ground water when surface water is available during wet periods. (Wet periods include annual spring snowmelt runoff and consecutive years of above-normal precipitation.)
- Store unused surface water above ground and underground during wet periods.
- Take water out of surface and ground water storage during dry periods. (Dry periods include annual summer months and consecutive years of below-normal precipitation.)
- Use more ground water during dry periods when insufficient water is available in surface water reservoirs.

5.4.2 Constraints/Limitations

Although there may be opportunities for conjunctive management in the Park City and Snyderville Basin area, the volume of water that would become available through this technology is likely limited. In order to determine the exact potential for conjunctive management within the study area, further investigation beyond the scope of this document would be required. If such an investigation is deemed appropriate by local water providers, it should carefully consider the following factors:

- **<u>The Nature of the Local Groundwater System</u>** - The local groundwater system is made up of several compartmentalized and fractured bedrock aquifers covered by a very thin alluvial fill. Because water moves fairly quickly through the fractured bedrock, storing significant volumes of water in any given compartment of the aquifer for any significant period of time may be difficult, unless the given compartment were to be substantially dewatered.

- **<u>Timing and Volume of Available Water Sources</u>** - In order to operate a conjunctive management project, sufficient water must be available at the appropriate times. Many aquifer recharge projects are designed to utilize excess surface water flows. Because downstream storage reservoirs (East Canyon Reservoir, Echo Reservoir and Willard Bay) capture and store most of the excess flows that leave the study area, there is very little unclaimed water available to recharge the aquifers during most years. During wet years when excess water may be available, the aquifers would likely be full and unable to receive any recharge.

- **<u>Ownership and Management of Surface and Groundwater Rights</u>** - In order to implement a conjunctive management project that does not have an aquifer storage component, it is necessary to have control of a significant portion of the surface and groundwater rights within the area of implementation. Without significant control over both resources, it is impossible to fully utilize surface water when it is available and preserve groundwater storage for use only when surface flows decline. Currently, there is no single entity within the study area that appears to have control over a large portion of the area's surface and groundwater rights, thus substantial cooperation between multiple entities would be required.

- **<u>Capacity to Treat Surface Water</u>** - Many conjunctive management projects require the ability to treat surface water to the appropriate level for the desired uses. If injection wells are to be used to recharge target aquifers, the water injected must be treated sufficiently so as to not degrade the groundwater in the receiving aquifer. Full utilization of surface water also requires sufficient capacity to treat available surface water flows. Currently, there are four surface water treatment plants in the study area. One treatment plant is located in Park City, and is designed primarily to treat the water surfacing through an abandoned mine. The second plant is located on East Canyon Creek and is designed to treat both the creek and East Canyon Reservoir water. The third is on Willow Creek. The fourth is the new Signal Hill plant designed to treat the shallow well field water and the diverted Weber River water.

- **<u>Adequate Groundwater Monitoring Wells</u>** - Monitoring the water levels in wells is essential to determine the opportunities for conjunctive management. In order to accurately assess conjunctive management opportunities, a network of monitoring wells within the area would be needed.

5.4.3 Potential Impacts

There are no significant environmental impacts expected if conjunctive management is implemented. There is potential for improving conditions for fish and wildlife. For example, emphasis on groundwater use during low flow summer conditions could help to maintain adequate in-stream flows for fish.

5.4.4 Recommendations

Potential exists for greater coordination of groundwater and surface water resources within the Basin. This coordinated management could result in greater efficiency and better utilization of the Basin's water resources. However, due to the likely limited amount of water that could be developed and the difficulties and uncertainties that exist at this time, the study recommends that if this option is developed, it should be on a local, smaller-scale, basis when more information becomes available and more confidence in the technology is attained. It has therefore been eliminated as a viable option for this study.

5.5 Water Reuse (Option 3)

Reusing treated wastewater effluent may be an attractive option for enhancing available water supplies in the study area. Reclaimed water can be used for a variety of purposes, including irrigation of agricultural crops, irrigation of urban landscapes, and industrial processes. While most wastewater treatment processes treat effluent to a quality that is sufficient to meet state standards for the irrigation of agricultural crops, additional treatment (tertiary filtration and disinfection) is required for urban irrigation and most industrial processes. A comprehensive and coordinated plan to utilize reclaimed water for these purposes within the study area could yield substantial benefits. Figure 5-5, at the end of this section, shows the location of a potential water reuse project within the Basin.

According to the Snyderville Basin Water Reclamation District (SBWRD), over 90 percent of the M&I water users in the Snyderville Basin are connected to their wastewater collection system. While a few septic tanks are still being permitted, most new construction is connecting to the wastewater system (Luers, 2004). Table 5-1 shows estimates of current and projected discharges from the two water reclamation facilities within the study area.

As shown in Table 5-1, in 2004, the average daily wastewater flow into the East Canyon Creek and Silver Creek water reclamation facilities was 2.97 mgd (2,063 gpm) and 0.91 mgd (632 gpm), respectively. This equates to a total wastewater discharge volume of approximately 4,300 acre-feet per year. In order to estimate wastewater volumes for 2030 and 2050, the average from the last five years for gallons per capita per day of wastewater produced was used in conjunction with the population projections from the Governor's Office of Planning and Budget. This projected an increase to approximately 6,500 acre-feet in 2030 and 8,800 acre-feet in 2050 at the East Canyon Creek facility, and 3,500 acre-feet in 2030 and 4,700 acre-feet in 2050 at the Silver Creek facility. (These future projections of wastewater volume assume that additional M&I water will be imported into the Snyderville Basin.)

While the discharge from the East Canyon Creek facility is treated to a sufficient level to accommodate most proposed uses, including urban irrigation, Type I, discharge from the Silver Creek facility could only be used for agricultural irrigation without additional treatment. Even though SBWRD is able to shift flows between the two facilities for operational purposes, it is assumed that the Silver Creek facility would need to be upgraded to meet Type 1 reuse standards. This cost is included in the Appendix. Thus, the total volume of 13,500 acre-feet per year from both plants in 2050 was considered in determining the amount available for reuse in the future.

TABLE 5-1
Current and Projected Discharges from
Snyderville Basin Water Reclamation District Facilities

Wastewater Treatment Plant	Treatment Process	Capacity* (mgd)	Current Discharge‡ 2004 (mgd)	Current Discharge‡ 2004 (Acre-Ft/ Year)	Projected Discharge† (Acre-Ft/Year) 2030	Projected Discharge† (Acre-Ft/Year) 2050
East Canyon Creek	Advanced Tertiary	4.00	2.97	3,300	6,500	8,800
Silver Creek	Oxidation Ditch	2.00	0.91	1,000	3,500	4,700
	Total	**6.00**	**3.88**	**4,300**	**10,000**	**13,500**
Estimated Total Available (35 percent of Total)		**--**	**1.35**	**1,500**	**3,500**	**4,700**
Probable Volume of Reuse		**--**	**--**	**--**	**2,000**	**3,600**

* Design capacities obtained from Snyderville Basin Water Reclamation District, Sept. 2004.
‡ Current discharges are 12-month averages obtained from Snyderville Basin Water Reclamation District, April 2005.
† Projected discharges are based on population projections from the Governor's Office of Planning and Budget. These discharges also assume additional water will be imported into the Snyderville Basin.

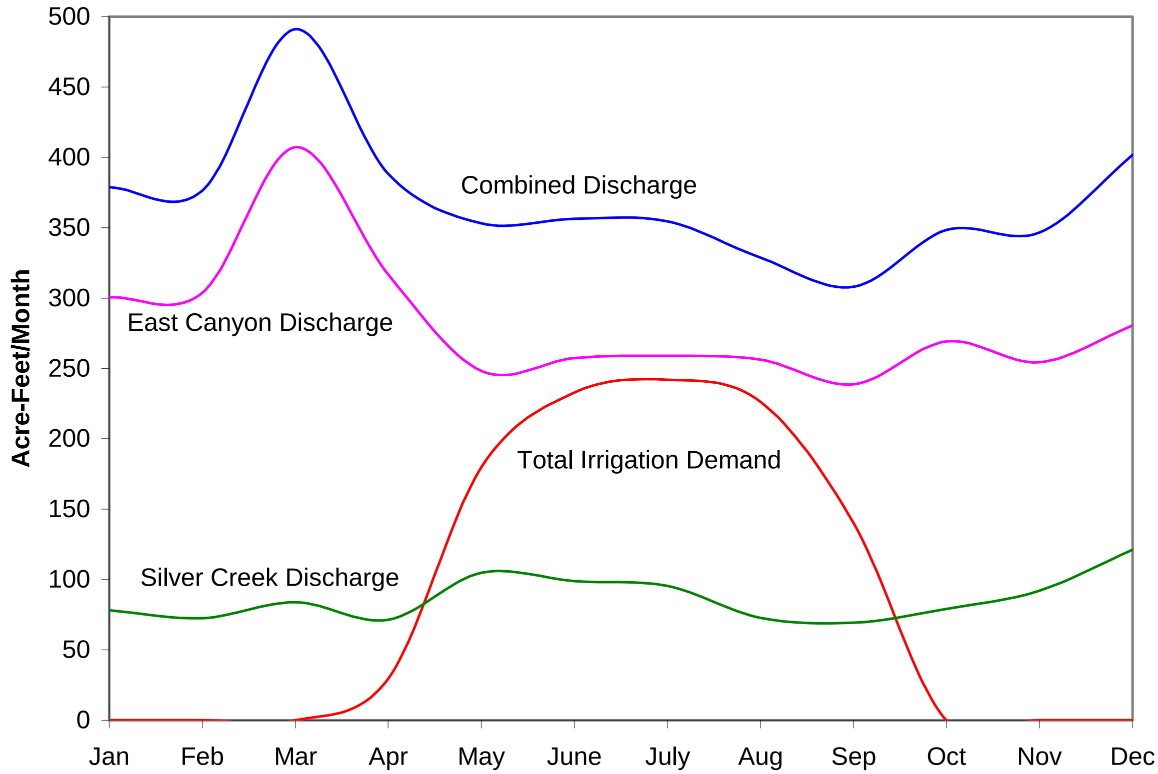
5.5.1 Current Possibilities for Reuse

SBWRD has indicated there could be two scenarios in which reuse water would be developed. The first scenario would be for SBWRD to develop a reuse project in order to comply with regulatory requirements. The second scenario would involve a water provider approaching them with the intent of acquiring reuse water to meet the water provider's needs. In this case, the water provider would likely decide if the development of reuse water is more economical than developing an alternative source (Luers, 2005).

The possibility for reuse to help meet some of the Basin's future water needs is strengthened by the fact that SBWRD is already planning to reuse some of the effluent for the irrigation of golf courses. During the summer of 2005, SBWRD installed a section of pipe to deliver this water in conjunction with other infrastructure to avoid additional installation costs in the future. Three golf courses may be supplied reclaimed water for irrigation purposes, including Jeremy Ranch Golf Course (a course near the East Canyon facility that would require little infrastructure for delivery), Glenwild Golf Course, and a proposed golf course to be built by The Canyons Ski Resort. Other proposed uses in the SBWRD's Phase I proposal include delivery to the Swaner Nature Preserve or for highway beautification. These uses would utilize over 1,000 acre-feet per year of reclaimed water. As shown in Figure 5-3, the current discharge volume from the East Canyon facility could easily meet this demand. This volume represents about 24 percent of the total effluent treated in the study area.

SBWRD is also considering a Phase II implementation of reuse. This would include delivery of about 600 acre-feet per year to Park Meadows Golf Course and Park City Municipal Golf Course. Together with Phase I, this would provide approximately 1,600 acre-feet per year of reclaimed water. SBWRD would likely not be able to implement this phase until either the Silver Creek facility is upgraded to meet Type I standards or until the population grows and the East Canyon facility is able to provide a greater volume of reclaimed water.

FIGURE 5-3
2004 Supply vs. Initial Reuse Demand



5.5.2 Constraints/Limitations

The amount of effluent discharged from these water reclamation facilities that would ultimately be available for reuse could be limited by a number of factors. One of these factors is the nature of the underlying water rights that produced the effluent. According to the State Engineer, a water right that was originally approved for municipal uses can be depleted 100 percent. In other words, the effluent from a municipal water right can be reused and completely consumed. On the other hand, a municipal water right that was originally approved for agricultural irrigation cannot be depleted 100 percent. Because there is typically some return flow associated with an agricultural water right, the State Engineer has determined that a portion of such a right, even if it has been converted to municipal uses, must be returned to the hydrologic system in order to avoid negative impacts on other water users. In the Park City area, only about 50 percent of the agricultural water right that has been converted to municipal uses can be depleted. This is calculated by dividing the local consumptive use of alfalfa (1.54 acre-feet/acre per year) by the water right duty (3.0 acre-feet/acre per year). In other words, only about 50 percent of the original agriculture water right can be diverted and depleted for M&I use. According to a preliminary water rights depletion evaluation conducted for Summit Water Distribution Company, Mountain Regional Water Special Service District and Park City, the total depletions allowed are over 6,700 acre-feet per year. This number would likely need to be further refined and would ultimately need to be reviewed by the State Engineer, but the initial analysis would suggest that the water rights depletion limits would not be the constraint for reuse in the Snyderville Basin.

The nature of the underlying water rights can also impact the locations where reclaimed water can be used. Water rights have a defined place of use where the water can be applied. According to the State Engineer, both the original use and the reuse of water must occur within the water right's place of use boundary. For example, SBWRD cannot reuse the effluent generated by Park City's water rights outside Park City's municipal boundaries. One way to overcome this limitation is to file change applications with the State Engineer's office to modify the reused water rights so that their place-of-use boundaries include the locations where the reclaimed water would be used.

Two other factors that may limit the amount of effluent that can be used are the nature of the proposed uses and the physical location of the uses in relation to the water reclamation facilities. While some industrial processes may have a water demand that is relatively constant year-round, most reuse applications (which are for outdoor irrigation) only have a seasonal demand. In the study area, the demand for irrigation exists in less than six months of the year, part of April through September. Therefore, seasonal uses are limited by the peak demand during July and would not be able to utilize the entire effluent, unless of course the off-season effluent could be stored for use during the peak times. The location of the use may also limit the amount of reuse due to the economics involved with pipelines and pumping stations.

Another factor that may limit the total volume of reclaimed water available for reuse includes potential downstream impacts to the environment. Environmental considerations that could limit the use of effluent include impacts to wildlife and other ecosystem values in the downstream environment if proper stream flows are not maintained. Due to drought and other conditions, East Canyon Creek has completely dried up during brief periods. In the future, SBWRD would likely discharge effluent to help maintain necessary stream flows before it would divert effluent for reuse applications providing that water quality regulations could be met. The need for additional water in the stream is greatest in August and September. Without an alternative delivery schedule with on-site storage, the peak irrigation demands that could be met would be significantly reduced due to the corresponding peak demands for the stream and for irrigation.

Lastly, it should also be noted that a 2005 Utah Legislative Task Force, studying water issues, drafted a wastewater reuse bill that could impact the use of reclaimed water within Utah. Both the final language of the bill and whether or not it becomes law won't be known until after Utah's 2006 Legislative Session. In addition to the proposed bill, there are also two active court cases involving water rights and reuse that may set important legal precedents on wastewater reuse.

5.5.3 Future Potential

After a preliminary analysis taking all the limiting factors into account as discussed above, UDWR roughly estimates that no more than 35 percent of the discharges shown in Table 5-1 will be able to be reused (3,500 acre-feet in 2030 and 4,700 acre-feet in 2050). The seasonal demand appears to be the limiting factor based on the peak of the irrigation demand curve. Thus, the 35 percent could potentially be higher if the primary use of effluent were to be an industrial process with a year-round demand or if the non-irrigation season effluent could be stored to help meet the peak demands.

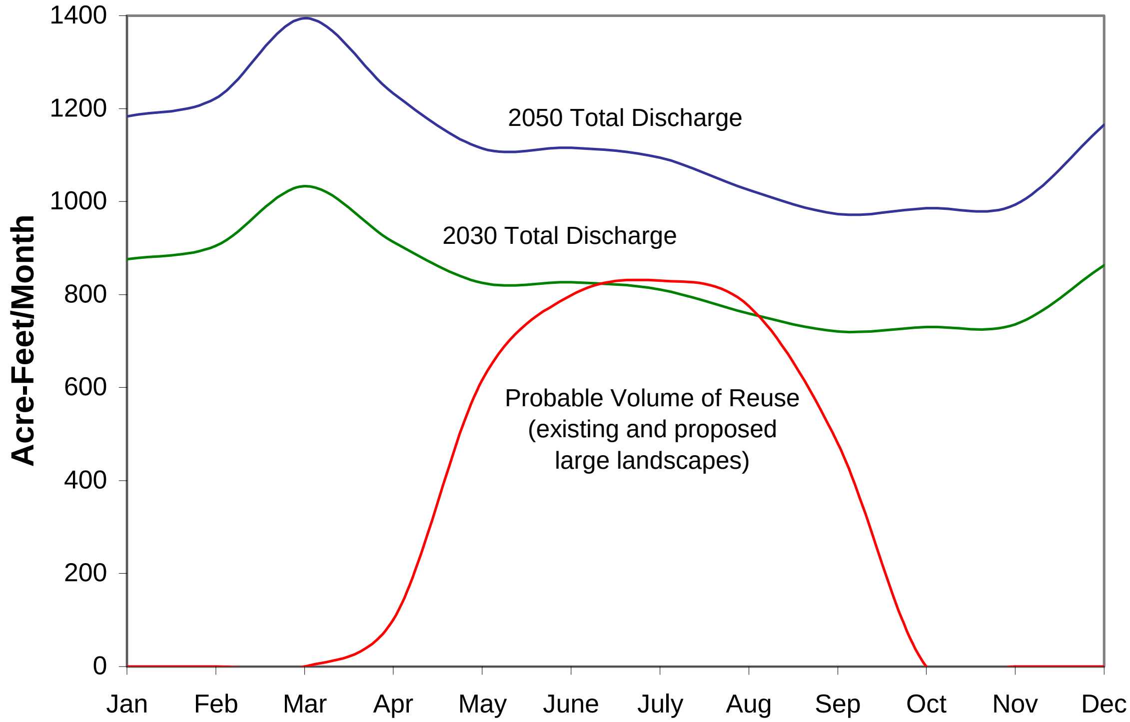
For particular years of low instream flows, an alternative delivery schedule may be necessary in conjunction with on-site storage to allow SBWRD to discharge effluent to help meet instream flow requirements. Based on 2003, the worst year on record, a total of 588 acre-feet would have been needed during July (41 acre-feet), August (318 acre-feet) and September (229 acre-feet). An alternative delivery schedule with on-site storage that supplied the extra water throughout the earlier months would reduce the volume needed during the low stream flow months. This would help to protect important environmental needs, while still allowing the maximum amount of reclaimed water to be available for reuse.

5.5.4 Probable Future Volume of Reuse

Although roughly 4,700 acre-feet per year of reclaimed water could be utilized by 2050, the probable volume of reuse that will be implemented is likely slightly lower. UDWR has identified large landscapes throughout the study area that could potentially be irrigated by reclaimed water including ten existing or proposed golf courses, the Swaner Nature Preserve, a proposed city sports park and other miscellaneous public landscape irrigation such as highway beautification. Using these large landscapes as the determining factor, the total probable volume of reclaimed water that could be implemented by 2050 is approximately 3,600 acre-feet per year.

As shown in Figure 5-4, this volume could nearly be supplied by 2030 without any storage, and could easily be supplied by 2050. One factor that may be important to note is that in 2050 this volume could be supplied during the worst dry-year on record for the area, as discussed earlier, and still provide the necessary water to meet instream flow requirements except for approximately 70 acre-feet in August. Thus, with very little storage or interruption in the supply, these demands could be met with significant reliability while still protecting the stream’s needs.

FIGURE 5-4
Probable Future Reuse Volume (2050)



5.5.5 Possible Reuse Delivery Pipeline

Two possible reuse pipelines have been analyzed for delivery of reclaimed water to the various locations discussed in the previous text (see Figure 5-5). One pipeline would extend from the East Canyon facility southeast along I-80 to Kimball Junction. In this area it would cross I-80 and extend south to the area near St. Mary's Church. It would then continue southeast along State Route 224. This main delivery line would have spurs to supply reclaimed water to Glenwild Golf Course, a future Canyons Golf Course, Park Meadows Golf Course and Park City Municipal Golf Course. It could also supply reclaimed water for irrigation of various public landscapes such as parks and cemeteries in the Park City Area. It ranges in size from 8-12 inches, and would be able to supply around 2,000 acre-feet per year. Much of the preliminary design of a section of this pipe has already been completed by SBWRD.

The second pipeline would extend south from the Silver Creek facility to the Quinn's Junction area. A large segment would branch off shortly after leaving the treatment facility running east up to multiple golf courses at Promontory Development. This pipeline ranges in size from eight to sixteen inches and is designed to initially deliver around 1,600 acre-feet per year. As part of the design of this pipeline, a pipeline system to connect the two lines has also been analyzed to allow continued flexibility in treatment by one facility or the other. This would allow either pipeline to deliver reclaimed water to a point on either side of the area in the case of interruption in the opposite pipeline. The designed redundancy in capacity could also be utilized in the future as additional landscapes are developed that could be supplied with reclaimed water along the pipeline, which could potentially eliminate the need for later expansion of the pipeline capacity.

The system from the East Canyon facility was estimated to cost $6,600,000 and to have a present value life cycle cost of $10,500,000. The system from the Silver Creek facility was estimated to cost $10,700,000 and to have a present value life cycle cost of $19,600,000. A combined system with the ability to shift capacity between the two sides was estimated to cost $19,100,000 and to have a present value life cycle cost of $32,200,000. More detailed cost estimates are available in the Appendix.

