PUBLIC NOTICE OF A REGULAR MEETING
OF THE HOSPITAL AUTHORITY
TUESDAY, APRIL 17, 2012 AT 5:30 PM
CLINTON CITY HALL

AGENDA

Meeting status: Completed

1. Call to Order
2. Opening Prayer Father Rex Arnold, St. Mary's Catholic Church
3. Consent Agenda
    A. Consider approval of minutes of April 3, 2012
4. Action Items:
    A. Consider Quit Claim deed to Transfer Clinic Property to Clinton City Council
5. City Managers Report
6. Audience Participation
7. Adjournment

Filed this 13th Day of April, 2012. Posted on the bulletin board in the lobby of the Clinton City Hall on Friday , April 13, 2012 at 1:30pm

MINUTES OF HOSPITAL AUTHORITY MEETING, APRIL 3, 2012

Minutes of a regular meeting of the Chairman and Trustee of the Clinton Hospital Authority of Clinton, Oklahoma, Custer County, held in the City Council Room, City Hall on Tuesday, April 3, 2012 at 5:30 p.m. A notice of this meeting with agenda was posted on the bulletin board in the lobby of Clinton City Hall on March 2, 2012.

Chairman Bryson called the meeting to order with the following present;

CHAIRMAN: Allen Bryson
TRUSTEES: Bob Marcy, Jason Hulin, Don Rodolph
ABSENT: Phyllis Smith
CITY MANAGER: Steve Hewitt
CITY CLERK: Lisa Anders
CITY TREASURER: Debra Blanchard
DEPUTY CLERK: Rhonda Williams
CITY ATTORNEY: Ryan Meacham
NEWS MEDIA: Gerald Green and Jarod Atha
OTHERS: Arnold Adams, David Crabtree, Jeremy Bush, L.R. Sights, Julie Menge, Narcy Smith, Matt Jett, Brian and Landon Aneshansley, Twilla Brown, Kent Powell, Jimmy Johnson, Gene McCullough, Debbie and Nicole Bryson, Jeff Weiford, and others.

Jarod Atha opened the meeting with prayer and Trustee Bob Marcy led the Pledge of Allegiance.

AGENDA ITEM NO. 3: CONSENT AGENDA

A. Minutes of the Regular Meeting of March 6, 2012
B. Consider Claims

Moved by Trustee Marcy and seconded by Trustee Hulin, that Consent Agenda Item No. 3 (a-b) be approved.

Chairman put the motion to a roll call vote:

Aye: Marcy, Hulin, Rodolph, Bryson
Nay: None

Chairman declared the motion carried.

AGENDA ITEM NO. 4 ACTION ITEMS

None

AGENDA ITEM NO .5: CITY MANAGER'S REPORT

None

AGENDA ITEM NO. 6: AUDIENCE PARTICIPATION

None

AGENDA ITEM NO. 7: ADJOURNMENT

Moved by Trustee Hulin and seconded by Trustee Marcy that the meeting adjourn.

Chairman put the motion to a roll call vote:

Aye: Hulin, Marcy, Rodolph, Bryson
Nay: None

Chairman declared the meeting adjourned at 5:32 pm.

PUBLIC NOTICE OF A REGULAR MEETING
OF THE PUBLIC WORKS AUTHORITY
TUESDAY, APRIL 17, 2012 AT 5:30 PM
CLINTON CITY HALL

AGENDA

Meeting status: Completed

1. Call to Order
2. Opening Prayer Father Rex Arnold, St. Mary's Catholic Church
3. Consent Agenda
    A. Consider Approval of Minutes on April 3, 2012
4. Action Items:
    A. Affirm Expenditure by Clinton Public Schools Board of Education to Joe D. Hall, General Contractor for School Construction
    B. Consider Garver Engineer's presentation regarding Long-term Water Supply Evaluation
5. City Manager's Report
6. Audience Participation
7. Adjournment
    A. Continue to Industrial Authority Agenda

Filed this 13th Day of April, 2012. Posted on the bulletin board in the lobby of the Clinton City Hall on April 13, 2012 at 1:30 p.m.

PW040312

MINUTES OF THE PUBLIC WORKS AUTHORITY MEETING, APRIL 3, 2012

Minutes of the regular meeting of the Chairman and Trustees of the Clinton Public Works Authority of Clinton, Oklahoma, Custer County, held in the City Council Room, City Hall on Tuesday, April 3, 2012 at 5:30 P.M. A notice of this meeting with agenda was posted on the bulletin board in the lobby of Clinton City Hall on March 30, 2012.

Chairman Bryson called the meeting to order with the following present:

CHAIRMAN: Allen Bryson
TRUSTEES: Bob Marcy, Jason Hulin, Don Rodolph
ABSENT: Phyllis Smith
CITY MANAGER: Steve Hewitt
CITY CLERK: Lisa Anders
CITY TREASURER: Debra Blanchard
DEPUTY CLERK: Rhonda Williams
CITY ATTORNEY: Ryan Meacham
NEWS MEDIA: Gerald Green and Jarod Atha
OTHERS: David Crabtree, Arnold Adams, Jeremy Brush, L.R. Sights, Julie Menge, Narcy Smith, Matt Jett, Brian & Landon Aneshansley, Jeff Weifold, Twila Brown, Debbie & Nicole Bryson, Kent Powell, Jimmy Johnson, Jenny Newlik, and others.

Jarod Atha opened the meeting with prayer and Trustee Bob Marcy led the Pledge of Allegiance.

AGENDA ITEM NO. 3: CONSENT AGENDA

A. Minutes of the Regular Meeting of March 6, 2012
B. Consider Claims

Moved by Trustee Marcy and seconded by Trustee Hulin, that Consent Agenda Item No. 3 (a-b) be approved.

Chairman put the motion to a roll call vote:

Aye: Marcy, Hulin, Rodolph, Bryson
Nay: None

Chairman declared the motion carried.

AGENDA ITEM NO. 4. ACTION ITEMS

4A. AFFIRM EXPENDITURE BY CLINTON PUBLIC SCHOOLS BOARD OF EDUCATION TO JOE D. HALL, GENERAL CONTRACTOR FOR SCHOOL CONSTRUCTION

Motion was made by Trustee Hulin and seconded by Trustee Rodolph to affirm the expenditures by Clinton Public Schools Board of Education to Joe D. Hall, General Contractor for school construction.

Chairman put the motion to a roll call vote:

Aye: Hulin, Rodolph, Marcy, Bryson
Nay: None

Chairman declared the motion carried.

AGENDA ITEM NO .5: CITY MANAGER'S REPORT

City Manager Steve Hewitt reported that Garver Engineering has completed their 20/20 Vision Report and it is very reviewed by Arnold Adams. A meeting is schedule with Garver for next week to review the report. He said presentation to the Council is scheduled for the April 17th meeting.

Trustee Rodolph said he had received .7 inch of rain at Stafford during the recent rains.

AGENDA ITEM NO. 6: AUDIENCE PARTICIPATION

Jimmy Johnson said the City had recently had a leak of the six inch water line and he complemented the water crew that worked on the problem and appreciated the good job.

