

**Navajo-Gallup Water Supply Project**

**APPENDIX D  
COST ESTIMATE SPREADSHEETS**

**SJR Alternative: Navajo - Gallup Water Supply Project Cost Scenarios. With GW.**

SJR Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Demand Years	Cost 2000 dollars	Navajo		Gallup		Totals
		A/F	\$Cost	A/F	\$Cost	\$ Cost \$
2040	Project Cost \$\$	12,940	\$188,452,168	3,750	\$39,740,045	\$228,192,214
50% Demands	Annual Energy \$		\$1,747,456		\$596,600	\$2,344,055
	Annual O&M \$		\$3,446,640		\$736,459	\$4,183,100
2010	Project Cost \$\$	11,141	\$169,002,355	7,500	\$78,300,643	\$247,302,998
	Annual Energy \$		\$1,668,101		\$1,160,945	\$2,829,046
	Annual O&M \$		\$3,051,375		\$1,322,370	\$4,373,745
2020	Project Cost \$\$	15,230	\$206,032,056	7,500	\$71,616,358	\$277,648,414
	Annual Energy \$		\$2,092,009		\$1,116,018	\$3,208,027
	Annual O&M \$		\$3,521,153		\$1,186,149	\$4,707,302
2030	Project Cost \$\$	21,291	\$252,600,414	7,500	\$64,029,690	\$316,630,105
	Annual Energy \$		\$2,605,354		\$1,068,942	\$3,674,296
	Annual O&M \$		\$4,066,108		\$1,040,265	\$5,106,374
(Attached) 2040	Project Cost \$\$	29,067	\$309,811,865	7,500	\$58,121,032	\$367,932,897
	Annual Energy \$		\$3,249,942		\$1,028,460	\$4,278,402
	Annual O&M \$		\$4,744,196		\$926,440	\$5,670,636
2040: No GW	Project Cost \$\$	32,254	\$330,627,493	7,500	\$56,113,728	\$386,741,221
	Annual Energy \$		\$3,611,272		\$1,014,790	\$4,626,062
	Annual O&M \$		\$4,994,648		\$879,979	\$5,874,626
2040: Laterals Lake Valley, Burnham Whiterock, Whitehorse Lake	Project Cost \$\$		\$6,289,466		Total:	\$393,030,687
	Annual Energy \$		\$45,042			\$4,671,104
	Annual O&M \$		\$50,944			\$5,925,570

**SJR Alternative: Navajo - Gallup Water Supply Project Cost/AF over Forty-Year Increments**

Demand Years	Cost 2000 dollars	Navajo		Gallup	
		A/F	\$Cost/AF	A/F	\$Cost/AF
2010	Share Cost \$\$	11,141	\$15,169	7,500	\$10,440
	Annual Energy \$		\$150		\$155
	Annual O&M \$		\$274		\$176
2020	Share Cost \$\$	15,430	\$13,528	7,500	\$9,549
	Annual Energy \$		\$137		\$149
	Annual O&M \$		\$231		\$158
2030	Share Cost \$\$	21,391	\$11,864	7,500	\$8,537
	Annual Energy \$		\$122		\$143
	Annual O&M \$		\$191		\$139
2040	Share Cost \$\$	29,067	\$10,659	7,500	\$7,749
	Annual Energy \$		\$112		\$137
	Annual O&M \$		\$163		\$124

NOTE:

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE IS CORE LINE FROM GALLEGOS - YAHTAHEY - WINDOW ROCK - GALLUP - CHURCHROCK
- 3.) NASCHITTI LATERAL INCLUDES SANOSTEE, NEWCOMB, TWO GREY HILLS, SHEEP SPRINGS, NASCHITTI CHAPTERS.
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES CROWNPOINT, DALTON PASS, BECENTI, COYOTE CANYON, STANDING ROCK, LITTLEWATER CHAPTERS.
- 5.) GALLEGOS RESERVOIR COST IS \$38,037,430 FOR 8,800 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) HUERFANO LATERAL IS FROM GALLEGOS/WTP-HUERFANO, NAGEEZI, PUEBLO PINTADO, TORREON NTUA SYSTEM.
- 8.) ASSUMME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.
- 9.) ALL COST ESTIMATES INCLUDES NAPI AND SHIPROCK AREA DEMANDS.

**Year 2040**

**SJR Alternative: Navajo - Gallup Water Supply Project Cost Scenario. With GW.**

SJR Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Peaking Factor = 1.3                      Demands:                      29,066 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,066	\$323,971,647	0	\$0	\$323,971,647
Annual Energy \$		\$3,323,467		\$0	\$3,323,467
Annual O&M \$		\$5,257,567		\$0	\$5,257,567

Peaking Factor = 1.3                      Demands:                      36,567 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,067	\$309,811,865	7,500	\$58,121,032	\$367,932,897
Annual Energy \$		\$3,249,942		\$1,028,460	\$4,278,402
Annual O&M \$		\$4,744,196		\$926,440	\$5,670,636

**NOTE:**

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE GOES FROM PNM DIV.-RES./WTP-666HIGHWAY.-WR-GALLUP-GALLUP AREA NAVAJOS.
- 3.) CUTTER LATERAL INCLUDES HUERFANO, NAGEEZI, PUEBLO PINTADO, TORREON, WHITEHORSE LAKE, COUNSELOR CHAPTERS.
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES DALTON PASS, BECENTI, LAKE VALLEY, STANDING ROCK, WHITEROCK, AND CROWNPOINT, AND LITTLEWATER CHAPTERS.
- 5.) RESERVOIR COST IS \$9,600,000 FOR 1,500 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) ASSUMME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.

**Navajo - Gallup Water Supply Project - San Juan River Alternative**  
 (Cost Estimates for Main Pipeline to Gallup and Church Rock, with G.W. demands, plus Gallup Area Navajo Demands)

Chapter Community	Populations		Daily Demand (R,3.4) Gal.	Annual Ground Water Production			Annual Demands Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1)	2040		1988 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$5		Gal./Day(5)	cfs	
	1980									
Hogback Div. Intake	0	0	0	0	0	\$0	0	0.00	59.18	
Reservoir/WTP	0	0	0	0	0	\$0	0	0.00	59.18	
NAPI Jct.	0	0	674,820	0	0	\$0	700	624,820	0.97	
Shiprock Jct.	13,804	46,985	3,339,749	0	0	\$0	3,741	4,341,674	6.72	
Sanostee	2,081	7,083	1,123,008	69	153	\$0	1,117	1,295,734	2.00	
Burnham Jct.	246	837	132,971	0	0	\$0	190	174,162	0.27	
Newcomb	1,334	5,281	835,413	113	69	\$0	847	982,745	1.52	
Sheep Springs	860	2,346	396,434	0	15	\$0	388	449,856	0.70	
Naschiti	1,338	5,238	836,106	82	77	\$0	862	1,003,213	1.55	
Tohatchi	2,318	7,860	1,852,376	180	207	\$0	1,107	1,284,797	1.98	
Coyote Cyn. Jct.	3,824	20,184	3,226,187	352	798	\$0	2,818	3,267,523	5.06	
Twin Lakes	1,367	5,695	1,071,224	67	153	\$0	1,047	1,215,024	1.88	
Ya-tah-ey Jct.	14,895	50,865	8,106,337	1,100	860	\$0	8,191	9,595,335	14.71	
Gamerco Hill	0	0	0	0	0	\$0	0	0	21.83	
Gallup Jct.	23,000	62,300	9,118,848	4,413	184	\$0	10,029	11,638,388	18.01	
Church Rock	6,089	13,818	2,225,860	250	365	\$0	2,127	2,467,530	3.82	
<b>228,273 2040 Population Served</b>							<b>33,121 Total Annual Demand(AP)</b>			

Chapter Community	Pipeline Dimension				Elevation			Headloss due to friction (F)	Pump Horsepower (HP)	Storage Demands (5)
	Area sq. ft.	Diameter in.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Hogback Div. Intake	14.80	4.34	82.1	0	5,075	5,075	0	0.0	0.0	0
Reservoir/WTP	14.80	4.34	82.1	0	5,075	5,150	75	0.3	538.2	0
NAPI Jct.	14.80	4.34	82.1	8,106	5,110	5,250	140	7.1	1411.3	0
Shiprock Jct.	14.55	4.30	51.7	91,642	5,250	5,160	-90	80.1	0.0	0
Sanostee	12.87	4.05	48.6	94,323	5,160	5,580	420	86.8	4230.4	4,863,581
Burnham Jct.	12.37	3.87	47.6	51,075	5,580	5,580	10	49.3	475.7	0
Newcomb	12.31	3.86	47.5	19,088	5,580	5,850	-270	18.4	0.0	3,779,794
Sheep Springs	11.93	3.80	46.8	51,174	5,350	5,390	40	49.4	3010.7	1,730,217
Naschiti	11.75	3.67	46.4	29,636	5,390	5,890	500	30.1	229.0	3,945,974
Tohatchi	11.26	3.80	45.6	90,183	5,890	6,100	210	91.5	2221.1	4,941,528
Coyote Cyn. Jct.	10.87	3.72	44.6	34,954	6,100	6,250	150	35.4	1308.6	0
Twin Lakes	9.80	3.50	42.0	15,984	6,250	6,390	140	17.8	918.8	4,673,171
Ya-tah-ey Jct.	9.13	3.41	40.9	31,181	6,390	6,580	190	35.1	1273.8	0
Gamerco Hill	8.46	2.64	31.6	20,682	6,580	6,335	-245	31.5	1438.6	0
Gallup Jct.	5.46	2.64	31.6	14,533	6,580	6,477	-83	22.4	0.0	0
Church Rock	0.95	1.10	13.2	46,082	6,477	6,660	183	185.7	228.2	0,491,654
<b>597,684 Total Pipeline Length(L)</b>							<b>17,082</b>			

