

Section 6 - Wastewater System

A. Capital Facilities Plan

The existing wastewater collection system consists of a network of eight and ten-inch lines throughout Kanab City proper. The existing lines generally flow toward the southwest with the majority of flow converging near the intersection of 700 South and Main Street. Effluent from the golf course area and the area south of Highway 89 conveyed by ten, twelve, and fifteen-inch lines converge with the flow from Kanab proper near this point. An eighteen inch outfall line carries the flow from that point south to the wastewater lagoons located near the Utah-Arizona border.

The State of Utah Division of Water Quality requires that collector lines be capable of conveying four hundred gallons per capita per day (400 gpcd). Larger trunk lines and outfall lines are required to convey two hundred and fifty gallons per capita per day (250 gpcd). These flow rate criteria were established by the State to account for the peaks in flow that occur in a typical wastewater conveyance system and should be used unless measured flow data is available.

For the wastewater system analysis, the elevation of each node was determined by use of a two-foot contour map of Kanab City. It should be noted that the elevations used to calculate the slope of each pipe section are natural ground elevations, not actual sewer invert elevations.

For each area in the wastewater conveyance system, a flow contribution was determined by estimating how many connections contributed to each trunk line and then multiplying those connections by a peak flow. A typical residential connection was used as a basis for flow calculation and all other types of connections are scaled to match the ERU (equivalent residential unit).

The analysis of the existing conveyance system shows that the existing trunk lines are able to support the current demand placed on the system. There are no areas requiring upgrades at present.

1. SERVICE STANDARD

The City of Kanab has chosen as its service standard the criteria set forth in Administrative Rules for Design Requirements for Wastewater Collection, Treatment and Disposal Systems (R317-3 of the Utah Administrative Code).

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2. INVENTORY OF EXISTING FACILITIES

An inventory of existing facilities was made from existing documentation available to Alpha Engineering. All existing facilities are shown on maps (See Appendix E) and were sent to the city for verification, corrections, and additions.

Collector Sewer Lines: The city owns an extensive system of pipelines, which collect flow from residential and commercial customers. Existing collection facilities are shown on the maps included in Appendix E. It is the city’s policy to require property owners to pay for the installation of required collector sewer lines at the time of construction. Because collectors are financed and installed with new development, no detailed estimate of replacement value has been prepared.

Outfall Sewer Lines: The major outfall sewer lines are summarized in the following table.

TABLE 19 – KANAB CITY EXISTING OUTFALL SEWER LINES

Location	Size (in)	Length (ft)	Replacement Cost	Contributing ERUs	Flow (gpm)	
					Design	Current
Golf Course area to Red Shadow Cr.	10	2,157	\$112,369	142	690	53
	12	3,475	\$193,304	181	1130	67
West Shadow Cr. To Main Line	15	1,237	\$81,906	211	2050	78
Main at Red Shadow to Kanab Creek Dr.	18	3,369	\$248,006	1,018	3650	378
Kanab Creek Drive to River Crossing E.	18	5,798	\$421,652	1,045	3650	388
River Crossing to Lagoons	18	3,928	\$277,810	1,062	3650	395

Lagoons: All wastewater collected by the city is conveyed to wastewater lagoons located near the Utah-Arizona border immediately west of the airport. There are four cells in the lagoon system. A summary of the features of each cell is presented below.

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TABLE 20 – KANAB CITY EXISTING WASTEWATER LAGOONS

Cell	Surface Area (square ft)		Elevation (feet)		Volume	
	High Water	Bottom	High Water	Bottom	(cubic feet)	(acre-feet)
1	1,376,544	1,252,506	4844.00	4838.00	7,887,150	181.06
2	1,380,288	1,256,080	4842.50	4836.50	7,909,104	181.57
3	1,020,498	912,660	4829.50	4823.50	5,799,474	133.14
4	1,024,104	916,104	4828.00	4822.00	5,820,624	133.62
Total	4,801,434	4,337,350			27,416,352	629.39

Kanab is currently using only two of the four lagoon cells (cells 1 and 2). With two cells in operation, the lagoons have a capacity of 348,280 gallons per day. With four cells in operation, the lagoons have a capacity of 609,280 gallons per day. The water balance at full capacity is summarized in the following table.