AGENDA ITEM NO. 7: ADJOURNMENT

Moved by Trustee Rodolph and seconded by Trustee Marcy that the meeting adjourn.

Chairman put the motion to a roll call vote:

Aye: Rodolph, Marcy, Hulin, Bryson
Nay: None

Chairman declared the meeting adjourned at 5:40 pm.

SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1897738

Feb 7, 2012

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1897738	2/6/2012	ORD1391600	3/7/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
SFT-127-SO	120 SERIES SCHOOL CHAIR - 17 1/2" SEAT HEIGHT	60	$24.88	$1,492.80

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$1,492.80
SHIPPING & HANDLING	$219.76
SALES TAX	$0.00
INVOICE TOTAL	$1,712.56

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$1,712.56

Donna Knight

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$1,712.56
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1897738
INVOICE DATE	2/6/2012
PAYMENT DUE	3/7/2012

SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1906734

Feb 24, 2012

Bill To	Ship To
Clinton Public Schools ISD-99 Custer County Accounts Payable 2130 W Gary Blvd Po Box 729 Clinton, OK 73601-5304 USA Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896 Email: Customer PO: 21 Rev - Bond Fd	Washington Elementary School Beth Richert 601 N 13th St Clinton, OK 73601-1831 USA Phone: 1 (580) 323-4039 Fax: Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1906734	2/23/2012	ORD1391600	3/24/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
VIR-785-PROMO	785 OPEN FRONT DESK W/ PLASTIC BOOKBOX	30	$46.88	$1,406.40

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$1,406.40
SHIPPING & HANDLING	$247.65
SALES TAX	$0.00
INVOICE TOTAL	$1,654.05

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$1,654.05

Carolyn Skinner

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$1,654.05
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1906734
INVOICE DATE	2/23/2012
PAYMENT DUE	3/24/2012

SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1911080

Mar 5, 2012

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1911080	3/2/2012	ORD1391600	4/1/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
ALV-SC20MC	MULTI-COLORED MOBILE TABORET W/ 20 DRAWERS	4	$98.99	$395.96

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$395.96
SHIPPING & HANDLING	$111.75
SALES TAX	$0.00
INVOICE TOTAL	$507.71

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$507.71

Congo Strings

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$507.71
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1911080
INVOICE DATE	3/2/2012
PAYMENT DUE	4/1/2012

SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1911101

Mar 5, 2012

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1911101	3/2/2012	ORD1391600	4/1/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
MWF-CV636M	OVAL C SERIES MDF CORE CONFERENCE TABLE - (36" W X 72" L)	1	$346.99	$346.99

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$346.99
SHIPPING & HANDLING	$128.94
SALES TAX	$0.00
INVOICE TOTAL	$475.93

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$475.93

Carolyn Stinnett

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$475.93
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1911101
INVOICE DATE	3/2/2012
PAYMENT DUE	4/1/2012

SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1913391

Mar 8, 2012

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21 Rav. Board Ed

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1913391	3/7/2012	ORD1391600	4/6/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
AND-WHP3X5	WATERHOG PREMIER ENTRANCE MAT (3' W X 5' L)	3	$87.99	$263.97
AND-WHC4X6	WATERHOG CLASSIC ENTRANCE MAT (4' W X 6' L)	6	$114.99	$689.94

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$953.91
SHIPPING & HANDLING	$78.76
SALES TAX	$0.00
INVOICE TOTAL	$1,032.67

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$1,032.67

Donna Knight

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$1,032.67
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1913391
INVOICE DATE	3/7/2012
PAYMENT DUE	4/6/2012

SCHOOL OUTFITTERS
Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1923626

Mar 30, 2012
Page 1 of 1

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1923626	3/29/2012	ORD1391600	4/28/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
EDS-7000	EASY-TO-ASSEMBLE STORAGE CABINET (36" W X 18" D X 72" H)	4	$268.99	$1,075.96

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$1,075.96
SHIPPING & HANDLING	$243.53
SALES TAX	$0.00
INVOICE TOTAL	$1,319.49

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$1,319.49

Donna Knight

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$1,319.49
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1923626
INVOICE DATE	3/29/2012
PAYMENT DUE	4/28/2012

EXHIBIT "D"

REQUISITION FOR PAYMENT
(Submit in Quadruplicate)

TO: BancFirst
Oklahoma City, Oklahoma

Please make the following payment from the Improvement Fund of Clinton Public Works Authority in your custody under Clinton Public Works Authority Series 2010 Bond Indenture, dated July 1, 2010:

Payee: School Outfitters

Address: 3736 Regent Ave. Cincinnati, Ohio 45212-37

Federal Tax ID # 611341943

Amount: $ 7,850.10

Purpose of Payment: Furniture for new building at Washington Elementary

Inv.#-1896660-859.26, 1896670-288.43, 1897138-1712.56,
1906734-1654.05, 1911080-507.71, 1911101-475.93, 1913391-1032.67
1923626-1319.49 total-785

It hereby is certified that the foregoing payment is for a purpose specified in Section 2 of Article II of said Indenture.

Please indicate on the accompanying copies of this Requisition the date of payment, etc., as provided below and return two copies to the Authority and one to the District.

INDEPENDENT SCHOOL DISTRICT NO. 99,
CUSTER COUNTY, OKLAHOMA

By: Ken Ivins

Requisition Paid: Date: 4-5-12

Balance in Payment Fund after payment: $ 54,137.64

1

SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave,
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1896660

Feb 2, 2012

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21 Rev. Bond 14.

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1896660	2/1/2012	ORD1391600	3/2/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
OSP-8620	TITANIUM FINISH STACKING VISITORS CHAIR W/OUT ARM RESTS	10	$74.99	$749.90

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$749.90
SHIPPING & HANDLING	$109.36
SALES TAX	$0.00
INVOICE TOTAL	$859.26

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$859.26

Carolyn Stringer

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$859.26
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1896660
INVOICE DATE	2/1/2012
PAYMENT DUE	3/2/2012

RECEIVE
FEB 07 2012



SCHOOL OUTFITTERS

Phone: 1-866-619-3776
Fax: 1-800-494-1036
3736 Regent Ave.
Cincinnati, Ohio 45212-3724
www.schooloutfitters.com

Invoice

Invoice #
INV1896670

Feb 3, 2012

Bill To
Clinton Public Schools ISD-99 Custer County
Accounts Payable
2130 W Gary Blvd
Po Box 729
Clinton, OK 73601-5304 USA
Phone: 1 (580) 323-4228 Fax: 1 (580) 323-3896
Email:
Customer PO: 21

Ship To
Washington Elementary School
Beth Richert
601 N 13th St

Clinton, OK 73601-1831 USA
Phone: 1 (580) 323-4039 Fax:
Email: beth.richert@clintonokschools.org