5.5.6 Potential Impacts

A July 8, 2005, field survey by Reclamation staff looked at several locations where pipelines might be sited to develop water reuse potential. This review noted the potential for impacts to cultural resources, wildlife habitat, spotted frog habitat, and wetlands. Such impacts could possibly be mitigated or avoided by project design.

5.5.7 Recommendations

The study concludes that water reuse is a viable option and should be further considered in the evaluation and ranking process of the study. Volumes of reuse water are estimated at 2,000 acre-feet per year for 2030 and 3,600 acre-feet per year by 2050.

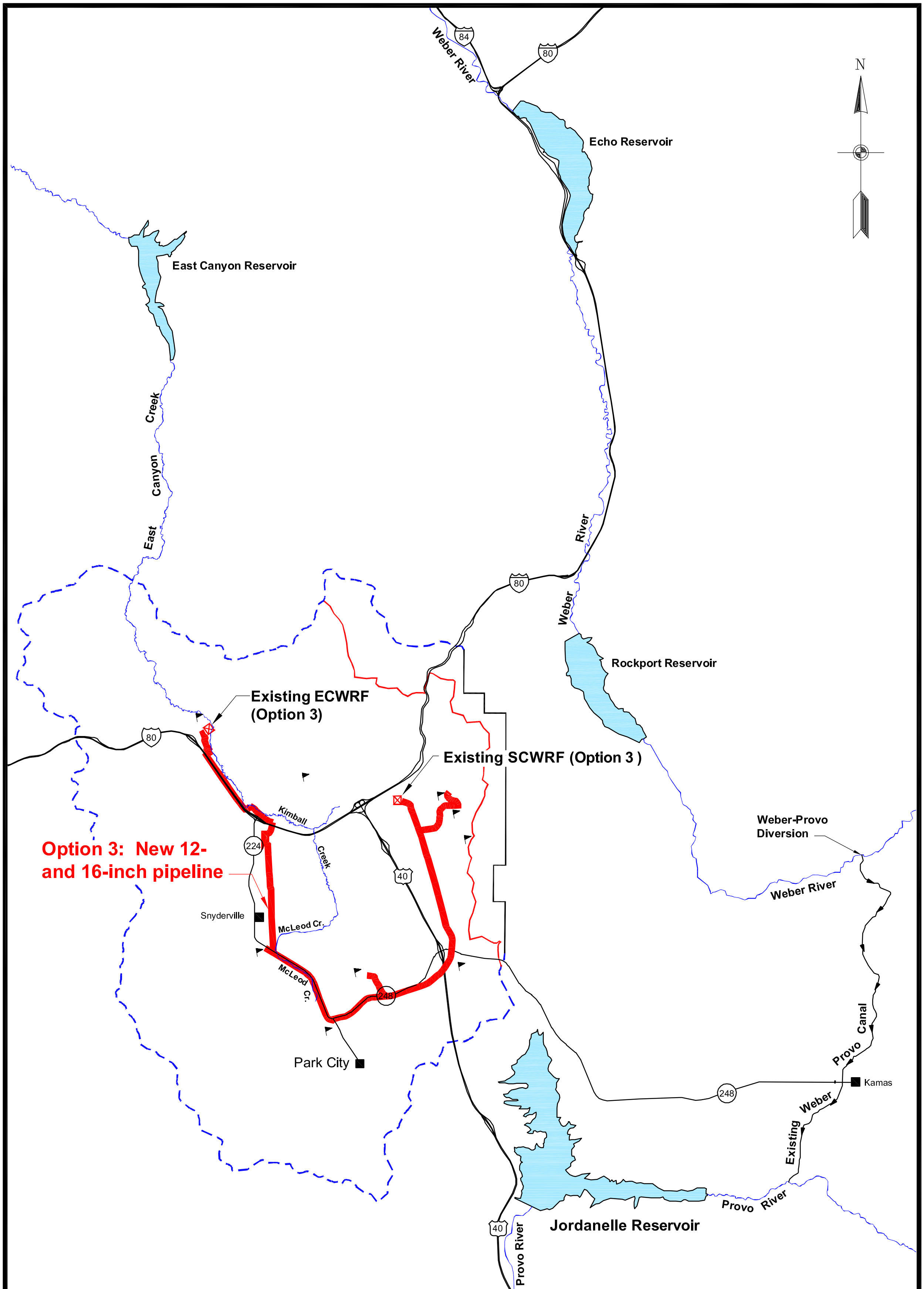


Figure 5-5
Option 3 Map
Park City and Snyderville Basin Water Supply Study Special Report

5.6 Provo River - JSSD (Option 4)

This option considers importation into the Snyderville Basin from the Provo River drainage. Importation could be made using JSSD's existing facilities or construction of new facilities.

5.6.1 Hydrology

Three sources of water from the Provo River drainage were considered: water developed by JSSD, non-natural (imported) flows of the Provo River, and natural flows of the Provo River. After evaluating the three sources, as explained below, the only viable additional supply from the Provo River drainage is an additional 500 acre-feet per year from JSSD.

Jordanelle Special Service District - As stated in Section 4.4.2 of this report, Park City currently receives 1,000 acre-feet per year of water from JSSD under a 20 year lease agreement that expires in 2022. This water comes from the Ontario Drain Tunnel. The facilities for this delivery have already been constructed and are in operation. They consist of a filtration water treatment plant located at the mouth of the Ontario Drain Tunnel on the northwest side of Jordanelle Reservoir and approximately 15,400 linear feet of 12-inch treated water transmission pipeline. Even though the existing 1,000 acre-feet per year delivery contract expires in 2022, both Park City and JSSD expect deliveries will continue in perpetuity. Park City currently pays $811 per acre-foot annually for this water supply, with an escalation factor of 4 percent per year. Additionally, they are anticipating increasing the deliveries by 500 acre-feet per year, for a total importation of 1,500 acre-feet per year.

Non-Natural Provo River Flows - Flows not naturally tributary to the Provo River were also considered as potential import sources to the Snyderville Basin. These consist, primarily, of mine tunnel flows in the Park City area. Park City currently uses the entire flows of the Judge and Spiro Tunnels. Based on water-year 2004, JSSD currently utilizes about 55 percent (5,433 acre-feet per year) of the flows of the Ontario Drain Tunnel No. 2. About 28 percent (2,694 acre-feet per year) is used by the Metropolitan Water District of Salt Lake and Sandy, and the remaining 17 percent (1,635 acre-feet per year) by the Midway Irrigation Company for a total yield of 9,762 acre-feet per year. JSSD also has approximately 523 acre-feet per year of surface water, 1,451 acre-feet per year of groundwater, 1,500 acre-feet per year of CUP M&I water, and 2,500 acre-feet per year of CUP irrigation water. Since these rights are all above Jordanelle Dam and the use of the non-JSSD water in the tunnel is downstream from the dam, JSSD plans to exchange these rights into the tunnel, thus essentially utilizing the entire remaining yield (4,329 acre-feet per year) of the tunnel.

Natural Provo River Flows - The only natural flow water within the Provo River drainage that is not fully utilized occurs only in extreme wet years when storage reservoirs are full and other means for recovering and exporting the surplus flows are already fully utilized. Also, any exportation out of the Basin would create considerable political and institutional problems, due to the impacts created on a fully utilized water supply system and the in-stream flow needs of sport fishery and the endangered June Sucker.

5.6.2 Option Description

The JSSD system can currently provide the 500 acre-feet per year to the East Park Tanks located along US-40. To provide water delivery to Park City, a new 12-inch diameter pipeline, approximately 18,000-feet in length, would need to be built along the existing state and county road right-of-ways as shown on Figure 5-6. The pipeline would connect to existing Park City waterlines at the Quinn's Junction Sports Complex. This pipeline was estimated to cost $2,700,000. The life cycle cost for this option, including all charges from JSSD, was estimated to be $18,600,000. More detailed cost estimates are available in the Appendix.

5.6.3 Potential Impacts

Any impacts associated with construction of existing facilities have already occurred. No significant impacts would be expected based on current information, but any future use of water from the Provo River drainage would need to consider the effects to operation of the Provo River Project and in particular, any potential consequences for the endangered June sucker and the state sensitive species Columbia spotted frog. Also, any effects to the Wasatch County Water Efficiency Project, particularly the environmental commitments for that project as related primarily to return flows, would need to be reviewed.

5.6.4 Recommendations

The study concludes that Option 4 in the amount of 500 acre-feet per year is a viable option and should be further considered in the evaluation and ranking process of the study.

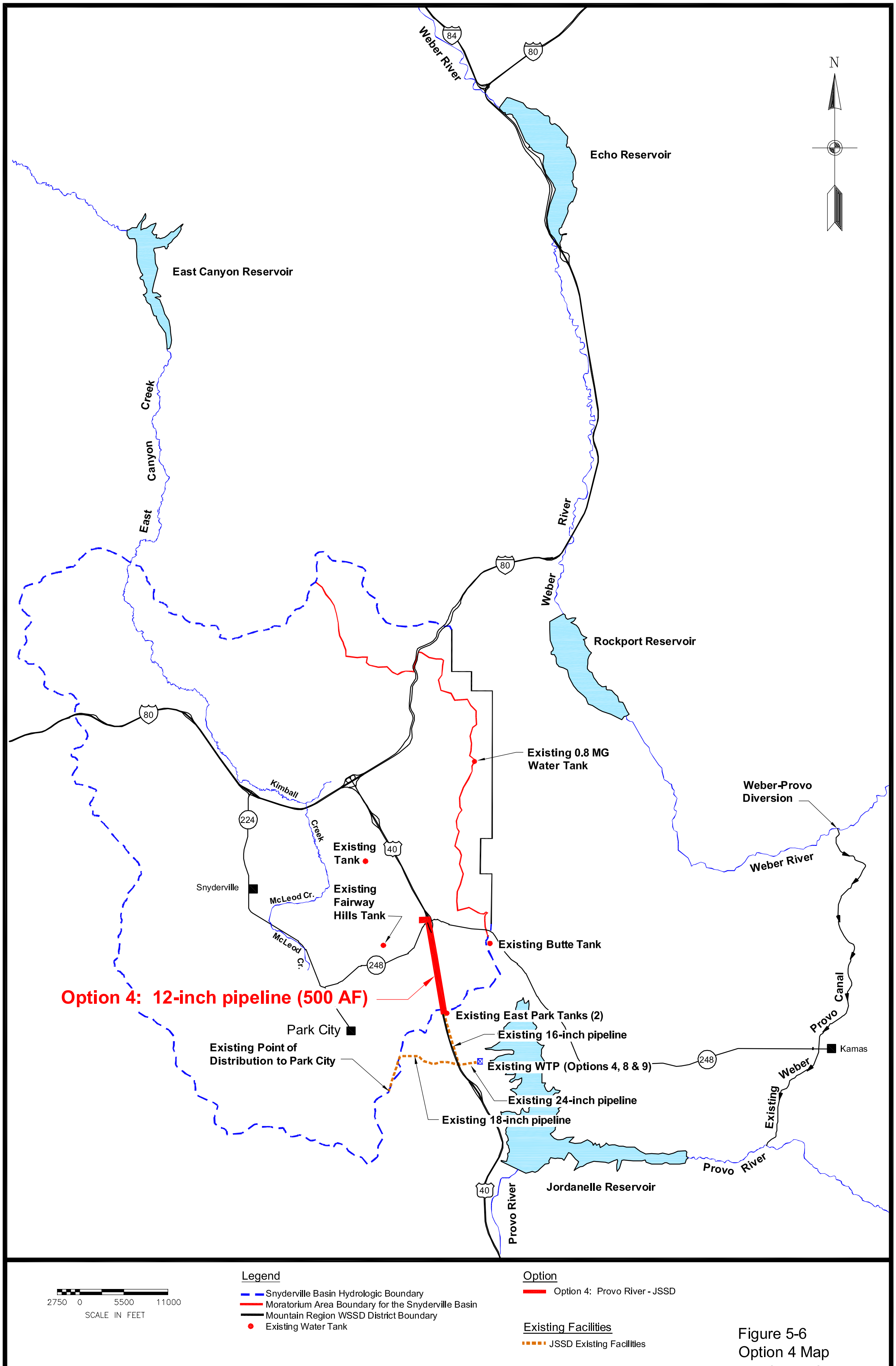


Figure 5-6
Option 4 Map
Park City and Snyderville Basin Water Supply Study Special Report

5.7 East Canyon Pipeline (Option 5)

This option considers importation into the Snyderville Basin from water stored in East Canyon Reservoir. The principal facilities include a new pipeline from East Canyon Reservoir to the north Jeremy Ranch boundary and from the south Jeremy Ranch boundary to the existing Summit Water Distribution Company Water Treatment Plant, as shown on Figure 5-7.

5.7.1 Option Description

This option has been studied for importation capacities of 5,000, 8,750, and 12,500 acre-feet per year. Design of the original East Canyon Pipeline Option was completed in September 1999 for SWDC (Michael L. Aldrich & Associates, 1999). The project consists of conveying water from East Canyon Reservoir south to a new water treatment facility located near Interstate 80 near Jeremy Ranch. Initially, SWDC received approvals for a 24-inch diameter pipeline to convey raw water from East Canyon Reservoir to the new treatment plant. After review of the projected demands within the Basin, the decision was made to increase the pipe diameter to 30-inches in order to accommodate future demands. By July 2002, approximately 7,000 linear feet of 30-inch pipeline along Rasmussen and Jeremy Roads had been installed. A water treatment facility with a capacity of 5.5 mgd (3,820 gpm), expandable to 22 mgd (15,500 gpm), has also been constructed. The original project was designed for an ultimate build-out capacity of 15,000 acre-feet, and a presumed peaking factor of 1.67.

A number of additional facilities would be required to deliver the volumes chosen for investigation in this study. A raw water intake and pump station and a raw water booster pump station would be required to pump water from East Canyon Reservoir to the water treatment plant. Approximately 63,000 linear feet of 30-inch pipeline would be required to convey the water between the two locations. A 3.5 mgd (2,430 gpm) expansion of the existing water treatment facility would be needed to meet the daily flow of 6,200 gpm, and a 16.5 mgd (11,500 gpm) expansion for a maximum daily flow of 22 mgd (15,500 gpm). Upgrades to two pump stations within the SWDC system, Trailside and IHC, and an additional 5,680 feet of 16-inch pipeline would be required to deliver finished water to Park City. Also, a 12-inch diameter, 16,500 foot pipeline and additional pump capacity would be required, if it was desired to deliver treated water to the Promontory Development. This pipeline would not be necessary if the Lost Creek Canyon Pipeline (Option 7) were also to be constructed. SWDC currently has 6.0 million gallons (MG) of finished water storage within their system; therefore, additional finished water storage was not considered necessary for this option.

With the existing water distribution infrastructure within the SWDC system, Park City could connect to this additional water supply at two different locations: Section 27 storage tank and near the White Barn just off State Road 224, halfway between Park City and the Canyons Ski Resort. The delivery pressure at the Section 27 storage tank may require the addition of a booster pump station within Park City's system, and the pressure at the White Barn would require a pressure reducing valve (only the White Barn connection was estimated). SWDC has interconnections with Community Water, Gorgoza, High Valley, and MRWSSD through which water could be distributed Basin-wide

Of the three capacities considered, the cost for the 5,000 acre-feet capacity is the highest cost per acre foot of capacity. This is due to the high capital costs associated with the relatively long pipeline. As the capacity increases, the cost per unit of capacity drops. The estimated costs are shown in Table 5-2. The first phase of this project that would allow initial delivery of water could be constructed for an estimated contract cost of $37,900,000. The components of phase one are listed in the Appendix. More detailed cost estimates are available in the Appendix.

TABLE 5-2
East Canyon Pipeline Cost Summary

Capacity	Capital Cost (New Facilities)	Capital Cost* (Existing & New)	Life Cycle Cost*
5,000	$35,200,000	$50,800,000	$124,700,000
8,750	$53,700,000	$69,300,000	$153,600,000
12,500	$67,300,000	$82,900,000	$181,200,000

* Method 3 costs (see Table 6-3).

There would need to be agreements developed between SWDC and Park City and/or MRWSSD to identify reservation of system capacity, buy-in costs of use of present facilities, as well as “wheeling fees” and rates and fees.

5.7.2 Hydrology

The water rights listed in Table 5-3 represent East Canyon Reservoir Storage rights that are available for importation through the East Canyon Pipeline. These storage rights fall into two main categories which includes: leased water from D&WCCC and water shares in D&WCCC stock. SWDC has indicated that they have sufficient additional water rights not listed in Table 5-3 to cover the current diversions from their water system. Therefore, Reclamation assumes that the water rights in Table 5-3 can be moved to the East Canyon Pipeline without reducing SWDC ability to divert water from their existing water system.

The first category of water rights SWDC has to store water in East Canyon Reservoir is based on an October 13, 1999, water lease contract between SWCD and D&WCCC. This lease annually provides up to 5,000 acre-feet of East Canyon Reservoir water. This water “will be comprised of rental pool water, water covered by treasury shares, water retired from historical irrigation or by reduction in the amount of stored water in East Canyon being available to all share holders or D&WCCC and other water as the Board of D&WCCC may decide.” The contract states that if D&WCCC cannot provide the excess water, SWDC will dedicate shares of D&WCCC stock to cover the water diverted on a basis of 7 acre-feet per share. In the memorandum decision allowing this leased water to be used in Snyderville Basin, the State Engineer required 714.3 shares of D&WCCC stock be dedicated to this project and 1,250 acres of irrigated land be retired. Although it is uncertain how D&WCCC will dedicate shares to the lease water, D&WCCC has indicated that in the event of water shortages they would decrease the yield of their shares to cover this lease.

Reclamation recognizes that a hydrology analysis completed in the mid-1990’s shows a minimum holdover volume in East Canyon Reservoir of over 7,000 acre-feet for each year of the prior 23 year period. However, in the future as the demand for water increases and the existing D&WCCC shares are being more fully utilized, this excess holdover water will likely decrease. Therefore Reclamation estimates that the volume of water available to the East Canyon Pipeline from water lease, to be between 2,500 and 5,000 acre-feet per year.

The second category of water right available for importation in the East Canyon Pipeline is based on shares of D&WCCC stock. In the past, SWDC has filed a variety of change applications to move these shares into their water system. Change Application Nos. a12859, a13561, a13565, and a13566, list the East Canyon Reservoir as a hereafter point of diversion and could likely be used in the East Canyon Pipeline. However, Change Application Nos. a13561, a13565, and a13566 are awaiting final approval and should they be rejected, a new change application would have to be filed to move affected D&WCCC shares to the East Canyon Pipeline. Change Application Nos. a18524 and a16374 will have to be withdrawn and a new change application filed. Change Application No. a16384, appears to be based on the same shares as other change applications in Table 5-3 and will likely be withdrawn. Reclamation notes that the State Engineer has typically quantified change applications based on D&WCCC stock at 7.0 acre-feet per share and D&WCCC has recently determined their stock yields 6.0 acre-feet per share. Future change applications based on D&WCCC stock could yield anywhere between 6.0 and 7.0 acre-feet per share.

In addition to the D&WCCC shares owned by SWDC, representatives from the Corporation of the Presiding Bishop of the LDS Church and Property Reserve Incorporated have indicated that they own shares of D&WCCC stock that could be dedicated to the East Canyon Pipeline project. Both these corporations are share holders in SWDC and are interested in the successful development of this project. These corporations have told Reclamation that, if necessary, they could move at least 400 shares of D&WCCC stock to the East Canyon Pipeline. Reclamation assumes that a change application will need to be filed on these shares.

Reclamation estimates that the volume of water available for the East Canyon Pipeline from D&WCCC shares, to be between 6,882 and 8,029 acre-feet per year. The lower range assumes shares of D&WCCC stock would yield 6.0 acre-feet each. The upper range assumes that shares of D&WCCC stock would yield 7.0 acre-feet each.

Looking at the two categories of water rights, the aggregate estimate of the volume of water available to the East Canyon Pipeline is roughly between 9,400 and 13,000 acre-feet per year. The lower range is the sum of the lower water volume estimates for each category of water and the upper range is the sum of the upper water volume estimates.

A reservoir operation model study, which is beyond the scope of this study, would more accurately determine the reliable yield from these rights, and identify any need for additional acquisitions to reach a firm 12,500 acre-feet supply. Reclamation recommends this reservoir operation model study be done as part of a feasibility study of this Option prior to final design and construction.

