

**JOINT SPECIAL MEETING
PAGE UTILITY ENTERPRISES
AND
PAGE CITY COUNCIL
October 2, 2024**

CALL TO ORDER: The joint special meeting of the Page Utility Board and Page City Council was called to order at 5:30 p.m. by Chairman Tony Ferrando and Mayor Bill Diak. The meeting was held in the City Council Chambers, 697 Vista Avenue, Page, Arizona. After a moment of meditation, Mayor Diak led the Pledge of Allegiance.

ROLL CALL: Board members present: Chairman Ferrando, Jeff Jones, Alan Nelson, Tom Geiger, Chuck Straub, and Ex-Officio Board member / Vice Mayor Kocjan.

Staff present: General Manager, Bryan Hill; Finance Director, and Executive Secretary, Donna Roberts.

Also present: Richard Humphreys, P.E., Carollo Engineers.

Council members present: Mayor Bill Diak; Vice Mayor John Kocjan; and City Councilors Steven Kidman, Richard Leightner, David Auge, Mike Farrow and Kenna Hettinger.

City Staff members present: City Manager, Darren Coldwell; City Attorney, Joshua Smith; IT Director, Kane Scott; Police Chief, Tim Lange; City Clerk, Cindy Scott and Deputy City Clerk, Jennifer Lange.

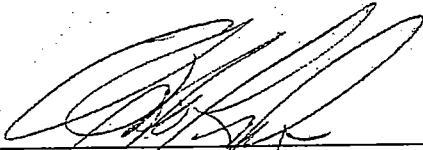
NEW BUSINESS: Discussion/Possible Action by the City Council pertaining to the Page Utility Enterprises Redundant Water Supply Coordination: Mayor Diak turned the meeting over to Vice Mayor Kocjan who then deferred to Bryan. Bryan then gave a brief history of the efforts made to date. He then introduced Richard Humphreys from Carollo Engineers. Richard provided the update to the Water Resource Recommendations of the Page Integrated Water Resources, Water, Water Wastewater, and Reclaimed Water Master Plan from April 2019. This study revealed the Page enjoys sufficient water allocation to nearly double in population. However, the study also indicates weaknesses within Page's raw water delivery system. Page Utility Board, staff and Page city Mayor began the effort to gain funding assistance from both Federal and State sources to accomplish the recommended Water Intake and Pipeline project as described in the 2004 United States Bureau of Reclamation Report titled, Page – LeChee Water Supply.

The information distributed for discussion is attached and that is by this reference made a part of herein.

There was a lengthy discussion. At the conclusion of the meeting, it was suggested that these joint meetings continue in the future. Chairman Ferrando recommended meeting on a quarterly basis and suggested that the Board's Executive Secretary and City Clerk coordinate these meetings.

ADJOURN: The meeting was adjourned at 6:54 p.m. by Chairman Ferrando and Mayor Diak.

APPROVED:



Chairman, Page Utility Enterprises Board



September 19, 2024

Page Utility Enterprises Utility Board
640 Haul Road
PO Box 1955
Page, AZ 86040-1955

Subject: Update to the Water Resource Recommendations of the Page Integrated Water Resources, Water, Wastewater, and Reclaimed Water Master Plan, April 2019

Dear Page Utility Board Members:

The Page Utility Integrated Water Resources, Water, Wastewater, and Reclaimed Water Master Plan (Master Plan) was completed in April 2019. After the Master Plan was completed, Page Utilities and Carollo Engineers completed additional work, and additional information is available that affect the conclusions and recommendations of Chapter 2 – Raw Water System Master Plan. Section 2.7 of the report contains the conclusions and recommendations for the raw water portion of the master plan, and Table 2.5 contains the phased implementation for the recommended options. Revised Section 2.7 and Table 2.5 are presented below with revisions and explanations as to why the revision is being made. Comments in parentheses explain the justification for the change.

2.7 Conclusions and Recommendations

1. The raw water pump station and transmission main was designed and is maintained according to United States Bureau of Reclamation (USBR) standard practices and appears to be well maintained. The 4,160 V motor control center is the switchgear for the pumps and is outdated and in need of replacement. This electrical equipment is a single point of failure for the raw water pump station at the Glenn Canyon Dam. Due to the critical nature of this pump station in supplying water to the City of Page, this equipment is recommended for replacement as soon as practical. (Although the original conclusion about maintenance and asset condition remains correct, recent work on an emergency response plan if the City's water supply system failed has highlighted the need to prevent a failure to any part of the raw water supply system. Therefore, the out-of-date electrical system poses an undesirable risk to the water supply system and should be replaced.)
2. The 12-inch raw water intake that takes water from the face of the dam is undersized for current flows, very difficult to inspect, maintain, and impossible to expand. This raw water intake was constructed in the 1950's, and the remaining useful life of this intake is not known and possibly not knowable. Therefore, Page should work to obtain a redundant water supply that provides additional capacity and does not rely on the 12-inch pipe going through the dam.
3. The 12-inch diameter portion of the raw water supply system between the raw water pump station and the tunnel entrance is undersized and not capable of supplying water for additional growth that Page anticipates, so Page should proceed immediately to expand the capacity of the raw water supply system.

4. The City may continue to pursue an 18-inch connection to the hollow jet tubes [Option 1] with the USBR to determine if a feasible connection location can be identified, and to determine if it is practical to cut 18-inch diameter holes through the concrete all the way to the raw water pump station, expand the pump station, and then construct an 18-inch pipeline from the pump station to the entrance to the tunnel. Option 1 provides additional capacity but not redundancy. If progress cannot be made with Option 1, then the City should pursue an intake upstream from the Glen Canyon Dam [Option 2] consistent with the USBR recommendations in the Page – LeChee Water Supply – Part 1 report. (Carollo determined that an 18-inch pipeline cannot be connected to the hollow jet tubes at the location shown in Figure 2.10 to deliver an increased flowrate to the raw water pump station. The USBR constructed an emergency 12-inch connection to two hollow jet tubes at a different location to protect the Page water supply from the Lake Powell water level dropping below the current intake.)
5. There are several investigations that need to take place to prove the viability of raw water expansion options. A feasibility study is recommended in collaboration with the USBR to address unknowns that include:
 - a. Can an 18-inch pipeline be connected to two hollow jet tubes, and can borings for an 18-inch main be made through the concrete inside the dam?
 - b. Can approvals and funding be obtained to follow recommendations in the USBR report: Page-LeChee Water Supply – Part 1, June 2004, to locate the intake in the Chains area.
 - c. What issues need to be addressed in connecting a new 18-inch pipeline to the existing 18-inch raw water pipeline as it leaves the canyon?
 - d. What are the current technical, legal, and political issues that need to be addressed to construct a new intake at the Chains location adjacent to Lake Powell?
 - e. What are the updated planning level costs to construct the intake and pipeline once feasibility studies are completed?

Table 2.5 **Phased Construction Program**

Phase	Additional Infrastructure
Phase 1	Update the electrical switchgear for the raw water pump station. (Needed to protect the existing raw water pump station from failure.)
Phase 2	[Option 1] Connect an 18-inch pipeline to two hollow jet tubes, run a pipeline through the dam to the intake pump station, expand the intake pump station, construct an 18-inch pipeline to the existing 18-inch pipeline at the entrance to the tunnel. [Option 2] Construct a new raw water intake structure including the building and pump lines in the Chains area.
Phase 3	[Option 1] Construct an 18-inch pipeline from the intake pump station to the entrance to the tunnel. [Option 2] Construct an 18-inch transmission main from the intake structure to a tie in point on the existing 18-inch pipeline. (With the difficulties in obtaining funding, prioritizing the improvements to the water supply will help focus funding efforts on the improvements that provide the greatest benefit. A single 18-inch pipeline from the intake to the treatment plant delivers the full capacity. A second parallel pipeline provides redundancy.)
Phase 4	18-inch transmission main from the tie-in to the Page WTP. (Provides redundancy.)

Page Utility Enterprises Utility Board
September 19, 2024

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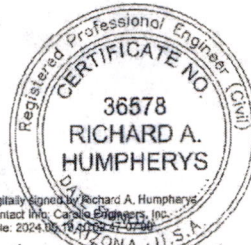
We are happy to discuss these recommendations further if you have questions.

Sincerely,
CAROLLO ENGINEERS, INC.

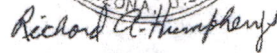


Richard A. Humpherys, P.E.
Vice President

RAH:ch



Digitally signed by Richard A. Humpherys
Contact Info: Carollo Engineers, Inc.
Date: 2024.09.19 11:02:47 -0700



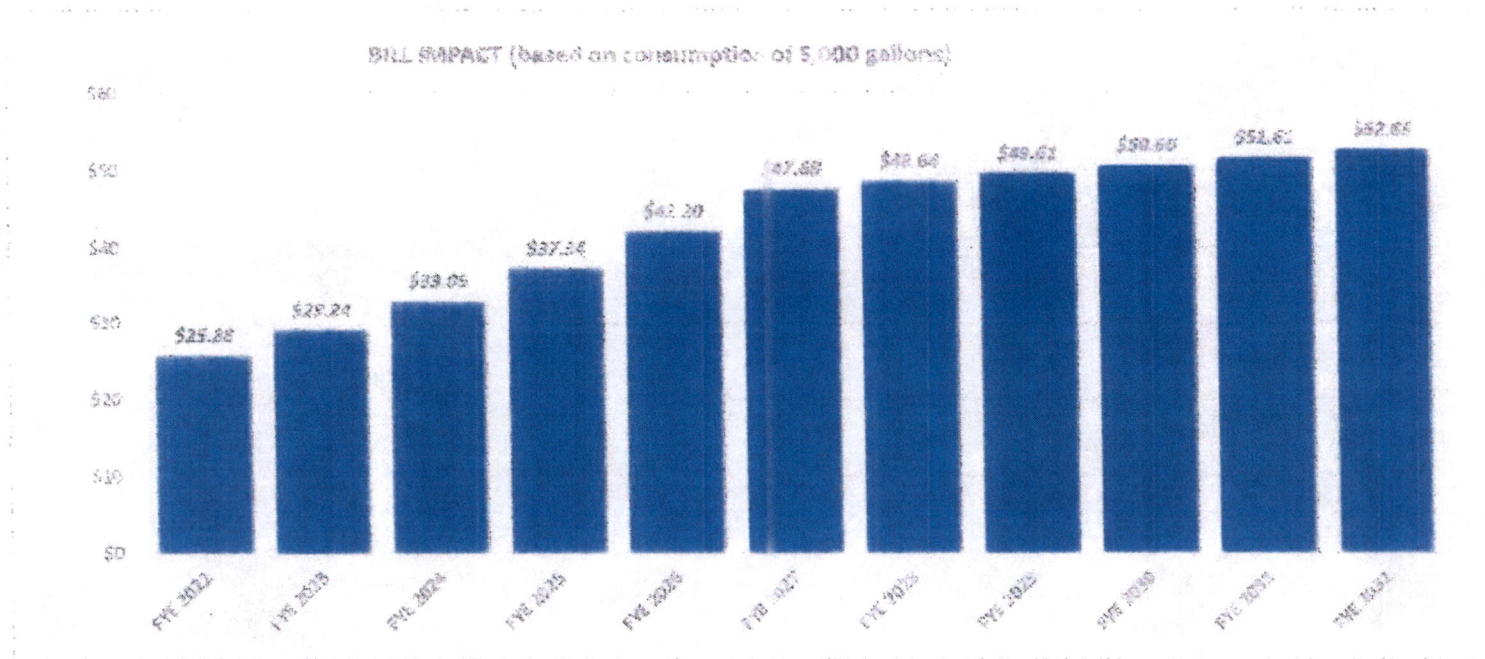


Figure 2 Water Utility Bill Impact for the Typical Water Customer under Scenario 2

1.4.2 Scenario 2: 100 Percent WIFA Financing

In Scenario 2, the entire raw water capital program is funded solely through WIFA loan issuances. This scenario requires that WIFA be able to finance the entire amount. This scenario requires a 13 percent rate increase annually for 5 years, followed by another 5 years with a 2 percent rate increase annually. As shown in Figure 2, water rates will more than double over the next 10 years to meet annual debt service payments on the WIFA loans.