ACCOUNT NUMBER	INVOICE NUMBER	INVOICE DATE	ORDER NUMBER	PAYMENT DUE
CI741619	INV1896670	2/2/2012	ORD1391600	3/3/2012

SKU #	DESCRIPTION	QUANTITY	UNIT PRICE	EXTENDED PRICE
SAF-9485BL	INDOOR/OUTDOOR PENTAGON RECEPTACLE (30 GALLONS)	2	$115.99	$231.98

ANY QUESTION OR DISCREPANCIES CONCERNING THIS ORDER MUST BE REPORTED WITHIN SEVEN DAYS TO OUR SALES AND SERVICE DEPARTMENT AT 1-866-619-1776

SUB TOTAL	$231.98
SHIPPING & HANDLING	$56.45
SALES TAX	$0.00
INVOICE TOTAL	$288.43

AMOUNT PAID/CREDIT	$0.00
AMOUNT DUE	$288.43

Carolyn Shinger

PLEASE RETURN BOTTOM PORTION OF THIS INVOICE WITH YOUR REMITTANCE TO:

School Outfitters
3736 Regent Ave.
Cincinnati, Ohio 45212-3724

PLEASE PAY THIS AMOUNT	$288.43
CLINTON PUBLIC SCHOOLS IS ... Accounts Payable	
ACCOUNT NO.	CI741619
INVOICE NO.	INV1896670
INVOICE DATE	2/2/2012
PAYMENT DUE	3/3/2012

Clinton
Hub City of Western Oklahoma

City of Clinton

Long-Term Water Supply Evaluation



Prepared for
City of Clinton

GARVER
GarverUSA.com

Long-Term Water Supply Evaluation
Clinton, Oklahoma

Prepared For:
City of Clinton

March 27, 2012

GARVER
1016 24th Avenue NW
Norman, Oklahoma 73069
405.329.2555

OK Certificate of Authorization # 4193 Exp. 06/30/12

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Executive Summary

Introduction

This evaluation identifies planning level supply needs to meet the projected 50-year water demand for the City of Clinton. Additionally, conveyance and treatment infrastructure are evaluated for a 25-year design life. The population of the City of Clinton was 9,033 based on the 2010 U.S. Census. The average daily demand is approximately 2.1 million gallons per day (MGD), while the maximum daily demand is about 4.2 MGD. The projected 2060 population is 9,468 residents. The average daily demand is expected to be almost 2.2 MGD, while the maximum daily demand will be approximately 4.4 MGD.

The City currently utilizes surface water in Clinton Lake and Foss Reservoir. The water from Clinton Lake is treated at the Clinton WTP and conveyed to the City. The water from Foss Reservoir is treated at the Foss WTP and conveyed to the City. The City is required by contract to purchase approximately 0.69 MGD of finished water from Foss. During normal years, the City's water resources are sufficient. However, the extraordinary drought conditions during 2011 resulted in Clinton Lake becoming an unreliable water supply source. The Clinton WTP was taken off-line during the fall of 2011, and treated water from Foss has been the only resource to meet the City's finished water demands. The Foss WTP has a rated capacity of 4.5 MGD. Finished water from Foss serves multiple communities. Based on Clinton's share of 48.6% of the finished water from Foss, the maximum allocation for Clinton is about 2.2 MGD. Therefore, unless Clinton Lake recovers in early 2012, the City of Clinton will be faced with a shortfall of finished water resources during peak demand periods in the summer of 2012.

The deficiency in water resources facing the City, currently, is attributable to a combination of drought conditions and management of Clinton Lake. The rainfall during the period of 2008-2010 was below normal. Then, during 2011, record low rainfall totals fell in Custer County. During the 24-month period from July, 2009 through June, 2011, the Clinton WTP produced 961.5 MG of finished water. However, if finished water from Foss had been utilized at the maximum rate, the City would have only needed 219.2 MG of finished water from Clinton Lake. Thus, there was an overutilization of 742.3 MG of finished water from Clinton Lake during the 2-year period. Aggressive management of Clinton Lake helps minimize City costs, because the cost of finished water from Clinton Lake is less than the cost of finished water from Foss. However, it is essential for water levels to be maintained in Clinton Lake so maximum daily demands can be met during the summer months.

Alternatives Evaluation

The plan alternatives developed for this study fit within the existing water supply portfolio of the City of Clinton. Each alternative consists of a modification which changes the Clinton Lake management strategy (1A), increases Foss WTP capacity (1B), augments water in Clinton Lake (2A, 3A, and 4A), or meets peak demands utilizing conveyance and treatment infrastructure improvements (2B, 3B, and 4B). The main components of each of the alternatives evaluated as part of this study are listed below:

- Alternative 1A – Treated Foss Water as Primary Source ("Do Nothing")
  - No infrastructure improvements
  - Less aggressive utilization of Clinton Lake resources to minimize likelihood of the reservoir becoming unreliable
- Alternative 1B – Foss WTP Expansion
  - Expand the Foss WTP to provide maximum daily demand to Clinton
  - Clinton Lake is the primary resource
- Alternative 2A – Raw Foss Water with Clinton Lake as Terminal Reservoir
  - Pump water from Foss Reservoir to Clinton Lake
  - Upgrade the Clinton WTP to include advanced treatment (reverse osmosis) which is necessary due to relatively poor Foss Reservoir water quality
- Alternative 2B – Raw Foss Water to Clinton WTP On-Demand
  - Pump water from Foss Reservoir to the WTP at Clinton Lake
  - Upgrade the Clinton WTP to include advanced treatment
- Alternative 3A – Washita Alluvium to Clinton Lake
  - Remove groundwater from the Washita Alluvium
  - Pump the water to Clinton Lake
  - Upgrade the Clinton WTP to include advanced treatment
- Alternative 3B – New In-Town WTP for Washita Alluvium
  - Remove groundwater from Washita Alluvium
  - Treat the water in-town at a new WTP that includes advanced treatment
- Alternative 4A – Rush Springs Aquifer to Clinton Lake
  - Remove groundwater from the Rush Springs Aquifer
  - Pump the water to Clinton Lake
  - Utilize existing treatment infrastructure at the Clinton WTP[1]
- Alternative 4B – Rush Springs Aquifer Direct Inject
  - Remove groundwater from the Rush Springs Aquifer
  - Provide minor wellhead treatment for disinfection purposes
  - Pump the water directly into the distribution system[1]

[1] Water quality testing should be performed on water from the Rush Springs Aquifer to confirm this assumption.