Reservoir / WTP	Total Capital Cost						Annual	
	Pump (\$)	Storage (\$)	Pipe Diameter used (in.)	Pipe-Common (\$/ft)	Pipe-Rock (\$/ft)	Total (\$)	Energy Cost \$	O&M Cost \$
Hogback Div. Intake	\$2,000,000					\$2,000,000	\$12,000	\$129,000
Reservoir/WTP	\$54,701,008					\$54,701,008	\$319,874	\$2,545,318
NAPI Jct.	\$863,696	\$0	52	\$1,300,830	\$189,620	\$2,334,161	\$276,678	\$41,900
Shiprock Jct.	\$0	\$0	52	\$14,621,106	\$1,906,525	\$16,827,832	\$0	\$82,638
Sanostee	\$2,589,012	\$1,296,675	50	\$14,532,291	\$1,693,441	\$20,311,419	\$828,367	\$237,566
Burnham Jct.	\$291,121	\$0	46	\$7,536,257	\$981,444	\$8,310,821	\$93,258	\$54,243
Newcomb	\$0	\$862,421	48	\$2,817,224	\$366,790	\$4,146,449	\$0	\$54,417
Sheep Springs	\$1,642,530	\$509,282	48	\$7,553,868	\$983,946	\$10,079,096	\$580,238	\$140,256
Naschiti	\$140,128	\$962,421	46	\$4,153,420	\$544,286	\$5,802,253	\$44,888	\$67,740
Tohatchi	\$1,259,317	\$1,296,675	46	\$12,730,967	\$1,656,331	\$17,042,980	\$435,445	\$178,175
Coyote Cyn. Jct.	\$799,048	\$0	46	\$4,934,275	\$641,977	\$6,375,900	\$256,160	\$50,887
Twin Lakes	\$962,322	\$1,296,675	42	\$2,003,236	\$260,328	\$4,122,561	\$180,135	\$95,678
Ya-tah-ey Jct.	\$779,576	\$0	42	\$4,003,024	\$524,205	\$5,302,784	\$249,730	\$53,799
Gamerco Hill	\$880,405	\$0	32	\$1,098,758	\$269,480	\$2,248,643	\$292,030	\$45,598
Gallup Jct.	\$0	\$0	32	\$1,417,264	\$183,987	\$1,601,251	\$0	\$8,006
Church Rock	\$139,635	\$2,305,200	14	\$2,081,603	\$275,512	\$4,801,951	\$44,731	\$109,579
<b>Sub-Total</b>	<b>\$56,701,008</b>	<b>\$10,454,345</b>	<b>\$9,719,419</b>	<b>\$91,761,106</b>	<b>\$10,649,306</b>	<b>\$168,285,214</b>	<b>\$3,602,632</b>	<b>\$3,785,791</b>
Capital Cost	\$56,701,008	\$10,454,345	\$9,719,419	\$91,761,106	\$10,649,306	\$168,285,214		
Contingency Cost	20%					\$33,657,043		
Mobilization Cost	10%					\$16,828,521		
Indirect Cost	27%					\$45,437,008		
<b>Totals</b>						<b>\$264,207,785</b>		

- NOTES:
- ALL POPULATIONS FROM 1980 CENSUS POPULATION AND HOUSEHOLD CHARACTERISTICS OF THE NAVAJO NATION, 1980
  - CITY OF GALLUP ANNUAL DEMAND IS 7.8M GPD.
  - ASSUME NAVAJO DEMAND OF 100 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED POPULATION.
  - ASSUME PIPELINE DEMANDS FOR MAIN AT THE APPROX. 80% OF 1.8.
  - ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON NAVAJO ANNUAL DEMAND. COST FROM THE 1980 NAVAJO HEAVY CONSTRUCTION COST DATA AND ROUNDED TO ONE DOLLAR.
  - STORAGE COST ARE FOR SANDWICH, BROOKS, TWO DORY HILLS, BERRIPARSON, TONATCHI, MEXICAN SPRING, CHURCH ROCK, FREDALIA, HANNAH LAKE, AND HANRICK FOR THE COST ESTIMATE SHEET.
  - ASSUME GALLON / DAY PEAKING FACTOR OF 1.30
  - ASSUME HEADLOSS 44 FEET PER SECTION FROM 1980 ASSOCIATES, 1980
  - ASSUME EFFICIENCY PER PUMP FROM 1980 ASSOCIATES, 1980. COST ROUNDED TO ONE (\$/GPM) ASSUME PUMPING EFFICIENCY AT 70%.
  - HEAD LOSS BASED ON 4 FEET PER SECTION BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA. SLIGHTLY HIGH INJECTION COEFFICIENT.
  - BASED ON 1980 DATA, THIS BASED ON BID COSTS FROM 1980-1984. WORKSHOP MATERIALS & UNION BENCHMARK ASSUME WTP COST OF \$45,101,008
  - PIPE INSTALLED COST FROM 1980 NAVAJO HEAVY CONSTRUCTION COST DATA. ASSUME 80% OF PIPE LENGTH IS COMMON AND 20% ROCK EXCAVATION
  - SETTLING RESERVOIR IS ASSUMED TO BE 1.8M ACF CAPACITY. COST ESTIMATE FROM STCLAND & MATATA. \$8,600,000
  - ANNUAL ENERGY COST BASED ON 1980 NAVAJO HEAVY CONSTRUCTION ANNUAL O&M COST - WTP PUMPS BASED ON 1000 PER HOUR PER HOUR
  - ANNUAL O&M COST BASED ON WTP COST, 80% O&M COST, WITHIN RESERVOIR COST - WTP PUMP COST - WTP STORAGE COST - WTP PIPELINE COST - 1.8%
  - WORKLOADING COST INCLUDES ADDITIONAL MOBILIZATION/DEPRECIATION AND APPURTENANCES AT 10% ADDITIONAL CONTINGENCY COST AT 20%
  - INDIRECT COST INCLUDES INFLATION, 10% TERRESTRIAL CONTRACT ADMIN. 1%, EMPLOYER 2%, SANDWICH 1%, BROOKS 1%, CHURCH ROCK 1%, FREDALIA 1%, HANNAH LAKE 1%, HANRICK 1%, AND CONSTRUCTION OTHER 10%

**Navajo - Gallup Water Supply Project - San Juan River Alternative**  
(Cost Estimate for Lateral Wasteline from Cudde Reservoir to Huerfano, Nageezi, Pueblo Pintado, Tomson)

Chapter Community	Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand	Cumulative Flow
	(1) 1990	2040	(2,4) Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$3	Ac-Ft	Gal./Day(6)	cfs
Cudde Reservoir	0	0	0	0	0	\$0	0	0	0.00
Huerfano	511	1,736	278,289	50	31	\$0	281	325,796	0.50
Nageezi	961	2,336	534,250	21	15	\$0	583	677,117	1.05
Counselor	2,447	8,229	1,302,831	5	31	\$0	1,462	1,696,442	2.92
Tomson	1,950	6,671	1,067,412	113	76	\$0	1,120	1,299,432	2.01

4.00 MGD  
20,079 2040 Population Served      3,446 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (5)	Pump Horsepower HP	Storage Demands (5) Gal
	Area sq ft (7)	Diameter ft	Diameter inches	Length ft	Beginning ft	Ending ft	Change ft			
Cudde Reservoir	1.55	1.40	16.8	0	5,930	5,930	0	0.0	0.0	0
Huerfano	1.55	1.40	16.8	136,961	5,930	6,850	920	412.4	1336.2	1,253,072
Nageezi	1.42	1.35	16.1	61,308	6,850	6,950	100	211.6	287.1	2,604,296
Counselor	1.16	1.21	14.6	105,773	6,950	6,960	-60	365.1	206.7	4,863,978
Tomson	0.50	0.80	9.6	85,396	6,850	6,500	-260	309.5	81.0	4,997,816

289,438 Total Pipeline Length(ft.)      1,911  
73.76 Total Pipeline Length (Miles)

Chapter Community	Total Capital Cost						Annual Energy Cost Treatment	Annual Energy Cost Pump Stations	Annual Operation and Maintenance Cost Treatment	Annual Operation and Maintenance Cost Pump Stations	Annual Operation and Maintenance Cost Storage Tanks	Annual Operation and Maintenance Cost Conveyance Pipe
	Water Treatment (\$10)	Pump (\$18)	Storage (\$5)	Pipe Diameter used (In.)	Pipe-Common (\$11)	Pipe-Rock (\$11)						
Cudde Reservoir	\$5,715,197	\$0	\$0	18	\$0	\$0	\$5,715,197	\$114,536	\$374,654	\$489,190		
Huerfano	\$817,775	\$320,423	\$0	18	\$7,735,813	\$1,014,245	\$9,886,256	\$489,190	\$1,145,359	\$46,762	\$140,525	\$108,308
Nageezi	\$175,888	\$559,352	\$0	15	\$3,115,144	\$410,084	\$4,260,468	\$114,536	\$46,762	\$140,525	\$108,308	
Counselor	\$125,517	\$1,296,675	\$0	15	\$5,374,472	\$707,506	\$7,505,170	\$114,536	\$46,762	\$140,525	\$108,308	
Tomson	\$49,566	\$1,296,675	\$0	10	\$2,912,223	\$382,204	\$4,650,668	\$114,536	\$46,762	\$140,525	\$108,308	
Sub-Total	\$5,715,197	\$1,699,546	\$3,513,125		\$19,137,652	\$2,524,038	\$32,059,559	\$1,440,974	\$46,762	\$140,525	\$108,308	
Capital Cost	\$5,715,197	\$1,699,546	\$3,513,125		\$19,137,652	\$2,524,038	\$32,059,559					
Contingency Cost		20%					\$6,411,912					
Mobilization Cost		10%					\$3,205,956					
Indirect Cost		27%					\$8,656,081					
Totals							\$50,333,507					