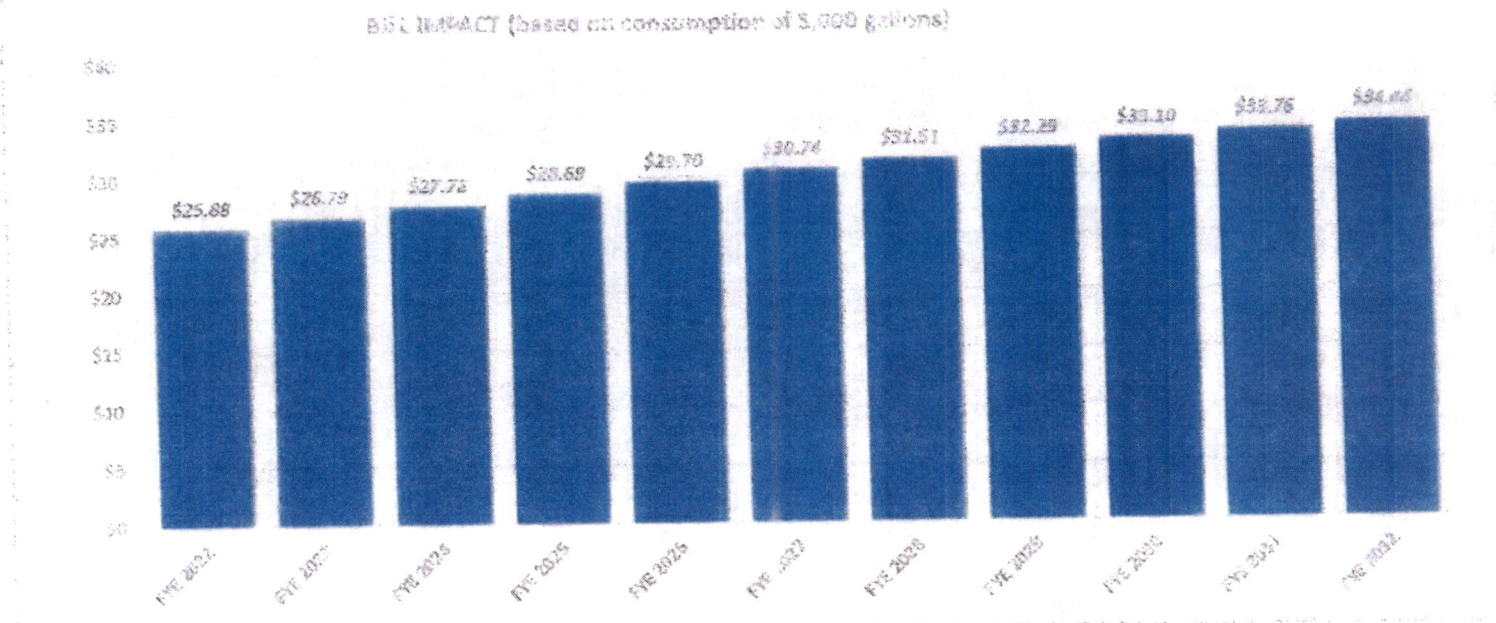
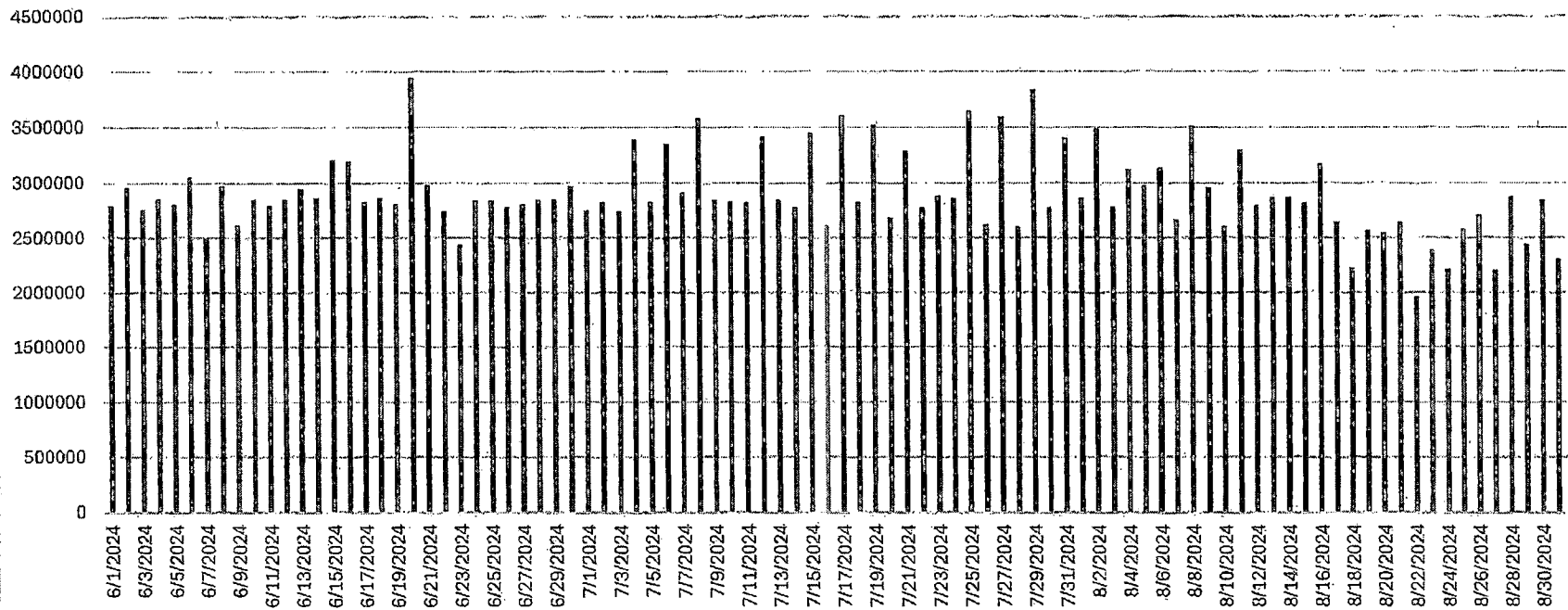


Figure 3 Water Utility Bill Impact for the Typical Water Customer under Scenario 3

1.4.3 Scenario 3: 50 Percent WIFA with 50 Percent Grant

More practically, funding the capital program is likely to come from more than a single source. The purpose of Scenario 3 is to show the magnitude of the water rates assuming 50 percent of the funding came from some sort of grant that PUE would not be required to repay. Under this scenario, rates would need to increase at a rate of 3.5 percent annually for 5 years, 2.5 percent annually for 3 years, and then 2 percent annual rate increase would be required into the future. As shown in Figure 3, the typical water rate would increase from \$25.88 per month to \$34.44 per month over the next 10 years.

June through August 2024
Daily Average = 2,898,391 Gal.
Daily Minimum = 1,954,000 Gal.
Daily Maximum = 3,949,000 Gal.



2024 GLEN CANYON DAM PUMP OPERATION HOURS

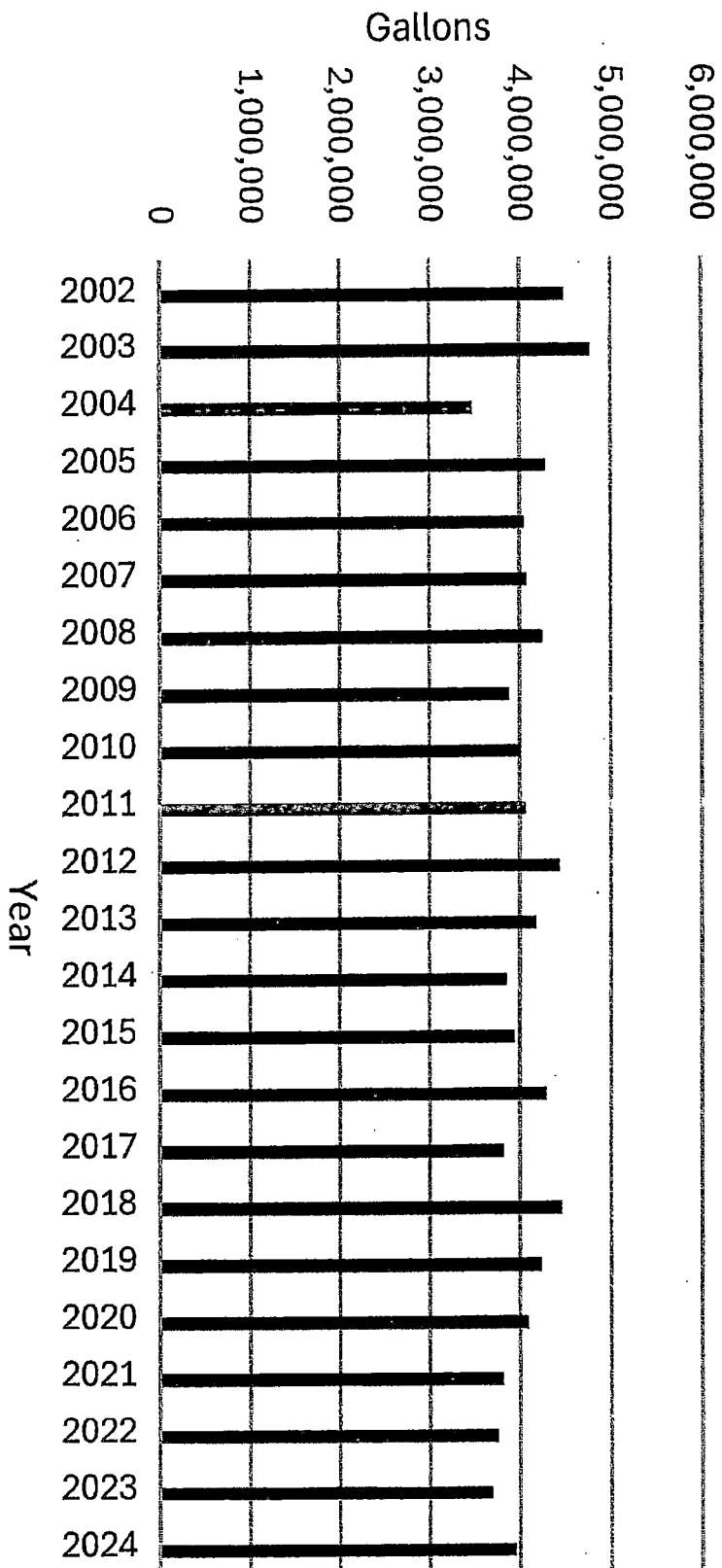
<u>MONTH</u>	<u>PUMP #1</u>	<u>PUMP #2</u>	<u>PUMP #3</u>
<u>APRIL</u>	693 tot / 23 aver	261 tot / 8.7 aver	0 tot / 0 aver
<u>MAY</u>	744 tot / 24 aver	521 tot / 16.8 aver	0 tot / 0 aver
<u>JUNE</u>	720 tot / 24 aver	705 tot / 24 aver	144 tot / 14.4 aver (10 days)
<u>JULY</u>	743 tot / 24 aver	734 tot / 23.6 aver	288 tot / 19.2 aver (15 days)
<u>AUG</u>	743 tot / 24 aver	713 tot / 23 aver	144 tot / 16 aver (9 days)
<u>SEPT*</u>	689 tot / 23.7 aver	615 tot / 21.2 aver	0 tot / 0 aver

* As of 9/29

tot - Total Monthly Hours

aver - Average Daily Hours

June-August Maximum 2002-2024



Chapter 2

RAW WATER SYSTEM MASTER PLAN

2.1 Introduction

The Page Utilities Enterprises (Page) has a raw water supply system that takes water from an intake on the face of the Glenn Canyon Dam. A pump station inside the dam then lifts the water and delivers it through a pipeline to the Page Water Treatment Plant (WTP). The Glen Canyon Dam is owned and operated by the United States Bureau of Reclamation (USBR), who also operates the dam and the electric power plant inside the dam. Since the pump station and pipeline is on USBR property, it is operated by the USBR, and any modifications to the water supply infrastructure must be completed to meet USBR standards.