Monetary and Non-Monetary Evaluation

The monetary evaluation consisted of combining estimated capital costs with estimated annual operation and maintenance costs for the 25-year planning horizon. The cost, per thousand gallons, varies significantly across the alternatives:

1. 1A – Treated Foss Water as Primary Source ("Do Nothing"): $1.69
2. 4A – Rush Springs Aquifer to Clinton Lake: $1.82
3. 4B – Rush Springs Aquifer Direct Inject: $2.18
4. 1B – Foss WTP Expansion: $3.19
5. 3B – New In-Town WTP for Washita Alluvium: $3.20
6. 2A – Raw Foss Water with Clinton Lake as Terminal Reservoir: $3.37
7. 3A – Washita Alluvium to Clinton Lake: $3.38
8. 2B – Raw Foss Water to Clinton WTP On-Demand: $3.56

The non-monetary evaluation consisted of ranking the alternatives based on 1) environmental impacts, 2) flexibility, 3) future implications, 4) implementability, 5) public acceptance, 6) redundancy, 7) reliability, 8) water quality, and 9) water rights. The average non-monetary rankings for each of the alternatives are shown below[2]:

1. 4A – Rush Springs Aquifer to Clinton Lake: 2.56
2. 3A – Washita Alluvium to Clinton Lake: 3.14
3. 2B – Raw Foss Water to Clinton WTP On-Demand: 4.06
4. 2A – Raw Foss Water with Clinton Lake as Terminal Reservoir: 4.25
5. 4B – Rush Springs Aquifer Direct Inject: 4.44
6. 3B – New In-Town WTP for Washita Alluvium: 4.67
7. 1B – Foss WTP Expansion: 6.39
8. 1A – Treated Foss Water as Primary Source ("Do Nothing"): 6.50

Combining the monetary and non-monetary rankings results in the following final rankings:

1. 4A – Rush Springs Aquifer to Clinton Lake
2. 4B – Rush Springs Aquifer Direct Inject
3. 3A – Washita Alluvium to Clinton Lake
4. 1A – Treated Foss Water as Primary Source ("Do Nothing")
5. (tie) 2A – Raw Foss Water with Clinton Lake as Terminal Reservoir
   3B – New In-Town WTP for Washita Alluvium
7. 2B – Raw Foss Water to Clinton WTP On-Demand
8. 1B – Foss WTP Expansion

Recommendations

The City should consider Alternative 4A. Alternative 4A provides a low-cost, redundant water supply. The capital costs are kept low because it is assumed that advanced treatment is not necessary for water

[2] The possible range is 1 to 8, with 1 being the best and 8 being the worst.

from the Rush Springs Aquifer. Additionally, it is assumed that the abandoned 16-inch water transmission line can be rehabilitated for this project.

In parallel with the implementation of Alternative 4A, the City should also consider Alternative 1A. While Alternative 1A does not add any additional water sources to the City's portfolio, Alternative 1A minimizes costs over the planning horizon. More conservative management of Clinton Lake should limit potential issues with water resources shortfalls in the future. A future detailed yield and drought response study of Clinton Lake would provide insight into the safe yield of the reservoir, as well as the management practices that will optimize use of water from Clinton Lake while also maintaining reserve capacity for drought periods.

Finally, the City should immediately pursue water conservation efforts and advertising in order to reduce demands to levels that can be met with the water resources available for 2011. The average finished water use during July 2011 was 3.29 MGD. Therefore, if Clinton Lake is still unreliable during the summer of 2012, the conservation target is an average of 1.1 MGD. Conservation strategies should be employed to protect and preserve public health, welfare, and safety; therefore, the priorities for use of finished water are domestic water use, sanitation, and fire protection. The City should pursue both internal and external conservation efforts to reduce demand to a sustainable level during the summer of 2012. The internal conservation efforts are as follows:

- Water supply auditing (production vs. consumption)
- In-network leak detection and repair
- Review of City government irrigation and water use strategies (street cleaning, vehicle washing, park fountains, public pools, etc.)

The City should adopt a council-approved Drought Emergency Response Plan as one of the external conservation efforts, which are outlined below:

- Multi-staged water use restrictions
- Formalized Drought Emergency Response Plan
- Public awareness drive
- Adoption of ordinances or regulations to implement the plan, including determination of fines for violations.

If the appropriate water conservation practices are implemented, the City should be able to obtain sufficient treated water from Foss to cover basic water demand needs during 2012.

1.0 Introduction

This evaluation identifies planning level supply needs to meet the projected 50-year water demand for the City of Clinton, as well as the conveyance and treatment infrastructure for a 25-year design life. The evaluation includes analysis of potential surface, ground, and treated water sources to supplement the existing finished water sources: the Clinton WTP at Clinton Lake and the Foss WTP at Foss Reservoir.

As detailed in previous studies (*Interim Water Supply Evaluation*), there are water resources that can be utilized around the City of Clinton. However, the time period required to implement any supplemental water source solutions is too long to address the water resource shortfall for the summer of 2012. The current evaluation focuses on long-term planning, although the current state of Clinton's water resources cannot be ignored. Furthermore, because no capital improvements were selected as a result of the *Interim Water Supply Evaluation*, the evaluation herein is free of any constraints to build upon a previously selected alternative. Therefore, the goal of this study is solely to provide the City of Clinton with a reliable, cost-effective, long-term water supply plan.

The remainder of this document contains seven sections. The population and water demand estimates are contained in Section 2. Section 3 is an evaluation of the existing system. Then, the plan alternatives are developed in Section 4, which includes water quantity and water quality analyses of each of the alternatives. The monetary evaluation is presented in Section 5, and the non-monetary evaluation is given in Section 6. Finally, the monetary and non-monetary rankings are combined for alternatives evaluation in Section 7, and the recommendations are made in Section 8.

2.0 Population and Water Demand Estimates

2.1 Historical Population

The historical population data for the City of Clinton is presented in Table 2.1. The City experienced marked growth in the 1920's, but the growth has been minimal in recent years.

Table 2.1. U.S. Census Data for Clinton, OK

Year	Population
1910	2781
1920	2596
1930	7512
1940	6736
1950	7555
1960	9617
1970	8513
1980	8796
1990	9298
2000	8833
2010	9033

2.2 Population Growth Estimate

The population growth for the City of Clinton was estimated based on the historical data in Table 2.1, as described in Appendix A. The population estimates for the City are presented in Table 2.2.

Table 2.2. Population Estimate for the City of Clinton

Year	Population
2010	9295
2015	9329
2020	9357
2025	9380
2030	9400
2035	9417
2040	9431
2045	9443
2050	9453
2055	9461
2060	9468

The estimated population for 2010, in Table 2.2, does not match the 2010 U.S. Census value reported in Table 2.1 because the calibration was performed to provide the best match to the data through the entire period, rather than solely minimizing the error for 2010 data/estimate pair. The comparison of the population projection to the population data is shown in Figure 2.1.