TABLE 21 – KANAB CITY WASTEWATER LAGOONS WATER BALANCE

Month	Gain ¹		Loss ¹		Net Gain ¹	Storage ¹
	Inflow	Precipitation	Evaporation	Percolation		
January	57.97	13.78	10.66	35.59	25.50	69.21
February	52.36	12.12	14.42	32.15	17.91	87.12
Mar	57.97	14.70	27.01	35.59	10.07	97.19
Apr	56.10	8.45	35.92	34.45	-5.81	91.38
May	57.97	6.61	30.96	35.59	-1.97	89.41
June	56.10	2.94	31.60	34.45	-7.01	82.40
July	57.97	9.28	71.92	35.59	-40.27	42.13
August	57.97	13.69	62.64	35.59	-26.58	15.55
September	56.10	8.63	45.84	34.45	-15.55	0.00
October	57.97	9.00	29.58	35.59	1.80	1.80
November	56.10	11.67	15.06	34.45	18.25	20.05
December	57.97	11.39	10.10	35.59	23.66	43.71
Total	682.53	122.26	385.70	419.09	0.00	

3. FINANCING OF EXISTING FACILITIES

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Existing Facilities have been financed through the water and sewer fund with revenues coming from impact fees, monthly user fees, grants, and loans. Long term debt that will be paid from the water and sewer fund is summarized below.

TABLE 22 – KANAB CITY LONG TERM WATER AND SEWER DEBT

Description	Balance Due June 30, 2005	Interest Rate	Payments (annual)	Matures
1987 Water and Sewer Bonds	\$39,416	5.00%	\$25,276	2007
1988 Water Bonds	\$81,000	7.40%	\$30,360 - \$31,496	2008
1992 Water Bonds	\$53,000	5.00%	\$7,750 - \$8,650	2013
1998 Water Bonds	\$897,769	2.00%	\$21,400 - \$91,180	2019
Total	\$1,071,185			

For impact fee analysis, water and sewer bonds will be divided evenly between water and sewer projects. Using this assumption, the total sewer debt on June 30, 2005 was \$19,708.

4. EXCESS CAPACITY

Equivalent Residential Units: In order to determine excess capacity, it is necessary to establish requirements for the existing Kanab City population. A large part of the current population is not connected to the wastewater system. As of February 2006 there were 1,756 water connections (1,519 residential and 237 commercial) and 966 sewer connections (898 residential and 68 commercial) suggesting that only about 59% (898/1,519) of the population has sewer service. With an estimated current Kanab City population of 3,589, the estimated number of people connected to the wastewater system is 2,118.

In order to determine the expected commercial and residential effluent per connection, the following preliminary assumptions have been made.

- Residential use is 100 gallons per day per citizen (gpcd).

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- The average flow per residential connection is 236 gpd (100 gpcd x 2.36 people per ERU).
- The average commercial connection is for an establishment with 3,500 square feet of floor area.
- Commercial effluent is 0.20 gallons per day per square foot of floor space.
- The average flow per commercial connection is 700 gallons per day (3,500 x 0.20).

These assumptions result in a residential flow of 0.212 mgd (236 gpd x 897 ERUs), and a commercial flow of 0.048 mgd (68 connections x 700 gpd per connection), and a total flow of 0.260 mgd from Kanab City for 2006. The average daily flow estimated from Kanab of 0.249 mgd based on sewage inflow records is 95.77% of the predicted flow based on the assumptions given above. As a result, the expected flow based on experienced flow rates is as follows.