- NOTES:
- ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
  - ASSUME NAVAJO DEMAND OF 80 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
  - ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 3.00 GAL./PERSON/DAY @ 4.5 PERSONS/HOUSEHOLD. COST FROM THE 1990 MEXICO HEAVY CONSTRUCTION COST DATA AND INDEXED TO 1998 DOLLARS.
  - ASSUME GALLON/DAY PERIOD FACTOR OF: 1.20
  - ASSUME VELOCITY OF 4 FEET PER SECOND FROM PDM ASSOCIATES, 1993
  - ASSUME 8000HP PER PUMP FROM PDM ASSOCIATES, 1998. COST INDEXED TO 1998 ON (1984) ASSUME PUMPING EFFICIENCY AT: 70%
  - HEAD LOSS BASED ON A FEET PER SECOND BASED ON HAZENWILLIAMS HEADLOSS FORMULA, DOUBLE FROM FRICTION COEFFICIENT
  - BASED ON PDM ANALYSIS BASED ON 800 COSTS FROM MEXICO HEAVY CONSTRUCTION & LABOR SOURCES. ASSUME WFP COST OF: \$4,715,197
  - PIPE INSTALLED COST FROM PDM ANALYSIS BASED ON 800/1000 DOLLARS. ASSUME 6% OF PIPE LENGTH IS DOWN AND 94% IS ROCK ELEVATION
  - ASSUME A CATCHER OVERSIGHT/HAZE COST OF: \$1,000,000
  - ANNUAL ENERGY COST BASED ON 1000 WHP PER HOUR ANNUAL COST \* 70% PUMPING BASED ON 1000 PER HOUR/24 HOUR
  - ANNUAL O&M COST BASED ON WFP COST, 80% O&M COST, 10% PUMPING COST \* 70% PUMP COST \* 6% STORAGE COST \* 4% PIPELINE COST \* 1.5%
  - MOBILIZATION COST INCLUDES ADDITIONAL LABOR/OPERATION AND SUPPLIES AT 10% ADDITIONAL CONSTRUCTION COST AT 8%
  - INDIRECT COST INCLUDES PROJECTIVE 1%, TRAVEL 2%, CONTRACT ADMIN. 1%, GENERAL 1%, SURETY 1%, DESIGN 4%, DESIGN SURVEY 1%, INVEST. 2%, DESIGN 1%, AND CONSTRUCTION OBSERV. 1%

**Navajo - Gallup Water Supply Project - San Juan River Alternative**  
(Cost Estimate for Lateral Waterline to Red Rock NTUA Water Line)

Chapter Community	Populations(1,2)		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1)	2040	Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. Prog. Dev. Cost \$	Ac-Ft	Gal./Day(8)	cts	cts
	1990									
Gallup Jct.	0	0	0	0	0	\$0	0	0	0.00	3.95
Red Rock	3,815	12,985	2,077,840	78	138	\$0	2,189	2,540,774	3.93	3.83

12,985 2040 Population Served

2,189 Total Annual Demand(AF)

Chapter Community	Pipe Line Dimensions				Elevation			Headloss due to friction (9) ft.	Pump Horsepower (5) HP	Storage Demands (5) Gal
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
	Gallup Jct.	0.98	1.12	13.4	0	6,477	6,477			
Red Rock	0.98	1.12	13.4	26,320	6,477	6,750	273	106.1	241.6	9,772,209

26,320 Total Pipeline Length(ft.)

242

4.98 Total Pipeline Length (Miles)

	Total Capital Cost							Annual Energy Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	
Gallup Jct.	\$0	\$0	\$0	14	\$0	\$0	\$0	Treatment \$0
Red Rock	\$147,830	\$147,830	\$2,305,200	14	\$1,189,436	\$157,429	\$3,799,894	Pump Stations \$47,356
Sub-Total	\$0	\$147,830	\$2,305,200		\$1,189,436	\$157,429	\$3,799,894	\$47,356
Capital Cost	\$0	\$147,830	\$2,305,200		\$1,189,436	\$157,429	\$3,799,894	Annual Operation and Maintenance Cost
Contingency Cost	20%						\$759,979	Treatment \$0
Mobilization Cost	10%						\$379,989	Pump Stations \$5,913
Indirect Cost	27%						\$1,025,971	Storage Tanks \$82,208
Totals							\$5,965,834	Conveyance Pipe \$6,734
								Total \$152,211

**NOTES:**

1. ALL NEW POPULATIONS FROM 1980 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1980
2. BASELINE NAVAJO DEMAND OF 199 GAL/DAY PER CAPITA AND BASED ON 1998 PROJECTED DEMANDS.
3. ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 3.00 GAL/HOUSEHOLD @ 4.4 PERSONS/HOUSEHOLD COST FROM THE 1998 MEDIUM HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 COLLAGE.
4. RED ROCK DEMANDS INCLUDE RED ROCK, BREADSPRING, CIRCLE TOWN CHAPTERS
5. BASELINE SLOPE: 1.00 PERCENT FACTOR OF SAFETY
6. BASELINE VELOCITY: 4 FEET PER SECOND FROM 1998 ASSOCIATES, 1998
7. NAVAJO 1998 PUMP FROM 1998 ASSOCIATES, 1998, COST ADDED TO 2000 GTPMP, ASSUME PUMPING EFFICIENCY AT 70%
8. HEAD LOSS BASED ON 1 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA, (EXCLUDE FROM FRICTION COEFFICIENT)
9. BASED ON APODYM ANALYSIS BASED ON BID COSTS FROM M&M, MORGANSON MARBLE & LABOR SOURCES, ASSUME WTP COST OF \$0
10. PIPE INSTALLED OFF FROM INDIAN ANALYSIS BASED ON 2000 PIPELINE COLLAGE, ASSUME 50% OF PIPE LENGTH IS COMMON AND 50% IS ROCK EXCAVATION
11. ANNUAL O&M COST BASED ON: INTAKE/RESERVOIR ANNUAL O&M COST \* %L, PUMPING: BASED ON \$0.25 PER GALLON/FT HOUR.
12. ANNUAL O&M COST BASED ON WTP COST, BOR O&M COST, HEAD/RESERVOIR COST \* %L, PUMP COST \* %L, STORAGE COST \* %L, PIPELINE COST \* %L
13. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION PREPARATION AND IMPLEMENTATION AT 10%. ADDITIONAL CONTINGENCY COST AT 10%.
14. INDIRECT COST VALUE FACULTY 10%, 10% CONTRACT ADMIN, 10% ENVIRON, 2% BASEMENTS, 1% GEOTECH, 1% ARCHIT, 0.5% DESIGN SURVEY, 1% INVEST, 1% DESIGN, 1% AND CONSTRUCTION O&M, 1%

**Navajo - Gallup Water Supply Project - San Juan River Alternative**  
(Cost Estimate for Lateral Waterline to Coyote Canyon, Standing Rock, and Dalton Pass NTUA Water Line)

Chapter Community	Populations <sup>(1,2)</sup>		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1) 1990	2040	Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. Prog. Dev. Cost \$	Ac-Ft	Gal /Day(S)	cts	cts
Coyote Cyn. Jct.	0	0	0	0	0	0	0	0	0.00	5.06
Coyote Canyon	1,234	4,200	672,034	32	61	0	692	802,849	1.24	5.06
Standing Rock	251	854	136,694	34	77	0	76	88,329	0.14	3.81
Dalton Pass	4,439	15,109	2,417,469	285	660	0	2,048	2,378,737	3.68	3.68

20,164 2040 Population Served

2,816 Total Annual Demand(AF)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction	Pump Horsepower	Storage Demands
	Area sq ft (7)	Diameter ft	Diameter inches	Length ft	Beginning ft	Ending ft	Change ft	(5) ft	HP	(5) Gal
Coyote Cyn. Jct.	1.26	1.27	15.2	0	6,250	6,250	0	0.0	0.0	0
Coyote Canyon	1.26	1.27	15.2	35,938	6,250	6,160	-90	124.1	27.9	3,087,881
Standing Rock	0.95	1.10	13.2	81,321	6,160	6,280	120	327.8	276.8	338,784
Dalton Pass	0.92	1.08	13.0	37,998	6,280	6,740	460	153.2	365.5	8,830,096

155,257 Total Pipeline Length(ft)

670

29.40 Total Pipeline Length (Miles)

	Total Capital Cost							Annual Energy Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(6)	Pipe Diameter used (In.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	
Coyote Cyn. Jct.	\$0	\$0	\$0	16	\$0	\$0	\$0	Treatment \$0
Coyote Canyon	\$17,066	\$962,421	16	\$1,828,059	\$240,286	\$3,045,952	\$3,045,952	Pump Stations \$131,394
Standing Rock	\$169,412	\$212,078	14	\$3,675,005	\$486,408	\$4,542,902	\$4,542,902	\$131,394
Dalton Pass	\$223,671	\$2,305,200	14	\$1,717,180	\$227,279	\$4,473,330	\$4,473,330	Annual Operation and Maintenance Cost
Sub-Total	\$0	\$410,169	\$3,479,699		\$7,218,245	\$954,072	\$12,062,185	Treatment \$0
Capital Cost	\$0	\$410,169	\$3,479,699		\$7,218,245	\$954,072	\$12,062,185	Pump Stations \$18,407
Contingency Cost	20%						\$2,412,437	Storage Tanks \$139,188
Mobilization Cost	10%						\$1,206,218	Conveyance Pipe \$40,862
Indirect Cost	27%						\$3,256,790	\$196,456
Totals							\$18,937,630	Total \$327,850