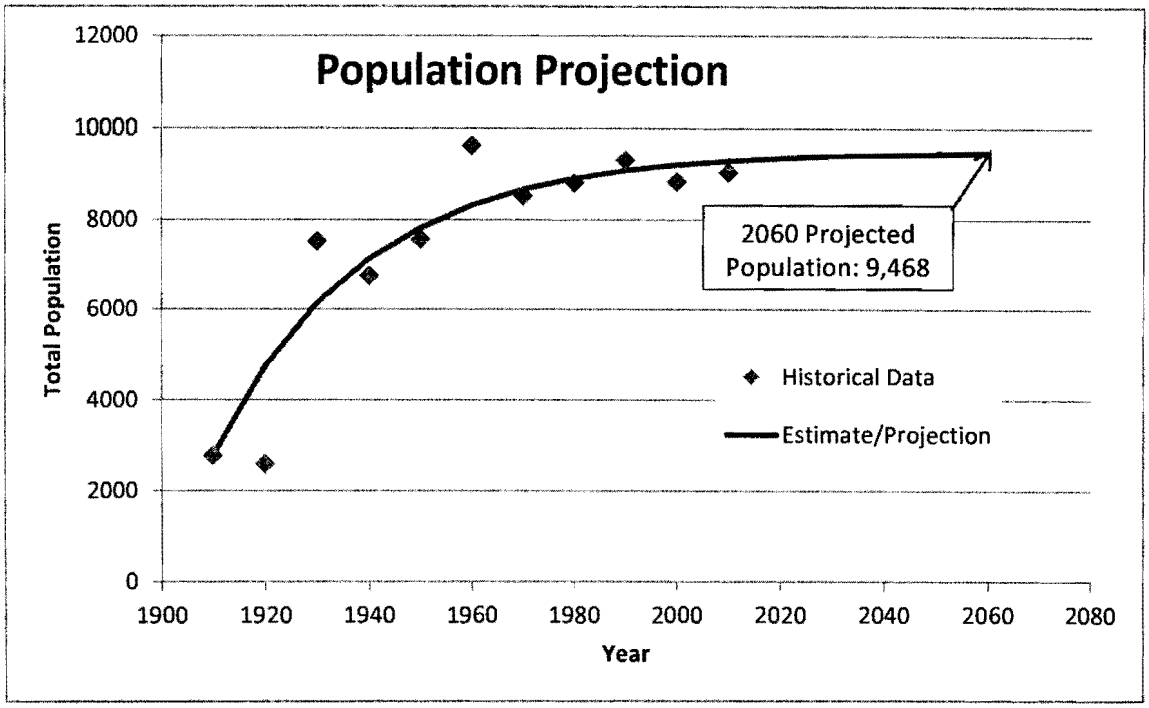


Figure 2.1. Historical population for the City of Clinton, along with a population projection through the year 2060.

2.3 Historical Water Demand

The historical water demand data for 1978-1979 was available from the 2000 Water Master Plan. Additionally, analysis of current City water production data yielded updated water demand values. The average and maximum daily demand values for these two time periods are shown in Table 2.3.

Table 2.3. Historical Demand Values for the City of Clinton

Year	Population	Average Daily Demand	Maximum Daily Demand
1978-1979	8796	1.88 MGD	3.35 MGD
2009-2011	9033	2.07 MGD	4.22 MGD

Based on the data presented in Table 2.3, the average daily per capita demand was 214 gpcd in 1978-1979, while it was 229 gpcd in the period from 2009-2011. As expected, the average per capita demand is fairly consistent. The elevated values for the present time period may be, at least partially, a result of the hot, dry weather during 2011. The maximum daily demand, per capita, was 381 gpcd for 1978-1979, whereas it was 467 gpcd for 2009-2011.

2.4 Water Demand Projection

The Oklahoma Water Resources Board (OWRB) provides water demand projection estimates in the Oklahoma Comprehensive Water Plan (OCWP). However, these projections are done on a county-by-county basis, so the results from the OCWP are not directly applicable to this study. However, components of the analysis are useful in the demand projection for the City of Clinton. First, the average daily per capita demand for Custer County, which includes the majority of Clinton, is approximately 206 gpcd. This value is consistent with the average per capita demand computed based on historical data. Additionally, the OWRB uses a steady per capita demand to generate the water demand projections for the next 50 years. In other words, OWRB does not anticipate increases in per capita water demand for their projections. As such, increases in water demand are directly related to increases in population served. Use of the conservative average daily per capita demand value of 229 gpcd from Section 2.3, along with the population projection from Section 2.2, results in the demand projection presented in Table 2.4. The maximum daily demand was estimated by applying the maximum day per capita demand of 467 gpcd to the population estimate.

Table 2.4. Water Demand Estimate for the City of Clinton

Year	Population	Average Daily Demand (MGD)	Maximum Daily Demand (MGD)
2010	9295	2.13	4.34
2015	9329	2.14	4.36
2020	9357	2.14	4.37
2025	9380	2.15	4.38
2030	9400	2.15	4.39
2035	9417	2.16	4.40
2040	9431	2.16	4.40
2045	9443	2.16	4.41
2050	9453	2.16	4.41
2055	9461	2.17	4.42
2060	9468	2.17	4.42

The important population and demand numbers for this study are the current, 25-year, and 50-year average and maximum day demands, which are summarized in Table 2.5. The source water alternatives are assessed for a 50-year planning horizon, whereas a 25-year planning horizon is used to assess conveyance and treatment infrastructure alternatives. However, as seen in Table 2.5, there is only a small difference (approximately 0.5%) between the water 25- and 50-year water demand rates.

Table 2.5. Planning Horizon Water Demands

Horizon	Year	Population	Average Daily Demand (MGD)	Maximum Daily Demand (MGD)
Current	2012	9,309	2.13	4.35
25-year	2037	9,423	2.16	4.40
50-year	2062	9,470	2.17	4.42

3.0 Existing System

3.1 Current Water Resources

In recent years, the City of Clinton has met water demand using surface water resources from Clinton Lake and Foss Reservoir. In this report, the terms draft, average yield, and safe yield will all be used. While the three terms are similar, the differences are important in this study. For the purposes of this report, the terms will be defined as follows:

- Draft – the amount of water that is removed from a water body for municipal supply. For example, "The City withdrew an average of 1 MGD from Clinton Lake, so the draft during the year was 365 million gallons."
- Average yield – the average amount of water that is available for withdrawal without depleting the reservoir. The yield of a reservoir is simply equal to the difference between inflows into the reservoir (precipitation, stream flows, etc.) and the outflows (evaporation, withdrawals, infiltration, etc.) over a period of time. The average yield can be calculated by analyzing the water budget for reservoir over a period of record.
- Safe yield – the maximum constant rate of withdrawal of water that is possible during a selected drought period.

3.1.1 Clinton Lake

OWRB lists the capacity of Clinton Lake as 3,980 acre-feet. The 2000 Water Master Plan provides a fair history of Clinton Lake, including that the yield was estimated at 730 to 1000 MG per year by Benham Engineering in 1926, but that the annual average is closer to 500 MG per year, with a minimum draft of 332 MG in 1955. The current permitted allocation for the City of Clinton for water from Clinton Lake is for 1,496 ac-ft/yr, which is equivalent to 487.5 MG per year. This value is slightly lower than, but consistent with, the long-term average yield of the lake. The estimated annual average reported in the 2000 Water Master Plan was 500 MG, while the average annual use reported for the period of 1975-2010 was 514.8 MG. The minimum annual draft value of 332 MG (0.910 MGD) reported in the 2000 Water Master Plan is consistent with the minimum value for the period of 1975-2010, which is 346.7 MG (0.950 MGD). The withdrawal of 346.7 MG occurred during 2004.