- Residential average daily flow: 226 gpd per connection (236 x 0.9577)
- Commercial average daily flow: 670 gpd per connection (700 x 0.9577)

Using these expected flow values, approximately 1,100 ERUs (898 residential units + 68 commercial connections x 670 gpd / 226 gpd per ERU) are serviced at present. There are no significant industrial users connected to the system. All current users are either classified as residential or commercial.

A peak flow of 565 gpd (226 gpd x 2.5) has been used to estimate the capacity of the existing outfall lines. Also, 565 gpd will be used to size future outfall lines for build-out conditions. The average daily flow of 226 gpd per connection will be used to estimate the capacity of the existing lagoons and size future lagoons for build-out conditions.

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Outfall Sewer Lines: The major outfall sewer lines are summarized in the following table.

TABLE 23 – OUTFALL SEWER LINES VALUE OF EXCESS CAPACITY

Location	Size (in)	Replacement Cost	Current ERUs	Build-out ERUs	Value of Excess			Value of Excess
					Current	Design	Needed	
Golf Course area to Red Shadow Cr.	10	\$112,369	142	7,952	56	690	2430	\$103,249
	12	\$193,304	181	8,819	71	1,130	2330	\$181,158
West Shadow Cr. to Main Line	15	\$81,906	211	8,866	83	2,050	1429	\$78,590
Main at Red Shadow to Kanab Creek Dr.	18	\$248,006	1,056	11,891	414	3,650	1016	\$219,876
Kanab Creek Drive to River Crossing E.	18	\$421,652	1,083	15,849	425	3,650	2569	\$372,556
River Crossing to Lagoons	18	\$277,810	1,100	20,233	432	3,650	4289	\$244,929
Total		\$1,335,047						\$1,200,358

Lagoons: The value of excess lagoon capacity is calculated as follows.

- Estimated current ERUs: 1,100
- Average gallons per day per ERU: 226
- Estimated capacity of existing lagoon system in gallons/day: 609,280 (See Section VI-A-2)
- Estimated capacity of existing lagoon system in ERUs: 2,696 (609,280 gpd / 226 gpd per ERU)
- Estimated replacement cost of existing lagoon system: \$6,507,110 (609,280 gpd x \$10.68/gpd (estimated from recent contract for Parowan City sewer expansion))

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- Proportionate cost for current connected population: \$2,654,978 (1,100 ERUs /2,696 ERUs x \$6,507,110)
- Value of excess lagoon (existing without irrigation) capacity: \$3,852,132

Summary: The total value of excess capacity in the existing sewer collection and treatment system is as follows.

TABLE 24 – KANAB CITY SEWER SYSTEM VALUE OF EXCESS CAPACITY

Subsystem	Value
Outfall sewer lines	\$1,200,358
Lagoon system	\$3,852,132
Total	\$5,052,490

5. ADDITIONAL FACILITIES NEEDED AT PRESENT

The existing system is adequate to serve the current population. No additional facilities are needed at present.

6. ADDITIONAL FACILITIES NEEDED AT BUILDOUT

Equivalent Residential Units (ERUs): With 20,991 ERUs expected at build-out and a flow of 226 gallons per ERU per day, the expected flow from residential areas at build-out is 4.744 mgd. There will be an estimated 1,291 acres of commercial development at build-out. With an estimated effluent of 670 gallons per day per commercial site and an assumed 2 sites per acre, a total estimated daily flow of 1.729 mgd can be expected from commercial properties. The total estimated average daily flow at build-out from all types of development is 6.473 mgd. Assuming an average daily flow of 226 gallons per day there will be approximately 28,645 ERUs at build-out.

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Collector Sewer Lines: Although numerous collector lines will be needed at build-out, it is the city's policy to require developers to install needed collectors. As a result, collector sewer lines have not been analyzed for build-out.

Outfall Sewer Lines: The analysis of the future wastewater flows is based on the city's Future Land Use Map (See Appendix E). This map was used to determine the areas and densities contributing to critical points along the main trunk line. The flows contributing to the main trunk line are based on a peaking factor of 2.5 times the average daily flow per unit of 226 gpm, giving 565 gpm peak flows.