As part of the Page Utility Integrated Water Resources, Water, Wastewater, and Reclaimed Water Master Plan, the raw water delivery system is being evaluated to determine any improvements that may be needed to supply water to the City of Page (City) for additional water demands that are anticipated from future growth. The original raw water system was constructed in the late 1950s, so the City also wants to make sure that the water supply is reliable for years to come.

This chapter presents results of the raw water system evaluation in the following sections:

- Section 2 documents the raw water system infrastructure and capacities.
- Section 3 contains a capacity evaluation of the raw water system.
- Section 4 presents four alternatives to increase the raw water system capacity and to provide redundancy.
- Section 5 presents costs for each expansion option.
- Section 6 provides recommendations for next steps.

2.2 Raw Water System

The City's existing raw water system includes the intake pipe in the dam, the raw water pumps inside the dam building, and the transmission main to the WTP.

Figure 2.1 presents the existing raw water system.

2.2.1 Intake

Raw water is drawn through a 12-inch intake pipe at the face of the dam, near the bottom of the dam. The intake pipeline has a valve that is used to isolate the raw water pipe as shown in Figure 2.2. An alternative water supply is available so water can be delivered through a 12-inch pipe connected to two of the penstocks. Penstocks are not always in operation, so the connection to two penstocks provides additional water supply reliability. The intake ends at the raw water pump station. Figure 2.3 and Figure 2.4 present the raw water intake from the penstocks.

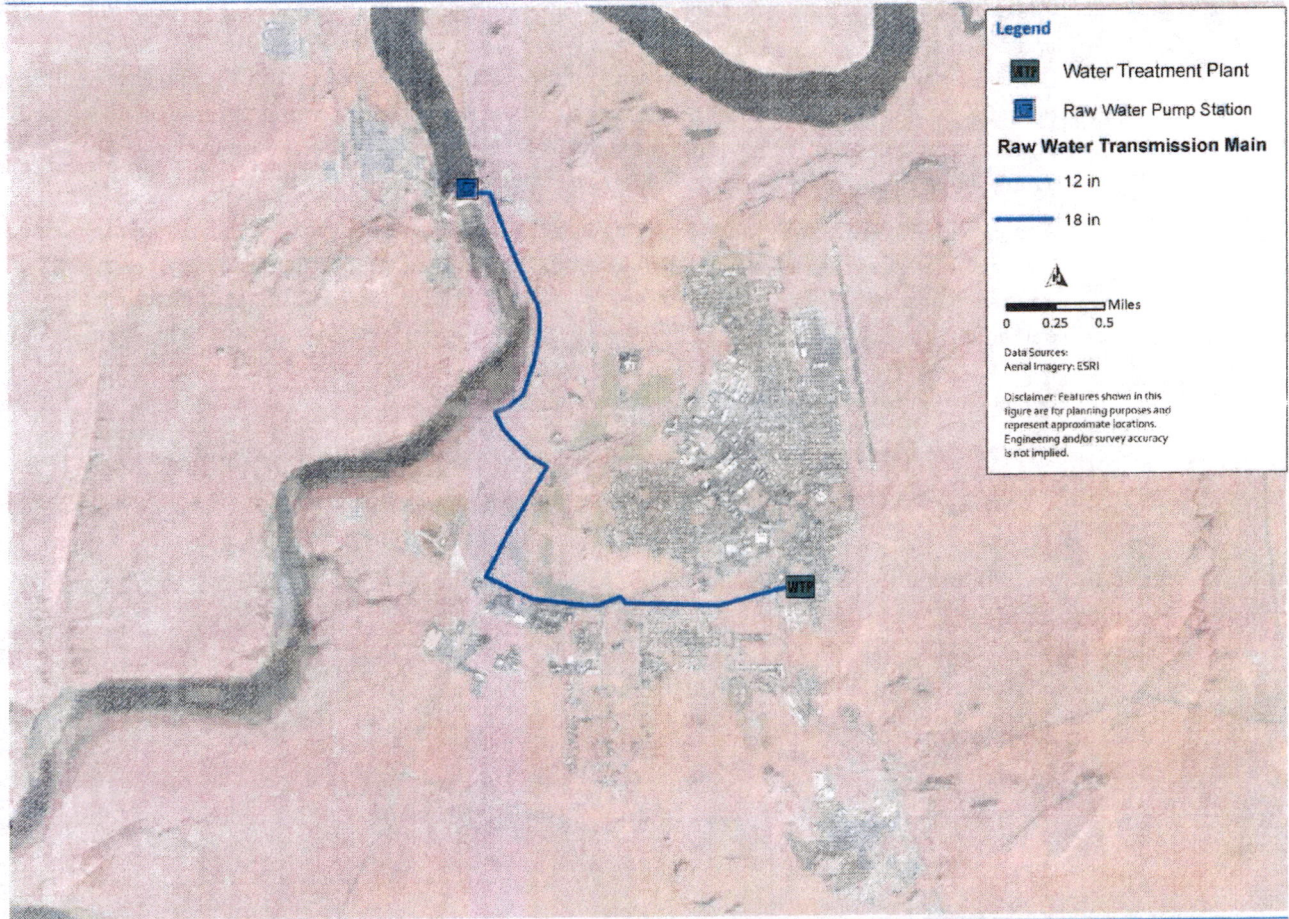


Figure 2.1 Existing Raw Water System

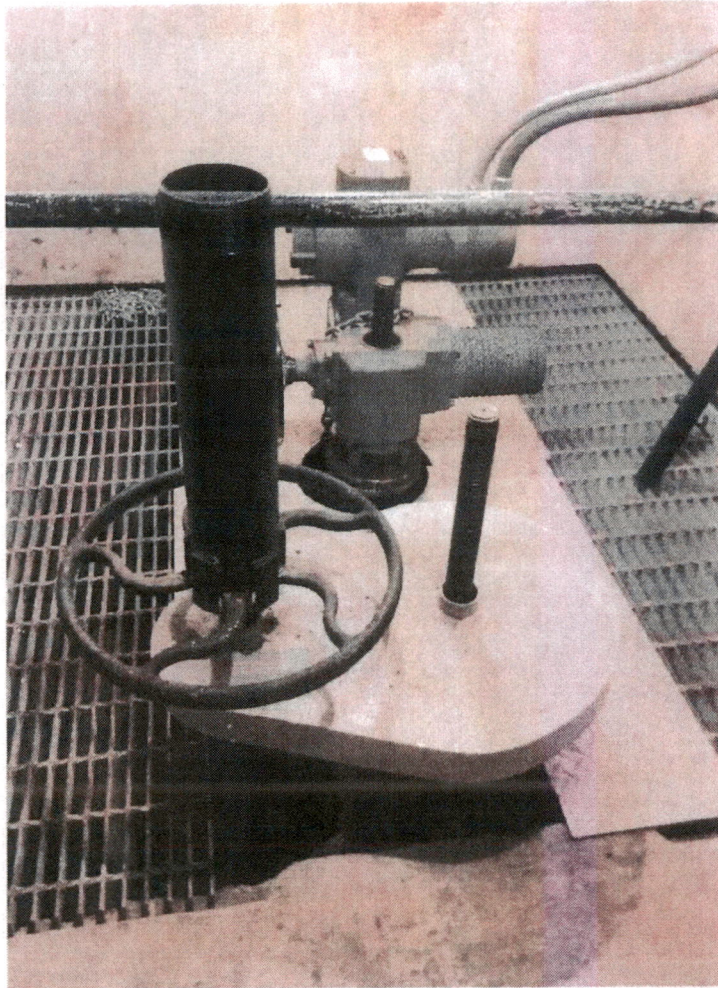


Figure 2.2 Raw Water Intake Isolation Valve

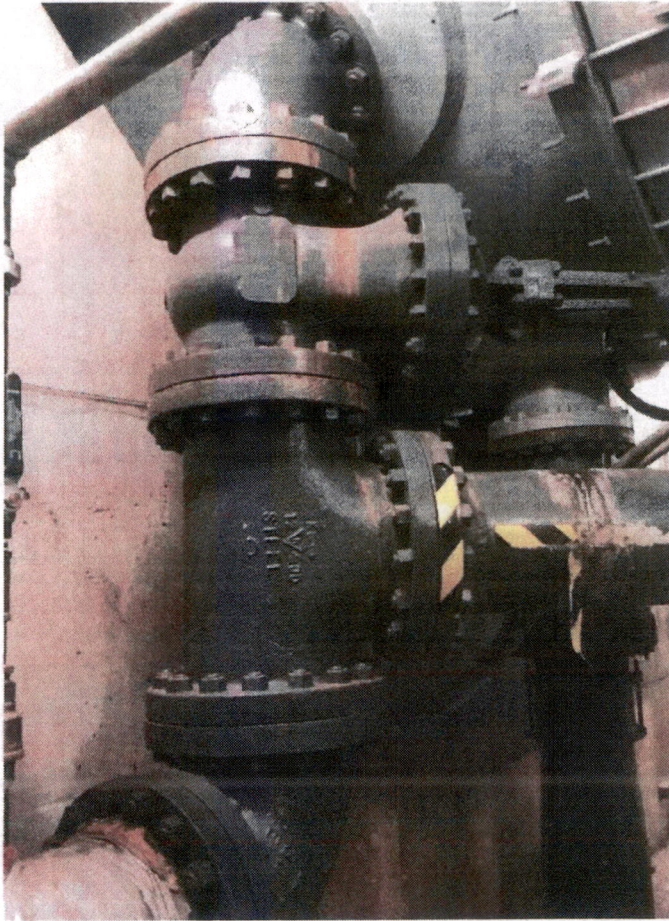


Figure 2.3 12-inch Raw Water Connection to Penstocks



Figure 2.4 12-inch Pipeline from Penstock to Raw Water Pump

2.2.2 Raw Water Pump Station

The raw water pump station consists of three pumps at elevation 3153.5 feet within the dam and a fourth pump that was added later at a lower level inside the dam at elevation 3124.75 feet. Each pump is designed to provide a flow of 910 gallons per minute (gpm). The pumps operate with a suction pressure of approximately 220 pounds per square inch (psi) at Lake Powell reservoir levels which are currently at 3582 feet above sea level. The discharge pressure is typically near 530 psi. The pumps are controlled automatically by the water level in the finished water reservoirs. Figure 2.5 through Figure 2.8 present the pumps at both levels, and a pressure gauge at the pump station.