While the average yield of raw water from Clinton Lake is approximately 1.34 MGD, the safe yield is unknown. The response of Clinton Lake to the recent climatic conditions suggests the safe yield of Clinton Lake is significantly less than the average yield. In fact, the City withdrew approximately 1 MGD from Clinton Lake in 2011, and this level of utilization resulted in levels in Clinton Lake decreasing to a point where production at the Clinton WTP was ceased. In other words, due to a lack of rainfall in the catchment area for Clinton Lake during 2011, a draft of 1 MGD was not sustainable. However, precise quantification requires a significant modeling effort due to a lack of data describing the water level in Clinton Lake (i.e., time series of elevation and volume). Thus, pending a yield study, it will be assumed

that the safe yield of Clinton Lake is zero for the purposes of this study. A safe yield of zero is the minimum safe yield possible for a reservoir[3].

Prior to 2011, the safe yield of Clinton Lake could be estimated using the minimum draft, which would make the safe yield 0.910 MGD. For the period of record, this was the minimum average rate of withdrawal. Since Clinton Lake was able to supply that amount of water, the maximum constant rate of withdrawal (i.e., the safe yield) was at least equal to that value. However, the state of Clinton Lake as a result of the recent drought suggests the safe yield may be less than previously thought. Clinton Lake is currently not able to provide any water for the City of Clinton. Analysis of the current shortfall of water in Clinton Lake is provided in Section 3.2.

3.1.2 Clinton Water Treatment Plant

The Clinton WTP adjacent to Clinton Lake treats raw water from Clinton Lake and produces finished water that flows to the City's water distribution system. The treatment consists of pretreatment, clarification, filtration and disinfection, as outlined in the corresponding subsections below. The findings of the analysis of the existing system are contained in the "Summary" subsection.

3.1.2.1 Pretreatment

Raw water flows through an 18" line from the intake at Lake Clinton to a raw water pump station inside the main operations building, which houses two 4,500 GPM pumps. Raw water flow is measured through an 18-inch Venturi flow meter before being conveyed to a 8.67' x 6' x 6.5' (side water depth) flash mix basin. A chemical storage and feed room in the main operations building houses three chemicals for preliminary treatment: alum, lime, and powder activated carbon. Each of the chemicals can be fed to the flow stream at the flash mix basin. A vertical turbine mixer provides mixing energy for coagulation before flow is split over two weirs to each of two solids contact clarifiers through 24" clarifier feed lines.

3.1.2.2 Clarification

Each of the 58' (diameter) x 17.83' (side wall depth) upflow solids contact clarifiers is equipped with a center column and propeller to provide mixing energy for flocculation and mixing of influent water with recirculated solids. Flocculated water flows through ports at the top of the column and downward through a 28' (diameter) cone-shaped flocculation zone. Water flows out from the bottom of the cone and upward through the separation zone to be collected in radial effluent launders. As the water flows upward, solid particles settle to the bottom of the basin. Settled water from each clarifier is collected in a main effluent launder and combined before being conveyed to the filters. Solids are occasionally removed from each clarifier through a timer-operated valve and stored in one of two solids handling lagoons.

[3] The minimum value of zero assumes that the reservoir can become dry without causing too much damage. If it is essential to maintain a minimum water level in the reservoir, the safe yield could actually be negative during an extreme drought situation, which would indicate that water would have to be supplied to the reservoir to maintain the minimum value.

3.1.2.3 Filtration

The filtration process consists of a cluster of four 19.67' x 14.08' rapid sand filters. Settled water flows into a center column and is distributed amongst the filter cells. Water flows into each cell, is filtered through 18 inches of anthracite and 12 inches of sand, and is collected beneath the gravel/block underdrain. The headloss through the filter increases as more particles are entrapped in the filter media, causing the water level to rise in the filter cell. When the water level reaches the maximum design filtering head, the unit is taken out of service and backwashed. Backwash waste is directed to one of two solids handling lagoons. Filtered water from each filter is combined and flows into the clearwell.

3.1.2.4 Disinfection

Filtered water is dosed with free chlorine from a gas chlorination system. The treated water is given disinfection contact time in a 600,000 gallon clearwell before being pumped to the distribution system with two high service pumps. Finished water is metered through a 16" propeller meter before being conveyed into the distribution system.

3.1.2.5 Summary

Based on the guidelines of the Oklahoma Administrative Code Title 252 Department of Environmental Quality Chapter 626 Public Water Supply Construction Standards, the Clinton WTP has a treatment capacity of 3.6 MGD. Production capacity is limited by the capacity of the rapid sand filters, as seen in Table 3.1.

The water treatment plant is composed of conventional treatment processes that are suitable for treatment of turbid water and/or softening of hard waters. The plant is well designed for removal of particulate organic and inorganic compounds, as well as dissolved inorganic compounds associated with hardness. The use of powder activated carbon and alum may also precipitate and/or absorb some dissolved organic constituents. The conventional process is not well suited for removal of dissolved solids, such as sulfates or chlorides, which are prevalent in the region's water supply.

Table 3.1. Clinton WTP Summary

Unit	Design Criteria for Each Unit	Number of Units	ODEQ Requirement	Capacity of Each Unit	Total Firm Capacity
Raw Water Pumps	4,500-gpm	2	Rated with largest pump out of service	6.5 mgd	6.5 mgd
Solids Contact Clarifiers	58-ft diameter x 17.8-ft (water depth)	2	Minimum 3 hours detention time	2.7 mgd	5.4 mgd
Filtration	277-sf each, dual media	4	Maximum 3 gpm/sf; rated with largest filter out of service	1.2 mgd	3.6 mgd
Disinfection	600,000-gal (total operating volume)	1	0.5-log *Giardia* inactivation; 2-log virus inactivation	5.0 mgd	5.0 mgd

3.1.3 Foss Reservoir

The OCWP reports the yield of Foss Reservoir to be 18,000 ac-ft/yr, with 17,634 ac-ft/yr currently permitted. Therefore, the remaining water supply yield to be permitted is 366 ac-ft/yr (0.327 MGD). Based on information provided by the City, the City of Clinton is required to purchase a minimum of 0.686 MGD from the Foss Conservancy District, while the maximum purchase is 2.19 MGD (based on 48.6% of the rated capacity of the WTP of 4.5 MGD).

3.1.4 Combination of Water Resources

Pending a yield study, the safe yield of Clinton Lake is assumed to be zero. The maximum allocation from Foss Reservoir is 2.19 MGD. Therefore, the combined water resource availability for the City is 2.19 MGD. This amount of water is not sufficient to meet demands throughout the year, either current or projected over the 50-year planning period, due to the seasonal variation in demand.

The rated capacity of the Clinton WTP is 3.6 MGD. Therefore, if water is available in Clinton Lake, the combined resources of Clinton Lake and Foss Reservoir can provide approximately 5.8 MGD for a maximum day scenario. This supply exceeds peak demands for the 50-year planning period. Therefore, availability of water in Clinton Lake is essential to offset peak demands (which exceed the City's allocation of water from Foss Reservoir).