**NOTES:**

- 1) ALL 1998 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1998
- 2) ANNUAL NAVAJO DEMANDS OF 160 GALLONS PER CAPITA AND BASED ON 1998 PROJECTED DEMANDS
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2.00 GAL/HOUSEHOLD @ 4.5 PERSONS/HOUSEHOLD. COST FROM THE 1998 HEAVY CONSTRUCTION COST DATA AND INDEXED TO 1998 DOLLARS
- 4) DALTON PASS DEMANDS INCLUDE DALTON PASS, CROSSPOINT, LITTLEWATER, REDDYS LAKE VALLEY, AND WINTERCREEK CHAPTERS
- 5) PIPELINE GALLERY DAY PEAKING FACTOR OF 1.30
- 6) PIPELINE VELOCITY 4 FEET PER SECOND FROM PDM ASSOCIATES, 1998
- 7) PIPELINE BHP/HP PER PUMP FROM PDM ASSOCIATES, 1998. COST INDEXED TO 2008 (BHP/HP) PIPELINE PUMPING EFFICIENCY AT 70%
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (ROULETE RICH FRICTION COEFFICIENT)
- 9) BASED ON HANDBOOK ANALYSIS BASED ON BIDD COSTS FROM MBE-HQAA, MORMON MANUFACTURING SOURCES. PIPELINE WTP COST \$0
- 10) PIPE INSTALLED COST FROM BIDD ANALYSIS BASED ON BIDD PRICE PER DOLLAR. PIPELINE 10% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION
- 11) ANNUAL ENERGY COST BASED ON WTP COST, BDR O&M COST, INTAKE/SERVICER COST \* 1%, PUMP COST \* 1%, STORAGE COST \* 1%, PIPELINE COST \* 8.5%
- 12) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANCES AT 10% ADDITIONAL CONTINGENCY COST AT 20%
13. INDIRECT COST INCLUDES: 1% PERMITS, 2% CONTRACT ADMIN., 1% EMPLOY., 2% SURVEYS, 1% GEOCHEM., 3.5% ADVECL., 0.5% DESIGN SURVEY, 1% INVEST, 2% DESIGN, 4% AND CONSTRUCTION OVERLAP, 1%

**Navajo - Gallup Water Supply Project - San Juan River Alternative**  
(Cost Estimate for Main Pipeline from Yahitney to Rock Springs and Window Rock)

Chapter Community	Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1) 1990	2040	(2,3,4) Gal.	1999 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. Prog. Dev. Cost \$	Ac-Ft	Gal./Day(6)	cms	cms
Ya-ta-hey Jct.	0	0	0	0	0	\$0	0	0	0.00	14.71
Rock Springs	3,118	10,813	1,698,056	58	123	\$0	1,779	2,064,723	3.19	14.71
Window Rock	11,767	40,052	6,408,281	1,043	787	\$0	6,412	7,440,812	11.51	11.51

**50,663 2040 Population Served**

**8,191 Total Annual Demand(AP)**

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (8) ft.	Pump Horsepower HP	Storage Demands (5) Gal.
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Ya-ta-hey Jct.	3.88	2.18	25.0	0	6,580	6,580	0	0.0	0.0	0
Rock Springs	3.68	2.16	28.0	29,439	6,580	6,760	200	57.9	614.7	7,941,242
Window Rock	2.88	1.91	23.0	58,887	6,850	6,780	110	127.0	442.3	28,617,740

**88,326 Total Pipeline Length(ft.)**

**1,057**

**16.73 Total Pipeline Length (Miles)**

Chapter Community	Total Capital Cost							Annual Energy Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(9)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	
Ya-ta-hey Jct.	\$0	\$0	\$0	26	\$0	\$0	\$0	Treatment \$0
Rock Springs	\$378,203	\$1,728,900	28	\$2,345,252	\$304,981	\$4,755,436	\$4,755,436	Pump Stations \$207,220
Window Rock	\$270,670	\$6,339,300	24	\$4,345,622	\$565,779	\$11,521,371	\$11,521,371	Storage Tanks \$267,220
Sub-Totals	\$0	\$646,873	\$8,068,200		\$6,690,974	\$870,760	\$16,278,807	Annual Operation and Maintenance Cost
Capital Cost	\$0	\$646,873	\$8,068,200		\$6,690,974	\$870,760	\$16,278,807	Treatment \$0
Contingency Cost	20%						\$3,255,361	Pump Stations \$25,675
Mobilization Cost	10%						\$1,627,681	Storage Tanks \$322,728
Indirect Cost	27%						\$4,394,738	Conveyance Pipe \$37,809
Totals							\$25,554,588	Total \$393,632

**NOTES:**

1. ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
2. ASSUME NAVAJO DEMANDS OF 160 GALLONS PER CAPITA AND BASED ON 1994 PROJECTED DEMANDS
3. ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2.5MG GAL/HOUSEHOLD @ 4.1 PERSON/HOUSEHOLD. COST FROM THE 1993 MANSION HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
4. ROCK SPRINGS DEMANDS INCLUDE ROCK SPRINGS, TAYATON, AND MAWELITO CHAPTERS. WINDOW ROCK INCLUDES ST. MICHAELS AND FT. DEBAND CHAPTERS
5. ASSUME GALLON/DAY PEAKING FACTOR OF 1.30
6. ASSUME VELOCITY 4.0 FEET PER SECOND FROM NEMA ASSOCIATES, 1999
7. ASSUME 2500-HP PER PUMP FROM NEMA ASSOCIATES, 1999. COST INDEXED TO 2000 (\$24/HP). ASSUME PUMPING EFFICIENCY AT 70%
8. HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA, DUCTILE IRON FRICTION COEFFICIENT
9. BASED ON HINDR ANALYSIS BASED ON BID COSTS FROM MINE-MIAL MORRISON MARBLE & URBOR SOURCES. ASSUME WTP COST OF \$0
10. PIPE INSTALLED COST FROM HINDR ANALYSIS BASED ON BOM-PUMP (94 DOLLARS). ASSUME 1% OF PIPE LENGTH IS COMMON AND 10% IS ROCK ELEVATION.
11. ANNUAL ENERGY COST BASED ON WTA/ENR/ENR/SUPPORT ANALYSIS. DAM COST 1.0% PUMPING BASED ON \$0.28 PER KWH/HR
12. ANNUAL DAM COST BASED ON WTP COST, BOM DAM COST, INTANS/ENR/ENR/COST \* 6%, PUMP COST \* 6%, STORAGE COST \* 6%, PIPELINE COST \* 6%
13. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANTS AT 10% ADDITIONAL CONTINGENCY COST AT 2%
14. INDIRECT COST MAJOR FACILITIES 1%, TRUCKS, CONTRACT ADMIN. 1%, EMPLOY. 2%, SAGMONTHE 1%, GEOCHEM. 1.5%, ADHOCOL. 9 5%, DESIGN SURVEY 1%, MANSION 2%, DESIGN 6%, AND CONSTRUCTION 66.8%



**Navajo - Gallup Water Supply Project - San Juan River Alternative**  
(Cost Estimate for Lateral Waterline to Manuelito NTUA Water line)

Chapter Community	Population(1,2)		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1)		Gal.	1998 Prod.	Est. 2040 Prod.	Est. Prog. Dev.	Ac-Ft	Gal./Day(8)	cfs	cfs
	1990	2040		Ac-Ft	Ac-Ft	Cost \$				
Gallup Jct. Manuelito	0	0	0	0	0	\$0	0	0	0.00	0.61
	\$31	2,148	343,641	79	48	\$0	339	399,348	0.61	0.61

2,148 2040 Population Served

339 Total Annual Demand(A/F)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction	Pump Horsepower	Storage Demands
	Area sq ft (7)	Diameter ft	Diameter inches	Length	Beginning ft	Ending ft	Change ft	(8)	HP	(5) Gal
Gallup Jct. Manuelito	0.15	0.44	5.3	0	6,477	6,477	0	0.0	0.0	0
	0.15	0.44	5.3	47,050	6,477	6,375	-102	506.7	39.9	1,512,875

47,050 Total Pipeline Length(L)

8.91 Total Pipeline Length (Miles)

40

Chapter Community	Total Capital Cost							Annual Energy Cost	
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (In.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	Treatment \$0	Pump Stations \$7,827
Gallup Jct. Manuelito	\$0	\$0	\$0	6	\$0	\$0	\$0	\$0	\$0
	\$24,434	\$24,434	\$599,352	6	\$1,092,292	\$152,426	\$1,868,505	\$1,868,505	\$7,827
Sub-Total	\$0	\$24,434	\$599,352		\$1,092,292	\$152,426	\$1,868,505	\$1,868,505	\$7,827