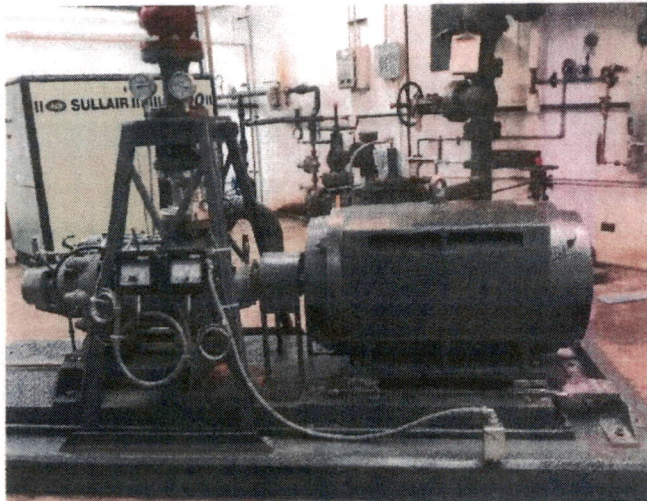


Figure 2.5 Raw Water Pump, Upper Level

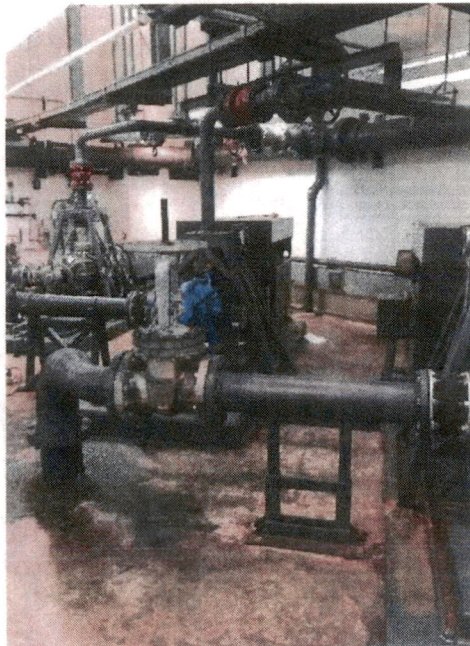


Figure 2.6 Raw Water Pump Station, Upper Level

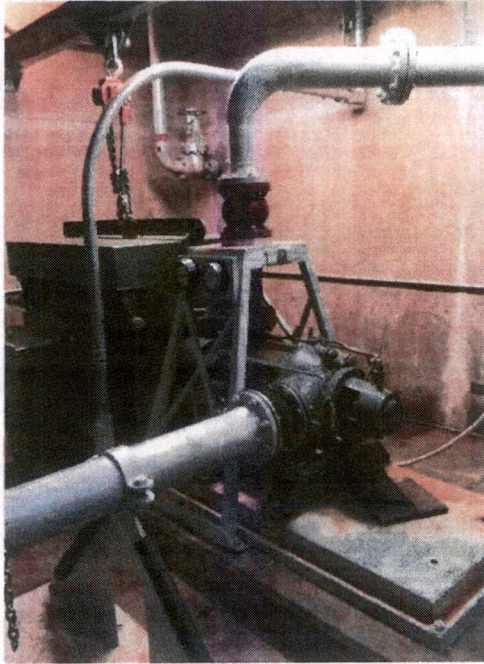


Figure 2.7 Raw Water Pump, Lower Level

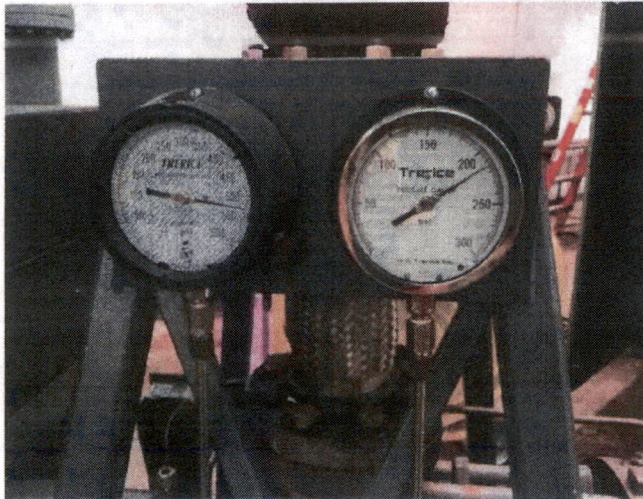


Figure 2.8 Suction and Discharge Pressures at the Raw Water Pump Station

2.2.3 Raw Water Pipeline

The raw water pipeline begins at the raw water pump station. The pipeline leaving the raw water pump station has a diameter of 12 inches and transitions to 18 inches near the entrance to the tunnel. The pipeline is located in the base of the access tunnel to the power plant that runs near the edge of the sandstone canyon wall. This transmission main is encased in concrete and runs through the tunnel approximately 6,550 feet to a point where the pipe rises vertically above the tunnel about 900 feet along the canyon wall to the surface. The transmission main then runs for

about 12,600 feet to the WTP. There is a connection along the raw water pipeline where water can be delivered to the National Golf Course for irrigation, but this connection has not been needed in the past several years.

Figure 2.1 shows the approximate location of the raw water transmission main. Figure 2.9 shows the encased raw water pipeline inside the tunnel.

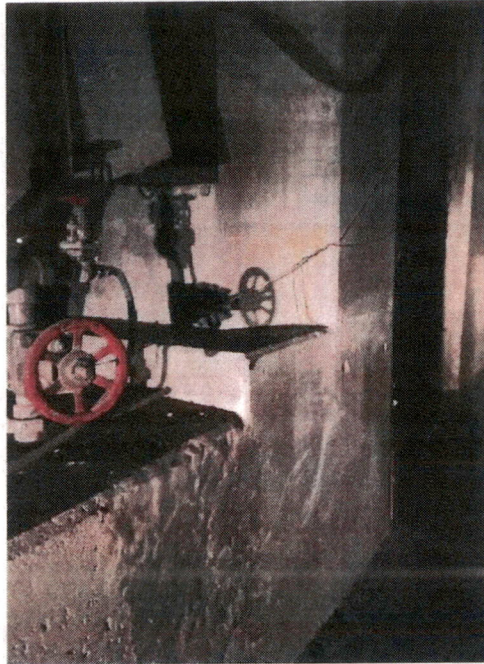


Figure 2.9 Encased Raw Water Pipeline Inside the Tunnel

2.3 Raw Water Capacity Evaluation

2.3.1 Water Demand Projections

Chapter 1 contains an evaluation of the water demands and demand projections that were used to evaluate the capacity requirements of the raw water pipeline and pump station. For convenience, the demand projections are summarized in Table 2.1. The maximum daily water demands are projected to increase to approximately 6 million gallons per day (mgd) by the year 2040.

Table 2.1 Water Demand Projection Summary

Planning Year	Average Daily Demand (mgd)	Maximum Daily Demand (mgd)
2017	2.0	4.0
2023	2.2	4.4
2028	2.4	4.8
2040	2.9	5.9

2.3.2 Infrastructure Performance Criteria

Performance criteria are the standards of measurement used to evaluate the adequacy of the existing raw water system infrastructure and to propose the infrastructure needs for future demand requirements. Performance criteria are set based on engineering best practices, and the level of service that the City expects to provide.

The raw water pump station should be sized to deliver the summer maximum daily demand with the largest pump out of service.

The raw water pipeline should be sized to deliver the maximum daily demand with a water velocity that is equal to or less than 5 feet per second (fps).

The City currently relies on a single water supply source. The City would like to have a second water supply source, or at least have redundancy in the raw water supply infrastructure so that a single point of failure does not cause an interruption to the Page water supply. The degree of redundancy the City chooses depends on the price the City is willing to pay to mitigate the potential risk that a failure will cause an interruption to the water supply. As a minimum, the City should have redundancy for the water needed to maintain public health and safety. Redundancy for the average daily demands would satisfy this need. Redundancy at this level would require outside irrigation to be curtailed in the event of a failure. Redundancy for maximum daily demands would likely come at a higher cost but would not require any curtailment in water use in the event of a failure.

2.3.3 Raw Water System Condition Evaluation

Except for the 18-inch transmission main to the WTP, which was replaced in 1996, the intake piping and 12-inch transmission main were installed during the construction of the Glen Canyon Dam and the Power Plant between 1957 and 1964. Therefore, the pipelines are about 60 years old. City staff have expressed concern about the condition of the intake pipe that conveys raw water from the face of the dam. The original pumps have been replaced since the dam was constructed. Infrastructure inside the dam, including pumps, piping, and valving at the pump station is maintained according to USBR standard procedures and appear to be in good condition.

2.3.4 Capacity Evaluation

Table 2.2 presents the City's raw water intake and transmission main capacity evaluation. Based on a maximum velocity of 5 fps, the 12-inch pipelines are currently operating well beyond their capacity and are not capable of supplying increased flows. The 18-inch pipeline will be operating just over its capacity by 2040.

Table 2.3 presents the raw water pump station capacity evaluation. The raw water pump station has four pumps that have a design flow of 910 gpm each, so the pump station firm capacity is close to 3.9 mgd, although the flow per pump decreases with the number of pumps that are operating. The pump station is operating just over its firm capacity, and will need to be expanded by at least 2 mgd to supply water demands by 2040.

The raw water intake has redundancy in the penstock intakes, but the penstock intakes do not operate simultaneously with the raw water intake, so the penstock intakes provide redundancy but no additional capacity. The raw water pump station has one spare pump for redundancy. The raw water transmission main is a single point of failure, so if this pipeline were to fail, the City of Page would not be able to supply water after the storage tanks at the water treatment plant are emptied.

Table 2.2 Raw Water Intake and Transmission Main Capacity Evaluation

Description	Size (in)	Flow Rate at 5 fps. (mgd)	2017 Maximum Day Flow (mgd)	2017 Maximum Day Velocity (fps)	2040 Maximum Day Flow (mgd)	2040 Maximum Day Velocity (fps)
Raw Water Intake, Penstock Intake, Raw Water Transmission Main	12	2.6	4.0	7.9	5.9	11.6
Transmission Main from Tunnel to WTP	18	5.8	4.0	3.5	5.9	5.2

Table 2.3 Raw Water Pump Station Capacity Evaluation

Pump Station	Total Capacity (mgd)	Firm Capacity (mgd)	2017 Maximum Day Demand (mgd)	2040 Maximum Day Demand (mgd)	Additional Firm Capacity Required by 2040 (mgd)
Raw Water Pump Station	5.2	3.9	4.0	5.9	2.0

2.4 Raw Water Supply Expansion Options

Four potential raw water supply expansion options were evaluated. The objectives of the raw water expansion are to:

- Provide a replacement for the 12-inch raw water pipelines that are undersized
- Provide additional capacity to serve new growth
- Provide redundancy to the raw water supply

Provide redundancy to the raw water pipeline. In an effort to spread costs over time while meeting future water demands identified in Table 2.1, a four phased expansion program has been planned. The first three phases provide the capacity for 6.6 mgd, consistent with the proposed expansion of the water treatment plant. The fourth phase provides a redundant water supply:

1. Phase 1 - There are four hollow jet tubes that are designed to pass spring runoff or high flows around the dam. With current operating practices, two of these tubes are always pressurized with water. Construct a new 18-inch intake pipe from two hollow jet tubes to the suction header of the raw water pump station, and make improvements to the suction header. Figure 2.10 shows one location where the hollow jet tubes are located. Figure 2.11 shows where water is discharged from the hollow jet tubes, and also shows the entrance to the access tunnel.