TABLE 5-3
Summary of Water Rights available for Importation
Summit Water Distribution Company

Water Right No.	Underlying Storage Right	No. of D&WCCC Shares	Quantity (Acre-Feet)
a21859 (35-10539)	Water Lease Agreement 1999		5,000.00
a12859 (35-5360)[1]	D&WCCC Certificates #13927, 13940, 13949	112.0	784.0
a18524 (35-7452)[2] (35-5470)	D&WCCC Certificate # 13568	311.0	2,177.0
a16374 (35-5742)[2]	D&WCCC Certificate # 13395	11.0	77.0
a13561 (35-9031)[3] a13565 (35-9032)[3] a13566 (35-9033)[3]	D&WCCC Certificates # 13569, 13959, 12777, 12063	313.0	2,191.0
a16384 (35-5741)[4]	D&WCCC Certificate #13569	0	0
LDS Church[5]	D&WCCC Shares	400	2,800
Total		**1,147**	**13,029.0**

[1] The December 21, 1984 Memorandum Decision approving Change Application No. a12859 allows a diversion rate of 1,400 acre-feet/year (which is greater than 7.0 acre-feet/share). If a future change application was filed on these shares the diversion rate could be significantly reduced. This study assumes these 112.0 shares will eventually be quantified between 6.0 and 7.0 acre-feet/share.
[2] This change application would have to be withdrawn and a new change application filed on the underlying storage shares. It is assumed that the new change application would be quantified between 6.0 and 7.0 acre-feet/share.
[3] The March 19, 1993 Memorandum Decision approving Change Application Nos. a13561, a13565, and a13566 allows a diversion rate of 2,190 acre-feet/year. In January 1996, the State Engineer issued a special order reopening the application for review. In March 1996, a second amended special order was issued stating that the stay on the prior approvals would remain in affect until a final agency decision could be made. No final decision has ever been issued.
[4] The underlying storage shares for the unapproved Change Application No. a16374 appear to have already been used in Change Application Nos. a13561, a13565, and a13566.
[5] The Corporation of the Presiding Bishop LDS Church and Property Reserve Incorporated have indicated that, if needed, they could dedicate at least 400 shares to the East Canyon Pipeline Project. It is assumed that these shares would be quantified between 6.0 and 7.0 acre-feet/share.

5.7.3 Potential Impacts

An environmental analysis sponsored by Summit Water Distribution Company and the Davis and Weber Counties Canal Company was completed in 1999, to facilitate permitting of the project. Permits identified in that document for the East Canyon Pipeline option include the following: Nationwide Permit Nos. 12 and 26, from the COE in accordance with Section 404 of the CWA; Endangered Species Act (ESA) consultation with the US Fish and Wildlife Service (FWS); consultation and determination of "no historic properties affected" by the Utah SHPO; water rights approvals and a stream alteration permit from the Utah State Engineer; a general storm water discharge permit (Utah Pollutant Discharge Elimination System – UPDES) and Section 401 water quality certification from the Utah Division of Water Quality (UDWQ); plan approval from the Division of Drinking Water; approval to construct within the state road right-of-way (ROW) from the Utah Department of Transportation (UDOT); coordination with the Utah Division of Wildlife Resources (UDWLR) for the Bonneville cutthroat trout; permits from

Summit County (essentially these have been obtained); and, permits from Morgan County, including a Conditional Use Permit and an excavation permit, and others as needed. In addition, rights-of-way and easements across private lands would need to be obtained. SWDC obtained a professional appraisal for right-of-way and easements in 1998, and Reclamation has reviewed and updated the estimate. Recently a 7,200 acre Ranch (Clayton Macfarlane Company) sold a conservation easement that covers a portion of the county road along East Canyon Creek in Summit and Morgan counties. Right of Way across this conservation easement would also have to be negotiated. The State Division of Forestry, Fire and State Lands (owner of the easement) has indicated this could probably be accomplished, but would likely take additional time for negotiation and legal work. If these facilities were to become part of a Federally-sponsored project, additional permits would be required, including NEPA compliance and use agreements with SWDC to use existing infrastructure.

A June 22, 2005, field review by Reclamation staff noted a potential for impacts to fish and wildlife and potential for impacts to spotted frog habitat. Such impacts could be mitigated or avoided by project design including the location of the pipeline corridor. The potential for effects to cultural resources, principally historic trails, can be avoided by installing the pipeline in the existing roadway.

5.7.4 Recommendations

The study concludes that the East Canyon Pipeline Option is a viable option and should be further considered in the evaluation and ranking process of the study.

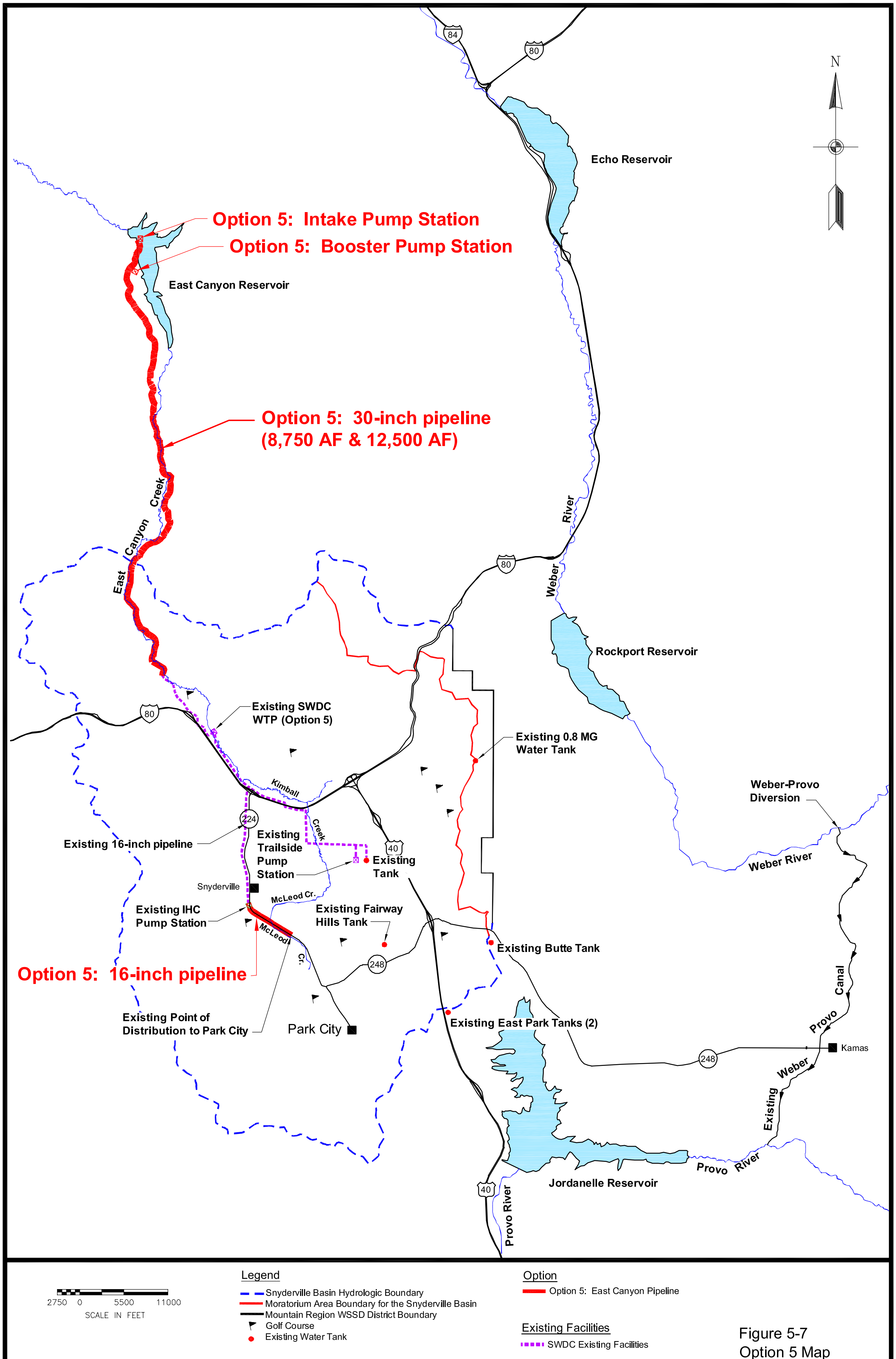


Figure 5-7
Option 5 Map
Park City and Snyderville
Basin Water Supply
Study Special Report

5.8 Brown's Canyon Pipeline (Option 6)

The Brown's Canyon Pipeline Option, would import water from Rockport Reservoir to the Snyderville Basin through a pipeline to be constructed through Browns Canyon. The Rockport Water Supply Infrastructure Project Phase I Pipeline Alignment Evaluation was completed in April, 2003 (MWH and BC&A, 2003). A subsequent technical memorandum, dated June 17, 2003, recommended the Brown's Canyon Option as the preferred alignment from the evaluation (MWH, 2003). This preferred alignment was used in the analysis for importing water into Snyderville Basin.

Weber Basin Water Conservancy District along with Park City and Summit County which includes Mountain Regional Water Special Service District (then known as Atkinson Special Service District), entered into a certain Memorandum of Understanding and Agreement (MOU), dated November 18, 1996, which set forth a framework for the development of a water project to deliver water, made available from WBWCD's sources, for distribution within the service areas of Park City and MRWSSD. Several studies have been commissioned to examine and recommend feasible pipeline corridors along with water treatment plant and reservoir sites in order to transport and treat water coming from Rockport Reservoir to the Snyderville Basin.

Within the last few years WBWCD, Park City, and MRWSSD, have determined not to pursue the project described in the MOU. The Parties have decided instead to participate in the Snyderville Basin Water Supply Study, currently being conducted by the Bureau of Reclamation to develop a plan for providing additional water to the Snyderville Basin.

5.8.1 Option Description

Two different versions of the Brown's Canyon Pipeline were investigated. Version A considered an intake below Wanship Dam. Version B located the intake just upstream of the Rockport Reservoir.

Version A would require modification to the intake structure below Wanship Dam in addition to a new raw water pump station and approximately 50,000 linear feet of 30-inch raw water pipeline to convey water to a new 9.0 mgd (6,200 gpm) / 22.0 mgd (15,500 gpm) water treatment facility. Three million gallons in raw water storage would be required at the water treatment plant. The finished water would be pumped through approximately 18,000 linear feet of 30-inch pipeline via a new pump station and terminate at a 4.5 MG storage reservoir located at the point of distribution in Round Valley. This option does not have a specific site designated for the location of the new water treatment facility. Property acquisition would be required to locate the water treatment facility and raw water storage.

Under Version B, water would be conveyed from near the upstream end of Rockport Reservoir through approximately 29,000 linear feet of 30-inch raw water pipeline to a 9.0 mgd (6,200 gpm) / 22.0 mgd (15,500 gpm) water treatment facility. Approximately 18,000 linear feet of 30-inch pipeline would be used to convey the finished water to a 4.5 MG terminal reservoir located at the point of distribution in Round Valley. A new raw water intake, similar to the diversion dam and Coanda screen discussed in Option 7, and a raw water pump station would both be required to pump the water from the reservoir to the water treatment plant. A finished water pump station would pump the treated water from the water treatment plant to the 4.5 MG terminal reservoir. Three million gallons in raw water storage would be required at the water treatment plant location. The general location of the treatment plant would be the same as proposed in Version A. Therefore, property acquisition would be required to locate the water treatment facility and raw water storage reservoir.

5.8.2 Hydrology

The 5,000 acre-feet per year of water to be imported by this Option consists of existing unsubscribed WBWCD water that has not yet been put to beneficial use. One-half of this supply (2,500 acre-feet per year) would come from Weber Basin Project supplies (a Bureau of Reclamation project) and the other half from Smith Morehouse Reservoir supplies (a WBWCD project). This water is available in the Weber River drainage. See Section 5.9.2 for a more detailed description of this water, and the need for a reservoir operation study.

5.8.3 Potential Impacts

An environmental evaluation of the Brown’s Canyon Option was completed on December 12, 2002, by MWH. The segment of pipeline from Wanship Dam to Rockport State Park, if contained within the Highway 32 right-of-way, and the segment parallel to the Weber River, if placed in the existing power line corridor, would not create any significant impacts to the environment. The segment along Brown’s Canyon Road could have some environmental impacts at three locations, two of which are crossings of unnamed drainages and the third where the road passes above a small reservoir. Where the pipeline leaves Brown’s Canyon Road, it would cross the Mountain Meadows area, which contains ephemeral drainages. This area would require wetland surveying. Also, since the water treatment plant does not have a specific site, a wetland survey and environmental analysis would be required once the final site location has been selected.

Implementation of this option would require permits and approvals from Summit County, UDOT for construction within the ROW, UDDW for plan and process approvals, UDWQ for storm water discharge permitting and water quality certification, and the Utah State Engineer for water rights and stream alternation, if necessary. In addition, an assessment of cultural resources would need to be conducted for the SHPO. Coordination with UDWLR and the US Fish and Wildlife Service would be required to ensure that ESA compliance occurs and fish and wildlife issues are addressed for the river diversion. Permitting by the COE would be required should any jurisdictional wetlands be impacted by the construction. Finally, Reclamation involvement in the project would require NEPA and Fish and Wildlife Coordination Act (FWCA) compliance. Approval from West Wanship Irrigation Company would be required for the intake modification.

5.8.4 Recommendations

This option is eliminated from further consideration, primarily because Mountain Regional Water Special Service District has already constructed the Lost Creek Canyon Pipeline, which currently is delivering 1,600 acre-feet per year, with the anticipation that it also be used to deliver the additional 5,000 acre-feet of WBWCD water. It was decided by the study team that constructing another pipeline to deliver water that could be delivered through the existing Lost Creek Canyon Pipeline could not be either environmentally or economically justified.

5.9 Lost Creek Canyon Pipeline (Option 7)

The Lost Creek Canyon Pipeline Option considers importation of water into the Snyderville Basin from the Weber River at the inlet to Rockport Reservoir. This option would utilize the existing Lost Creek Canyon Pipeline discussed in Chapter 4, adding a pump station and pipelines to deliver up to an additional 5,000 acre-feet per year from the Weber River, as well as additional new facilities required to convey water to the point of distribution to Park City and other water providers in the Basin. A detailed discussion of this concept follows. See Figure 5-8.

5.9.1 Option Description

This Option consists of intake and booster stations on the Weber River at the inlet to Rockport Reservoir, the existing pipeline through Lost Creek Canyon to the existing MRWSSD Signal Hill Water Treatment Plant site, an expanded or new water treatment plant, a 16-inch diameter, 13,000 feet pipeline and facilities necessary to convey water to Park City, and a 12-inch diameter, 16,500 feet pipeline to deliver water to other providers in the Basin. This option was analyzed for capacity increases to the existing 1,600 acre-feet per year of 2,500 acre-feet per year and 5,000 acre-feet per year.

Reclamation performed a study for a pump station that would pump water from the base of Wanship Dam or from the Weber River above Rockport Reservoir to the existing booster pump station that is part of the Lost Creek Canyon Pipeline Option discussed in Chapter 4 (Reclamation, 2004). WBWCD proposes to sell 2,500 acre-feet of water per year to both Park City and MRWSSD for a total of 5,000 acre-feet. In order to receive the full benefits of this sale, a pump station would need to be constructed either at the base of Wanship Dam or above Rockport Reservoir. The pump station would be designed for a maximum capacity of 9.0 mgd (6,200 gpm). Four intake options were evaluated in the Reclamation study. Due to costs, environmental impacts, and operation and maintenance considerations, Reclamation's Option 3 – River Large Option, was chosen as the best intake option to be incorporated into this analysis. This Option consists of a diversion dam with a Coanda screen inlet that would be constructed on the Weber River approximately 1,000 feet upstream of the reservoir inlet. Approximately 830 linear feet of 24-inch pipeline would divert water into the existing Lost Creek Canyon booster pump station on the south end of the reservoir. The maximum pumping head to convey the raw water from the river to the existing pump station is approximately 35 feet.

After the raw water is conveyed from the Weber River to the raw water booster pump station, the water would be pumped through the existing 24-inch Lost Creek Canyon raw water pipeline to the Signal Hill Water Treatment Plant, as discussed in Chapter 4. To provide the desired capacity of 9.0 mgd (6,200 gpm, 5,000 acre-feet annually), an upgrade to the existing booster pump station, the addition of 3 MG in raw water storage, a 3 mgd (2,080 gpm) expansion to the build-out capacity of 6 mgd of the existing water treatment plant, and a new 1.5 mgd (1,040 gpm) water treatment plant are incorporated into the alternative.

To provide water delivery to the points of distribution, a new 16-inch diameter, 13,000 feet pipeline would be required for delivery to Park City, and a 12-inch diameter, 16,500 feet pipeline for delivery to MRWSSD's existing 20-inch distribution main located in the Silver Creek Industrial Park. MRWSSD has interconnections with several water systems within the Basin through which water could be distributed basin wide.

The estimated costs per acre-foot for Option 7 increase as the capacity increases due to the relatively low capital cost, and operation and pumping costs being a higher proportion of total costs. The estimated costs for the various capacities are shown in Table 5-4. The first phase of this project that would allow initial delivery of water could be constructed for an estimated contract cost of $4,300,000. The components of phase one are listed in the Appendix. More detailed cost estimates are available in the Appendix.

TABLE 5-4
Lost Creek Canyon Pipeline Cost Summary

Capacity	Capital Cost (New Facilities)	Capital Cost (Existing & New)	Life Cycle Cost
2,500	$10,200,000	$20,100,000	$47,100,000
5,000	$25,500,000	$37,800,000	$84,400,000

5.9.2 Hydrology

The 5,000 acre-feet per year of water to be imported by this Option consists of existing unsubscribed WBWCD water that has not yet been put to beneficial use. One-half of this supply (2,500 acre-feet per year) would come from Weber Basin Project supplies (a Bureau of Reclamation project) and the other half from Smith Morehouse Reservoir supplies (a WBWCD project). This water is available in the Weber River drainage.

The Weber Basin Project supply would come from certificated Water Right No. 35-828(A27609). This right was approved for diversions of up to 60,000 acre-feet per year at Wanship Dam to be used for municipal purposes within the WBWCD service area. Of this total, 2,500 acre feet per year has been reserved and dedicated to this Option. This water would be available nearly every year because municipal water users are guaranteed a full supply of project water even when agricultural water users experience water shortages. In order to use this water for the Lost Creek Canyon Pipeline Option, a change application would need to be filed and approved by the State Engineer to add a new point of diversion at the proposed intake structure upstream from Rockport Reservoir.

The Smith Morehouse Reservoir storage rights include certificated Water Right Nos. 35-8733 (1,040 acre-feet), 35-832 (5,000 acre-feet), 35-5407 (1,860 acre-feet), and 35-5529 (450 acre feet) for a total storage right of 8,350 acre feet. WBWCD has title to all these water rights except Water Right No. 35-8733, which is owned by Smith Morehouse Reservoir Company. Therefore, WBWCD has a right to 7,310 acre-feet of storage water in the Smith Morehouse Reservoir. WBWCD has indicated that only about 300 acre-feet of this storage has been subscribed and that 2,500 acre-feet of the remaining unsubscribed water has been reserved for use in the Snyderville Basin. A change application would need to be filed and approved by the State Engineer to add a new point of diversion on the Weber River above Rockport Reservoir for this Smith Morehouse water.

A reservoir operation study, which is beyond the scope of this study, would more accurately determine the reliable yield from the two sources mentioned above. However, Reclamation believes that the proposed 5,000 acre-feet per year water supply is available for importation to the Snyderville Basin. Reclamation recommends, however, that a reservoir operation model study be completed prior to final design and construction, just as is recommended for Option 5 (see Section 5.7). See Table 5-5.

TABLE 5-5
Summary of Water Rights available for Importation Into the Lost Creek Canyon Pipeline

Water Right No.	Underlying Storage Right	Total Water Right (Acre-Feet)	Quantity Dedicated to Project (Acre-Feet)
35-828 (A27609)	Rockport Reservoir	60,000	2,500
35-832 (A27614)	Smith Morehouse Reservoir	5,000	
35-5407 (A35794a)	Smith Morehouse Reservoir	1,860	2,500
35-5529 (A35794b)	Smith Morehouse Reservoir	450	
Total			**5,000**

5.9.3 Potential Impacts

Each pumping option presented in the Wanship Pump Station and Pipeline Preliminary Design Project was reviewed for its environmental impact and the potential need for compliance with NEPA, the CWA, the ESA, the FWCA, NHPA, and other laws and regulations. If construction of the diversion structure and installation of the pipelines proposed in this alternative have Federal involvement, NEPA compliance would be required. In addition, construction activities that pose impacts to jurisdictional rivers and associated wetlands, such as the proposed diversion dam and Coanda screen, would require a Section 404, "Dredge and Fill Permit" from the COE, in accordance with the CWA. A diversion dam on the Weber River could adversely affect aquatic resources unless measures are taken to ensure fish passage and adequate water releases. Design of the diversion structure to include a fish passage could reduce or eliminate potential effects to fish and meet the requirements of the FWCA. The preliminary analysis of this option conducted by Reclamation for the ESA, concluded that Federally endangered or threatened species would not likely be affected by the proposed diversion. It was also concluded that no further need of cultural resource fieldwork would be required to meet the requirements of the SHPO for "No Effect to Historic Properties". It should be noted that the finished water facilities may require SHPO consultation as that was not conducted as part of the Reclamation study.

In addition to the permitting requirements on a Federal level, state and Summit County permits and approvals would be required for this alternative, UDOT for construction within the ROW, UDDW for plan and process approvals, UDWQ for storm water discharge permitting and water quality certification, and the Utah State Engineer for water rights and stream alternation, if necessary.

5.9.4 Recommendations

The study concludes that the Lost Creek Canyon Pipeline Option is a viable option and should be further considered in the evaluation and ranking process of the study.