Chapter Community	Annual Operation and Maintenance Cost								
	Capital Cost	Contingency Cost	Mobilization Cost	Indirect Cost	Totals	Treatment \$0	Pump Stations \$373,701	Storage Tanks \$23,974	Conveyance Pipe \$8,224
Gallup Jct. Manuelito	\$0	20%	10%	27%	\$0	\$373,701	\$23,974	\$8,224	\$39,002
	\$24,434	\$4,887	\$2,443	\$742,853	\$774,617	\$373,701	\$23,974	\$8,224	\$39,002
Sub-Total	\$24,434	\$4,887	\$2,443	\$742,853	\$774,617	\$373,701	\$23,974	\$8,224	\$39,002

**NOTES:**

1. ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, NEG SUBSTATE MINIMUM DEMANDS OF 100 GALLONS PER CAPITA AND BASED ON 1998 PROJECTED DEMANDS.
2. SUBMITTED MINIMUM STORAGE DEMANDS ARE BASED ON LOW RAINFALL HOUSEHOLD @ 45 PERSONS/HOUSEHOLD. COST FROM THE USE MEANS HEAVY CONSTRUCTION COST DATA AND ADJUSTED TO 1998 DOLLARS.
3. PIPE ROCK DEMANDS INCLUDE PIPE ROCK, BREAKAWAYS, CHECKVALVES/VALVES.
4. SUBSTATE MINIMUM DRY WEATHER FACTOR OF: 1.30
5. PIPELINE VELOCITY = 1.5 FT/SEC FROM PERM ASSOCIATED, 1998.
6. ASSUME 5000 GPM PER PUMP FROM PERM ASSOCIATED, 1998. COST ADJUSTED TO 1998 (\$/GPM). ASSUME PUMPING EFFICIENCY AT: 70%
7. HEAD LOSS BASED ON 1.5 FT/SEC PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA, SCHEDULE 40SH FLOW CONDITION.
8. BASED ON PERM ANALYSIS BASED ON BID COSTS FROM MICHIGAN ADRIAN HANDEL, S. LEBRON SOURCE. ASSUME WPP COST OF PIPE INSTALLED COST FROM PERM ANALYSIS BASED ON BID PRICE/100 DOLLARS, ASSUME 80% OF PIPE LENGTH IS COMMON AND 20% IS ROCK EXCAVATION.
9. ANNUAL ENERGY COST BASED ON 1998 WPP/1000 GALLONS ANNUAL GPM COST \* 10%, PUMPING, BASED ON 30-40 PER HOUR/1000 GPM.
10. ANNUAL O&M COST BASED ON WPP COST \* 10% O&M COST, INFRASTRUCTURE COST \* 1%, PLANT COST \* 1%, STORAGE COST \* 1%, PIPELINE COST \* 1.5%.
11. MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARETION AND APPURTENANCES AT 10%, ADDITIONAL CONTINGENCY COST AT 30%.
12. INDIRECT COST INCLUDES FACILITIES, 1%, TRAVEL, CONTRACT ADMIN., 1%, SURVEY, 2%, LABORERS 1%, GEOTECH. & VE. ACQUIS. 0.5%, DESIGN SURVEY, 1%, INVEST. 2%, DESIGN 1%, AND CONSTRUCTION DIRECT, 1%.

**NIIP Alternative: Navajo - Gallup Water Supply Project Cost Scenarios. With GW.**

NIIP Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Demand Years	Cost 2000 dollars	Navajo		Gallup		Totals \$ Cost \$
		A/F	\$Cost	A/F	\$Cost	
2010	Project Cost \$\$	11,141	\$177,472,504	7,500	\$84,323,220	\$261,795,724
	Annual Energy \$		\$1,209,292		\$677,369	\$1,886,661
	Annual O&M \$		\$929,415		\$1,770,058	\$2,699,473
2020	Project Cost \$\$	15,230	\$221,037,608	7,500	\$76,811,215	\$297,848,823
	Annual Energy \$		\$1,559,858		\$644,212	\$2,204,070
	Annual O&M \$		\$1,508,585		\$1,553,408	\$3,061,993
2030	Project Cost \$\$	21,291	\$289,756,411	7,500	\$69,702,466	\$359,458,877
	Annual Energy \$		\$1,862,118		\$807,680	\$2,469,798
	Annual O&M \$		\$2,409,182		\$1,309,836	\$3,719,014
2040	Project Cost \$\$	29,067	\$326,392,762	7,500	\$63,733,056	\$390,125,818
	Annual Energy \$		\$2,391,538		\$577,958	\$2,969,496
	Annual O&M \$		\$2,947,375		\$1,130,182	\$4,077,551
2040: No GW	Project Cost \$\$	32,254	\$348,110,088	7,500	\$61,334,101	\$409,444,189
	Annual Energy \$		\$2,645,752		\$566,693	\$3,212,445
	Annual O&M \$		\$3,243,243		\$1,079,273	\$4,322,516
2040: Laterals Lake Valley,Burnham Whiterock,Whitehorse Lake	Project Cost \$\$		\$8,121,709			<b>Total: \$417,565,891</b>
	Annual Energy \$		\$53,903			\$3,266,344
	Annual O&M \$		\$24,396			\$4,346,911

**NIIP Alternative: Navajo - Gallup Water Supply Project Cost/AF over Forty-Year Increments**

Demand Years	Cost 2000 dollars	Navajo		Gallup	
		A/F	\$Cost/AF	A/F	\$Cost/AF
2010	Share Cost \$\$	11,141	\$15,929	7,500	\$11,243
	Annual Energy \$		\$109		\$90
	Annual O&M \$		\$83		\$236
2020	Share Cost \$\$	15,230	\$14,514	7,500	\$10,241
	Annual Energy \$		\$102		\$86
	Annual O&M \$		\$99		\$207
2030	Share Cost \$\$	21,291	\$13,610	7,500	\$9,294
	Annual Energy \$		\$87		\$81
	Annual O&M \$		\$113		\$175
2040	Share Cost \$\$	29,067	\$11,229	7,500	\$8,498
	Annual Energy \$		\$82		\$77
	Annual O&M \$		\$101		\$151

**NOTE:**

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE IS CORE LINE FROM GALLEGOS - YAHTAHEY - WINDOW ROCK - GALLUP - CHURCHROCK
- 3.) NASCHITTI LATERAL INCLUDES SANOSTEE, NEWCOMB, TWO GREY HILLS, SHEEP SPRINGS, NASCHITTI CHAPTERS.
- 4.) COYOTE CYH. JCT. LATERAL INCLUDES CROWNPOINT, DALTON PASS, BECENTI, COYOTE CANYON, STANDING ROCK, LITTLEWATER CHAPTERS.
- 5.) GALLEGOS RESERVOIR COST IS \$38,037,430 FOR 8,800 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) HUERFANO LATERAL IS FROM GALLEGOS/WTP-HUERFANO,NAGEEZI, FUEBLO PINTADO, TORREON NTUA SYSTEM
- 8.) ASSUME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.
- 9.) ALL COST ESTIMATES INCLUDES NAPI AND SHIPROCK AREA DEMANDS.

**2040 NIIP Alternative: Navajo - Gallup Water Supply Project Cost. With GW.**

NIIP Alternative: With Prorated Project Cost for the City of Gallup, New Mexico.

Peaking Factor = 1.3 Demands: 29,066 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,066	\$353,693,927	0	\$0	\$353,693,927
Annual Energy \$		\$2,433,493		\$0	\$2,433,493
Annual O&M \$		\$3,734,238		\$0	\$3,734,238

Peaking Factor = 1.3 Demands: 36,567 Acre-Feet

	Navajo		Gallup		Totals
	A/F	\$Cost	A/F	\$Cost	\$ Cost \$
Project Cost \$\$	29,067	\$326,392,762	7,500	\$63,733,056	\$390,125,818
Annual Energy \$		\$2,391,538		\$577,956	\$2,969,494
Annual O&M \$		\$2,947,375		\$1,130,182	\$4,077,556

**NOTE:**

- 1.) ALL COST ESTIMATES HAVE BEEN COST INDEXED TO 2000 DOLLARS
- 2.) MAINLINE IS CORE LINE FROM GALLEGOS - YAHTAHEY - WINDOW ROCK - GALLUP - CHURCHROCK
- 3.) NASCHITTI LATERAL INCLUDES SANOSTEE, NEWCOMB, TWO GREY HILLS, SHEEP SPRINGS, NASCHITTI CHAPT
- 4.) COYOTE CYN. JCT. LATERAL INCLUDES CROWNPOINT, DALTON PASS, BECENTI, COYOTE CANYON, STANDING ROCK, LITTLEWATER CHAPTERS.
- 5.) GALLEGOS RESERVOIR COST IS \$36,037,430 FOR 8,800 A/F
- 6.) WHOLE PROJECT HAS A PF=1.30.
- 7.) HUERFANO LATERAL IS FROM GALLEGOSWTP-HUERFANO,NAGEEZI, PUEBLO PINTADO, TORREON NTUA SYSTEM.
- 8.) ASSUMME PIPE COST ARE DIVIDED BY 90% COMMON AND 10% ROCK EXCAVATION.