2. Phase 2 - Increase the capacity of the raw water pump station by adding two additional pumps. One pump could be added now, and the second pump could be added in the future when water demands require an additional pump. Improvements will also be made to the capacity of the raw water pump station discharge header.
3. Phase 3 - Construct an 18-inch pipeline from the raw water pump station to the 18-inch pipe at the entrance to the tunnel.
4. Phase 4 - Develop a redundant water supply that may be used for growth in the distant future.

The following sections describe four redundant raw water delivery options that would comprise Phase 4 of the raw water expansion.

2.4.1 Option 1 – Take the Water Supply from the Hollow Jet Tubes

Option 1 Phase 4 consists of developing an alternative water source by connecting a second pipe to the hollow jet tubes and delivering the raw water to a new raw water pump station. The location of the new raw water pump station is not determined but might be located outside current buildings at the dam if there is no space in buildings at the dam. The new pump station would include four 1,550 gpm pumps that would provide a firm capacity of an additional 6.6 mgd. A new 18-inch transmission main would connect the new raw water pump station with the WTP. The pipeline route could go along the tunnel that provides access to the dam, or a separate tunnel could be bored through the canyon wall up to the surface. Cost estimates in this report are based on the new transmission main running parallel to the existing transmission main.

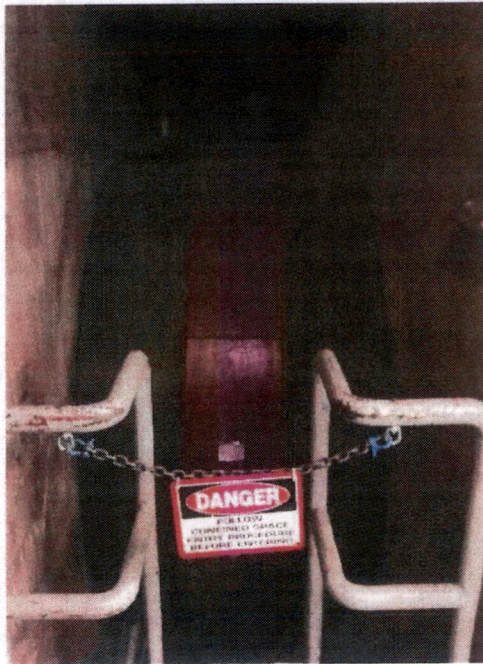


Figure 2.10 Hollow Jet Tube Access



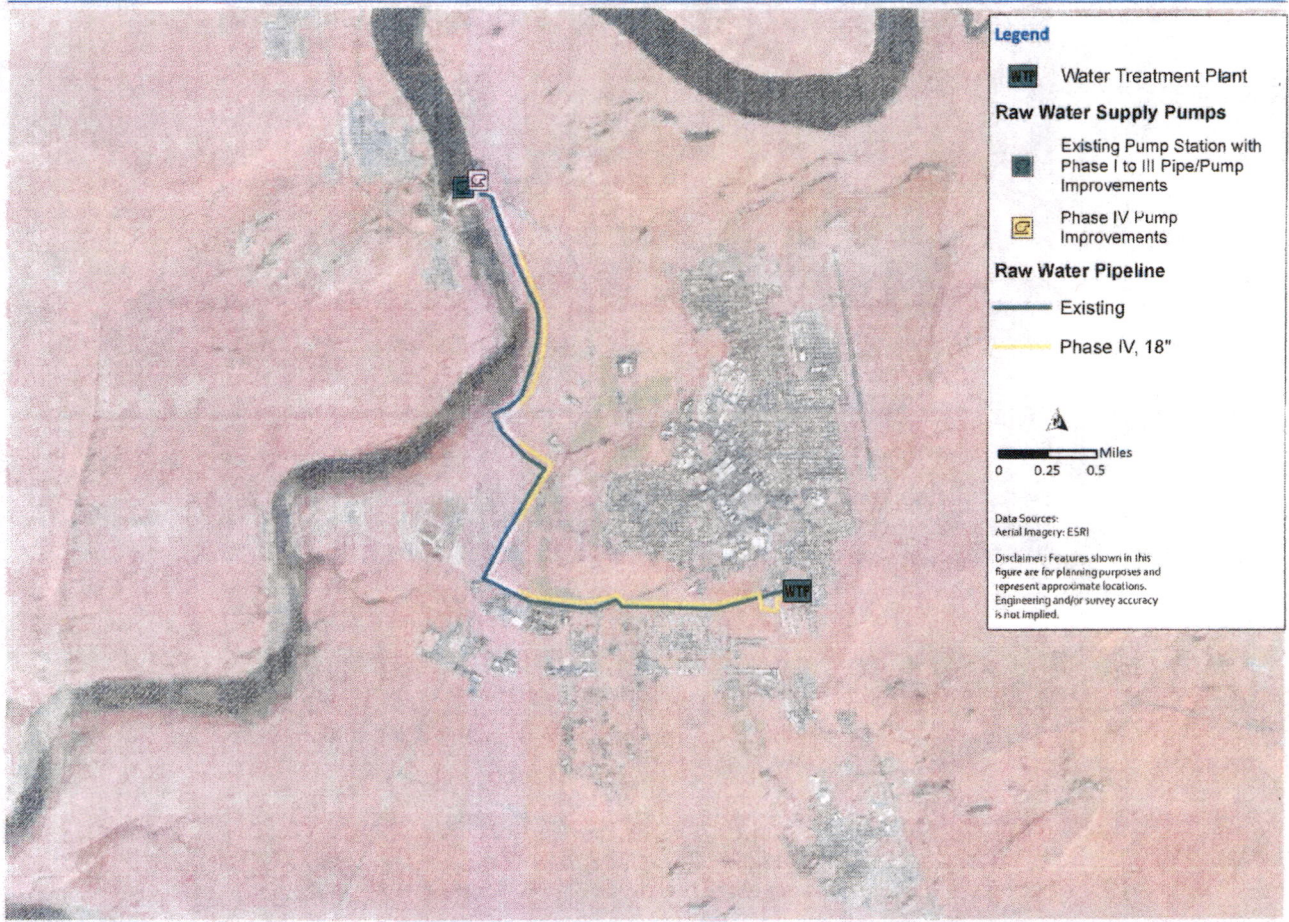
Figure 2.11 Hollow Jet Valves and Entrance to the Access Tunnel

Table 2.4 summarizes the components of each phase of the construction program and Figure 2.12 shows the location of each construction phase on the map.

Table 2.4 Phased Construction Program – Option 1

Phase	Additional Infrastructure
Phase 1	Connect two hollow jet tubes to a new 18-inch raw water pipeline to the existing raw water pump station
	Add a new strainer on the pipe from the hollow jet tubes
	Increase the capacity of the pump station suction header
Phase 2	Add two 910 gpm pumps to the raw water pump station
	Upgrade electrical switchgear for all the pumps
Phase 3	Increase the capacity of the raw water pump station discharge header
	Replace the 12-inch transmission main from the raw water pump station to the entrance of the tunnel with an 18-inch pipeline
Phase 4	Connect a second raw water intake pipe to the hollow jet tubes
	Add a booster pump station with 4 pumps, 1,550 gpm each
	Construct an 18-inch transmission main to the WTP

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Phone: 307.632.1234
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www.carollo.com

Figure 2.12 Option 1 Phased Raw Water System Improvements

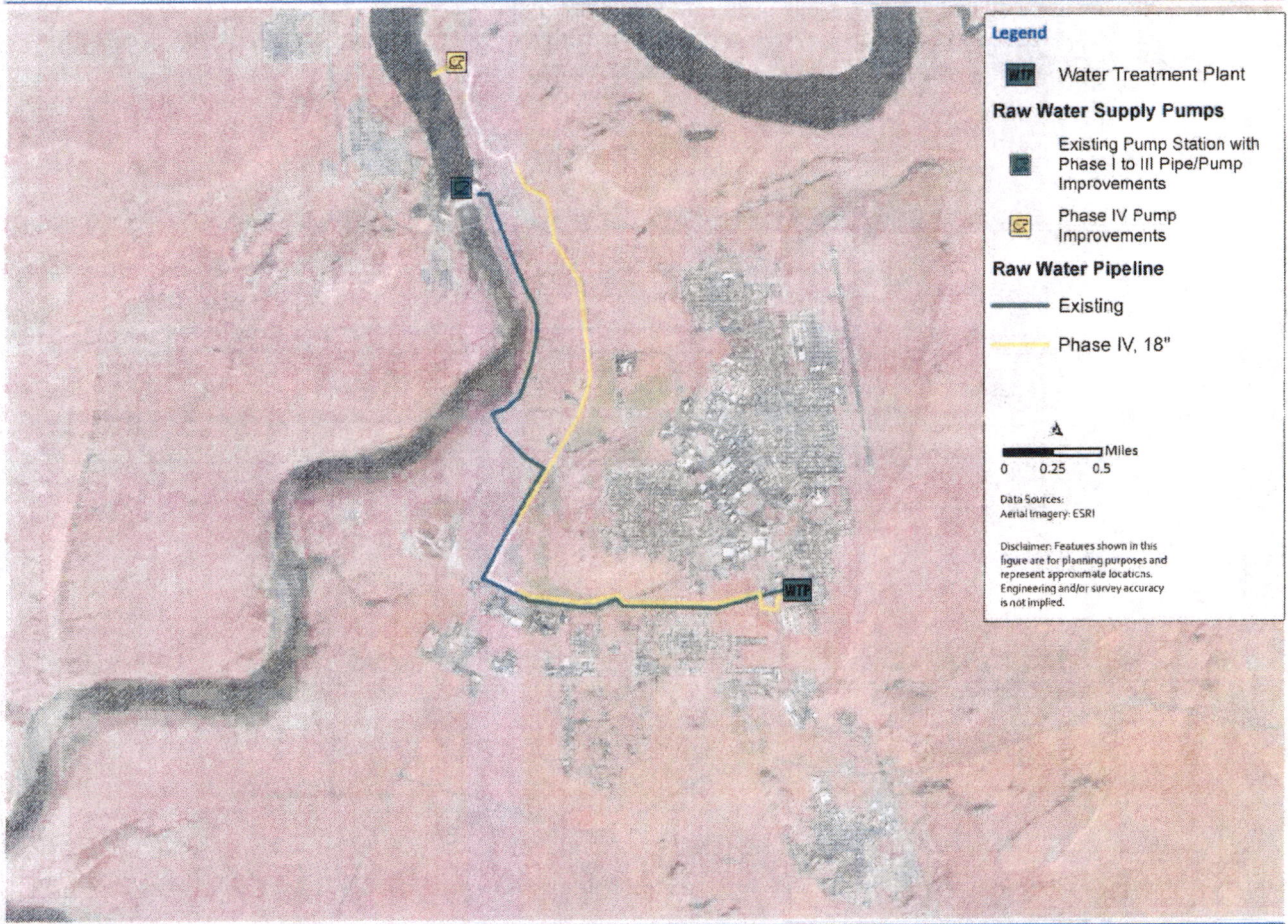
2.4.2 Option 2 – Water Intake Upstream of the Glen Canyon Dam

Option 2 Phase 4 consists of constructing a new intake located upstream of the Glen Canyon Dam that would take water directly from Lake Powell. This option was studied in detail previously and documented in the report: Page-LeChee Water Supply - Part 1, June 2004 by the USBR. This project includes an intake structure that takes water from the lower levels of Lake Powell, a pump station with four 1,550 gpm pumps, and a new 18-inch transmission main that delivers water to the WTP.