As shown in Table 23, in order to convey the build-out flows, the excess capacity of the existing outfall lines will be utilized. Parallel lines will be required from the golf course area to the wastewater lagoons.

The southeast portion of Kanab City currently consists of residential / agricultural land. At build-out stage, this area will be very low density residential. In order to collect the anticipated effluent from this area, a 15" line will be needed to the area south of the airport where a lift station will be required to deliver the flow to the lagoons.

The area on the East Side of Kanab, adjacent Highway 89, will have commercial / industrial zoning. The flow from this area as well as a large area of low and very low-density residential zoning will be conveyed through an 18" line that will tie into the existing main line north of the airport.

The Kanab Creek Ranchos area is served by private septic systems. It is expected that this area will eventually be connected to the wastewater system. Alpha Engineering prepared a detailed study, preliminary design, and preliminary cost estimate for this area in 1995. A 10" main line will be required to convey the flow from Kanab Creek Ranchos to a connection point on the main trunk line. In addition the 250 acres that is proposed to be annexed into Kanab City will require the 10-inch line to be upgraded to a 12-inch line. The cost of the 10" sewer line cannot be paid for by impact fees since the need is not attributable to growth. The cost estimates shown on line item West Kanab in Table 25 reflect the portion of cost attributable to the increase of pipe size from 10" to 12" for the Ranchos area.

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TABLE 25 – OUTFALL SEWER ADDITIONAL LINES NEEDED AT BUILDOUT

Location	Flow (gpm)	Length (ft)	Diameter (in)	Cost (\$)
Golf Course area to Red Shadow Cr.	2,430	2,157	18	\$160,831
	2,330	2,441	18	\$182,007
West Shadow Cr. to Main Line	1,429	1,237	18	\$92,234
Main at Red Shadow to Kanab Creek Dr.	1,016	3,369	15	\$219,490
East City to Kanab Creek Drive	1,553	14,000	18	\$1,043,875
Kanab Creek Drive to River Crossing East	2,569	5,798	18	\$432,313
River Crossing to Lagoons	4,289	3,928	30	\$505,318
West Kanab	1,720	14,500	12	\$77,152
East of Airport to Lagoons (gravity)	1,449	15,500	15	\$1,009,825
East of Airport to Lagoons (pressure)	1,449	1,600	12	\$91,900
Total				\$3,814,946

Sewer Lift Station: A lift station will be needed in order to serve the southeast part of the city. The station, which is expected to be built south of the airport, will cost an estimated \$180,000.

Treatment: After the capacity of the lagoon system is exceeded, the city plans to build a mechanical treatment plant to meet wastewater treatment needs at build-out. As discussed under Equivalent Residential Units above, there will be an estimated flow of 6.474 mgd at build-out. At an estimated cost of eight dollars per gallon per day of capacity (Rogers, 2006) for a one million gallon expandable plant, and five dollars per gallon per day of capacity (Rogers, 2006) for the additional 5.474 mgd plant, the mechanical treatment plant will cost approximately \$35,370,000. The existing ERUs will contribute 0.249 mgd (valued at \$1,360,385 (0.249x\$35,370,000/6.474) to the mechanical treatment plant, therefore, future ERUs will be responsible for \$34,009,615 of the total

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cost. It is anticipated that the plant will be constructed at the site of the existing lagoons, with some of the lagoons being used for emergency backup.

Total Cost: The total estimated cost of additional facilities needed at build-out is summarized below.

TABLE 26 - ESTIMATED COST OF ADDITIONAL FACILITIES NEEDED AT BUILDOUT

Item	Cost
Outfall sewer lines	\$3,814,946
Sewer lift station	\$180,000
Mechanical treatment plant	\$34,009,615
Total	\$38,004,561

1 See section VI-A-4.

7. METHOD OF FINANCING NEEDED FACILITIES

Facilities needed due to growth should be financed through impact fees. The Ranchos area will require a 12-inch line, however, only the cost to expand from a 10-inch to a 12-inch line due to the McCowan subdivision should be paid for through impact fees since the 10-inch line is needed for the existing homes.