3.2 Analysis of City's Current Water Supply Shortfall

During the fall of 2011, the City's WTP was taken off-line due to a lack of water in Clinton Lake. The shortfall in Clinton Lake was not due, directly, to a shortage of water resources. Instead, the current crisis was the result of an overly aggressive management system for the water in Clinton Lake, in conjunction with an extreme drought in western Oklahoma.

3.2.1 Recent Rainfall for Clinton Lake

The annual rainfall for Custer County over the last 5 years is shown in Table 3.2. As a reference, 13.90 inches of precipitation fell during the previous driest year on record for Custer County, 1956 (OCS, 2011). The data for 2011 suggests 2011 set a record for the driest year on record for Custer County. The average annual precipitation for Washita County is 29.60 inches, while the driest year on record is 1910 (9.57 inches of precipitation). The Custer County Mesonet Site was selected because of proximity to Clinton Lake and its watershed.

Table 3.2. Rainfall for the Custer County (Butler, OK) Mesonet Site

Year	Rainfall (inches)
2007	40.03
2008	27.47
2009	26.48
2010	23.08
2011	12.77
Average	29.47

As is shown in Table 3.2, the rainfall over the last four years has been below average, after a bountiful 2007. Specifically, the rainfall in 2010 was about half a foot below normal, while the rainfall in 2011 is

near record low levels for the region; only 6.46 inches of precipitation fell during the first nine months of 2011. As a result, the inflows into Clinton Lake from the tributary streams and directly from precipitation have been severely limited during the last two years. The excessive heat during 2011 further exacerbated the issue by increasing evaporation and transpiration from the lake surface, plants, and the ground surface.

3.2.2 Management of Clinton Lake and Foss Reservoir

A water budget-type analysis was conducted in order to gain an understanding of the management of the water resources available to the City: Clinton Lake and treated water from Foss Reservoir. The data used for the analysis came from the City of Clinton Utility Billing History for the period of July 2009 – June 2011, specifically the Clinton Lake production and Foss purchase amounts, which were available on a monthly basis. It was assumed that the maximum amount of water available from Foss was 1.824 MGD (48% of 3.8 MGD, which is a conservative value based on the current state of the Foss WTP), and that amount was available throughout the year. The Foss WTP was de-rated from 4.5 MGD to 3.8 MGD based on discussions with Foss personnel and data provided on Foss finished water production.

For this analysis, the amount of Clinton Lake water that could have been conserved by prioritizing use of water from Foss Reservoir was calculated. Detailed explanation of the steps used for the analysis is provided in Appendix B.

The average daily demand (equal to the average total production) in each month is shown in blue in Figure 3.1, along with the maximum Foss allocation (red). Based on Figure 3.1, it is apparent that the majority of the demand for the City of Clinton can be met solely with water from Foss Reservoir.

The total amount of Clinton Lake production and the Clinton Lake production volume necessary, given maximum utilization of Foss supply, were each aggregated over the two-year period. The two series are shown in Figure 3.2, along with the monthly average daily demand and maximum Foss allocations.

The difference between the actual Clinton WTP production and the required Clinton WTP production at the end of the period shown in Figure 3.2 represents the overutilization of Clinton Lake during the 24-month period. The total volume produced from the WTP at Clinton Lake was 961.5 MG, while the volume necessary from Clinton Lake, assuming maximum allocation use from Foss, was 219.2 MG. Therefore, the overutilization of the supply of water at Clinton Lake was 742.3 MG over the two-year period culminating at the end of June 2011. Additionally, it should be noted that the Clinton Lake use required is only a small percentage of the total demand (1,485 MG over the 2-year period), which is expected based on Figure 3.1. Foss production is able to account for the majority of the water demand for the City of Clinton.

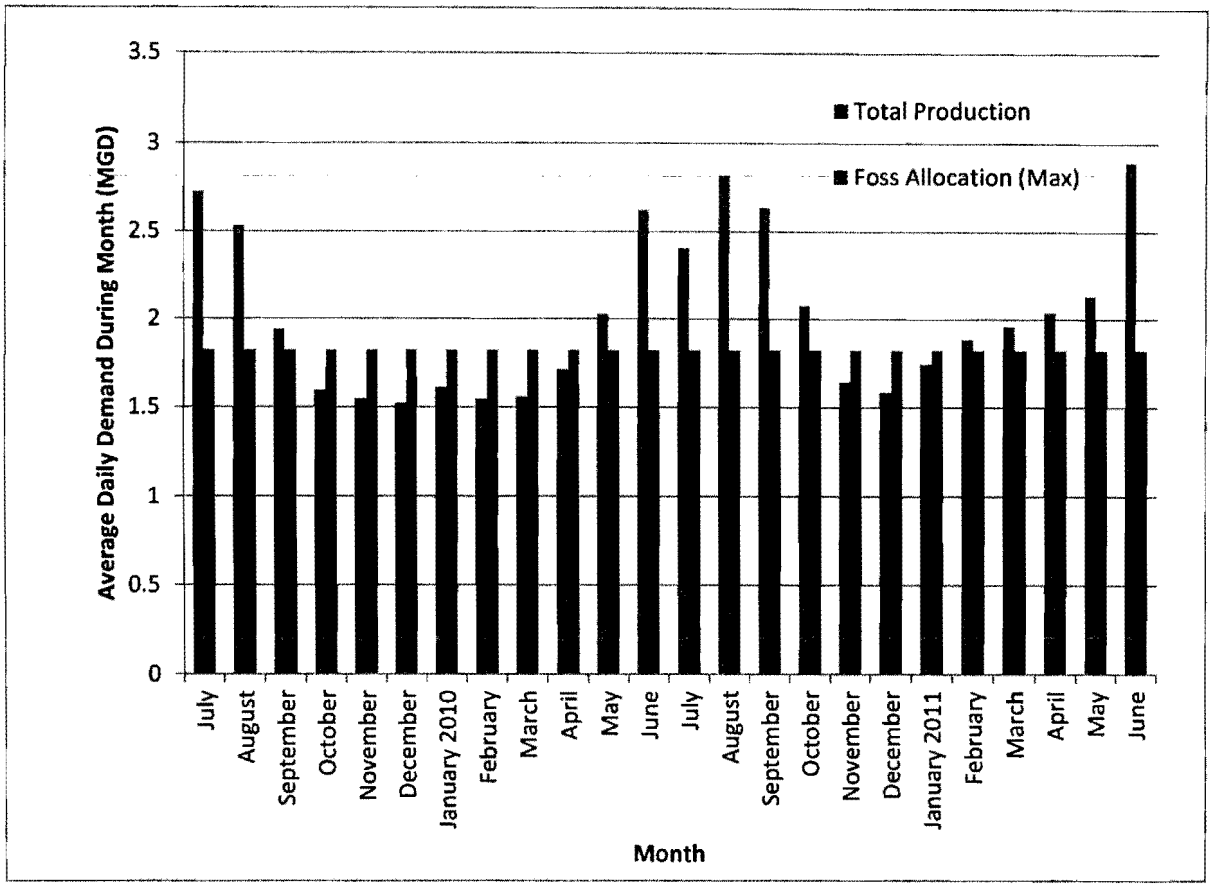


Figure 3.1. Comparison of the City of Clinton's average daily demand on a monthly basis to the maximum treated water allocation from Foss Reservoir.