Table 2.5 summarizes the contents of each phase for Option 2. Figure 2.13 shows the location of each phase of improvements.

Table 2.5 Phased Construction Program – Option 2

Phase	Additional Infrastructure
Phase 1	Connect two hollow jet tubes to a new 18-inch raw water pipeline to the existing raw water pump station
	Add a new strainer on the pipe from the hollow jet tubes
	Increase the capacity of the pump station suction header
Phase 2	Add two 910 gpm pumps to the raw water pump station
	Upgrade electrical switchgear for all the pumps
	Increase the capacity of the raw water pump station discharge header
Phase 3	Replace the 12-inch transmission main from the raw water pump station to the entrance of the tunnel with an 18-inch pipeline
Phase 4	New raw water intake structure, building and pump lines
	18-inch transmission main to WTP



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www.carollo.com

Figure 2.13 Option 2 Phased Raw Water System Improvements

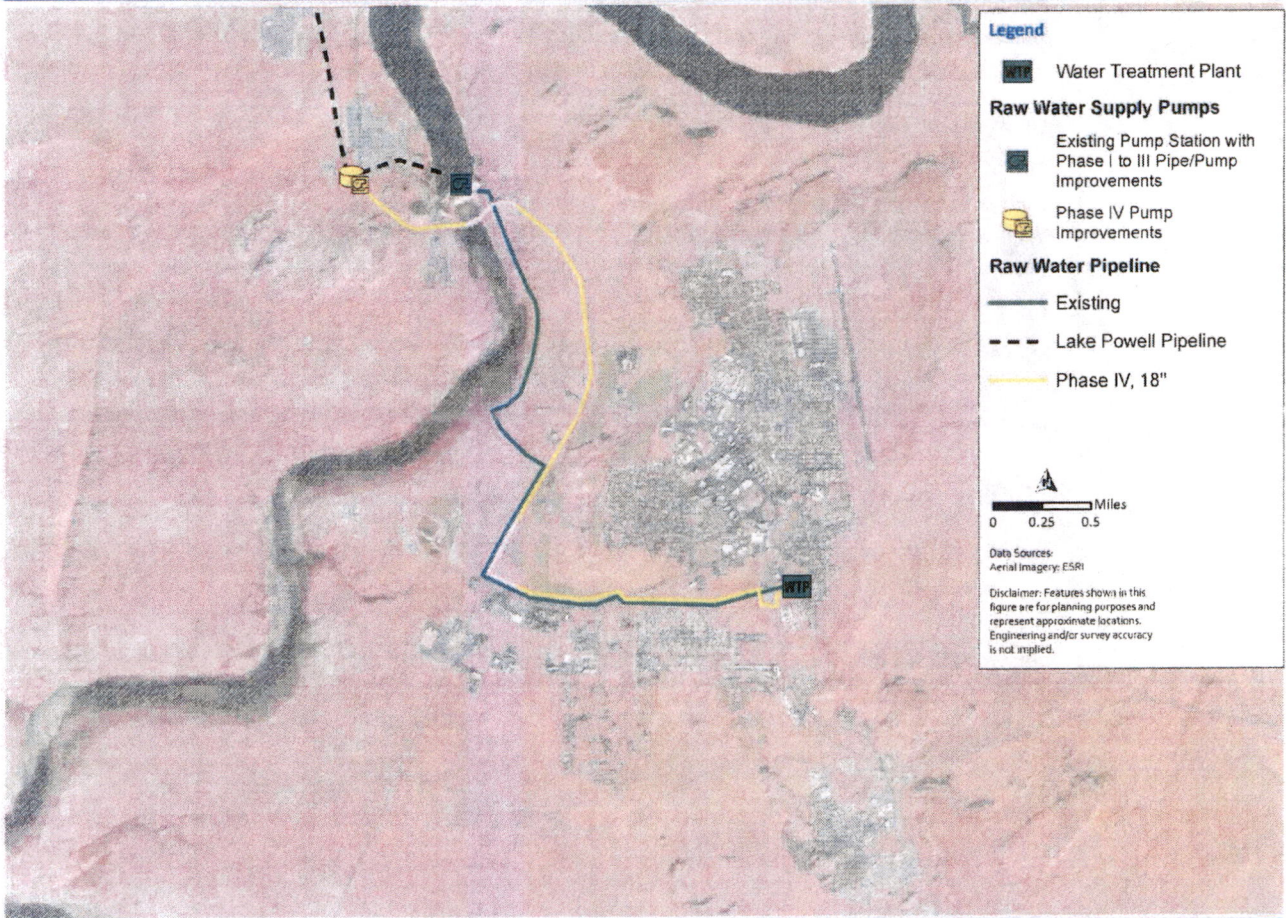
2.4.3 Option 3 – Connect to the Lake Powell Pipeline

Option 3 Phase 4 consists of taking water from the proposed Lake Powell pipeline. The Lake Powell Pipeline Project is planned to transport water from Lake Powell to St. George and other growing areas in southern Utah. The pump station that will draw water from the lake will be located on the west side of the Glen Canyon Dam. The operating hydraulic gradeline at the point of the proposed connection is not known, but a pressure reducing, or pumping station will be required to manage the hydraulic gradeline needed to deliver water to the Page water treatment plant. A storage tank could be constructed near the Lake Powell pipeline and then a pump station could deliver water to the Page WTP. A new 18-inch transmission main will be needed to deliver raw water across the dam and then south to the WTP. This pipeline could be located on top of the dam, or possibly in one of the tunnels that runs across the dam.

Table 2.6 summarizes the components of each construction phase. Figure 2.14 shows the location of each construction phase.

Table 2.6 Phased Construction Program – Option 3

Phase	Additional Infrastructure
Phase 1	Connect two hollow jet tubes to a new 18-inch raw water pipeline to the existing raw water pump station
	Add a new strainer on the pipe from the hollow jet tubes
	Increase the capacity of the pump station suction header
Phase 2	Add two 910 gpm pumps to the raw water pump station
	Upgrade electrical switchgear for all the pumps
	Increase the capacity of the raw water pump station discharge header
Phase 3	Replace the 12-inch transmission main from the raw water pump station to the entrance of the tunnel with an 18-inch pipeline
Phase 4	Make a connection to Lake Powell Pipeline (pump station, storage, or a PRV)
	Construct a new 18-inch transmission main to WTP



Carollo, LLC
11000 E. South Parkway, Suite 200, Denver, Colorado 80231
www.carollo.com

Figure 2.14 Option 3 Phased Raw Water System Improvements

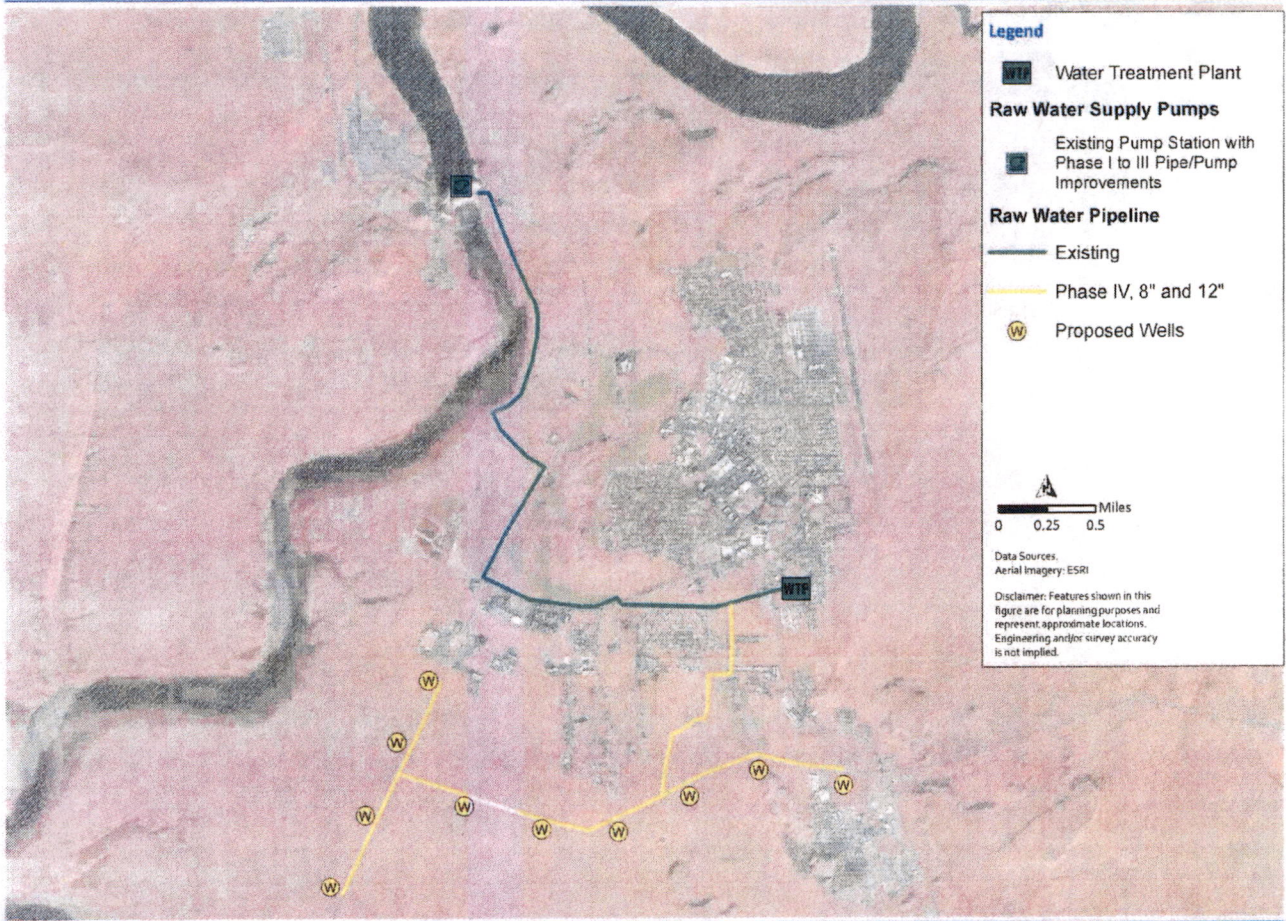
2.4.4 Option 4 – Develop a Well Field along Hwy 89 and Hwy 98

Option 4 Phase 4 consists of developing a well field along Hwy 89 and Hwy 98. The water table in this region is expected to be around 1,500 feet requiring deep wells. The water yield is expected to be very low, around 200 gpm. At least 10 wells will need to be constructed to provide a water supply of 2,000 gpm. Due to the cost of constructing a well field, this option is intended only to provide a current average day demand redundancy to allow the 12-inch raw water intake and 12-inch raw water transmission main to be replaced.

Table 2.7 summarizes the components of each construction phase. Figure 2.15 shows the infrastructure that would be constructed in each phase.