**Navajo - Gallup Water Supply Project - NIPF Alternative**  
(Cost Estimate for Main Waterline to Gallup and Church Rock, with G.W. demands, plus Gallup area Navajo Demands)

Chapter Community	Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1)	2040	Gal	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$	Ac-Ft	Gal./Day(6)	cfs	
	1990									
Galegos Reservoir	0	0	0	0	0	\$0	0	0	0.00	66
WTP	0	20,873	3,964,870	0	0	\$0	4,441	4,966,595	7.68	65
Huerfano Jct.	5,999	20,079	3,212,592	208	153	\$0	3,446	3,998,790	6.19	57
Burnham	245	837	133,971	0	0	\$0	150	174,162	0.27	51
Lake Valley	637	2,168	346,909	22	46	\$0	343	397,595	0.62	51
Naschitz Jct.	5,914	19,789	3,166,291	851	334	\$0	3,213	3,728,550	5.77	50
Tohatchi	2,318	7,890	1,282,378	180	307	\$0	1,107	1,284,797	1.59	44
Coyote Cyn. Jct.	5,287	17,996	2,879,288	130	752	\$0	2,473	2,870,330	4.44	42
Twin Lakes	1,967	6,695	1,071,224	104	153	\$0	1,047	1,215,024	1.88	38
Yah-ta-hey Jct.	14,585	50,665	8,106,337	1,048	890	\$0	8,191	9,505,235	14.71	36
Gameroo Hill	0	0	0	0	0	\$0	0	0	0.00	21
Gallup Jct.	23,600	82,330	9,116,848	105	184	\$0	10,029	11,638,368	18.01	21
Church Rock	4,069	13,918	2,228,800	273	398	\$0	2,127	2,487,630	3.82	3
<b>223,240 2040 Population Served</b>										
<b>36,567 Total Annual Demand(AF)</b>										

Chapter Community	Pipe Dimensions				Elevation			Headloss due to friction (ft)	Pump Horsepower (HP)	Storage Demand (ft)
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Galegos Reservoir	16.34	4.56	54.7	0	5,980	5,980	0	0.0	0.0	
WTP	16.34	4.56	54.7	1,000	5,960	6,005	45	0.8	485.9	
Huerfano Jct.	14.42	4.29	51.4	4,478	6,005	6,010	5	3.9	83.6	
Burnham	12.87	4.05	48.6	59,732	6,010	6,195	185	52.2	1980.1	
Lake Valley	12.81	4.04	48.5	72,046	6,195	5,740	-455	66.3	0.0	
Naschitz Jct.	12.65	4.01	47.7	75,272	5,740	5,895	155	73.6	234.6	
Tohatchi	11.21	3.78	45.3	82,686	5,895	6,100	205	63.9	2553.1	4,941.2
Coyote Cyn. Jct.	10.71	3.69	44.3	34,954	6,100	6,250	150	37.3	1301.2	
Twin Lakes	9.60	3.50	42.0	15,594	6,250	6,380	130	17.6	918.8	4,673.1
Yah-ta-hey Jct.	9.13	3.41	40.9	31,181	6,380	6,560	180	35.1	1273.8	
Gameroo Hill	5.46	2.84	31.6	20,482	6,560	6,490	-70	31.6	0.0	
Gallup Jct.	5.46	2.84	31.6	15,072	6,490	6,477	-13	23.3	36.4	
Church Rock	0.95	1.10	13.2	46,041	6,477	6,680	203	185.8	228.1	9,491.1
<b>456,518 Total Pipeline Length(ft.)</b>										
<b>86.46 Total Pipeline Length (Miles)</b>										
<b>10,095</b>										

Reservoir / WTP	Total Capital Cost						Annual		
	Pump (\$)	Storage (\$)	Pipe Diameter used (in.)	Pipe-Common (\$/ft)	Pipe-Rock (\$/ft)	Total (\$)	Energy Cost \$	O&M Cost \$	
Galegos Reservoir	\$36,037,430					\$36,037,430	\$226,225	\$2,282,246	
WTP	\$49,616,237	\$297,025	30	58	\$173,806	\$22,702	\$50,309,769	\$301,448	\$2,075,851
Huerfano Jct.	\$51,149	\$0	52	52	\$718,155	\$93,774	\$854,079	\$16,385	\$6,111
Burnham	\$1,211,807	\$0	50	50	\$8,740,667	\$1,138,839	\$11,091,313	\$388,192	\$97,876
Lake Valley	\$0	\$0	50	50	\$11,100,088	\$1,446,253	\$12,546,338	\$0	\$62,732
Naschitz Jct.	\$143,688	\$0	48	48	\$11,257,130	\$1,485,623	\$12,868,440	\$46,029	\$69,961
Tohatchi	\$2,174,501	\$1,298,675	46	46	\$11,872,354	\$1,518,638	\$18,882,168	\$696,582	\$204,802
Coyote Cyn. Jct.	\$796,305	\$0	44	44	\$4,711,388	\$612,595	\$6,120,287	\$255,089	\$58,472
Twin Lakes	\$562,322	\$962,421	42	42	\$2,003,236	\$260,323	\$3,788,907	\$180,135	\$72,308
Yah-ta-hey Jct.	\$779,576	\$0	42	42	\$4,003,004	\$520,205	\$5,302,784	\$249,730	\$53,799
Gameroo Hill	\$0	\$0	32	32	\$1,998,788	\$259,480	\$2,258,268	\$0	\$11,291
Gallup Jct.	\$22,267	\$0	32	32	\$1,470,840	\$180,942	\$1,684,049	\$7,133	\$8,200
Church Rock	\$139,803	\$2,306,200	14	14	\$2,080,664	\$275,396	\$4,800,644	\$44,721	\$109,572
Sub-Total	\$87,853,687	\$6,178,242	\$4,584,296	\$59,931,105	\$7,804,766	\$166,332,077	\$2,185,444	\$2,831,366	

Capital Cost	\$87,853,687	\$6,178,242	\$4,584,296	\$59,931,105	\$7,804,766	\$166,332,077	\$2,185,444	\$2,831,366
Contingency Cost	20%					\$33,266,415		
Mobilization Cost	10%					\$16,633,208		
Indirect Cost	27%					\$44,909,861		
<b>Totals</b>						<b>\$261,141,360</b>		

- NOTES:**
- 1) NAVajo 1998 POPULATION FROM CENSUS DATA FROM THE "CHAPTER MAJORS, 1998 EDITION, DIVISION OF COMMUNITY DEVELOPMENT"
  - 2) GALLUP DEMANDS ARE 7.38 AF PER YEAR FOR THE YEAR 2040
  - 3) ASSUME NAVajo DEMANDS OF 780 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
  - 4) ASSUME 100 AF PER YEAR FOR NIPF DELIVERY WILL BE AT THE WTP FACILITY. BIFROCK LATERALS DEMANDS AT THE WTP ALSO (2.14 AF/YR)
  - 5) ESTIMATED NAVajo STORAGE DEMANDS ARE BASED ON AVERAGE DRAINAGE ON PROD. 3 DAYS COST FROM THE 1988 MEXICO HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2008 DOLLARS
  - 6) STORAGE DEMANDS ARE ONLY MET FOR TOHATCHI, MEXICAN SPRINGS, TWIN LAKES, MANUELITO, AND CHURCH ROCK CHAPTERS, SINCE THEY FALL ON THE MAIN LINE TO GALLUP.
  - 7) ASSUME VELOCITY = 4 FEET PER SECOND FROM (FROM ASSOCIATES, 1988)
  - 8) ASSUME 80% EFF PER FOOT FROM (FROM ASSOCIATES, 1988). COST ADDED TO 2008 (2010) ASSUME PUMPING EFFICIENCY AT 70%
  - 9) HEADLOSSES BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA. SLIGHTLY IRON FRICTION COEFFICIENT
  - 10) BASED ON INDIAN ANALYSIS BASED ON BID COSTS FROM MEX-AM, MORRISON MAVERICK, & VEOR SOURCE. ASSUME WTP COST OF \$49,616,237
  - 11) PIPE INSTALLED COST FROM INDIAN ANALYSIS BASED ON BID PRICES DOLLARS. ASSUME 30% OF PIPE LENGTH IS COMMON AND 70% IS ROCK EXCAVATION
  - 12) GALLEGO RESERVOIR IS ASSUMED TO BE FULL AF PLUS CAPACITY. 1998 COST ESTIMATE FROM USBR INDEXED TO 2008 \$36,037,430
  - 13) ANNUAL ENERGY COST BASED ON WEIGHTED-RESERVOIR ANNUAL DAM COST \* 1% PLUMBING BASED ON \$0.10 PER HOUR PER HOUR
  - 14) ANNUAL O&M COST BASED ON WTP COST: BOR O&M COST, INTAKE/RESERVOIR COST \* 1%, PUMP COST \* 1%, STORAGE COST \* 1%, PIPELINE COST \* 1.5%
  - 15) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANCES AT 1% ADDITIONAL CONTINGENCY COST AT 20%
  - 16) INDIRECT COST INCLUDES FACILITATING 1%, 10% CONTRACT ADMIN. 1%, ENVIRON. 1%, EASEMENTS 1%, GEOTECH. 0.5%, ACHEQ. 0.5%, DESIGN SURVEY 1%, INVEST. 2%, DESIGN 1%, AND CONSTRUCTION OBSER. 1%

**Navajo - Gallup Water Supply Project - NIIP Alternative**

(Cost Estimate for Lateral Waterline from Gallegos/WTP to Huerfano, Nageezi, Pueblo Pintado, Torreon)

Chapter Community	Populations		Daily Demand (3,4) Gal.	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$		Gal./Day(8)	cfs	
	Huerfano Jct.	0	0	0	0	0	\$0	0	0	0.00
Huerfano	511	1,739	278,289	59	31	\$0	281	325,799	0.50	6.1
Nageezi	981	3,339	534,250	31	15	\$0	583	677,117	1.05	5.6
Counselor	2,447	8,329	1,332,631	5	31	\$0	1,462	1,696,442	2.62	4.6
Torreon	1,960	6,671	1,067,412	113	76	\$0	1,120	1,299,432	2.01	2.0
				20,079 2040 Population Served		\$0	3,446 Total Annual Demand(AF)			