B. Development Impact Fee Analysis

1. SERVICE AREA

Most of the facilities included in the Capital Facilities Plan serve a large portion of the city. Because of this, and the difficulty in assigning benefits to a given area or number of lots, the entire city will be included in a single service area.

2. PROPORTIONATE SHARE

In order to determine the proportionate share for each type of establishment the following table has been derived from the state code.

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TABLE 27 – PROPORTIONATE SHARE

Type	Units	GPD /Unit	ERUs
Permanent residence	Residence	400	1.0000
Hotels & motels	Room	150	0.3750
RV parks	Space	100	0.2500
Airports	Passenger	3	0.0075
	Employee	15	0.0375
Boarding houses	Residents	50	0.1250
	Nonresidents	10	0.0250
Bowling alleys w/snack bar	Alley	100	0.2500
Bowling alleys w/o snack bar	Alley	85	0.2125
Churches	Person	5	0.1250
	Resident member	100	0.2500
Country clubs	Non-resident member	25	0.0625
	Employee	15	0.0375
Dentist's office	Chair	200	0.5000
	Staff member	35	0.0875
Doctor's office	Patient	10	0.0250
	Staff member	35	0.0875
Fairgrounds	Person	1	0.0025
Fire station w/food preparation	Full-time employee	70	0.1750
Fire station w/o food preparation	Full-time employee	5	0.0125
Gyms	Participant	25	0.0625
	Spectator	4	0.0100
Hairdresser	Chair	50	0.1250
	Operator	35	0.0875
Hospitals	Bed	250	0.6250
Industrial buildings w/showers (exclusive of industrial waste)	Employee per shift	35	0.0875
Industrial buildings w/o showers (exclusive of industrial waste)	Employee per shift	15	0.0375
Jail facilities	Inmate	115	0.2875
	Employee	10	0.0250
Launderette	Washer	580	1.4500
Movie Theaters (auditorium)	Seat	5	0.0125
Movie Theaters (drive-in)	Car	10	0.0250
Nursing Homes	Bed	280	0.7000
Office buildings w/cafeteria	Employee	25	0.0625
Office buildings w/o cafeteria	Employee	15	0.0375
Picnic parks	Person	5	0.0125

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TABLE 27 – PROPORTIONATE SHARE Cont

Type	Units	GPD /Unit	ERUs
Restaurants w/24 hour service	Seat	50	0.1250
Restaurants w/o 24 hour service	Seat	35	0.0875
Restaurants – single service utensils	Customer/day	10	0.0250
Rooming house	Person	40	0.1000
Schools – boarding	Person	75	0.1875
Schools w/o cafeteria & showers	Person	15	0.0375
Schools w/cafeteria w/o showers	Person	20	0.0500
Schools w/cafeteria & showers	Person	25	0.0625
Service stations	Vehicle/day	10	0.0250
Skating rinks & dance halls w/kitchen	Person	13	0.0325
Skating rinks & dance halls w/o kitchen	Person	10	0.0250
Ski areas w/o kitchen	Person	10	0.0250
Stores	Toilet stall	500	1.2500
	Employee	11	0.0275
Swimming pools & bath houses	Person	10	0.0250
Taverns, bars, cocktail lounges	Seat	20	0.0500
Visitor centers	Visitor day	5	0.0125

3. CREDITS FOR PAST AND FUTURE CONTRIBUTIONS

Existing improvements have been paid for out of the water and sewer fund with little or no contribution from the general fund. As a result, no credit for past contributions is applicable. There were outstanding loans in the amount of \$19,708 as of June 30, 2005, which will be paid out of the sewer fund. This amount will be applied as a credit toward the impact fee.

4. IMPACT FEE CALCULATION

Impact fees have been calculated based upon the following assumptions.