Table 2.7 Phased Construction Program – Option 4

	Infrastructure Addition
Phase 1	Connect two hollow jet tubes to a new 18-inch raw water pipeline to the existing raw water pump station
	Add a new strainer on the pipe from the hollow jet tubes
	Increase the capacity of the pump station suction header
Phase 2	Add two 910 gpm pumps to the raw water pump station
	Upgrade electrical switchgear for all the pumps
	Increase the capacity of the raw water pump station discharge header
Phase 3	Replace the 12-inch transmission main from the raw water pump station to the entrance of the tunnel with an 18-inch pipeline
Phase 4	Drill 10 wells
	Equip 10 wells
	New 8-inch raw water transmission main along Hwy 89
	New 12-inch raw water main along Hwy 98 to the WTP



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Figure 2.15 Option 4 Phased Raw Water System Improvements

2.5 Cost Estimates

2.5.1 Cost Development Methodology

Cost estimates have been developed for the water supply expansion options identified in the previous sections. These estimates were prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineers (A.A.C.E.) International for a Class 5 estimate. Table 2.8 summarizes the A.A.C.E. International cost estimating classifications, the level of project definition (percent of design), uses, appropriate cost estimating methodologies, and the expected accuracy of each class. Design work would need to be undertaken to obtain more precise cost estimates. When preparing capital project estimates, the expected accuracy range of the cost estimate should be considered when establishing the CIP budgets.

Table 2.8 A.A.C.E. International Cost Estimating Classification Summary

Estimate Class	Maturity Level of Project Definition Deliverables - (Level of Engineering Design)	End Use	Typical Cost Estimating Methodology Used	Expected Accuracy Range (Low/High)
Class 5	0% to 2%	Conceptual screening	Capacity factored, parametric models, judgment or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -10% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

2.5.2 Costs

Costs were developed for the recommended infrastructure addition using R.S. Means and other unit cost sources. Multipliers for overhead (10 percent), construction profit (6 percent), sales tax (65 percent of applicable costs at 9.1 percent), and contingencies (10 percent) were then added to prepare construction costs for each project. The construction cost represents what the City should expect to pay a contractor to construct the project. The City will have other expenses to complete the project including design, inspection, project management, and contingencies. A multiplier of 1.4 was used to represent these additional costs and applied to the construction cost to obtain a project cost for each infrastructure addition.

2.5.3 Water Supply Option Cost Estimates

Table 2.9 through Table 2.12 summarize the cost estimates for each of the raw water supply expansion options and phases.

Table 2.9 Cost Estimate for Option 1 - Connect to the Hollow Jet Tubes

Phase	Infrastructure Required	Construction Cost (\$)	Project Cost (\$)
Phase 1	Connect to two hollow jet tubes, construct a new intake pipe from hollow jet tubes to the raw water pump station and increase the capacity of the pump station suction header	\$880,000	\$1,232,000
Phase 2	Add two 910 gpm pumps to the pump station, increase the capacity of the pump discharge header, and replace electrical switchgear for the pumps	\$2,483,000	\$3,476,000
Phase 3	Construct an 18-inch pipeline from the raw water pump station to the 18-inch pipe in the tunnel.	\$288,000	\$403,000
Subtotal (Phase 1 to 3)		\$3,651,000	\$5,111,000
Phase 4	Connect to water sources	\$400,000	\$560,000
	Raw water intake pipe	\$221,000	\$309,000
	Booster pump station with 4 pumps, 1,550 gpm each	\$3,395,000	\$4,753,000
	Construct 18-inch transmission main from new booster pump station to WTP	\$8,353,000	\$11,694,000
Subtotal (Phase 4)		\$12,369,000	\$17,316,000
Total (Option 1)		\$16,020,000	\$22,427,000

Table 2.10 Cost Estimate for Option 2 - Water Intake Upstream of the Glen Canyon Dam

Phase	Infrastructure Required	Construction Cost (\$)	Project Cost (\$)
Phase 1	Connect to two hollow jet tubes, construct a new intake pipe from hollow jet tubes to the raw water pump station and increase the capacity of the pump station suction header	\$880,000	\$1,232,000
Phase 2	Add two 910 gpm pumps to the pump station, increase the capacity of the pump discharge header, and replace electrical switchgear for the pumps	\$2,483,000	\$3,476,000
Phase 3	Construct an 18-inch pipeline from the raw water pump station to the 18-inch pipe in the tunnel.	\$288,000	\$403,000
Subtotal (Phase 1 to 3)		\$3,651,000	\$5,111,000
Phase 4	Intake Structure, Building and Pump lines	\$14,600,000	\$20,440,000
	18-inch new transmission main from new booster pump station to WTP	\$7,815,000	\$10,941,000
Subtotal (Phase 4)		\$22,415,000	\$31,381,000
Total (Option 2)		\$26,066,000	436,492,000

Table 2.11 Cost Estimate for Option 3 - Connection with the Lake Powell Pipeline Project

Phase	Infrastructure Required	Construction Cost (\$)	Project Cost (\$)
Phase 1	Connect to two hollow jet tubes, construct a new intake pipe from hollow jet tubes to the raw water pump station and increase the capacity of the pump station suction header	\$880,000	\$1,232,000
Phase 2	Add two 910 gpm pumps to the pump station, increase the capacity of the pump discharge header, and replace electrical switchgear for the pumps	\$2,483,000	\$3,476,000
Phase 3	Construct an 18-inch pipeline from the raw water pump station to the 18-inch pipe in the tunnel.	\$288,000	\$403,000
Subtotal (Phase 1 to 3)		\$3,651,000	\$5,111,000
Phase 4	Connection with Lake Powell Pipeline (Pump station – a part ownership and PRV)	\$3,000,000	\$4,200,000
	18-inch new transmission main to WTP	\$8,386,000	\$11,741,000
	Approval from Agency for Connection	\$1,000,000	\$1,400,000
Subtotal (Phase 4)		\$12,386,000	\$17,341,000
Total (Option 3)		\$16,037,000	\$22,452,000

Table 2.12 Cost Estimate for Option 4 - Develop Well Field along Hwy 89 and Hwy 98

Phase	Infrastructure Required	Construction Cost (\$)	Project Cost (\$)
Phase 1	Connect to two hollow jet tubes, construct a new intake pipe from hollow jet tubes to the raw water pump station and increase the capacity of the pump station suction header	\$880,000	\$1,232,000
Phase 2	Add two 910 gpm pumps to the pump station, increase the capacity of the pump discharge header, and replace electrical switchgear for the pumps	\$2,483,000	\$3,476,000
Phase 3	Construct an 18-inch pipeline from the raw water pump station to the 18-inch pipe in the tunnel.	\$288,000	\$403,000
Subtotal (Phase 1 to 3)		\$3,651,000	\$5,111,000
Phase 4	Well Drilling and Equipment Cost	\$25,220,000	\$35,308,000
	New Transmission Main	\$4,800,000	\$6,720,000
Subtotal (Phase 4)		\$30,020,000	\$42,028,000
Total (Option 4)		\$33,671,000	\$47,139,000

2.6 Water Supply Expansion Options Comparison

Table 2.13 presents the cost estimates of each of the waster expansion options. Based on the costs of the options, Options 1 and 3 are similar, and lower than Options 2 and 4. However, in addition to costs, there are other factors that need to be considered.

For each of the options, approval will be needed from the USBR. The first step in obtaining this approval is preparing a proposal that is based on a preliminary design. Designs will need to comply with the design standards of the USBR, and the USBR will oversee the design. The USBR may have perspectives on which option is the most feasible, and less disruptive to USBR activities. The USBR has been briefed on each of these options, and follow-up is needed to obtain buy-in on a selected option.

Option 3 requires the additional coordination with the entities that will be constructing the Lake Powell Pipeline, and initial contact to coordinate this option has not taken place. One downside of Option 3 is that the timing of the Lake Powell pipeline may or may not coincide with the time that Page needs the raw water system expansion.

A connection to the Lake Powell pipeline may provide other benefits to Page even if not used for the current raw water supply expansion. The City's planning area extends to the north side of the Colorado River. Development on this side of the Colorado River may be years into the future, but the current raw water system is not likely to be able to provide water to this side of the river. Therefore, the connection to the Lake Powell pipeline may be the mechanism for providing a water supply to this side of the river that initiates growth. For this reason, the City should initiate discussions with the pipeline owners to see about a connection to the pipeline.

Table 2.13 Cost Comparison

	Description	Project Cost (\$)
Option 1	Connection with the hollow jet tubes	\$22,427,000
Option 2	Water intake from upstream of the Glen Canyon Dam	\$36,492,000
Option 3	Connection with the Lake Powell Pipeline Project	\$22,452,000
Option 4	Developing water field along Hwy 89 and Hwy 98	\$47,139,000

2.7 Conclusions and Recommendations

1. The raw water pump station and transmission main was designed and is maintained according to USBR standard practices, and appears to be well maintained.
2. The 12-inch raw water intake that takes water from the face of the dam is infrastructure that is very difficult to access for inspections, maintain, and impossible to expand. This raw water intake was constructed in the 1950's and the remaining useful life of this intake is not known and possibly not knowable. Therefore, Page should work to obtain a redundant raw water supply.
3. The 12-inch diameter portion of the raw water supply system is undersized and not capable of supplying water for additional growth that Page anticipates, so Page should proceed immediately to find a way to expand the capacity of the raw water supply system.
4. Based on the information that is available currently, Option 1 is recommended as the preferred way to expand the capacity of the Page Raw water system, pending further investigations for feasibility.
5. Option 3 should be pursued for a water supply for development on the west side of the Colorado River.

6. There are several investigations that need to take place to prove the viability of the raw water expansion options. A feasibility study is recommended that would be completed in collaboration with the USBR to address unknowns that include:
 - a. What is the best way to connect to the hollow jet tubes and the existing pump station?
 - b. Where should the second raw water pump station be located?
 - c. What is the feasibility of locating an additional raw water pipeline in the access tunnel to the dam?
 - d. What issues need to be addressed in connecting with the existing 18-inch raw water pipeline as it leaves the canyon?
 - e. What are the current technical, legal, and political issues that need to be addressed to construct a new intake from Lake Powell?
 - f. What are the current technical, legal, and political issues that need to be addressed to construct a connection to the Lake Powell Pipeline?
 - g. If a well field is constructed, where are better locations for wells?
 - h. Planning level costs would need to be refined based on the additional insights obtained from the feasibility study.