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (9) ft.	Pump Horsepower HP	Storage Demands (5) Gal	
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.				
Huerfano Jct.	1.55	1.40	16.8	0	6,010	6,010	0	0.0	0.0		
Huerfano	1.55	1.40	16.8	96,788	6,010	6,303	793	297.5	1093.6	1,253.07	
Nageezi	1.42	1.35	16.1	61,308	6,803	6,947	144	211.6	327.8	2,604.29	
Counselor	1.16	1.21	14.6	105,773	6,947	6,800	-147	365.1	163.9	5,002.35	
Torreon	0.50	0.80	9.6	85,396	6,800	6,892	-108	506.5	130.5	4,997.81	
				351,265 Total Pipeline Length(ft.)			1,716				
				66.53 Total Pipeline Length (Miles)							

	Total Capital Cost						Annual Energy Cost Treatment \$0	Annual Operation and Maintenance Cost Treatment \$0
	Water Treatment \$(10)	Pump \$(8)	Storage \$(9)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)		
Huerfano Jct.	\$0	\$0	\$0	18	\$0	\$0	\$0	\$0
Huerfano	\$669,279	\$320,423	\$320,423	18	\$5,679,730	\$731,550	\$7,300,932	\$336,345
Nageezi	\$200,493	\$362,421	16	\$3,115,144	\$410,084	\$4,688,141	\$336,345	
Counselor	\$100,308	\$1,296,675	16	\$5,374,472	\$707,506	\$7,478,961	\$41,996	
Torreon	\$79,881	\$1,296,675	10	\$2,912,223	\$382,204	\$4,680,983	\$155,048	
Sub-Total	\$0	\$1,049,960	\$3,876,194		\$16,981,570	\$2,241,353	\$24,149,077	\$96,115
Capital Cost	\$0	\$1,049,960	\$3,876,194		\$16,981,570	\$2,241,353	\$24,149,077	\$253,161
Contingency Cost	20%						\$4,829,815	
Mobilization Cost	10%						\$2,414,908	
Indirect Cost	27%						\$6,520,251	
Totals							\$37,914,051	\$629,506

- NOTES:
- ALL 1990 POPULATIONS FROM "1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION", 1993
  - ASSUME NAVAJO DEMANDS OF 160 GALLONS PER CAPITA AND BASED ON 2040 PROJECTED DEMANDS
  - ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - 90% FRICTION - 3 DAYS COST FROM THE 1989 MERRILL HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS
  - ASSUME GALLOWAY PUMPING FACTOR OF 1.30
  - ASSUME VELOCITY - 4 FEET PER SECOND FROM (PDM ASSOCIATES, 1993)
  - ASSUME \$800/HP PER PUMP FROM (PDM ASSOCIATES, 1993). COST INDEXED TO 2000 (\$800/HP) ASSUME PUMPS EFFICIENCY AT: 70%
  - HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (DUCTILE IRON FRICTION COEFFICIENT)
  - BASED ON HNDWR ANALYSIS BASED ON BID COSTS FROM MSE-HOK, MORRISON MANERLE, & USBOR SOURCES. ASSUME WTP COST OF \$0
  - PIPE INSTALLED COST FROM HNDWR ANALYSIS BASED ON BOR-PAL 1999 DOLLARS. ASSUME 30% OF PIPE LENGTH IS COMMON AND 70% IS ROCK EXCAVATION
  - ANNUAL ENERGY COST BASED ON 10% HNDWR PUMPING COST. ANNUAL O&M COST 10%. PUMPS BASED ON 30% PER HOUR/WT HOUR
  - ANNUAL O&M COST BASED ON WTP COST. BOR O&M COST 10% HERE SERVICE COST 10%, PUMP COST 10%, STORAGE COST 10%, PIPELINE COST 10%
  - MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 30%
  - INDIRECT COST INCLUDES FACILITATING (1%), TRAVEL (2%), CONTRACT ADMIN. (1%), ENVIRON. (2%), EASEMENTS (1%), GEOCHEM. (0.5%), ACHIEV. (0.5%), DESIGN SURVEY (1%), INVEST. (2%), DESIGN (6%), AND CONSTRUCTION OBLIG. (10%)

**Navajo - Gallup Water Supply Project - NRP Alternative**  
(Cost Estimate for Lateral Waterline to Red Rock NTUA Water line)

Chapter Community	Populations(1,2)		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	(1)	2040	Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$	Ac-Ft	Gal./Day(6)	cfs	
	1990									
Gallup Jct.	0	0	0	0	0	\$0	0	0	0.00	
Red Rock	3,815	12,985	2,077,840	78	138	\$0	2,189	2,540,774	3.93	
			<b>12,985 2040 Population Served</b>			<b>\$0</b>		<b>2,189 Total Annual Demand(AF)</b>		

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction	Pump Horsepower	Storage	
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.	(9) ft.	HP	(5) Ga	
Gallup Jct.	0.98	1.12	13.4	0	6,490	6,490	0	0.0	0.0		
Red Rock	0.98	1.12	13.4	26,320	6,490	6,750	260	106.1	233.3	9.77	
				<b>26,320 Total Pipeline Length(ft.)</b>						<b>233</b>	
				<b>4.98 Total Pipeline Length (Miles)</b>							

Chapter Community	Total Capital Cost						Annual Energy Cost	Annual Operation and Maintenance C	
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)			Total \$
Gallup Jct.	\$0	\$0	\$0	14	\$0	\$0	\$0	\$0	
Red Rock		\$142,760	\$2,305,200	14	\$1,189,436	\$157,429	\$3,794,825	\$45,732	
Sub-Total	\$0	\$142,760	\$2,305,200		\$1,189,436	\$157,429	\$3,794,825	\$45,732	
Capital Cost	\$0	\$142,760	\$2,305,200		\$1,189,436	\$157,429	\$3,794,825	\$45,732	
Contingency Cost	20%						\$758,965	\$5,710	
Mobilization Cost	10%						\$379,482	\$92,208	
Indirect Cost	27%						\$1,024,603	\$8,734	
Totals							\$5,957,875	\$164,653	
							<b>Total</b>	<b>\$150,385</b>	

**NOTES:**

- 1) ALL 1990 POPULATIONS FROM 1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION, 1990
- 2) ASSUME NAVAJO DEMANDS OF 100 GALLONS PER CAPITA AND BASED ON 1990 PROJECTED DEMANDS
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - 0.97 PROD \* 5 DAYS. COST FROM THE 1980 MANSHEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS
- 4) RED ROCK DEMANDS INCLUDE RED ROCK, BREADSPRING, CHICKILTAH CHAPTERS
- 5) ASSUME GALLON / DAY PEAKING FACTOR OF: 1.30
- 6) ASSUME VELOCITY = 4 FEET PER SECOND FROM (P&M ASSOCIATES, 1990)
- 7) ASSUME 8000HP PER PUMP FROM (P&M ASSOCIATES, 1990). COST INDEXED TO 2000 (8000HP) HORSEPOWER. EFFICIENCY AT 70%
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEAD LOSS FORMULA (SHORTLE FROM FRICTION COEFFICIENT)
- 9) BASED ON HNDWR ANALYSIS BASED ON BID COSTS FROM M&E-HOZ, HORNBY'S MANERLE, & USBOR SOURCE. ASSUME WTP COST \$0
- 10) PIPE INSTALLED COST FROM HNDWR ANALYSIS BASED ON \$0.95/FT (1990 DOLLARS). ASSUME 80% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION
- 11) ANNUAL ENERGY COST BASED ON INTAKE/RESERVOIR ANNUAL O&M COST \* 10%, PUMPING BASED ON \$0.04 PER KILOWATT HOUR
- 12) ANNUAL O&M COST BASED ON WTP COST, \$0.04 O&M COST, INTAKE/RESERVOIR COST \* 6%, PUMP COST \* 4%, STORAGE COST \* 4%, PIPELINE COST \* 2.5%
- 13) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%
- 14) INDIRECT COST INCLUDES FACILITATING 1%, TERP&P, CONTRACT ADMIN. 1%, EMPHON 2%, EASEMENT 1%, GEOCHD&L 0.5%, ACHE&L 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 6%, AND CONSTRUCTION OBSER. 10%









**Navajo - Gallup Water Supply Project - NIIP Alternative**  
(Cost Estimate for Lateral to Shiprock/666 Jct. from Gallup Reservoir)

Chapter Community	2040 Shiprock Populations		Daily Demand	Annual Ground Water Production			Annual Demand Minus Production	Peak Daily Demand		Cumulative Flow
	Total Population	Population Served	Gal.	1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$	Ac-Ft	Gal./Day(8)	cms	ct
WTP	0	0	0	0	0	\$0	0	0	0.00	
Hogback	0	0	0	0	0	\$0	0	0	0.00	
Shiprock	46,985	20,873	3,339,749	0	0	\$0	3,741	4,341,674	6.72	

20,873 2040 Population Served

3,741 Total Annual Demand(AF)

Chapter Community	Pipe Line Dimensions				Elevation			Headloss due to friction	Horsepower	Storage Dema
	Area sq. ft. (7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.	(9) ft.	HP	(5, Ga
WTP	1.68	1.46	17.5	0	6,010	6,010	0	0.0	0.0	
Hogback	1.68	1.46	17.5	139,824	6,010	5,400	-610	421.1	0.0	
Shiprock	1.68	1.46	17.5	55,532	5,400	5,164	-236	167.2	0.0	

195,356 Total Pipeline Length(ft.)  
37.00 Total Pipeline Length (Miles)