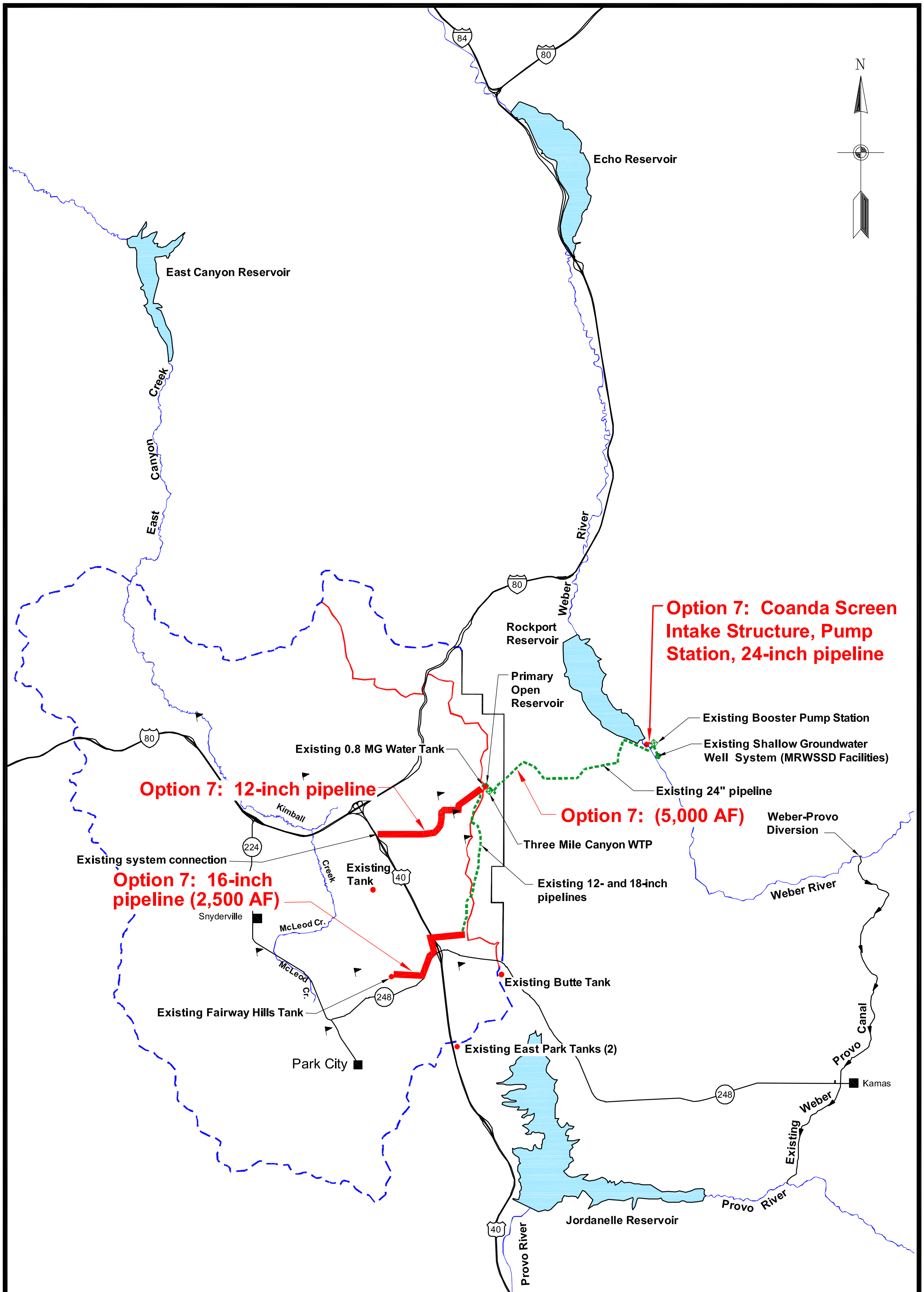


Figure 5-8
Option 7 Map
Park City and Snyderville Basin Water Supply Study Special Report

5.10 Weber River via Weber-Provo Canal (Option 8)

This option involves diverting 5,000 acre-feet per year of water from the Weber River through the Weber-Provo Canal to the Provo River, then through Jordanelle Reservoir, and JSSD facilities to Snyderville Basin.

5.10.1 Option Description

Under this concept, the imported water would be diverted through the Weber-Provo Canal on a space available basis, as determined by the Provo River Water User's Association (PRWUA) and the Bureau of Reclamation. The water would be withdrawn from Jordanelle Reservoir through JSSD facilities on an acre-foot per acre-foot basis as it enters the reservoir, ensuring that no storage takes place. Adequate real-time measurement would be required at the Weber-Provo Canal and at the JSSD intake structure to ensure accurate accounting of the imported water through the system. Flow measurement data and all equipment and facilities associated with this option would be made assessable to PRWUA, the Central Utah Water Conservancy District, and Reclamation for monitoring and inspection. New 16-inch pipelines would need to be constructed to deliver the 5,000 acre-feet per year to Park City and MRWSSD. A total of 28,000-feet of 16-inch pipeline would be required. Booster pumping of the delivered water would also be required. See Figure 5-9 for the approximate pipeline alignments.

The capital cost for the pipelines is estimated to be $7,200,000. The estimated life cycle cost including JSSD charges is $105,200,000. More detailed cost estimates are available in the Appendix.

5.10.2 Hydrology

The 5,000 acre-feet per year of water to be imported by this Option consists of existing unsubscribed WBWCD water that has not yet been put to beneficial use. One-half of this supply (2,500 acre-feet per year) would come from Weber Basin Project supplies (a Bureau of Reclamation project), and the other half from Smith Morehouse Reservoir supplies (a WBWCD project). This water is available in the Weber River drainage. See Section 5.9.2 for a more detailed description of this water, and the need for a reservoir operation study.

5.10.3 Potential Impacts

Since the facilities proposed in this option have not been studied in detail, permitting requirements and environmental impacts associated with it have not been defined. It is anticipated that the permitting and impacts associated with this alternative would be similar to, but more complex than, those identified in Option 7. Specifically, state and county permits and approvals would be required from Summit and Wasatch Counties, UDOT for construction within the ROW, UDDW for plan approval, and UDWQ for storm water discharge permitting and water quality certification, and the Utah State Engineer for water rights and stream alternation, if necessary. An assessment of cultural resources would need to be conducted for the SHPO. Coordination with UDWLR and the U.S. Fish and Wildlife Service, would be required to ensure that the ESA and fish and wildlife needs are satisfied. Permitting by the COE would be required should any jurisdictional wetlands be impacted by the alternative. Approval from the Provo River Water Users Association and Reclamation would be required to use the Weber-Provo Canal, as well as approval from Central Utah Water Conservancy District and Reclamation to utilize Jordanelle Reservoir. Finally, Federal involvement in the option and the reservoir intake would require NEPA compliance.

As with Option 4 above, any future use of water from the Provo River drainage would need to consider the effects to operation of the Provo River Project and in particular, any potential consequences for the endangered June sucker and the state sensitive species Columbia spotted frog. Also, any effects to the Wasatch County Water Efficiency Project, particularly the environmental commitments for that project as related primarily to return flows, would need to be reviewed.

5.10.4 Recommendations

The study concludes that Option 8 is a viable option and should be further considered in the evaluation and ranking process of the study.

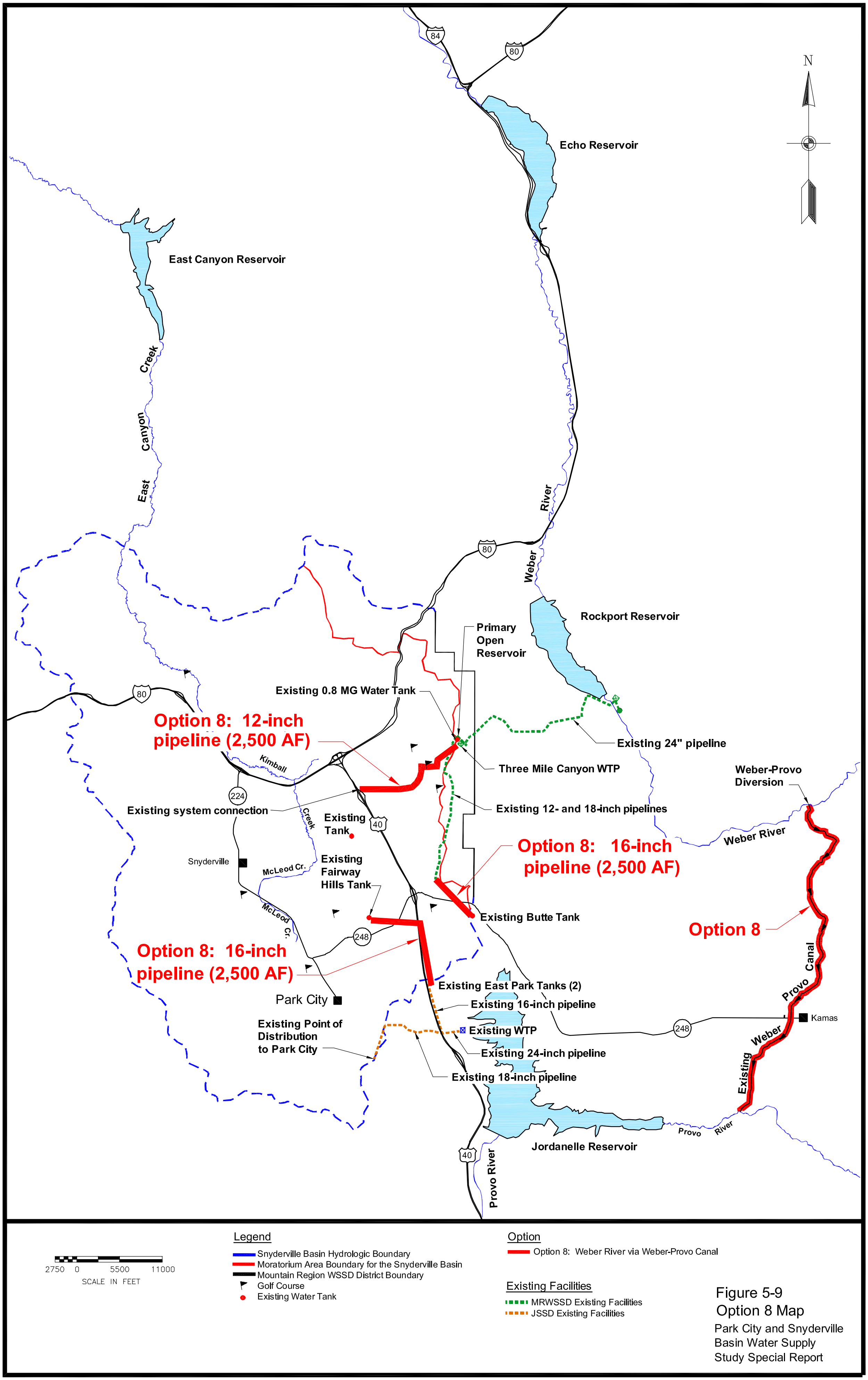


Figure 5-9
Option 8 Map
Park City and Snyderville Basin Water Supply Study Special Report

5.11 Lost Creek Canyon and Weber-Provo Canal (Option 9)

This Option is a combination of Options 7 and 8, wherein 2,500 acre-feet per year of the WBWCD water supply would be delivered through the Lost Creek Canyon Pipeline to the Promontory Development and 2,500 acre-feet per year would be delivered through the Weber-Provo Canal/Jordanelle Reservoir/JSSD to Park City (see Figure 5-10).

5.11.1 Option Description

Of the total 5,000 acre-feet per year developed by this Option, 2,500 acre-feet per year would be delivered to Park City. To make this delivery, a new 16-inch pipeline, 18,000 feet in length, would need to be constructed between the East Park Tank and Park City's existing water system. The pipeline would be constructed along the state and county right-of-ways.

Of the remaining 2,500 acre-feet per year, 1,200 acre-feet per year would be delivered to the Promontory Development and the remaining 1,300 acre-feet per year retained by MRWSSD for future growth. To provide the water delivery to Promontory Development, a new 12-inch pipeline would be required for connection to MRWSSD's existing 20-inch distribution main located in the Silver Creek Industrial Park. The water intake costs for the diversion and intake on the Weber River covered in Option 7 are also included in Option 9.

The capital costs for Option 9 are estimated to be $4,200,000 for the pipeline between JSSD and Park City, and $10,200,000 to improve the Lost Creek Canyon facilities (see Option 7 and 9 Capital Costs table in the Appendix). This is a total new capital cost of $14,400,000. The estimated life cycle cost including JSSD charges is $98,600,000 ($53,400,000 for the JSSD to Park City pipeline and $45,200,000 for the Lost Creek Canyon pipeline improvement). More detailed cost estimates are available in the Appendix.

5.11.2 Hydrology

The 5,000 acre-feet per year of water to be imported by this Option consists of existing unsubscribed WBWCD water that has not yet been put to beneficial use. One-half of this supply (2,500 acre-feet per year) would come from Weber Basin Project supplies (a Bureau of Reclamation project) and the other half from Smith Morehouse Reservoir supplies (a WBWCD project). This water is available in the Weber River drainage. See Section 5.9.2 for a more detailed description of this water, and the need for a reservoir operation study.

5.11.3 Potential Impacts

The potential effects for Options 7 and 8, as described above in Sections 5.9.3 and 5.10.3, would apply to this alternative.

5.11.4 Recommendations

The study concludes that Option 9 is a viable option and should be further considered in the evaluation and ranking process of the study.

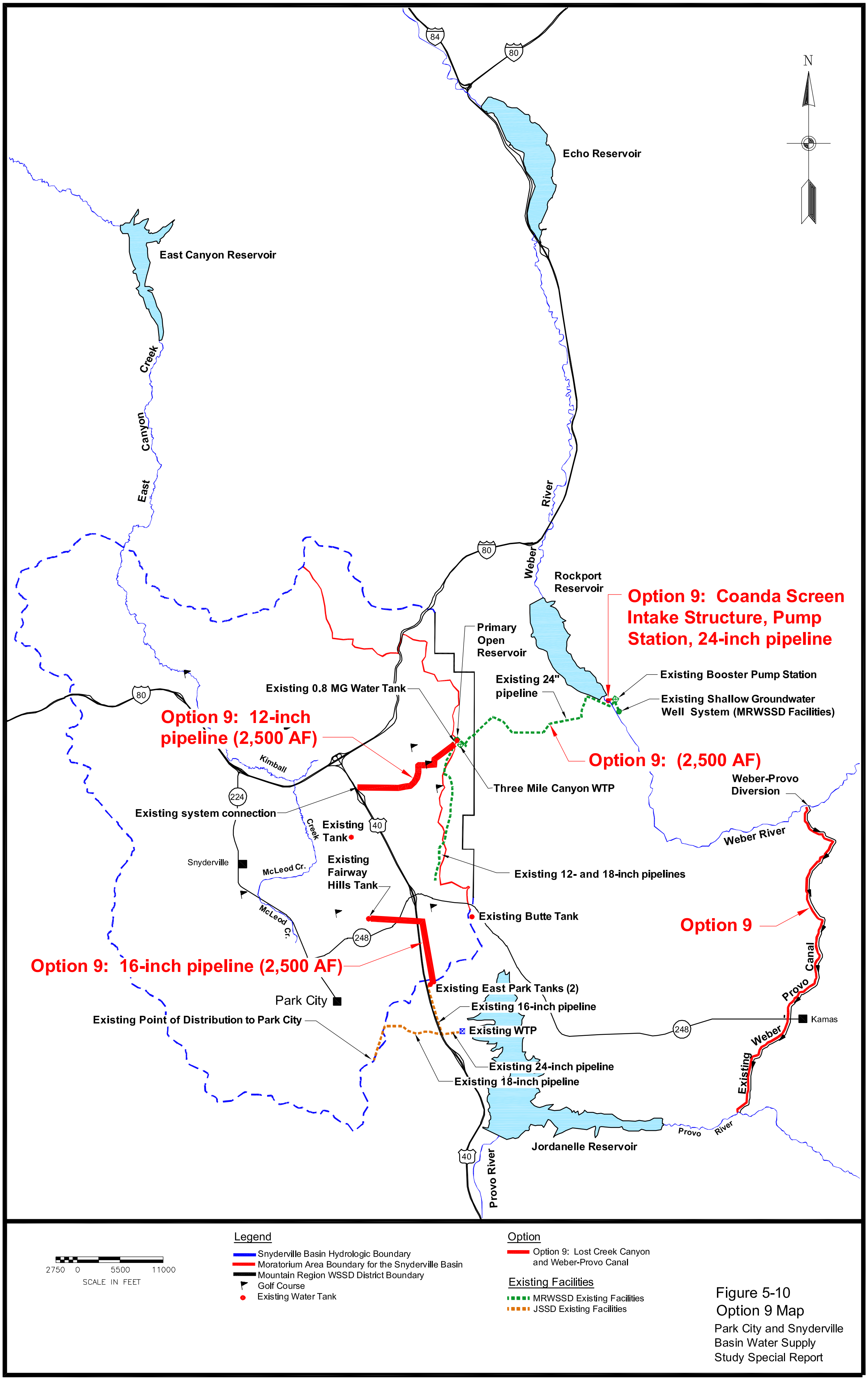


Figure 5-10
Option 9 Map
Park City and Snyderville Basin Water Supply Study Special Report

5.12 Future Development Options Summary

The six Options considered viable for development are shown in Table 5-6. These six include: Option 3 - **Water Reuse**, Option 4 - **Provo River - JSSD** (Importation), Option 5 - **East Canyon Pipeline** (Importation), Option 7 - **Lost Creek Canyon Pipeline** (Weber River Importation), Option 8 - **Weber River via Weber-Provo Canal** (Importation), and Option 9 - **Lost Creek Canyon and Weber-Provo Canal** (Importation).

Table 5-6
Summary of Needs and Development Options
Units: Acre-Feet per Year

Existing and Projected Needs	2001	2030	2050
Population	23,900	64,300	86,300
Calculated M&I Demand	**9,800**	**25,300**	**32,000**
Water conservation	0	(2,300)	(5,000)
Adjusted M&I Demand	**9,800**	**23,000**	**27,000**
Minimum in-stream flow and wastewater dilution req.	0	1,100	1,600
Mine tunnel concerns – mine collapse, water quality	0	2,000	2,000
Projected M&I Demand	**9,800**	**26,100**	**30,600**
Estimated Current Production Capacity	**14,000**	**14,000**	**14,000**
Lost Creek Canyon Project	na	1,600	1,600
Jordanelle Special Service District imports	na	1,000	1,000
Increased groundwater development	na	200	300
Future agricultural conversions (Status report: 450-900)	na	400	500
Surplus/Redundancy	(4,200)	(6,500)	(7,500)
Projected Reliable Supply	**9,800**	**10,700**	**9,900**
Projected M&I Needs (Future Development)	**0**	**15,400**	**20,700**
Development Options			
1 – Additional In-Basin Surface Water Storage	0	0	0
2 – Conjunctive Management of Surface & Groundwater	0	0	0
3 – Water Reuse	**0**	**2,000**	**3,600**
4 – Provo River – JSSD	**0**	**500**	**500**
5 – East Canyon Pipeline	**0**	***12,500**	***12,500**
6 – Brown's Canyon Pipeline			
7 – Lost Creek Canyon Pipeline	**0**	*****5,000***	*****5,000***
8 – Weber River via Weber-Provo Canal	**0**	*****5,000***	*****5,000***
9 – Lost Creek Canyon and Weber-Provo Canal	**0**	*****5,000***	*****5,000***

* Additional approvals and potential acquisitions may be needed to yield the full 12,500 acre-feet supply.
** These options are dependent upon the same 5,000 acre-feet water supply – hence only one of the three can be developed.

Chapter 6 – Evaluation and Preferred Plan

As noted in previous sections of this report, nine options were identified as potential development projects to help meet future water needs in Park City and Snyderville Basin. Each of the nine was studied in detail to determine viability. Results of this analysis are presented in Chapter 5.

Of the nine Options originally identified, six were considered viable for further evaluation and ranking. The Options eliminated include: Additional Surface Water Storage (Option 1), Conjunctive Management of Surface and Groundwater (Option 2), and Weber River Importation via Brown's Canyon (Option 6).

The Options considered viable for further evaluation include: Option 3 - **Water Reuse**, Option 4 - **Provo River - JSSD** (Importation), Option 5 - **East Canyon Pipeline** (Importation), Option 7 - **Lost Creek Canyon Pipeline** (Weber River Importation), Option 8 - **Weber River via Weber-Provo Canal** (Importation), and Option 9 - **Lost Creek Canyon and Weber-Provo Canal** (Importation). This chapter identifies evaluation criteria and procedures used in evaluating and rating the remaining six options. It also explains the rationale used in formulating the preferred plan.

6.1 Evaluation Criteria

Option evaluation criteria were used by Reclamation to evaluate the six viable options identified in Chapter 5. The evaluation criteria were developed by Reclamation with input from stakeholders and the public. These criteria include economic, environmental, social, institutional, and system reliability.

6.2 Option Evaluation

Available data associated with the evaluation criteria was gathered by Reclamation and other contributors to the study. This data was organized and used in evaluating the options. The study team divided the evaluation into two separate parts: Economic Factors Evaluation, and Non-Economic Factors Evaluation.

6.2.1 Economic Factors Evaluation

Economic factors are based on capital costs and present-value life cycle costs (some of which have already been discussed in Chapter 5). The capital costs are the estimated costs to construct the facilities. The purpose of evaluating the capital costs is to determine the magnitude of funding required to construct a given Option.

Life cycle costs represent the total discounted present value of capital costs (deferred construction costs discounted to present value), operation, maintenance and replacement costs (OM&R), and the cost of water. The cost per acre-foot delivered is calculated by dividing the life cycle cost by the projected total quantity of water delivered over the 50-year life of the project. Results of the economic factors evaluation are shown in Table 6-1. A more detailed description of costs is included in the Appendix.

Table 6-1 shows two costs for Option 5 – East Canyon Pipeline. The first cost is based upon a capacity and water supply of 8,750 acre feet per year, and the second cost is based upon a capacity and water supply of 12,500 acre-feet per year. The purpose for showing both versions of Option 5 is to identify a cost range for the option. If the full 12,500 acre-feet water supply is developed, as discussed in Section 5.7.2, costs would be as shown for the 12,500 acre-feet option.