- Value of excess capacity: \$5,052,490
- Additional improvements needed at build-out: \$38,004,561
- Long term debt: \$19,708

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The value of excess capacity plus the cost of additional improvements needed at build-out less payments on long term debt is \$43,037,343. With an estimated additional 27,545 (28,645 – 1,100) ERUs at build-out, the estimated cost per ERU will be \$1,562.44. Assuming an interest rate of 5.00% and a loan period of 20 years, payments would total \$1.605 for every dollar borrowed. Therefore, the maximum allowable impact fee is \$2,508. The following table contains a schedule of maximum impact fees.

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TABLE 28 – WASTEWATER SYSTEM MAXIMUM ALLOWABLE IMPACT FEES

Type	Units	ERUs	Impact Fee / Unit
Permanent residence	Residence	1.0000	\$2,508
Hotels & motels	Room	0.3750	\$941
RV parks	Space	0.2500	\$627
Airports	Passenger	0.0075	\$19
	Employee	0.0375	\$94
Boarding houses	Residents	0.1250	\$314
	Nonresidents	0.0250	\$63
Bowling alleys w/snack bar	Alley	0.2500	\$627
Bowling alleys w/o snack bar	Alley	0.2125	\$533
Churches	Person	0.0125	\$31
Country clubs	Resident member	0.2500	\$627
	Non-resident member	0.0625	\$157
	Employee	0.0375	\$94
Dentist's office	Chair	0.5000	\$1,254
	Staff member	0.0875	\$219
Doctor's office	Patient	0.0250	\$63
	Staff member	0.0875	\$219
Fairgrounds	Person	0.0025	\$6
Fire station w/food preparation	Full-time employee	0.1750	\$439
Fire station w/o food preparation	Full-time employee	0.0125	\$31
Gyms	Participant	0.0625	\$157
	Spectator	0.0100	\$25
Hairdresser	Chair	0.1250	\$314
	Operator	0.0875	\$219
Hospitals	Bed	0.6250	\$1,568
Industrial buildings w/showers (exclusive of industrial waste)	Employee per shift	0.0875	\$219
Industrial buildings w/o showers (exclusive of industrial waste)	Employee per shift	0.0375	\$94
Jail facilities	Inmate	0.2875	\$721
	Employee	0.0250	\$63
Launderette	Washer	1.4500	\$3,637
Movie Theaters (auditorium)	Seat	0.0125	\$31
Movie Theaters (drive-in)	Car	0.0250	\$63
Nursing Homes	Bed	0.7000	\$1,756
Office buildings w/cafeteria	Employee	0.0625	\$157
Office buildings w/o cafeteria	Employee	0.0375	\$94
Picnic parks	Person	0.0125	\$31

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TABLE 28 – WASTEWATER SYSTEM MAXIMUM ALLOWABLE IMPACT FEES Cont

Type	Units	ERUs	Impact Fee / Unit
Restaurants w/24 hour service	Seat	0.1250	\$314
Restaurants w/o 24 hour service	Seat	0.0875	\$219
Restaurants – single service utensils	Customer/day	0.0250	\$63
Rooming house	Person	0.1000	\$251
Schools – boarding	Person	0.1875	\$470
Schools w/o cafeteria & showers	Person	0.0375	\$94
Schools w/cafeteria w/o showers	Person	0.0500	\$125
Schools w/cafeteria & showers	Person	0.0625	\$157
Service stations	Vehicle/day	0.0250	\$63
Skating rinks & dance halls w/kitchen	Person	0.0325	\$82
Skating rinks & dance halls w/o kitchen	Person	0.0250	\$63
Ski areas w/o kitchen	Person	0.0250	\$63
Stores	Toilet stall	1.2500	\$3,135
	Employee	0.0275	\$69
Swimming pools & bath houses	Person	0.0250	\$63
Taverns, bars, cocktail lounges	Seat	0.0500	\$125
Visitor centers	Visitor day	0.0125	\$31