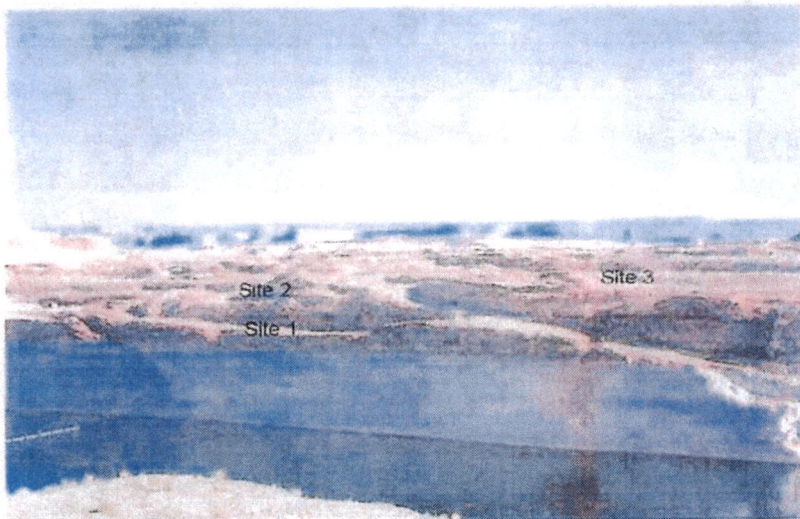
RECLAMATION

Managing Water in the West

Page-LeChee Water Supply - Part 1

Concept Design Study - Report of Findings

City of Page, Arizona
Navajo Nation Chapter of LeChee
Upper Colorado Region




U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

June 2004

**Page-LeChee Water Supply - Part 1
Concept Design Study
Report of Findings**

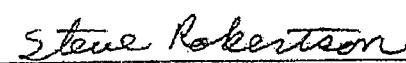
Signature Sheet

Prepared by:



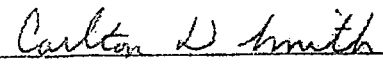
Richard LaFond, D-8120, Structural Engineer
Team Leader

6/17/04
Date



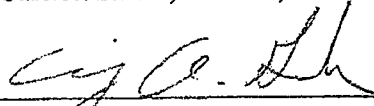
Steve Robertson, D-8140, Civil Engineer

6/16/04
Date



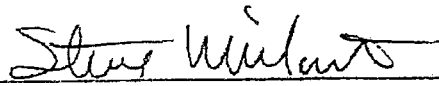
Carlton Smith, D-8160, Construction Liaison Engineer

6-17-04
Date



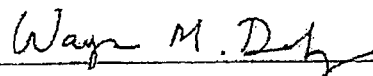
Craig Grush, D-8170, Cost Estimator

6/17/2004
Date



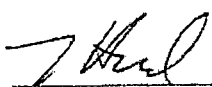
Steve Willcut, D-8320, Geologist

6/17/04
Date



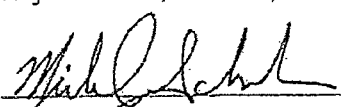
Wayne Delzer, D-8410, Mechanical Engineer

6/17/04
Date



Terry Hummel, D-8420, Mechanical Engineer

6/18/04
Date



Michael Schuh, D-8440, Electrical Engineer

6/17/04
Date

Peer Reviewed by:

Paul M. Ruchti, P.E.
Paul Ruchti, D-8120, Structural Engineer, PE

6/17/2004
Date

PAGE-LECHEE WATER SUPPLY - PART 1 CONCEPT DESIGN STUDY

Executive Summary

The existing water supply for the City of Page and the neighboring Navajo Nation Chapter of LeChee is obtained from Lake Powell through pumping and conveyance facilities that were initially installed during the construction of Glen Canyon Dam and Power Plant between 1957 and 1964. Since that time, system improvements to increase capacity have occurred; however, additional intake facilities are required to permit the City of Page and Navajo Nation Chapter of LeChee (LeChee) to fully use their water allocation, and provide dependability and redundancy to their water delivery system. Through a contract with the Bureau of Reclamation (Reclamation) and as clarified through subsequent letters of concurrence, the City of Page is allocated an annual delivery of water from storage in Lake Powell to allow for the consumptive use of 2,740 acre-feet. As a contractual obligation, the City is required to deliver up to 100,000 gallons of treated water per day to LeChee.

Future raw water requirements and alternatives to increase system capacity to meet these requirements were investigated by Tetra Tech RMC in 2002 [1]. As part of this investigation, appraisal level estimates were prepared for three options and a New Lake Intake alternative was recommended for further study based on its cost and ability to meet future water needs. Costs for pump stations and pipelines were based on unit cost data; dollars per horsepower for pump stations, and dollars per lineal foot for various diameters of pipelines.

This Report of Findings develops the New Lake Intake alternative in greater detail to permit a better definition of required features, understanding of obstacles, and development of more accurate construction cost estimates. Part 1 of the water supply study documents the necessary features and improvements between Lake Powell and the Water Treatment Plant. Part 2 of the water supply study will address facilities and features between the Water Treatment Plant and LeChee.

The proposed modified water supply system between Lake Powell and the Water Treatment Plant will continue to use the existing water supply system. In its current configuration, the existing water supply line consists of a 12-inch pipe from the reservoir intake at elevation 3480.0 feet, to three horizontal pumping units plus one backup unit located in the Machine Shop of the Glen

The vertical shaft plants also have the capability of being retrofitted for deeper withdrawal from Lake Powell at a future date. Although most microtunneling companies contacted during this study were reluctant to state they had the capability of installing the deeper lake tap under a head of 230 feet (assumed reservoir level during construction, elevation 3600), it would be possible to excavate a deeper vertical shaft, install the shallow lake tap now, and make provisions for installing a deeper lake tap in the future should the reservoir water level continue to fall.

Level of Study

The scope of this concept study was limited to the development of a modified water supply system that incorporates the existing system with a new reservoir-side intake, pumping plant, and pipeline connecting to the existing water treatment plant. The purpose of the study was to develop a better definition of required features, understanding of obstacles, and development of more accurate construction cost estimates; and to use these costs to compare plant types and withdrawal levels.

This study is based on available existing design data from past work accomplished by Reclamation and the City of Page in the vicinity of the proposed work, and is generally limited to the references listed at the end of this report. Although a limited topographic survey near the proposed pumping plant sites was obtained by the City of Page, this concept study utilized data from aerial surveys provided by Reclamation and the City of Page. No geologic exploration at the proposed plant sites or along the proposed pipeline, or surveys of the cliff face and reservoir bottom, were accomplished to verify assumptions used to develop the alternatives. Cost estimates can change as more design data becomes available.

Concepts and assumptions used in this study have not been subject to detailed design and value engineering. Preliminary identification and sizing of required features was accomplished based on engineering judgment, limited analyses, available design data, and assumptions in the absence of data. Major features were broken down into their cost components and quantities were calculated for these components. Unit prices based on recent work of similar nature and adjusted for location and current economic trends were determined for the identified cost components and a field cost estimate was calculated.

based on its cost and ability to meet future water needs.

This Report of Findings develops the New Lake Intake alternative in greater detail to permit a better definition of required features, understanding of obstacles, and development of more accurate construction cost estimates. Part 1 of the water supply study documents the necessary features and improvements between Lake Powell and the Water Treatment Plant. Part 2 of the water supply study will address facilities and features between the Water Treatment Plant and LeChee. Part 2 work will be the subject of a separate future report.

Future Water Needs

Through a contract with the Bureau of Reclamation and as clarified through subsequent letters of concurrence, the City of Page is allocated an annual delivery of water from storage in Lake Powell to allow for the consumptive use of 2,740 acre-feet per year. As a contractual obligation, the City is required to deliver up to 100,000 gallons of treated water per day (112 acre-feet per year) to LeChee. The existing infrastructure does not allow the City of Page to meet their peak demands or allow the City and LeChee to utilize their full water allocation.

For the purpose of this study, population growth and future water needs estimates developed by Tetra Tech RMC [1] are assumed to be accurate. Future raw water requirements for Page and LeChee were estimated based upon projected future population and per capita water use in each community. The following Table 1 summarizes their year 2000, and estimated future population and treated water demands for the City of Page and LeChee, combined.

Table 1: Population and Water Demands ⁷²⁰⁰*

Year	2000	2008	2020	2026	2040
Population	8,789	10,438	12,962	14,299	17,728
Annual Demand (acre-feet)	2,410	2,943	3,852	4,217	5,134
Average Daily Demand (mgd)	2.15	2.63	3.44	3.76	4.58
Average Daily Demand (gpm)	1,493	1,826	2,389	2,611	3,181
Peak Daily Demand (mgd)	4.55	5.60	7.43	8.14	9.96
Peak Daily Demand (gpm)	3,160	3,889	5,160	5,653	6,917
Page Golf Course Peak Demand (gpm)	1,944	1,944	1,944	1,944	1,944
Total Peak Demand (gpm)	5,104	5,833	7,104	7,597	8,861

* Summary Report by Tetra Tech RMC dated January 2003 [1].

Between 1980 and 1982, under the Service Road Tunnel Rehabilitation contract [7], the 12-inch water line installed downstream from the 12-inch stub at the river outlet valve structure, and upstream of the grouted, vertical 12-inch pipe at tunnel station 60+02.39, was replaced by an 18-inch cement mortar-lined, steel pipe encased in concrete below the tunnel invert. See Figures 21 (557-D-3368), 22 (557-D -3396), 23 (557-D 3397), and 24 (557-D 3398).

In 1991, the City of Page let a contract [8] to drill a new vertical access hole near the existing shaft to accommodate an 18-inch steel pipe between the canyon rim and the power plant access tunnel below, and replace approximately 1,000 feet of dual 12.75 OD pipe with a single 18-inch diameter mortar-lined ductile iron pipe. See Figures 25 through 29 (Dibble and Associates Sheets 1 through 5). In 1997, the City of Page let a contract [9] to replace the remaining dual 12.75 OD pipe with a single 18-inch diameter mortar-lined ductile iron pipe thus completing the 18-inch water line from the river outlet valve structure to the water treatment plant. See Figures 30 through 37 (MCM Engineering, Inc. Sheets 1 through 8.). In its current configuration the water supply line consists of 12-inch pipe from the reservoir intake to the river outlet valve structure, and 18-inch pipe from the valve structure to the water treatment plant.

The pumping units are maintained by personnel from the Glen Canyon Field Division Office who also operate the dam and power plant. The pumping plant is operated remotely by the City of Page over phone lines from the City Command Center. Based on storage tank levels at the water treatment plant, the system automatically operates Pump Units 1, 2, and 3. Pump Unit 4 is a backup unit and cannot be operated remotely but has been energized manually at peak demand times [2].

Evaluation of Existing Pumping Units

The four horizontal pumps installed in the Glen Canyon Power Plant are Gould Model 3360 pumps. The manufacturer's pump curves indicate the pumps have a minimum operating head of 760 feet for the impeller trim indicated. (See Appendix A, Figure A-10). Due to the age of the existing pump units, the Glen Canyon Field Division Office can no longer obtain parts for the existing units. A Flowserve Model 100NMB pump was procured by the Glen Canyon Field Division Office in March 2003 to replace the Unit 2 Gould pump which was taken out of service in February 2003 due to a bearing failure. The Flowserve manufacturer's curves indicate that the pump's minimum operating head is 670 feet for the impeller trim indicated. (see Appendix A,

ATTACHMENT #3

PAGE UTILITY ENTERPRISES
WATER FUND
BALANCE SHEET
July 31, 2024

ASSETS

Current Assets

Cash & Working Funds	3,644,851
LGIP Reserve Account	4,596,608
Customer Accounts Receivable	269,598
Other Accounts Receivable	469
Provision For Uncollectable Accts	(24,023)

Total Current Assets 8,487,504

Fixed Assets

Water Plant in Service	2,042,149
Other Tangible Assets	22,540,097
Depreciation & Amortization	(18,529,044)
Work in Progress	

Net Fixed Assets 6,053,202

Other Assets

Prepayments	127,103
Inventory-Material & Supplies	203,328

Total Other Assets 330,431

Total Assets 14,871,138

LIABILITIES AND EQUITY

Current Liabilities

Accounts Payable	132,585
Customer Deposits Payable	130,415
Misc Current & Accrued Liabilities	670,690

Total Current Liabilities 933,689

Total Liabilities 933,689

Equity & Net Revenues

Accumulated Net Revenues	13,861,760
Current Net Revenues	75,689

Total Equity & Net Revenues 13,937,449

Total Liabilities and Equity 14,871,138