TABLE 6-1
Economic Factors Evaluation Summary

Economic Factors	Option 3	Option 4	Option 5[1]	Option 7[1]	Option 8	Option 9
Capital Costs (new) [2] (Units 1,000)	$19,100	$2,700	$53,700 - $67,300	$25,500	$7,200	$14,400
Capital Costs (total) (Units: 1,000)	$19,850	$2,700	$69,300 - $82,900	$37,800	$7,200	$24,300
Capital Costs per acre-foot capacity[3]	$5,510	$5,400	$7,920 - $6,630	$7,560	$1,440	$2,880
Present Annual O&M Costs per acre-foot at full Capacity[4]	n/a	n/a	$470 - $447	$455	n/a	n/a
Life Cycle Costs per acre-foot delivered	$179	$744	$418 - $376	$369	$460	$426

[1] Option 5 costs are shown as a range, consistent with a capacity between 8,750 acre-feet per year and 12,500 acre feet per year, as explained in Sections 5.7.2 and 6.3.2. Also, costs for Options 5 and 7 are based on cost estimate Method 3 (see Table 6-3).
[2] Capital costs of new facilities only
[3] Based on capital costs (total) rather than capital costs (new).
[4] Includes O&M, treatment and cost of water.

6.2.2 Non-Economic Factors Evaluation

The non-economic factors category includes the environmental, social, institutional, and system reliability factors. The study team applied these non-economic criteria to each of the options. The following basic assumptions were made to make the comparisons between options more logical and directly comparable:

1. Each option was evaluated on a per acre-foot basis generally, rather than for the total water supply.

2. In the future all the existing reservoir water rights will be fully used to meet the growing water demands. Consequently, the reservoirs will experience the same draw down whether the water is imported into the Snyderville Basin or used down stream.

3. All import water, regardless of which option, would be delivered to the same specific area (such as a specific subdivision), and would consequently result in the same impacts (per acre-foot supplied) on return flows, instream flows, and water quality. (They would have essentially the same return flow volume and quality since the wastewater would be treated to the same level, and meet applicable water quality standards.)

Potential impacts (both positive and negative) were identified during the initial evaluation, however none were considered sufficiently significant to prevent or limit development of any of the six Options. A discussion of some of the more significant non-economic factors which have the greatest potential for differing impacts among the options is presented below.

6.2.2.1 Environmental – Environmental factors considered include: environmental compliance, cultural resources, visual resources, fish and wildlife, threatened and endangered species, water quality, and instream flows. Environmental compliance and water quality were identified as the two environmental factors with the most potential for differing impacts among the options. The study team found no significant differences among the six Options for the other environmental factors. Consequently, they are not discussed in the following paragraphs.

Environmental Compliance. Any of the six options would require National Environmental Protection Act (NEPA) compliance prior to construction, assuming that all would involve some type of Federal action. NEPA requires analysis and documentation of potential impacts to the human environment, and also requires consideration of alternatives to a proposed action. Public notification of the proposed action, and the opportunity for public involvement in the decision making process are required to varying degrees, depending on the type of documentation required. If an action is minor or routine in nature, and defined as such within an agency's NEPA regulations, it may be categorically excluded from NEPA analysis and documentation. If not categorically excluded, then an action must be analyzed in an Environmental Assessment or an Environmental Impact Statement. Based on available information, it is anticipated that any of the viable options which are selected as preferred options would require at least the preparation of an Environmental Assessment to determine whether there would be significant impacts to the human environment. If no significant impacts to the human environment are found, a Finding of No Significant Impact could be issued at the conclusion of the Environmental Assessment preparation and review process (which includes opportunity for public comment on the draft Environmental Assessment). If significant impacts were found, the preparation of an Environmental Impact Statement would be required. Compliance with NEPA would normally take about one year for the completion of an Environmental Assessment and Finding of No Significant Impact, and two to four years for the completion of an Environmental Impact Statement and Record of Decision.

Compliance with other environmental and cultural resource laws, including the Clean Water Act (CWA), the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, the National Historic Preservation Act (NHPA) and others, would also be needed and would occur concurrent with the NEPA process.

Based upon existing information presented in Chapter 5, including preliminary analyses by Reclamation staff, there does not appear to be significant environmental or cultural resource obstacles that would prevent implementation of any of the six options. There would, however, be differences in the complexity of the analysis and documentation, and therefore the time required to complete them, depending on the level of impact, and controversy associated with development.

Without a more detailed analysis, which would be performed during a formal NEPA process prior to construction, Reclamation anticipates that environmental compliance to meet NEPA, CWA, ESA, and NHPA, would be more difficult for the East Canyon Pipeline Option than for the Lost Creek Canyon Pipeline Option. This conclusion acknowledges the level of environmental analysis completed to date for both projects. This determination is premised on the facts that the majority of Option 7 alignment has already been disturbed (construction of the existing pipeline), there appears to be greater local opposition to Option 5 than Option 7 creating greater controversy, permitting appears to be more challenging for Option 5 than for Option 7, and the size difference of the projects (longer and larger pipeline transporting more water, therefore perceived greater impacts) would require longer time to identify and analyze potential impacts.

Water Quality.   Water quality is an issue in East Canyon Reservoir, Echo Reservoir, East Canyon Creek, and Silver Creek. The State of Utah Department of Environmental Quality has determined that each of the four streams and reservoirs need a Total Maximum Daily Load (TMDL) Analysis. TMDL Projects and Reports have been completed for East Canyon Reservoir, East Canyon Creek, and Silver Creek. A TMDL Analysis is under way for Echo Reservoir. The parameters of concern for East Canyon Reservoir, East Canyon Creek, and Echo Reservoir, are total phosphorus and dissolved oxygen. The parameters of concern for Silver Creek are Cadmium and Zinc. The completed reports can be found on the State of Utah's Web site.

Since it was identified as a potential problem in the late 1990's, significant progress has been made in the Park City/Synderville area to reduce phosphorus loading into East Canyon Creek and East Canyon Reservoir. Since the geologic formations in the area are rich in phosphorus (Phosphoria Formation), erosion control with future development is a major issue. It is generally understood that further phosphorus reductions will have to be implemented in the East Canyon Creek watershed, and possibly Silver Creek watershed, to improve water quality in East Canyon Reservoir and Echo Reservoir, and to offset any new phosphorus loading from future development.

There do not appear to be significant water quality differences within the Snyderville Basin for any of the six options. This conclusion is based on the assumptions that, (1) the water, whether from East Canyon Reservoir or Rockport Reservoir area, would be delivered to the same location (subdivision, city, etc.) which would result in the return flows being the same (per acre foot delivered) to East Canyon Creek or Silver Creek, regardless of where the water comes from, and (2) that the water, regardless of where it comes from, would be treated to the same standard. The treatment costs for the culinary water supply, as well as for the treated wastewater effluent, would be approximately the same for either the East Canyon Reservoir water supply or the Rockport Reservoir area supply.

Therefore, based on these assumptions, all import options would have similar water quality impacts on East Canyon Creek, East Canyon Reservoir, Silver Creek, and Echo Reservoir. For purposes of this study, all options are rated equal with regard to water quality.

6.2.2.2 Social – Social factors considered include private land, conservation easements, public acceptability, recreation, environmental justice, and Indian trust assets. Potentially significant social impact differences among the options include impacts on private lands and impacts within established conservation easements. The study team found no significant differences among the six Options for the other social factors, and has not discussed them in this section.

Private Land. As discussed in Chapter 5, Option 5 would require more land use permits and right-of-way easements across private lands, than would any of the other options. Option 7 would have the least impact, followed by Options 4, 8, 9 and 5. This ranking is based primarily on the length of private land right-of-way needed and the difficulty with which it can be acquired. East Canyon Resort has expressed strong opposition to Option 5's proposed alignment across their property.

Conservation Easements. Recently a 7,200 acre Ranch (Clayton Macfarlane Company) sold a conservation easement that covers a portion of the county road along East Canyon Creek in Summit and Morgan counties. Right-of-way along this road for the East Canyon Pipeline (Option 5), which is within the conservation easement, would have to be negotiated**.** The State Division of Forestry, Fire and State Lands (owner of the easement) has indicated this could probably be accomplished, but would likely take additional time for negotiation and legal work.

6.2.2.3 Institutional – Institutional factors considered include funding capability, ability to meet time constraints, water rights and agreements, hydrologic efficiency, compatibility with growth needs in other areas, and development risk. Potentially significant institutional impact differences among the options include: funding capability, ability to meet time constraints, and water rights and agreements. The study team found no significant differences among the six Options for the other institutional factors, and has not discussed them in this section.

Funding Capability – Several factors influence capability and timing of funding - size of the project, government vs. private, Federal vs. local Government, etc. Since the method of funding has not yet been determined, all are considered equal with regard to the ability to get the funds in a timely manner. However, looking at size alone when considering the ability to add the next increment of water, it is easier to fund and implement a smaller less expensive project than a larger one. Therefore the options are ranked in order of their total capital cost.

Ability to Meet Time Constraints – Permitting and meeting time constraints would be a challenge for any of the options. All options must get appropriate local, state, and Federal approvals and permits. Options 8 and 9 would also require agreements with Reclamation and water entities in the Provo River Drainage to allow transport of water into the Provo River drainage and through Federal water facilities (Provo Reservoir Canal and Jordanelle Reservoir).

Summit County permits for constructing Option 5 have been obtained, but others with Morgan County or other agencies have not been obtained or have expired. Option 7 would also require additional permits. It is anticipated that obtaining the needed permits to construct Options 8 or 9 would be the most difficult, with Option 5 being next most difficult due primarily to the size of the project and controversy involved, followed by Option 7.

Water Rights and Agreements - Water rights for Option 3 still need to be approved by the State Engineer's Office, although approval would seem likely. Option 4 would require an agreement with the Jordanelle Special Service District, which should not be a major obstacle.

Options 7, 8 and 9 all depend on the same 5,000 acre-feet per year water supply provided by WBWCD at Rockport Reservoir. A change in point of diversion for this right would need to be filed and approved by the State Engineer, although approval would seem likely. This water supply consists of existing unsubscribed WBWCD water that has not yet been put to beneficial use. An agreement was executed on November 18, 1996, (and re-negotiated in May 2004) between WBWCD, Park City, and MRWSSD, making this water available from WBWCD's sources for distribution within the service areas of Park City and MRWSSD.

The water supply for Option 5 has several potential concerns, as identified in Chapter 5, Section 5.7.2. These issues include obtaining necessary water right approvals by the State Engineer and executing the necessary water supply contracts with D&WCCC. It is presumed that these issues would be resolved before proceeding with development of the East Canyon Pipeline Option. The study team concludes that securing the necessary water rights and agreements to proceed with Option 5 could be more difficult and time consuming than for any of the other options.

Summary - Based on the information presented in the preceding paragraphs of this section, Reclamation concludes that Option 7 has a greater likelihood of meeting the critical time constraints imposed by the rapid growth of the area than any of the other options, followed by Option 5, then Options 8 and 9.

6.2.2.4 System Reliability - System reliability is rated based on facility integrity and system redundancy. All six projects are rated equal on facility integrity and reliability, as all are anticipated to be designed and constructed to the same standard. System redundancy would be enhanced by constructing multiple sources of water to meet needs, as opposed to only one source or pipeline.

6.3 Selection of Preferred Plan

The six options that were determined viable in Chapter 5, and therefore included in the evaluation process, are shown in Table 6-2. This section explains the process and rationale used in selecting the preferred plan from among these six Options.

TABLE 6-2
Development Options Summary
Units: Acre-Feet per Year Capacity

Development Options	2001	2030	2050
In-Basin Development			
3 – Water Reuse	0	2,000	3,600
Importation			
4 – Provo River – JSSD	0	500	500
5 – East Canyon Pipeline	0	12,500[1]	12,500[1]
7 – Lost Creek Canyon Pipeline	0	*5,000*[2]	*5,000*[2]
8 – Weber River via Weber Provo Canal	0	*5,000*[2]	*5,000*[2]
9 – Lost Creek Canyon and Weber Provo Canal	0	*5,000*[2]	*5,000*[2]
Total Potential Development	**0**	**20,000**	**21,600**

[1] Additional water right approvals and potential acquisitions may be needed to yield the full supply.
[2] These options are dependent upon the same 5,000 acre-feet water supply – hence only one of the three can be developed.

6.3.1 Preferred Options

Of the six viable Options, only Options 5 and 7 are selected to be included in the preferred plan (refer to relative costs in Table 6-1, and the non-economic factors). Both are needed to meet the projected water needs of Park City and Snyderville Basin. Option 3 is not included because it is an in-Basin Option that, due to its economic attractiveness, would likely be developed by local entities. The associated Option 3 development potential of 2,000 acre-feet per year in 2030 and 3,600 acre-feet per year in 2050 is assumed to be developed, and therefore subtracted from the projected Basin demand that would otherwise need to be developed, similar to subtracting the estimated quantities of groundwater and agricultural conversion water as explained in Chapter 5. Options 8 and 9 are eliminated because Option 7 is the highest ranking of the three and therefore becomes the preferred method for importing WBWCD water from the Rockport Reservoir area to the Snyderville Basin. Option 4 is eliminated because of high cost relative to the other options.

As the options have now been narrowed to two, a more detailed comparison of the two was conducted in order to rank the options and make recommendations with regard to construction priority. This comparative evaluation considered factors in both evaluation categories – economic and non-economic.

6.3.2 Economic Comparisons

Four different cost estimates shown in Table 6-3, were prepared for Option 5, the East Canyon Pipeline Option, and for Option 7, the Lost Creek Canyon Pipeline Option. Costs are for comparative purposes only and include similar unit-costs and assumptions. Cost estimate "Method 1" includes all costs necessary to complete each independent Option. This method ignores "sunk" costs for facilities already constructed. Method 2 includes costs for all facilities (new and existing) as if none have been constructed. Method 3 includes costs for all facilities by adding actual sunk costs for existing facilities to Method 1's estimated costs for new facilities.

Method 4 is the same as Method 1's estimated costs for new facilities, which includes 10 percent for unlisted items, but does not include 20 percent for contingencies or 12 percent for engineering, design, and construction oversight. It represents a "contract" cost only. Table 6-3 shows the estimated costs of each Option for the four methods. A more detailed presentation of the cost estimates is included in the Appendix.

Table 6-3 shows costs for Option 5 – East Canyon Pipeline (8,750 acre-feet per year capacity and water supply), Option 5 – East Canyon Pipeline (12,500 acre-feet per year capacity and water supply), and Option 7 – Lost Creek Canyon Pipeline (5,000 acre-feet per year additional capacity and water supply). As explained above for Table 6-1, the purpose for showing both versions of Option 5 is to identify a cost range for two stages for the option.

TABLE 6-3
Option Cost Estimate Summary by Method

Options	Method 1[1] New Facilities Only	Method 2[2] All Facilities (USBR)	Method 3[3] All Facilities (Includes Sunk Costs)	Method 4[4] (New Facilities Contract Cost Only)
Option 5 - East Canyon Pipeline (8,750 AF capacity and water supply)				
Capital Costs				
Capital Cost (Units: 1,000)	$53,700	$76,000	$69,300	$39,900
Capital Cost per AF Capacity	$6,140	$8,690	$7,920	$4,560
Option 5 - East Canyon Pipeline (12,500 AF capacity and water supply)				
Capital Costs				
Capital Cost (Units: 1,000)	$67,300	$89,600	$82,900	$51,400
Capital Cost per AF Capacity	$5,380	$7,170	$6,630	$4,110
Option 7 - Lost Creek Canyon Pipeline (5,000 AF capacity and water supply)				
Capital Costs				
Capital Cost (Units: 1,000)	$25,500	$40,300	$37,800	$19,000
Capital Cost per AF Capacity	$5,100	$8,060	$7,560	$3,800

[1] Method 1 – Costs for new facilities only. Cost of existing facilities excluded (no sunk costs). Costs include 10% for unlisted contract items, 20% for contingencies, and 12% for engineering, design, and construction oversight.
[2] Method 2 – Cost of all facilities (new and existing) as if none have been constructed. Costs include 10% for unlisted items, 20% for contingencies, and 12% for engineering, design, and construction oversight.
[3] Method 3 – Cost of all facilities (new and existing). Existing facility sunk costs are added to cost of new facilities. Costs include 10% for unlisted items, 20% for contingencies, and 12% for engineering, design, and construction oversight.
[4] Method 4 – Method 1 (new facilities only) - contract of "field" costs only – which includes 10% for unlisted items but does not include 20% for contingencies, or 12% for engineering, design, and construction oversight.

As shown in Table 6-3, the capital cost for Option 7 is much lower than the capital cost for Option 5. Also, Option 7 capital cost per acre-foot capacity for Methods 1 and 4 is less than costs for Option 5. However, Option 7 capital cost per acre-foot capacity for Methods 2 and 3 is inside the range of costs for Option 5. Cost per acre-foot differences between the two options are considered to be within the margin of error of the analysis, and therefore, do not indicate a conclusive preference of one over the other.

6.3.3 Non-Economic Comparisons

As mentioned in Section 6.2.2, no potential impact has been identified that would prevent or limit development of either Option 5 or Option 7. However, some could have significant impact on the timing of development.

Park City and other areas within the Snyderville Basin have an immediate need for additional water supplies, making timing of permanent water deliveries critically important. The available supplies are already behind the projected demand curve (Figures 4.1 and 6.1). Based on the information presented in Chapter 5 and the analysis presented in Section 6.2.2, the non-economic factors comparison ranks Option 7 ahead of Option 5, primarily due to the potential impacts of timing.

6.3.4 Preferred Plan

As stated above, the preferred plan includes both the Lost Creek Canyon Pipeline Option (Option 7) and the East Canyon Pipeline Option (Option 5), as both are needed to meet future water needs in the Park City and Snyderville Basin area. Furthermore, the study team sees benefits of having two future water sources in the basin, as opposed to only one. With both projects operational, fewer interconnects are needed, and greater overall system reliability can be maintained during emergency situations (more than one source and one pipeline). The preferred plan, therefore, calls for development of both Options. The Lost Creek Canyon Pipeline (Option 7) is ranked higher in priority than the East Canyon Pipeline (Option 5) and should be implemented first for the following reasons:

- A primary reason for the congressional legislation was to find a permanent solution to Park City's immediate and critical need for 2,500 acre feet of water per year. Option 7 is the least costly, would require only 2½ miles of additional pipeline, and would require the shortest time to implement for Park City's need.
- Option 7 is a smaller project and has a lower new facility project capital cost, i.e. $25,500,000 instead of $67,300,000, which makes obtaining funding easier and faster.
- Option 7 can be implemented in less time and with less risk.
- Option 7 has fewer easements, water rights, and land use permit issues to resolve.
- Option 7 has water delivery agreements in place.
- A majority of the infrastructure for Option 7 is already constructed.
- Environmental compliance is expected to take less time because Option 7 is a smaller project with fewer expected adverse impacts.
- Option 7 has a lower capital contract cost per acre-foot capacity, although both projects are relatively close and are considered within the margin of error of the cost estimates.

The East Canyon Pipeline Option, however, is also needed and should move forward immediately and as expeditiously as possible to meet the future, rapidly growing, water needs in other areas of the Snyderville Basin.

Table 6-4 shows the priority ranking and the quantities of water recommended for development under each option.

TABLE 6-4
Preferred Plan
Development Option Priority and Needs
Units: Acre-Feet per Year

		2030	2050
Priority	**Development Option**		
1	Option 7 - Lost Creek Canyon Pipeline	5,000	5,000
2	Option 5 - East Canyon Pipeline	8,400	12,100
	Total Developed	**13,400**	**17,100**

6.4 Summary and Recommendations

Both the Lost Creek Canyon Pipeline and the East Canyon Pipeline Options are needed to meet the Basin's long-term needs through the year 2050. There are no major environmental or other significant adverse impacts for either option which would preclude their eventual development.

Reclamation recognizes that Park City and the other areas within the Snyderville Basin have an immediate need for permanent water supplies, making timing of water deliveries critically important. The available supplies are already behind the projected demand curve (Figures 4.1 and 6.1). Park City, MRWSSC and WBWCD have an agreement in place for delivering 5,000 acre-feet per year, of which 2,500 acre-feet per year is required by Park City. MRWSSD currently has excess capacity in the existing Lost Creek Canyon Pipeline, which could, with relatively low cost, be used to deliver a portion of this contracted water to Park City prior to the construction of Option 7. This study concludes that the Lost Creek Canyon Pipeline Option can provide a permanent supply of imported water to Park City more quickly, at a lower capital cost, and with less risk, than can the East Canyon Pipeline Option. Reclamation, therefore, recommends that the Lost Creek Canyon Pipeline Option be implemented first to meet the immediate Park City need, and a portion of the future needs of the Snyderville Basin area. Reclamation recommends that final design and construction of the Lost Creek Canyon Pipeline Option begin immediately.