	Total Capital Cost						Annual		
	Reservoir / WTP \$(10)	Pump \$(8)	Storage \$(9)	Pipe Diameter used (in.)	Pipe-Common \$(11)	Pipe-Rock \$(11)	Total \$	Energy Cost \$	O&M Cost \$
WTP	\$0	\$0	\$0	18	\$0	\$0	\$0	\$0	\$0
Hogback	\$0	\$0	\$0	18	\$7,897,520	\$1,035,446	\$8,932,966	\$0	\$44,665
Shiprock	\$0	\$0	\$0	18	\$3,136,551	\$411,234	\$3,547,785	\$0	\$17,739
<b>Sub-Total</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>		<b>\$11,034,071</b>	<b>\$1,446,680</b>	<b>\$12,480,751</b>	<b>\$0</b>	<b>\$62,404</b>

Capital Cost	\$0	\$0	\$0	\$11,034,071	\$1,446,680	\$12,480,751
Contingency Cost	20%					\$2,496,150
Mobilization Cost	10%					\$1,248,075
Indirect Cost	27%					\$3,369,803
<b>Totals</b>						<b>\$19,594,779</b>

**NOTES:**

- 1) NAVAJO 1990 POPULATION FROM CENSUS DATA FROM THE "CHAPTER IMAGES, 1990 EDITION, DIVISION OF COMMUNITY DEVELOPMENT"
- 2) GALLUP DEMANDS ARE 4,399 AF PER YEAR FOR THE YEAR 2010.
- 3) ASSUME NAVAJO DEMANDS OF 180 GALLONS PER CAPITA AND BASED ON 2010 PROJECTED DEMANDS.
- 4) ASSUME NO PIPELINE DEMANDS FOR NIIP, SINCE THEIR DEMANDS ARE MET VIA NIIP CANALS.
- 5) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON 2,000 GAL/HOUSEHOLD @ 4.5 PERSON/HOUSEHOLD. COST FROM THE 1993 HEAVY CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
- 6) STORAGE DEMANDS ARE ONLY MET FOR BURKHAN, NASCUTTL, TOCHACH, MEXICAN SPRINGS, AND TWIN LAKES CHAPTERS, SINCE THEY FALL ON THE MAIN LINE TO GALLUP.
- 7) ASSUME GALLON/DAY PEAKING FACTOR OF 1.30
- 8) ASSUME VELOCITY 14 FEET PER SECOND FROM (PWA ASSOCIATES, 1998)
- 9) ASSUME 8800HP PER PUMP FROM (PWA ASSOCIATES, 1998). COST INDEXED TO 2000 (\$819HP) ASSUME PUMPING EFFICIENCY AT 70%
- 10) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (EXACTLY FROM FRICTION COEFFICIENT)
- 11) BASED ON INDIAN ANALYSIS BASED ON BID COSTS FROM HBS-1994, JOHNSON HAWKINS, & USBOR BOYCES. ASSUME WTP COST \$5,119,511
- 12) PIPE INSTALLED COST FROM INDIAN ANALYSIS BASED ON BOR PLAN (198 DOLLARS). ASSUME 90% OF PIPE LENGTH IS CORNACH AND 10% IS ROCK EXCAVATION.
- 13) GALLUP RESERVOIR IS ASSUMED TO BE 4,300 AF PLUS CAPACITY. 1980 COST ESTIMATE FROM USBR INDEXED TO 2000 \$0
- 14) ANNUAL ENERGY COST BASED ON INTAKE/RESERVOIR ANNUAL O&M COST \* 10%, PUMPING BASED ON 80.04 PER KILOWATT HOUR.
- 15) ANNUAL O&M COST BASED ON WTP COST: BOR O&M COST, INTAKE/RESERVOIR COST \* 8%, PUMP COST \* 4%, STORAGE COST \* 4%, PIPELINE COST \* 0.5%
- 16) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION PREPARATION AND APPURTENANTS AT 10%, ADDITIONAL CONTINGENCY COST AT 20%
- 17) INDIRECT COST INCLUDE FACILITATING 1%, TENDERS CONTRACT ADMIN 1%, EMPLOY 2%, AGREEMENTS 2%, GEOCHEM 0.5%, ACHIEV 0.5%, DESIGN SURVEY 1%, INVEST 2%, DESIGN 8%, AND CONSTRUCTION OBSER. 10%

**Navajo - Gallup Water Supply Project - NIIP Alternative**  
(Cost Estimate for Lateral Waterline to Manueito NTUA Water line)

Chapter Community	Populations(1,2)		Daily Demand Gal	Annual Ground Water Production			Annual Demand Minus Production Ac-Ft	Peak Daily Demand		Cumulative Flow cfs
	(1) 1990	2040		1998 Prod. Ac-Ft	Est. 2040 Prod. Ac-Ft	Est. GW Dev. Cost \$\$		Gal./Day(6)	cfs	
Gallup Jct. Manueito	0 631	0 2,148	0 343,641	0 78	0 46	\$0 \$0	0 339	0 393,348	0.00 0.81	0.6 0.6

2,148 2040 Population Served

\$0

339 Total Annual Demand(AP)

Chapter Community	Pipeline Dimensions				Elevation			Headloss due to friction (9) ft.	Pump Horsepower HP	Storage Demands (5) Gal
	Area sq.ft.(7)	Diameter ft.	Diameter inches	Length ft.	Beginning ft.	Ending ft.	Change ft.			
Gallup Jct. Manueito	0.15 0.15	0.44 0.44	5.3 5.3	0 47,050	6,477 6,477	6,477 6,375	0 -102	0.0 506.7	0.0 39.9	0 1,512,872

47,050 Total Pipeline Length(ft.)

40

8.91 Total Pipeline Length (Miles)

Chapter Community	Total Capital Cost						Annual Energy Cost	Annual Operation and Maintenance Cost
	Water Treatment \$(10)	Pump \$(8)	Storage \$(5)	Pipe Diameter used (In.)	Pipe-Common \$(11)	Pipe-Rock \$(11)		
Gallup Jct. Manueito	\$0	\$0	\$599,352	6	\$1,092,292	\$152,426	\$1,868,505	\$0 \$7,827
Sub-Total	\$0	\$24,434	\$599,352		\$1,092,292	\$152,426	\$1,868,505	\$7,827
Capital Cost	\$0	\$24,434	\$599,352		\$1,092,292	\$152,426	\$1,868,505	\$0
Contingency Cost	20%							\$373,701
Mobilization Cost	10%							\$188,850
Indirect Cost	27%							\$504,496
<b>Totals</b>							<b>\$2,933,553</b>	<b>\$31,175</b>
								<b>Total \$39,002</b>

**NOTES:**

- 1) ALL 1990 POPULATIONS FROM "1990 CENSUS POPULATION AND HOUSING CHARACTERISTICS OF THE NAVAJO NATION", 1990
- 2) ASSUME NAVAJO DEMANDS OF 100 GALLONS PER CAPITA AND BASED ON 2010 PROJECTED DEMANDS.
- 3) ESTIMATED NAVAJO STORAGE DEMANDS ARE BASED ON AVG DAILY DEMAND - GW PROD \* 5 DAYS. COST FROM THE 1988 MANSHEV CONSTRUCTION COST DATA AND INDEXED TO 2000 DOLLARS.
- 4) RED ROCK DEMANDS INCLUDE RED ROCK, BREADSPRINGS, CHICHILTAH CHAPTERS.
- 5) ASSUME GALLON / DAY PEAKING FACTOR C = 1.30
- 6) ASSUME VELOCITY = 4 FEET PER SECOND FROM PWH ASSOCIATES, 1999
- 7) ASSUME EFFICIENCY PER PUMP FROM PWH ASSOCIATES, 1999. COST INDEXED TO 2000 (\$612M) ASSUME PUMPING EFFICIENCY = 70%
- 8) HEAD LOSS BASED ON 4 FEET PER SECOND BASED ON HAZEN-WILLIAMS HEADLOSS FORMULA (DUGLITE IRON FRICTION COEFFICIENT)
- 9) BASED ON INHWR ANALYSIS BASED ON BIC COSTS FROM M&E-HOLA, NORMANSON MANERLE, & USBOR SOURCES. ASSUME WTP = \$0
- 10) PIPE INSTALLED COST FROM INHWR ANALYSIS BASED ON BOR-PWA(199 DOLLARS). ASSUME 90% OF PIPE LENGTH IS COMMON AND 10% IS ROCK EXCAVATION.
- 11) ANNUAL O&M COST BASED ON: INTAKE/WTP/RESERVOIR ANNUAL O&M COST \* 10%, PUMPING: BASED ON \$0.08 PER KWH/ATW HOUR.
- 12) ANNUAL O&M COST BASED ON: WTP COST; BOR O&M COST; INTAKE/RESERVOIR COST \* 8%, PUMP COST \* 4%, STORAGE COST \* 4%, PIPELINE COST \* 0.5%.
- 13) MOBILIZATION COST INCLUDES ADDITIONAL MOBILIZATION/PREPARATION AND APPURTENANTS AT 10%. ADDITIONAL CONTINGENCY COST AT 20%.
- 14) INDIRECT COST INCLUDE FACILITATING: 1%, TRIP: 2%, CONTRACT ADMIN.: 1%, ENVIRON.: 2%, EASEMENTS: 1%, GEOCHEM.: 0.5%, AGROEOL.: 0.5%, DESIGN SURVEY: 1%, INVEST: 2%, DESIGN: 8%, AND CONSTRUCTION OBSER.: 10%.