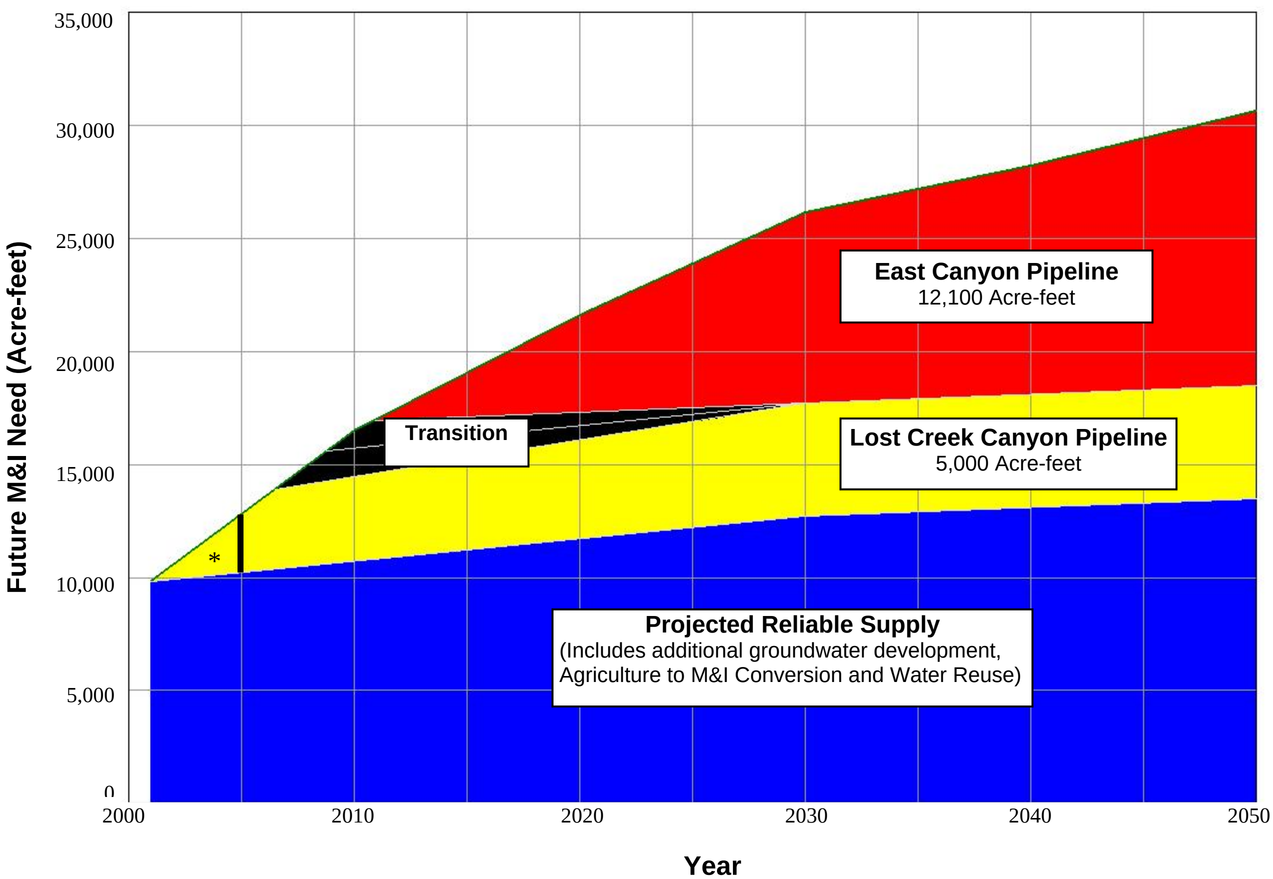
Reclamation acknowledges the continuing rapid growth within the Snyderville Basin and the need for additional water supplies beyond that provided by the Lost Creek Canyon Pipeline Option. The East Canyon Pipeline Option should be constructed while the water rights are available and committed for use in the Snyderville Basin. Since the East Canyon Pipeline Option is determined to be a viable project and is critically needed to meet future demands, Reclamation recommends that efforts begin immediately to move the East Canyon Pipeline Option forward in order to ensure that the necessary water rights, land use permits, water supply agreements, environmental clearances, and funding, are in place to allow timely design and construction of this Option.

Reclamation further recommends that Park City, Summit County, MRWSSD, SWDC, WBWCD, and other stakeholders cooperate together with water development in the Snyderville Basin. The next step should be a coordinated effort to develop a Master Plan for the Snyderville Basin, including all water suppliers and local government entities in the Basin. As both the Lost Creek Canyon and the East Canyon Pipeline projects are needed, good communication and cooperation are essential in developing the plans and infrastructure needed to maximize benefits to the residents of Park City and Snyderville Basin. Reclamation therefore recommends that efforts be conscientiously implemented to build relationships of cooperation and understanding among all stakeholder entities. Improved cooperation will greatly enhance the ability to meet the future water needs of the Snyderville Basin.

Figure 6-1 shows a recommended timeline for implementing the preferred plan. As shown, the Lost Creek Canyon Pipeline Option would meet M&I needs in the immediate and near future with the East Canyon Pipeline Option meeting later needs. The figure also shows a “transition” or “over-lap” period where both projects would meet growth needs in the basin at the same time. This would likely occur as the Lost Creek Canyon Pipeline Option water is near full utilization and the East Canyon Pipeline Option has been constructed and is operational. Factors which could govern the size of the over-lap would include how quickly the East Canyon Pipeline Option can be constructed, the location of need within the Basin, and which water supply is the most marketable in terms of cost of water, proximity to growth areas, customer service, etc.

Table 6-5 is a study summary which shows existing and projected needs, current water supply, and the preferred plan for meeting those projected needs.

Figure 6-1
Preferred Plan Implementation



*Area to the left of the vertical line (2005) indicates M&I demands in excess of projected reliable supply. In order to meet the M&I demands, reserve capacity is being used.

TABLE 6-5
Study Summary
Units: Acre-Feet per Year

Existing and Projected Needs	2001	2030	2050
Population	23,900	64,300	86,300
Calculated M&I Demand	**9,800**	**25,300**	**32,000**
Water conservation	0	(2,300)	(5,000)
Adjusted M&I Demand	**9,800**	**23,000**	**27,000**
Min instream flow and wastewater dilution requirement	0	1,100	1,600
Mine tunnel concerns – mine collapse, water quality	0	2,000	2,000
Projected M&I Demand	**9,800**	**26,100**	**30,600**
Estimated Current Production Capacity	**14,000**	**14,000**	**14,000**
Lost Creek Canyon Project	na	1,600	1,600
Jordanelle Special Service District imports	na	1,000	1,000
Increased groundwater development	na	200	300
Future agricultural conversions	na	400	500
Reserve Capacity	(4,200)	(6,500)	(7,500)
Projected Reliable Supply	**9,800**	**10,700**	**9,900**
Projected Future M&I Needs (Future Development)	**0**	**15,400**	**20,700**
Future Water Reuse (Developed by Others)	0	2,000	3,600
Projected Additional M&I Needs (Preferred Plan)	**0**	**13,400**	**17,100**
Preferred Plan			
Lost Creek Canyon Pipeline	--	5,000	5,000
East Canyon Pipeline	--	8,400	12,100
Total Future Development	**--**	**13,400**	**17,100**

References

1. Browns Canyon Water Supply Evaluation, Mountain Regional Water Special Service District and Weber Basin Water Conservancy District, MWH, November 2000.

   The objective of the Browns Canyon Water Supply Evaluation is to develop a cost estimate to deliver water from the Weber River drainage to eastern and western Summit County. The remainder of this technical memorandum presents a brief history on the Browns Canyon Water Supply Project, a cursory review of the future water supply needs as they relate to the Browns Canyon Water Supply Project, an overview of proposed facilities, and the economic analysis completed for the proposed facilities.

2. Draft Long Range Strategic Water Plan, Mountain Regional Water Special Service District, May 14, 2000.

   This Long Range Strategic Water Plan is presented as a comprehensive water planning and implementation tool for Mountain Regional Water Special Service District of Summit County. This plan outlines the goals, objectives, policies, strategies, and values necessary to accomplish responsive and dynamic long-range water planning for Summit County.

3. East Canyon Pipeline Project – Storm Water Pollution Prevention Plan, Summit Water Distribution Company, February 2000 with update in March 2000.

   The Storm Water Pollution Prevention Plan for the East Canyon Pipeline Project addresses the requirements of the Storm Water Discharge Permit for controlling erosion during construction and operation of the project.

4. East Canyon Pipeline Project – Environmental Assessment (Morgan and Summit Counties, UT), Summit Water Distribution Company, September 1999.

   This report analyzes the anticipated environmental impacts of the East Canyon Pipeline Project.

5. East Canyon Pipeline Project – Project Permits and Approvals, Summit Water Distribution Company, September 1999.

   These documents include project permits and approvals from the Utah State Engineer, Army Corps of Engineers, Utah Division of Water Quality, Utah Division of Drinking Water, Bureau of Reclamation, Utah Department of Transportation, and others for the construction of the East Canyon Pipeline Project.

6. East Canyon Pipeline Project – Stream Restoration Water Quality and Fishery Values, Summit Water Distribution Company, September 1999.

Summit Water Distribution Company has committed in an agreement with the Division of Water Resources to take affirmative steps to increase in-stream flows in the creek, lower creek water temperatures, create, restore, and maintain riparian habitat, improve water quality, and provide angler access.

7. East Canyon Pipeline Project – Water Quality and Stream Enhancement Report, Summit Water Distribution Company, September 1999.

   This report addresses the key water quality issues associated with the East Canyon Pipeline Project and outlines voluntary components of the project that are aimed at restoring the natural stream environment and fishery values in East Canyon Creek.

8. Green River Pipeline Cost Analysis, Utah Division of Water Resources, October 2002, Draft. Addendum to the Report in October 2003.

   This report looks at various alternatives to import water from the Green River drainage, a major tributary to the Colorado River, for use along the Wasatch Front. In particular, it investigates the feasibility of importing water from either Fontenelle Reservoir in western Wyoming or Flaming Gorge Reservoir, near the Utah Wyoming border, into the Bear River or Weber River drainage.

9. Groundwater Conditions in Utah, Spring 2002, Report No. 43, Utah Division of Water Resources, Utah Division of Water Rights, U. S. Geologic Survey, 2002.

   This report contains information on well construction, ground-water withdrawal, water-level changes, precipitation, streamflow, and chemical quality of water. This report also includes individual discussions of selected significant areas of ground-water development in the State for calendar year 2001.

10. Hydrology and Snowmelt Simulation of Snyderville Basin, Park City, and adjacent areas, Summit County, Utah, Technical Publication No. 115, Utah Division of Water Resources, Utah Division of Water Rights, U. S. Geologic Survey, 2002.

    This report describes the hydrologic system and documents the quantity and quality of water resources in the Snyderville Basin and adjacent areas. The report is based on the most recent interpretation of hydrological data and geology and assist planners in assessing the effects of increased development on surface-water flows, ground-water levels, spring discharge, and the quality of the area's water resources. This report also indicates where additional ground-water monitoring would help to determine the extent of the effects of increased development. The results of this study provide a basis for comparison from which possible future changes to the hydrological system can be identified. Information summarized in this report includes: climatic data; surface-water flow; water levels in wells; discharge from springs, wells, and mine tunnels; and water-quality data.

11. Investigation of Water Supply Options, East Canyon Reservoir Rockport Reservoir, Weber Basin Water Conservancy District, CRS Engineers, April 1998.

This report is limited to providing relative cost information for two options for providing water to the Snyderville Basin. Summit Water Distribution Company proposed construction of a transmission main from East Canyon Reservoir via East Canyon to Jeremy Ranch for treatment. Weber Basin Water Conservancy District proposed an alternate project which would treat water at Rockport Reservoir and pump it to the top of Kents Canyon for subsequent feed into distribution systems.

12. Municipal and Industrial Water Supply Studies, Utah Weber River Basin, Utah Division of Water Resources, July 1996.

The total municipal and industrial (M&I) water supplies and uses for the Weber River Basin, are computed by compiling the results of the four separate areas (Summit County, Morgan County, Ogden Valley, and the Wasatch Front) in this report. All of the data was compiled for the 1992 calendar year. The reliable annual M&I water supply under present conditions for the Weber River Basin is 263,226 acre-feet.

13. Preliminary Engineering Report for Lost Creek Canyon Pipeline Project, Mountain Regional Water Special Service District and Promontory L.L.C., Aqua Engineering, Inc., February 2003.

The purpose of this project is to convey raw water for irrigation and culinary use to the Mountain Regional Water Special Service District service areas in the Silver Creek Basin. The project includes: a system of interconnected shallow wells, a booster pumping facility, a water transmission line to the divide between the Weber River Basin and Silver Creek Basin, two open reservoirs for irrigation and treatment supply, and a raw water treatment facility.

14. Preliminary Investigation, Upper Weber Water Supply, Park City Municipal Corporation, Entranco, Inc., May 2001.

The preliminary investigation was undertaken by Park City Municipal Corporation to help meet its challenges in providing public utilities such as water and sewer. This investigation centers around a 14-mile pipeline that would extend from an existing lake storage reservoir to Park City's water system. Three primary alternatives were identified and evaluated for determining probable least cost over the expected life of the project.

15. Summit County Regional Water Management Plan, Summit County Water Systems, MWH, December 2001.

The Summit County Regional Water Management Plan was developed to aid public water systems, along with state and county agencies, with long range planning. The management plan includes summaries of 34 public water systems located in Summit County.

16. The Geology of the Synderville Basin and Its Relation to Ground-Water Conditions, Francis X. Ashland, Charles E. Bishop, Mike Lowe, and Bea H. Mayes, Utah Geological Survey, Open-File Report 337, August 1996.

    This study takes a detailed look at the water bearing rock formations in the Snyderville Basin, their relationship to one another and their water bearing and transmitting properties. A detailed review of the fracture patterns is made as well as effects of faults on ground-water movement. This study is the first to define and divide the Synderville Basin into discrete ground-water compartments, and recommendations for future study are made.

17. The Upper Weber River Water Development Project for Summit County, Weber Basin Water Conservancy District, February 1996.

    The District has investigated the potential for development of a culinary water source to be supplied to the Snyderville Basin largely out of Smith & Morehouse Reservoir. Several Options have been considered for providing the most economical and reliable source to the Snyderville and Park City areas. A preferred alternative was identified to bring water from Wanship Dam through Kent Canyon to Park City. Two 1,000 gpm wells would be drilled and a 9 mgd package water treatment plant would be constructed.

18. Utah State Water Plan, Weber River Basin, Utah Division of Water Resources, May 1997.

    This report provides a detailed analysis of water related issues, data, and information for the 11 major hydrological river basins within the state, including the Weber River Basin.

19. Wanship Pump Station and Pipeline Preliminary Design, Bureau of Reclamation, August 2004, 95 Percent Review.

    It is proposed that a pump station be constructed to pump water from the base of Wanship Dam or above Rockport Reservoir, to an existing booster pump station. The existing booster pump station is part of a project know as Lost Creek Canyon Project constructed by Mountain Regional Water Special Service District. This report represents a preliminary level of designs and cost estimates for four different pump station and pipeline alternatives and is intended to direct decision makers to the best possible option.

20. Wanship Water Transmission System Predesign Study, Weber Basin Water Conservancy District, MWH and Bowen, Collins & Associates, December 2001.

    The objective of this report is to provide an update to the transmission and storage sections of the Wanship Water Treatment Plant Predesign Study, based upon developments of the past year. The Wanship WTP Predesign Study examined water transmission and storage options for delivering water from Wanship Reservoir to Park City.

21. Wanship Water Treatment Plant Predesign Report, Weber Basin Water Conservancy District, MWH and Bowen, Collins & Associates, September 2000.

The purpose of the Wanship Water Treatment Plant Predesign Project is to prepare the framework for development of a new potable water supply for areas of Summit County in and around Park City. The Pre-design Project consists of four principal component tasks: Identify and preliminarily configure the raw water source for the new potable supply; Identify the preferred raw and treated water transmission corridors; Select a preferred water treatment process train and conduct a pilot study to verify and optimize the process selection; and finally, Identify and preliminarily configure the site of the new Wanship WTP.

22. Water Related Land Use Inventories, Weber River Basin, Utah Division of Water Resources, December 1992.

The land use inventory program of UDWR was set up to provide the land use data needed in preparation of water budgets, hydrological inventory reports and other state water planning activities. UDWR inventoried over 246,000 acres of land in the Weber River Basin. This represents only about 16 percent of the entire Basin. Areas not inventoried are mainly rangeland and national forests. Of the inventoried acres, 142,102 were irrigated land, 18,747 were wet/open water areas, and 81,027 were residential/industrial areas.

23. Water Supply and Water Demand Update, Park City Municipal Corporation, MWH, May 2000.

The purpose of the Water Supply and Water Demand Update is to characterize the existing potable water consumption patterns and to update the potable water demands within the boundaries of Park City at buildout. The maximum day summer demands are expected to increase from the existing 5,960 gpm to 9,700 gpm at buildout, which is projected to occur by 2019.

24. Weber River Basin Planning for the Future, Utah Division of Water Resources, July 20, 2004, Public Draft.

This document is the latest in the “Utah State Water Plan” series and is intended to guide and direct water-related planning and management in the Weber River Basin into the next century. It summarizes key data obtained through the previous water planning documents, introduces new data where available, and addresses issues of importance to all future water planning efforts.

25. 2005 Heavy Construction Cost Data, 19th Annual Edition, R.S. Means, 2004

26. East Canyon Creek Flow Augmentation Feasibility Study, Summit and Morgan Counties, Kleinfelder, Inc., Barnett Intermountain Water Consulting, and CRS Consulting

Engineers, Inc., February 14, 2005, Prepared for Snyderville Basin Water Reclamation District.

27. East Juab County Water Efficiency Projects, Draft Appraisal Study, U.S. Bureau of Reclamation, May 2005.

28. Increasing Utah's Usable Water Supply through Conjunctive Management of Water, Utah Division of Water Resources In-House Draft, September 13, 2004.

29. Flitton, John S. Legal Counsel for Summit Water Distribution Company. Written Communication, December 19, 2005, and letter from Utah Division of Public Utilities to Utah Public Service Commission, August 2, 2002.

30. Luers, Michael D. General Manager. Snyderville Basin Water Reclamation District. Telephone conversation record. September 22, 2004.

31. Luers, Michael D. General Manager. Snyderville Basin Water Reclamation District. Written Communication, November 10, 2005.

32. McMurray, Steven R., of McMurray, McMurray, Dale & Parkinson, Legal Counsel for East Canyon Resort, Clayton Macfarlane Company, and 910 Cattle Company. Letter with 18 Exhibits, March 28, 2002. Addresses Issues and Lawsuit(s) opposing the Summit Water Distribution Company's proposed East Canyon Water Pipeline.

33. Sanks, Robert L. et. al., Pumping Station Design, Second Edition, Butterworth-Heinemann, 1998.

34. Snyderville Basin Water Supply Study - Status Report, Bureau of Reclamation, March 2005.

35. Summit County 2004 Concurrency Reports, PWS within Snyderville Basin, Summit County Concurrency Officer Files, April, 2004.

36. Silver Creek Total Maximum Daily Load for Dissolved Zinc and Cadmium, Utah Department of Environmental Quality, Division of Water Quality, Approved by EPA August 4, 2004.

37. Total Maximum Daily Load for East Canyon Reservoir, Utah Department of Environmental Quality, Division of Water Quality, April 1, 2000.

38. Total Maximum Daily Load for East Canyon Creek, Utah Department of Environmental Quality, Division of Water Quality, April 1, 2000.

39. Utah Agricultural Experiment Station Research Report No. 145, Robert W. Hill, Utah State University, Logan, Utah, Submitted to the Utah Department of Natural Resources, Division of Water Resources and Division of Water Rights.

40. Utah's M&I Water Conservation Plan – Investing in the Future, Utah Division of Water Resources, 2003b.

Appendix – Cost Estimates

Cost Assumptions

All costs are in 2005 dollars

Cost Per Horse Power

The required horsepower was calculated with the power routine in the spreadsheet. It accounts for static and dynamic heads. A redundancy factor of 1.25 was used.

New Installation
Full cost of pumps, controls and structures.
East Juab Study[22] (Draft) $1150/HP (SBWSS[34]) $1340/HP
Using the cost curve in Sanks[33] (corrected with ENR-CCI) which was based on gallons per minute EC Intake $1,500/HP LC Intake $1,300/HP
Sanks was determined to be reasonable due to the respective difficulties building the inlet structures. For booster pump plants, $1,150/HP was used.

Upgrade Horse Power
Full cost of pumps and controls installed only. No structure
East Juab Study $500/HP (SBWSS[34]) $440/HP Used $490/HP

On Option 5, it was assumed that the intake plant and booster pump plant would be built in their entirety at the beginning of the project, with the pumping capacity added as needed. Therefore, for the 8,750 acre-feet and 12,500 acre-feet estimates, the pump plant costs were calculated as the new horsepower cost, minus the upgrade horsepower cost. This provides the cost of the buildings, which would be built at the beginning of the project. Then the pump horsepower was added at the upgrade cost as needed.

Treatment Plant

Treatment Plant and upgrade capital costs were taken from actual costs of the existing facilities. This is reasonable for cost comparison purposes. Actual costs would probably be higher.
Building 0.40 $/gpd = $400,000 /mgd
WTP Expansion 0.90 $/gpd = $900,000 /mgd
It was assumed that treatment costs would be equal for each Option for comparison purposes. In reality the costs would differ somewhat due to different water characteristics.
Sanks uses 5 percent of capitol cost for pumps and controls as a reasonable estimate of maintenance costs. Treatment maintenance was calculated at 5 percent of equipment which was calculated as capacity times the WTP expansion cost, plus 1 percent of building cost (1 percent is a real estate industry standard for building maintenance costs).
Treatment Plant wastewater disposal costs were not included. It was assumed that these costs would be equal, and could be ignored for comparison purposes.

East Canyon Pipeline Costs

Ductile iron pipe prices are from a supplier.
Butterfly valve price is from a supplier.

Tees and elbows are a multiple of the per foot pipe price. The multiple was obtained from RSMeans 24 inch pipe prices.
Installation costs per piece is estimated from RSMeans 24 inch pipe costs.

Power Costs

Pump and pipeline power costs were calculated using Utah Power's Schedule No. 8 rates for high demand uses, and Schedule No. 6 for moderate demand uses (less than 1,000 kW). Historical water demand for Park City was used for monthly demand distribution. Water demand was phased in at 525 acre-feet per year until capacity was reached.
Treatment plant power costs were determined by calculating the high month power cost using Schedule No. 8, and dividing that by the plant capacity for a unit cost, which is included in the treatment costs. SWDC's power requirements were used, and the calculated unit cost matched the unit cost provided by MRSSD. This does not account for lower costs during lower usage months, but since both water treatment plants have the same treatment costs applied, this was acceptable for comparison purposes.

Treatment Costs

SWDC's power use estimate for the highest month was used to determine a unit cost of power for treatment. This corresponded closely with the power costs estimated by MRWSSD. For other treatment costs, $50 per thousand gallons was used.

Life Cycle Costs

Life cycle costs include capital costs (both new facilities and sunk cost in existing facilities), use of facilities charges, operation maintenance and replacement costs, and the cost of water. The life cycle costs were calculated at present worth using the rates from Office of Management and Budget Circular No. A-94 dated January 2005. Since the design life is 50 years, the 30 year rates of 5.2 percent nominal interest rate and 3.1 percent real interest rate were used to discount future expenditures. An exception to this was necessary for use of facilities for the options involving JSSD. JSSD imposed a 4 percent escalator to their use of facilities charges. Using the 4 percent as the inflation factor yields a 1.2 percent real interest rate for discounting the JSSD use of facilities costs. This significantly increases the life cycle costs for the JSSD options. If real inflation exceeds the projected inflation of 2.1 percent, or JSSD reduces their escalation factor to match the inflation projection, the JSSD life cycle costs would decrease significantly to where the JSSD Option could be competitive.

Deferred construction costs and pump replacement costs were discounted using Equation 1 below. Annual operation and maintenance costs were discounted using Equation 2 below.

Equation 1 $$P = \frac{A}{(1+r)^n}$$

Equation 2 $$P = \frac{A}{r} * \left(1-(1+r)^{-n}\right)$$

Where: P = present value
A = amount discounted

r = discount rate (real interest rate)
n = number of years

For power, treatment, and water costs, both equations were used. Each cost was calculated using Equation 1 in tabular form in 525 acre-feet per year increments until capacity was reached. From the year capacity was reached to year 50, Equation 2 was used. The 525 acre-feet per year increment was used to reach the projected need in 2030.

Pump Replacement

Recommended replacement frequency is from 10 to 20 years depending on use.
Moderate use is expected, so a replacement frequency of 13 years was chosen, requiring 3 replacements in 50 years.
Replacement cost per HP was calculated as 40 percent of the upgrade cost per HP.

O&M

Sanks uses 5 percent of capitol cost for pumps and controls as a reasonable estimate of maintenance costs. Maintenance of equipment is calculated at 5 percent of cost throughout these estimates. One percent is a real estate industry standard for building maintenance costs, and is used for that purpose throughout these estimates.
Pipeline costs were calculated as 5 percent of the pipeline fitting cost, 5 percent of the horsepower upgrade cost, and 1 percent of building costs. Pump plant equipment costs were determined by using upgrade horsepower costs as equipment costs. Pump plant building costs were determined by subtracting pump upgrade cost from new pump installation cost.

Cost to Water Provider

For Option 5, East Canyon Pipeline, a cost of $15,150 per acre-foot of capacity was used in place of capital costs and use of facilities. This cost was applied at 525 acre-feet per year until the 12,500 acre-feet of capacity was reached, and then discounted to present value. This total replaced capital costs and use of facilities costs. There is no financing component to these calculations.

For Option 7, Lost Creek Canyon Pipeline, the applicable portions of the existing bond payments were discounted to present value. Future construction costs and bonding costs were calculated and a 30 year bond payment schedule at 5.1 percent was calculated. These future payments were discounted to present value. This total replaced capital costs and cost of existing facilities.

Cost of Water

For Option 5, East Canyon Pipeline, a cost of $160 per acre-foot was applied to the first 5,000 acre feet used, and $20.70 was applied to each additional acre foot. This reflects SWDC's contract with Davis & Weber Counties Canal Company for 5,000 acre feet, and the annual assessment on SWDC's Davis & Weber Counties Canal Company water shares.
For Option 7, Lost Creek Canyon Pipeline, a cost of $110 per acre-foot was the price quoted by WBWCD, the water supplier.

Table 6- 3

Method 1 includes capital costs for new facilities only, using Reclamation's estimating standards which include an additional 10 percent for unlisted contract items, 20 percent for contingencies, and 12 percent for engineering design and construction oversight.

Method 2 includes capital costs for new and existing facilities using Reclamtion's estimating standards.

Method 3 includes capital costs for new facilities, and the actual costs for the existing facilities updated to 2005 using the ENR-CCI Index.

Method 4 is the contract cost of new facilities only.

Method 5 attempts to capture the difference in business plans of the public and private water suppliers. Option 5 capital costs were calculated using $15,000 per "A" share of SWDC plus the $150 conversion fee. Purchases were phased at 525 shares per year until a total of 12,500 shares were purchased. No provision was made to finance these purchases. Option 7 capital costs were calculated using 5,000/6,600 times the bond payments for the existing facilities (the reduction factor reflects the 1,600 acre-feet of existing capacity). Additional bonds were calculated such that 85 percent of the bond proceeds would cover construction costs, and equal annual payments were made at 5.2 percent, over 30 years. The accuracy of the representation of costs for Method 5 is suspect and therefore this method is not included in the body of the report.

Cost of Right of Way Easements

Right of way easements across private lands would need to be obtained for Options 5 and 7. For Option 7, a 30 feet by 4,200 feet right of way from Promontory Development to Highway 40 is required. Current land sales in the area have been for approximately two dollars per square foot. A worst case of 80 percent of this cost would be required for a perpetual easement for a total of $201,600. For Option 5, Reclamation estimated a 30 feet by 24,000 feet perpetual land easement containing approximately 16.53 acres of recreational property in Morgan County would cost $27,000. Recently a 7,200 acre Ranch (Clayton Macfarlane Company) sold a conservation easement that covers a portion of the County road along East Canyon Creek in Summit and Morgan counties. Right of Way across this conservation easement will also have to be negotiated, but this cost is not included in these estimates.

Acre-Feet Delivered

To reach the 2030 demand from the 2005 supply, 525 acre-feet per year increments were used. Life cycle cost estimates assume this 525 acre-feet per year increment until the option reaches capacity, then the system operates at capacity the remainder of the 50 year lifecycle.

The cost per acre-foot delivered calculation takes the total lifecycle cost and divides it by the total number of acre-feet delivered over the 50 year lifecycle. The calculated acre-feet delivered for all Options, except Options 3 and 4, are:

Acre-Foot Capacity	Acre-Feet Delivered	Discounted Acre-Feet Delivered
2,500	120,250	60,461
5,000	228,625	110,326
8,750	374,800	168,308
12,500	488,300	209,625

Options 3 and 4 were calculated as though the full capacity was delivered the entire 50 years:

Acre-Foot Capacity	Acre-Feet Delivered	Discounted Acre-Feet Delivered
500	25,000	13,015
3,600	180,000	93,711

Cost Tables

OPTION 3 - COMBINED WATER REUSE PIPELINE
(3600 Ac-Ft)
Capital Costs

Item	Quantity	Unit	Unit Cost	Cost
SCWRF to Quinns Junction				
12" PVC Pipe Installed	10,000	LF	$47	$472,100
14" PVC Pipe Installed	17,500	LF	$61	$1,059,275
16" PVC Pipe Installed	4,600	LF	$69	$317,354
Fittings @ 15%	1	LS	$277,309	$277,309
Jack 24" under Hiwy40&189	1,600	LF	$284	$454,400
Jacking Pits	4	EA	$12,000	$48,000
Pumping HP	330	EA	$1,150	$379,500
Asphalt @ 10%of pipeline length	3,050	LF	$65	$198,403
Mobilization @ 5%	1	LS	$160,317	$160,317
			Subtotal	$3,366,658
ECWRF to Park Meadows GC				
8" PVC Pipe Installed	10,500	LF	$25	$262,805
10" PVC Pipe Installed	8,500	LF	$34	$287,725
12" PVC Pipe Installed	46,500	LF	$47	$2,195,265
Fittings @ 15%	1	LS	$411,869	$411,869
Asphalt @ 10%	6,550	LF	$65	$426,078
Pumping HP	600	EA	$1,150	$690,000
Mobilization @ 5%	1	LS	$213,687	$213,687
			Subtotal	$4,487,428
Interconnection				
12" PVC Pipe Installed	8,500	LF	$47	$401,285
Fittings @ 15%	1	LS	$60,193	$60,193
Asphalt @ 10% of pipeline length	822	LF	$65	$53,439
Pumping HP	285	EA	$1,150	$327,750
Mobilization @ 5%	1	LS	$42,133	$42,133
			Subtotal	$884,800
Membrane Treatment Facilities				
Membrane Filtration Facilities	3	MGD	$1,300,000	$3,900,000
Mobilization @ 5%	1	LS	$268,611	$268,611
			Subtotal	$4,168,611
			Subtotal	$12,907,497
Unlisted Items @		10%		$1,290,750
			Contract Cost	$14,198,247
Contingency @		20%		$2,839,649
			Field Cost	$17,037,896
Engineering Design & Construction Oversight @		12%		$2,044,548
			Total Cost =	**$19,100,000**
2/23/2006			COST PER ACRE FOOT	$5,306

Costs are appraisal level and are to be used for option comparisons only

LIFE CYCLE COST ANALYSIS
OPTION 3 - COMBINED WATER REUSE PIPELINE
(3600 Ac-Ft)

	Rate	0.031		Present Value
	Yrs.	50		
Capital Costs				$19,100,000
Replacement @ 40% of Original Installation At 13, 26, and 39 years			$238,140	$340,203
O & M @ 5% of Original Installation			$67,236	$1,697,595
Power Present Annual Cost			$152,017	$3,838,170
Treatment of Silver Creek WRF Water	161	$/Ac-Ft		$6,498,552
Cost of Water		0	0	$0
Cost of Existing Facilities (PV)				$750,000
			Total Present Worth =	$32,200,000
2/23/2006				

Costs are appraisal level and are to be used for option comparisons only

OPTION 3 - SILVER CREEK WRF WATER REUSE PIPELINE
(1600 Ac-Ft))
Capital Costs

Item	Quantity	Unit	Unit Cost	Cost
SCWRF TO Park Meadows GC				
12" PVC Pipe Installed	10,000	LF	$47	$472,100
14" PVC Pipe Installed	17,500	LF	$61	$1,059,275
16" PVC Pipe Installed	4,600	LF	$69	$317,354
Fittings @ 15%	1	LS	$277,309	$277,309
Pumping HP	330	EA	$1,150	$379,500
Asphalt @ 10%	3,210	LF	$65	$208,811
Jack 24" under Hiwy40&189	1,600	LF	$284	$454,400
Jacking Pits	4	EA	$12,000	$48,000
Membrane Filtration Facilities	3	MGD	$1,300,000	$3,900,000
Mobilization @ 5%	1	LS	$135,717	$135,717
			Subtotal	$7,252,466
Unlisted Items @		10%		$725,247
			Contract Cost	$7,977,713
Contingency @		20%		$1,595,543
			Field Cost	$9,573,256
Engineering Design & Construction Oversight @		12%		$1,148,791
			Total Cost =	**$10,700,000**
			COST PER ACRE FOOT	$5,350

LIFE CYCLE COST ANALYSIS

				Present Value
	Rate	0.031		
	Yrs.	50		
Capital Costs				$10,700,000
Replacement @ 40% of Original Installation			$64,680	$92,401
At 13, 26, and 39 years				
O & M @ 5% of Original Installation			$21,950	$554,211
Power Present Annual Cost			$67,563	$1,705,853
Treatment of Silver Creek WRF Water	$161	$/Ac-Ft		$6,498,552
Cost of Water		0	0	$0
Use of Existing Facilities				$0
			Total Present Worth	$19,600,000

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 3 - EAST CANYON WRF WATER REUSE PIPELINE (2000 Ac-Ft) Capital Costs				
Item	Quantity	Unit	Unit Cost	Cost
8" PVC Pipe Installed	10,500	LF	$25	$262,805
10" PVC Pipe Installed	8,500	LF	$34	$287,725
12" PVC Pipe Installed	46,500	LF	$47	$2,195,265
Fittings @ 15%	1	LS	$411,869	$411,869
Asphalt @ 10%	6,550	LF	$65	$426,078
Pumping HP	600	EA	$1,150	$690,000
Mobilization @ 5%	1	LS	$213,687	$213,687
			Subtotal	$4,487,428
Unlisted Items @		10%		$448,743
			Contract Cost	$4,936,171
Contingency @		20%		$987,234
			Field Cost	$5,923,405
Engineering Design & Construction Oversight @		12%		$710,809
			Total Cost =	**$6,600,000**
			COST PER ACRE FOOT	$4,125

LIFE CYCLE COST ANALYSIS				
	Rate	0.031		Present Value
	Yrs.	50		
Capital Costs				$6,600,000
Replacement @ 40% of Original Installation			$117,600	$168,001
At 13, 26, and 39 years				
O & M @ 5% of Original Installation			$35,293	$891,099
Power Present Annual Cost			$84,454	$2,132,317
Cost of Water		0	0	$0
Cost of Existing Facilities (PV)				$750,000
			Total Present Worth =	$10,500,000

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 4 - JSSD TANK TO PARK CITY AT QUINN'S JUNCTION
500 AC-FT JSSD WATER
CAPITAL COSTS

Item	Quantity	Unit	Unit Cost	Cost
12" DIP	18,000	LF	$74	$1,326,780
Fittings @ 15%	1	LS	$199,017	$199,017
Pumping HP	150	EA	$1,300	$195,000
Mobilization @ 5%	1	LS	$86,040	$86,040
			Subtotal	$1,806,837
Unlisted Items @		10%		$180,684
			Contract Cost	$1,987,521
Contingency @		20%		$397,504
			Field Cost	$2,385,025
Engineering Design & Construction Oversight @		12%		$286,203
			Total Cost =	**$2,700,000**
			COST PER ACRE FOOT	$5,400

OPTION 4 - JSSD TANK TO PARK CITY AT QUINN'S JUNCTION
500 AC-FT JSSD WATER
LIFE CYCLE COST ANALYSIS

					Present Value
	I	0.031			
	N	50			
Capital Costs					$2,700,000
Replacement @ 40% of Original Installation At 13, 26, and 39 years				$29,400	$42,000
O & M @ 5% of Original Installation				$14,841	$374,706
Power Present Cost				$6,819	$172,180
Cost of Water		0	$/Ac-Ft		$0
Use of Existing Facilities		820/Ac-Ft	plus 4%/yr./Ac-Ft		$15,348,514
				Total Present Worth	$18,600,000

2/23/2006
Costs are appraisal level and are to be used for option comparisons only

OPTION 5 - EAST CANYON PIPELINE
5,000 Ac-Ft
Capital Costs

Item	Quantity	Unit	Unit Cost	Cost
Intake Pump Plant (HP)	2,000	HP	$1,500	$3,000,000
Booster Pump Plant	1,500	HP	$1,150	$1,725,000
24" pipeline	1	LS	$11,420,063	$11,420,063
Ultrasonic Flow Meter w/ Vault	1	LS	$75,000	$75,000
Mobilization @ 5%	1	LS	$811,003	$811,003
Substation	1	LS	$2,500,000	$2,500,000
Right of Way	1	LS	$27,000	$27,000
			Subtotal	$19,558,067
Park City Connection				
16" PVC Pipeline	5680	LF	$100	$567,233
Fittings	1	LS	$85,085	$85,085
Upgrade Pump Capacity	800	HP	$490	$392,000
Mobilization @ 5%	1	LS	$52,216	$52,216
			Subtotal	$1,096,534
Treatment				
Plant Expansion	3.5	mgd	$900,000	$3,150,000
			Subtotal	$23,804,601
Unlisted Items @		10%		$2,380,460
			Contract Cost	$26,185,061
Contingency @		20%		$5,237,012
			Field Cost	$31,422,073
Engineering Design & Construction Oversight @		12%		$3,770,649
			Total Cost =	**$35,200,000**
			COST PER ACRE FOOT	$7,040

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 5 - EAST CANYON PIPELINE 5,000 Ac-Ft LIFE CYCLE COST ANALYSIS					
	Rate	0.031			Present Value
	Yrs.	50			
Capital Costs					$35,200,000
Pipeline Pump Replacement @ 40% of Original Installation At 13, 26, and 39 years				$842,800	$1,204,010
Pipeline O & M @ 5% of Original Installation				$225,355	$5,689,818
Pipeline Power Cost					$20,110,881
Treatment Cost	$161	/Ac-Ft	+ Maint.		$29,758,740
Cost of water					$17,218,122
Cost of Existing Facilities (2005 $)					$15,553,276
				Total Present Worth	$124,700,000

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 5 - EAST CANYON PIPELINE
8,750 Ac-Ft
Capital Costs

Item	Quantity	Unit	Unit Cost	Cost
Phase 1				
Intake Pump Plant	1	LS	$3,535,000	$3,535,000
Booster Pump Plant	1	LS	$1,650,000	$1,650,000
Intake Pump Plant Pumps (HP)	2,000	HP	$490	$980,000
Booster Pump Plant Pumps (HP)	1,500	HP	$490	$735,000
30" pipeline	1	LS	$13,440,051	$13,440,051
Ultrasonic Flow Meter w/ Vault	1	LS	$75,000	$75,000
Mobilization @ 5%	1	LS	$1,020,753	$1,020,753
Substation	1	LS	$3,000,000	$3,000,000
Treatment Plant Expansion	3.5	mgd	$900,000	$3,150,000
Right of Way	1	LS	$27,000	$27,000
			Subtotal	$27,612,803
Park City Connection				
16" PVC Pipeline	5680	LF	$100	$567,233
Fittings	1	LS	$85,085	$85,085
Upgrade Pump Capacity	800	HP	$490	$392,000
Mobilization @ 5%	1	LS	$52,216	$52,216
			Subtotal	$1,096,534
Phase 2				
Intake Pump Plant Pumps (HP)	1,500	HP	$490	$735,000
Booster Pump Plant Pumps (HP)	1,000	HP	$490	$490,000
Mobilization @ 5%	1	LS	$61,250	$61,250
Treatment Plant Expansion	7	mgd	$900,000	$6,300,000
			Subtotal	$7,586,250
			Subtotal	$36,295,587
Unlisted Items @		10%		$3,629,559
			Contract Cost	$39,925,146
Contingency @		20%		$7,985,029
			Field Cost	$47,910,175
Engineering Design & Construction Oversight @		12%		$5,749,221
			Total Cost =	**$53,700,000**
			COST PER ACRE FOOT	$6,137

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 5 - EAST CANYON PIPELINE
8,750 Ac-Ft
LIFE CYCLE COST ANALYSIS

	Rate	0.031		Present Value
	Yrs.	50		
Capital Costs Phase 1				$45,750,997
Capital Costs Phase 2		9	$7,949,003	$6,039,273
Transmission Pump Replacement @ 40% of Original Installation at 13 year intervals				
Phase 1 AT 13,26 AND 39 YEARS		13,26,39	$842,800	$1,204,010
Phase 2 AT 22,35 AND 48 YEARS		22,35,48	$490,000	$1,470,000
Pipeline O & M @ 5% of Original Installation				$7,693,251
Pipeline Power Cost				$12,292,184
Treatment Cost	$161	/Ac-Ft	+ Maint.	$44,476,672
Cost of water				$19,090,235
Method 1	**(New Facilities)**		**Life Cycle Present Worth**	$138,000,000
Cost of Existing Facilities (Reclamation estimate)				$22,300,000
Method 2		**Total**	**Life Cycle Present Worth**	$160,300,000
Actual Cost of Existing Facilities (2005 $)				$15,600,000
Method 3		**Total**	**Life Cycle Present Worth**	$153,600,000
Method 4			**Life Cycle Present Worth**	$124,700,000
Method 5			**Cost to Wholesaler**	$191,500,000
			Cost Per Ac-Ft Delivered (PV)	$511

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 5 - EAST CANYON PIPELINE
12,500 Ac-Ft
Capital Costs

Item	Quantity	Unit	Unit Cost	Cost
Phase 1				
Intake Pump Plant	1	LS	$5,050,000	$5,050,000
Booster Pump Plant	1	LS	$2,640,000	$2,640,000
Intake Pump Plant Pumps (HP)	2,000	HP	$490	$980,000
Booster Pump Plant Pumps (HP)	1,500	HP	$490	$735,000
30" pipeline	1	LS	$13,440,051	$13,440,051
Ultrasonic Flow Meter w/ Vault	1	LS	$75,000	$75,000
Mobilization @ 5%	1	LS	$1,146,003	$1,146,003
Electrical Substation	1	LS	$3,870,000	$3,870,000
Treatment Plant Expansion	3.5	mgd	$900,000	$3,150,000
Right of Way	1	LS	$27,000	$27,000
			Subtotal	$31,113,053
Park City Connection				
16" PVC Pipeline	5680	LF	$100	$567,233
Fittings	1	LS	$85,085	$85,085
Upgrade Pump Capacity	800	HP	$490	$392,000
Mobilization @ 5%	1	LS	$52,216	$52,216
			Subtotal	$1,096,534
Phase 2				
Intake Pump Plant Pumps (HP)	1,500	HP	$490	$735,000
Booster Pump Plant Pumps (HP)	1,000	HP	$490	$490,000
Mobilization @ 5%	1	LS	$61,250	$61,250
Treatment Plant Expansion	7	mgd	$900,000	$6,300,000
			Subtotal	$7,586,250
Phase3				
Intake Pump Plant Pumps (HP)	1,500	HP	$490	$735,000
Booster Pump Plant Pumps (HP)	1,500	HP	$490	$735,000
Mobilization @ 5%	1	LS	$73,500	$73,500
Treatment Plant Expansion	6	mgd	$900,000	$5,400,000
			Subtotal	$6,943,500
			Subtotal	$46,739,337
Unlisted Items @		10%		$4,673,934
			Contract Cost	$51,413,271
Contingency @		20%		$10,282,654
			Field Cost	$61,695,925
Engineering Design & Construction Oversight @		12%		$5,608,720
			Total Cost =	**$67,300,000**
			COST PER ACRE FOOT	$5,384

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 5 - EAST CANYON PIPELINE
12,500 Ac-Ft
LIFE CYCLE COST ANALYSIS

	Rate	0.031		Present Value
	Yrs.	50		
Capital Costs Phase 1				$49,565,903
Capital Costs Phase 2		9	$10,923,446	$8,299,113
Capital Costs Phase 3		16	$6,810,651	$4,178,785
Transmission Pump Replacement @ 40% of Original Installation at 13 year intervals				
Phase 1 AT 13,26 AND 39 YEARS		13,26,39	$842,800	$1,204,010
Phase 2 AT 22,35 AND 48 YEARS		22,35,48	$490,000	$531,831
Phase 3 AT 31 AND 44 YEARS		29,42	$588,000	$405,714
			Annual	
Pipeline O & M @ 5% of Original Installation				$9,495,551
Pipeline Power Cost				$17,511,105
Treatment Cost	$161	/Ac-Ft	+ Maint.	$54,572,800
Cost of water				$20,027,913
Method 1	**(New Facilities)**		**Life Cycle Present Worth**	$165,800,000
Cost of Existing Facilities (Reclamation estimate)				$22,300,000
Method 2	**Total**		**Life Cycle Present Worth**	$188,100,000
Actual Cost of Existing Facilities (2005 $)				$15,600,000
Method 3	**Total**		**Life Cycle Present Worth**	$181,400,000
Method 4			**Life Cycle Present Worth**	$151,146,765.53
Method 5			**Cost to Provider**	$240,200,000
			Cost Per Ac-Ft Delivered (PV)	$492

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTIONS 7 AND 9 - LOST CREEK CANYON PIPELINE Increase capacity by 2500 ac-ft from 1600 to 4100 ac-ft Capital Costs				
Item	Quantity	Unit	Unit Cost	Cost
Phase 1				
Diversion to Pump Plant				
Diversion dam w/ Coanda screen	1	LS	$200,000	$200,000
24" pipeline	830	LF	$115	$95,583
12" DI Pipeline to MR 20" @ Hiwy 40	16,500	LF	$74	$1,216,215
Fittings @ 15%	1	LS	$196,769.7	$196,770
Intake Pump Plant (HP)	150	HP	$1,300	$195,000
Ultrasonic Flow Meter w/ Vault	1	LS	$75,000	$75,000
Mobilization @ 5%	1	LS	$98,928	$98,928
Right of Way	1	LS	$201,600	$201,600
			Subtotal	$2,279,096
Phase 2				
Treatment Plant Expansion	3	mgd	$900,000	$2,700,000
Phase 3				
New Treatment Plant	1.5	mgd	$1,300,000	$1,950,000
			Subtotal	$6,929,096
Unlisted Items @ 10%		10%		$692,910
			Contract Cost	$7,622,005
Contingency @ 20%		20%		$1,524,401
			Field Cost	$9,146,407
Engineering Design & Construction Oversight @		12%		$1,097,569
			Total Cost =	**$10,200,000**
			$/Ac-Ft Capacity	$4,080

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTIONS 7 AND 9 - LOST CREEK CANYON PIPELINE
Increase capacity by 2500 ac-ft from 1600 to 4100 ac-ft
LIFE CYCLE COST ANALYSIS

Life Cycle Costs For 2500 Ac-Ft Portion	Rate	0.031		Present Value
	Yrs.	50		
Capital Costs Phase 1				$3,354,951
Capital Costs Phase 2		4	$3,974,545	$3,517,651
Capital Costs Phase 3		7	$2,870,504	$2,318,182
Transmission Pump Replacement @ 40% of Original Installation At 13, 26, and 39 years			$370,010	$528,590
			Annual	
Pipeline O & M @ 5% of Original Installation			$50,001	$1,262,444
Transmission Power Cost				$3,670,222
Treatment Cost	$161	/Ac-Ft	+ OM	$16,106,198.17
Note: Treatment costs assumes1200 ac-ft for Irrigation				
Cost of Water	110	$/Ac-Ft		$6,467,061
Cost of Existing Facilities (PV)				$9,915,284
			Total Present Worth	$47,100,000

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 7 - LOST CREEK CANYON PIPELINE
Increase capacity by 5000 ac-ft from 1600 to 6600 ac-ft
Capital Costs - Phased

Item	Quantity	Unit	Unit Cost	Cost
Phase 1				
Diversion to Pump Plant				
Diversion dam w/ Coanda screen	1	LS	$250,000	$250,000
24" pipeline	830	LF	$115	$95,583
12" DI Pipeline to MR 20" @ Hiwy 40	16,500	LF	$74	$1,216,215
Fittings @ 15%	1	LS	$196,770	$196,770
Intake Pump Plant	150	HP	$1,300	$195,000
Ultrasonic Flow Meter w/ Vault	1	LS	$75,000	$75,000
Mobilization @ 5%	1	LS	$101,428	$101,428
Right of Way	1	LS	$201,600	$201,600
			Subtotal	$2,331,596
Promontory to Park City				
16" DI Pipeline	13000	LF	$100	$1,298,245
Fittings @ 15%	1	LS	$194,737	$194,737
Mobilization @ 5%	1	LS	$74,649	$74,649
			Subtotal	$1,567,631
Phase 2				
Booster Pump Plant Upgrade				
Pump Upgrade	3,800	HP	$490	$1,862,000
Surge Tank	1	LS	$300,000	$300,000
Mobilization @ 5%	1	LS	$108,100	$108,100
Treatment Plant Expansion	3	mgd	$900,000	$2,700,000
			Subtotal	$4,970,100
Phase 3				
3 MG Raw Water Storage Pond	1	LS	$600,000	$600,000
New Treatment Plant	6.0	mgd	$1,300,000	$7,800,000
			Subtotal	$8,400,000
			Total	$17,269,327
Unlisted Items @ 10%		10%		$1,726,933
			Contract Cost	$18,996,259
Contingency @ 20%		20%		$3,799,252
			Field Cost	$22,795,511
Engineering Design & Construction Oversight @		12%		$2,735,461
			Total Cost =	**$25,500,000**
			$/Ac-Ft Capacity	$5,100

2/28/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 7 - LOST CREEK CANYON PIPELINE
Increase capacity by 5000 ac-ft from 1600 to 6600 ac-ft
LIFE CYCLE COST ANALYSIS - PHASED

Life Cycle Costs for 5000 Ac-Ft Portion	Rate	Yrs.		Present Value
	0.031	50		
Capital Costs Phase 1				$5,757,623
Capital Costs Phase 2		4	$7,338,882	$6,495,241
Capital Costs Phase 3		7	$12,403,495	$10,016,902
Transmission Pump Replacement @ 40% of Original Installation at 13 year intervals				
Phase 1 AT 13,26 AND 39 YEARS		13,26,39	$29,400	$42,000
Phase 2 AT 17,30 AND 43 YEARS		17,30,43	$564,242	$713,406
Pipeline O & M @ 5% of Original Installation			$74,205	$2,344,299
Transmission Power Cost			$6,682,035	$6,682,035
Treatment Cost	$161	/Ac-Ft	$28,158,606	$28,158,606
Note: Treatment costs assumes1200 ac-ft for Irrigation				
Cost of Water	$110	/Ac-Ft	$11,837,459	$11,837,459
Method 1	**(New Facilities)**		**Life Cycle Present Worth**	$72,100,000
Cost of Existing Facilities (Reclamation estimate)				$14,800,000
Method 2	**Total**		**Life Cycle Present Worth**	$86,900,000
Actual Cost of Existing Facilities (2005 $)				12,300,000
Method 3	**Total**		**Life Cycle Present Worth**	$84,400,000
Method 4			**Life Cycle Present Worth**	$66,400,000
Method 5			**Cost to Provider**	$108,200,000
	$/Ac-Ft Delivered		$467	

2/28/2006

Costs are appraisal level and are to be used for option comparisons only

OPTION 7 - LOST CREEK CANYON PIPELINE
Increase capacity by 5900 ac-ft from 1600 to 7500 ac-ft
Capital Costs - Phased

Item	Quantity	Unit	Unit Cost	Cost
Phase 1				
Diversion to Pump Plant				
Diversion dam w/ Coanda screen	1	LS	$275,000	$275,000
24" pipeline	830	LF	$115	$95,583
12" DI Pipeline to MR 20" @ Hiwy 40	16,500	LF	$74	$1,216,215
Fittings @ 15%	1	LS	$196,770	$196,770
Intake Pump Plant	200	HP	$1,300	$260,000
Ultrasonic Flow Meter w/ Vault	1	LS	$75,000	$75,000
Mobilization @ 5%	1	LS	$105,928	$105,928
Right of Way	1	LS	$201,600	$201,600
			Subtotal	$2,426,096
Promontory to Park City				
16" DI Pipeline	13000	LF	$100	$1,298,245
Fittings @ 15%	1	LS	$194,737	$194,737
Mobilization @ 5%	1	LS	$74,649	$74,649
			Subtotal	$1,567,631
Phase 2				
Booster Pump Plant Upgrade				
Pump Upgrade	4,200	HP	$490	$2,058,000
Surge Tank	1	LS	$300,000	$300,000
Mobilization @ 5%	1	LS	$117,900	$117,900
Treatment Plant Expansion	3	mgd	$900,000	$2,700,000
			Subtotal	$5,175,900
Phase 3				
3 MG Raw Water Storage Pond	1	LS	$600,000	$600,000
New Treatment Plant	7.5	mgd	$1,300,000	$9,750,000
			Subtotal	$10,350,000
			Total	$19,519,627
Unlisted Items @		10%		$1,951,963
			Contract Cost	$21,471,589
Contingency @		20%		$4,294,318
			Field Cost	$25,765,907
Engineering Design & Construction Oversight @		12%		$3,091,909
			Total Cost =	**$28,900,000**
			$/Ac-Ft Capacity	$4,898

2/28/2006
Costs are appraisal level and are to be used for option comparisons only

OPTION 7 - LOST CREEK CANYON PIPELINE
Increase capacity by 5900 ac-ft from 1600 to 7500 ac-ft
LIFE CYCLE COST ANALYSIS - PHASED

Life Cycle Costs for 5000 Ac-Ft Portion	Rate	Yrs.		Present Value
	0.031	50		
Capital Costs Phase 1				$5,912,956
Capital Costs Phase 2		4	$7,663,236	$6,782,309
Capital Costs Phase 3		7	$15,323,807	$12,375,308
Transmission Pump Replacement @ 40% of Original Installation at 13 year intervals				
Phase 1 AT 13,26 AND 39 YEARS		13,26,39	$39,200	$56,000
Phase 2 AT 17,30 AND 43 YEARS		17,30,43	$647,584	$818,780
			Annual	
Pipeline O & M @ 5% of Original Installation				
Years 1 - 4		4	$51,226	$189,958
Years 5 - 50			$89,598	$1,929,945
Transmission Power Cost				$8,010,734
Treatment Cost	$161	/Ac-Ft		$25,042,289
Note: Treatment costs assumes1200 ac-ft for Irrigation				
Cost of water	$110	/Ac-Ft		$13,534,546
Cost of Existing Facilities				$12,318,989
			Total Present Worth	$87,000,000

2/28/2006
Costs are appraisal level and are to be used for option comparisons only

OPTION 8 - JSSD TANKS TO QUINN'S JUNCTION AND PARK CITY
5000 AC-FT WEBER BASIN WATER
CAPITAL COSTS

Item	Quantity	Unit	Unit Cost	Cost
16" DI Pipe Installed	28,000	LF	$113	$3,159,940
Fittings @ 15%	1	LS	$473,991	$473,991
Jack 24" under Hiwy189	700	LF	$284	$198,800
Jacking Pits	2	EA	$12,000	$24,000
Pumping HP	600	EA	$1,300	$780,000
Mobilization @ 5%	1	LS	$231,837	$231,837
			Subtotal	$4,868,568
Unlisted Items @		10%		$486,857
			Contract Cost	$5,355,424
Contingency @		20%		$1,071,085
			Field Cost	$6,426,509
Engineering Design & Construction Oversight @		12%		$771,181
			Total Cost =	**$7,200,000**
			$/Ac-Ft Capacity	$1,440

OPTION 8 - JSSD TANKS TO QUINN'S JUNCTION AND PARK CITY
5000 AC-FT WEBER BASIN WATER
LIFE CYCLE COST ANALYSIS

				Present Value
	Rate	0.031		
	Yrs.	50		
Capital Costs				$7,200,000
Replacement @ 40% of Original Installation			$117,600	$168,001
At 13, 26, and 39 years				
O & M @ 5% of Original Installation			$43,260	$1,092,229
Power Present Annual Cost				$1,467,733
Cost of Water		110	$/Ac-Ft	$11,837,459
Use of Existing Facilities		500/Ac-Ft	plus 4%/yr./Ac-Ft	$83,469,455
			Total Present Worth	$105,200,000

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

No costs included for use of the Weber-Provo Canal or Jordanelle Reservoir.

OPTION 9 - JSSD TANK TO PARK CITY
2500 AC-FT WEBER BASIN WATER
CAPITAL COSTS

Item	Quantity	Unit	Unit Cost	Cost
16" DIP	18000	LF	112.855	$2,031,390
Fittings @ 15%	1	LS	304708.5	$304,709
Pumping HP	300	EA	1300	$390,000
Mobilization @ 5%	1	LS	136304.925	$136,305
			Subtotal	$2,862,403
Unlisted Items @		10%		$286,240
			Contract Cost	$3,148,644
Contingency @		0%		$0
			Field Cost	$3,148,644
Engineering Design & Construction Oversight @		0%		$0
			Total Cost =	**$3,100,000**

OPTION 9 - JSSD TANK TO PARK CITY
2500 AC-FT WEBER BASIN WATER
LIFE CYCLE COST ANALYSIS

	Rate	0.031		Present Value
	Yrs.	50		
Capital Costs				$3,100,000
Replacement @ 40% of Original Installation			58800	$84,001
At 13, 26, and 39 years				
O & M @ 5% of Original Installation			25015.425	$631,596
Power Present Cost				$801,854
Cost of Water		110	$/Ac-Ft	$6,705,487
Use of Existing Facilities		500/Ac-Ft	plus 4%/yr./Ac-Ft	$44,504,023
			Total Present Worth	$55,800,000

1/30/2006
Costs are appraisal level and are to be used for option comparisons only
No costs included for use of the Weber-Provo Canal or Jordanelle Reservoir.

OPTION 9 - JSSD TANK TO PARK CITY
2500 AC-FT WEBER BASIN WATER
LIFE CYCLE COST ANALYSIS

				Present Value
	Rate	0.031		
	Yrs.	50		
Capital Costs				$4,200,000
Replacement @ 40% of Original Installation			$58,800	$84,001
At 13, 26, and 39 years				
O & M @ 5% of Original Installation			$25,015	$631,596
Power Present Cost				$801,854
Cost of Water		110	$/Ac-Ft	$5,918,729
Use of Existing Facilities		500/Ac-Ft	plus 4%/yr./Ac-Ft	$41,734,728
JSSD			Total Present Worth	$53,400,000

OPTION 9 - LOST CREEK CANYON PIPELINE
Increase capacity by 2500 ac-ft from 1600 to 4100 ac-ft
LIFE CYCLE COST ANALYSIS

					Present Value
Life Cycle Costs For 2500 Ac-Ft Portion	Rate		0.031		
	Yrs.		50		
Capital Costs Phase 1					$3,354,951
Capital Costs Phase 2			8	$3,974,545	$3,113,279
Capital Costs Phase 3			14	$2,870,504	$1,872,134
Transmission Pump Replacement @ 40% of Original Installation				$370,010	$528,590
At 13, 26, and 39 years					
				Annual	
Pipeline O & M @ 5% of Original Installation				$50,001	$1,262,444
Transmission Power Cost					$3,670,222
Treatment Cost	$161	/Ac-Ft		+ OM	$15,522,461
Note: Treatment costs assumes1200 ac-ft for Irrigation					
Cost of Water	110	$/Ac-Ft			$5,918,729
Cost of Existing Facilities (PV)					$9,915,284
Lost Creek Canyon Pipeline			Total Present Worth		$45,200,000

Option 9	Total Present Worth	$98,600,000

2/23/2006
Costs are appraisal level and are to be used for option comparisons only

Annual Operating Costs at Capacity (does not include capital or replacement costs)

	Option 5			Option 7	
Acre-Feet	5000	8750	12500	2500	5000
Pipeline					
Power	$373,588	$670,766	$1,098,835	$156,178	$322,886
($/ac-ft)	$75	$77	$88	$62	$65
Treatment	$804,331	$1,407,580	$2,010,828	$402,166	$804,331
($/ac-ft)	$161	$161	$161	$161	$161
Cost of water	$800,000	$877,663	$955,325	$275,000	$550,000
($/ac-ft)	$160	$100	$76	$110	$110
Maintenance	$738,501	$1,151,651	$1,520,201	$351,228	$595,932
($/ac-ft)	$148	$132	$122	$140	$119
Total	$2,716,964	$4,108,129	$5,585,636	$1,185,045	$2,273,604
($/ac-ft)	$543	$470	$447	$474	$455

Table 6-3	Method 1 New Facilities	Method 2 All Facilities (USBR)	Method 3 All Facilities	Method 4 (Contract Cost)	Method 5 Cost to Supplier
Option 5 - East Canyon Pipeline (8,750 Ac-Ft)					
Capital Costs					
Contract Cost	$53,700,000	$76,000,000	$69,300,000	$39,900,000	$132,300,000
Contract Cost per Ac-Ft Capacity	$6,137	$8,686	$7,920	$4,560	$15,125
Contract Cost per Ac-Ft Delivered	$143	$203	$185	$106	$353
Option 5 - East Canyon Pipeline (12,500 Ac-Ft)					
Capital Costs					
Contract Cost	$67,300,000	$89,600,000	$82,900,000	$51,400,000	$189,100,000
Contract Cost per Ac-Ft Capacity	$5,384	$7,168	$6,632	$4,112	$15,125
Contract Cost per Ac-Ft Delivered	$138	$183	$170	$105	$387
Option 7 - Lost Creek Canyon Pipeline (5,000 Ac-Ft)					
Capital Costs					
Contract Cost	$25,500,000	$40,300,000	$37,800,000	$19,000,000	$92,100,000
Contract Cost per Ac-Ft Capacity	$5,100	$8,060	$7,560	$3,800	$18,420
Contract Cost per Ac-Ft Delivered	$112	$176	$165	$83	$403

2/23/2006

Costs are appraisal level and are to be used for option comparisons only

TOTAL LIFE CYCLE COSTS

	Option 3 Water Reuse	Option 4 Provo River (JSSD)	Option 5 Canyon Pipeline	East	Option 7 Lost Creek Canyon Pipeline	Option 8 Weber Provo Canal	Option 9 L.C., W.P. Canal
Capacity (Acre-feet)	3600	500	8750	12500	5000	5000	5000
Capital Cost of New Facilities							
Contract Cost	$14,200,000	$2,000,000	$39,900,000	$51,400,000	$19,000,000	$5,400,000	$10,800,000
Field Cost	$17,000,000	$2,400,000	$47,900,000	$61,700,000	$22,800,000	$6,400,000	$12,900,000
Total Cost	$19,100,000	$2,700,000	$53,700,000	$67,300,000	$25,500,000	$7,200,000	$14,400,000
Contract Cost per Acre-foot Capacity	$3,944	$4,000	$4,560	$4,112	$3,800	$1,080	$2,160
Capital Cost per Acre-foot Capacity	$5,306	$5,400	$6,137	$5,384	$5,100	$1,440	$2,880
Life Cycle Cost (Present Value)							
New Facilities							
Capital Cost (PV)	$19,100,000	$2,700,000	$51,800,000	$62,000,000	$22,300,000	$7,200,000	$12,500,000
O,M&R	$12,400,000	$600,000	$67,100,000	$83,700,000	$37,900,000	$2,700,000	$22,500,000
Cost of Water	$0	$0	$19,100,000	$20,000,000	$11,800,000	$11,800,000	$11,800,000
Total Cost	$31,450,000	$3,300,000	$138,000,000	$165,800,000	$72,100,000	$21,700,000	$44,200,000
Use of Existing Facilities							
Sunk Capital Costs	$750,000	$0	$15,600,000	$15,600,000	$12,300,000	$0	$9,900,000
Use of Facilities Charges	$0	$15,300,000	$0	$0	$0	$83,500,000	$44,500,000
Total Life Cycle Cost	$32,200,000	$18,600,000	$153,600,000	$181,400,000	$84,400,000	$105,200,000	$98,600,000
Life Cycle Cost Per Acre-foot Delivered	$179	$744	$410	$371	$369	$460	$431

2/28/2006

Costs are appraisal level and are to be used for option comparisons only