It is not possible to precisely determine what the water level would have been in Clinton Lake if the City had employed a strategy to maximize utilization of water from Foss Reservoir without significant effort that was beyond the scope of this study. However, the calculated overutilization of 742.3 MG is equal to 57% of the total capacity of Clinton Lake. Additionally, based on the two-year volume of 219.2 MG necessary from Clinton Lake to meet the demand above the available treated water from Foss, the 742.3 MG overutilization is equivalent to the necessary demand for 6.75 additional years. Additional information regarding the limitations of this analysis and the information that would be necessary to accurately estimate the Clinton Lake water level that would have resulted from maximizing water from Foss is contained in Appendix C. However, in conclusion, it is reasonable to assume that, in spite of the drought conditions, the City would not be faced with as severe a water resources shortfall if a more conservative approach had been employed for management of Clinton Lake.

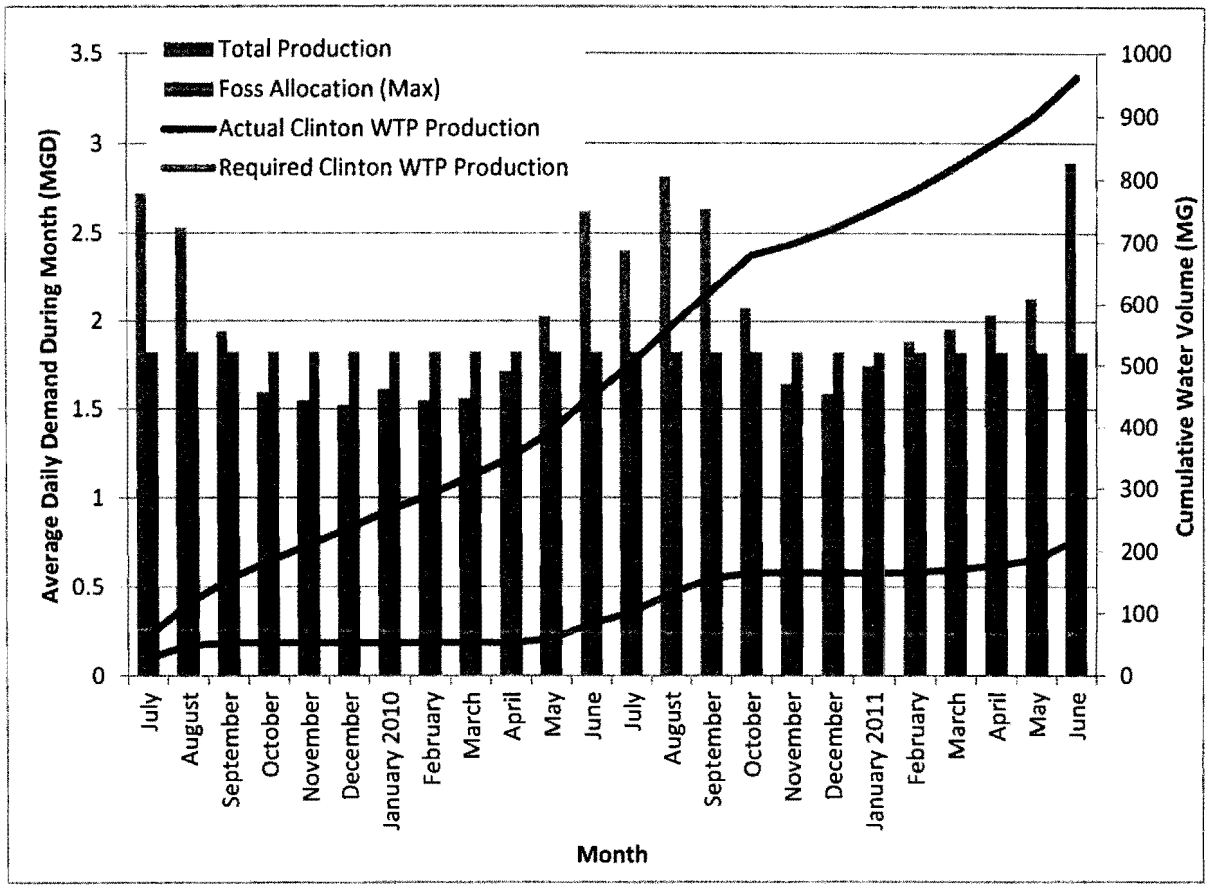


Figure 3.2. Presentation of the monthly demand for the City of Clinton, as well as the cumulative total production from Clinton Lake (purple line) and Clinton Lake use required (green line) from July 2009 – June 2011.

4.0 Plan Alternatives

4.1 Additional Water Resources

There are a number of water resources in the area surrounding the City of Clinton. The primary water resource is the Washita River and its related resources: Foss Reservoir and the Washita Alluvium and Terrace Deposits Aquifer (Washita Alluvium). Diversion of water from the Washita River is not feasible because all the surface water rights for the upper Washita have already been allocated by OWRB. However, use of raw water from Foss Reservoir and the Washita Alluvium are evaluated in plan alternatives. Additionally, use of ground water from the Rush Springs Aquifer is evaluated.

4.1.1 Foss Reservoir

Foss Reservoir is located in southwestern Custer County, approximately 9.5 miles north of Clinton Lake. The OWRB lists the area and capacity of the impoundment as 8,800 acres and 256,220 acre-feet, respectively. Additionally, the yield of Foss Reservoir is 18,000 acre-feet/year (approximately 16.1 MGD). The Foss WTP is rated at a capacity of 4.5 MGD. Treatment processes at the Foss WTP remove total dissolved solids (TDS) from the water. However, this treatment generates reject water with elevated TDS levels. In order to discharge the reject water into the Washita River, additional raw water from Foss Reservoir is discharged to the Washita River in order to dilute the reject water.

4.1.2 Washita Alluvium

The Washita River Alluvium and Terrace Deposits is a high-yield aquifer that is currently utilized by the City, as well as numerous individuals. The City withdraws water from the Washita Alluvium for irrigation of the City's Riverside Golf Course. Allocation of ground water from the Washita Alluvium is based on the equal proportionate shares value of 2 acre-feet/acre/year, which was determined based on a previous yield study performed by others. There are numerous high-yield wells (greater than 500 gpm) in the Washita Alluvium near Clinton, as documented in the *Interim Water Supply Evaluation*.

Information about the quality of water from the Washita Alluvium was obtained through water quality analysis of water from the City wells at Riverside Golf Course. As documented in *Work Order 15: Interim Water Supply Evaluation*, the hardness, total dissolved solids (TDS), and sulfate values are well above the desired maximum contaminant levels, as shown in Table 4.1. While the elevated constituent levels do not violate any primary drinking water standards, they are significantly higher than desired. The measured hardness value is 1,743 mg/L, while the desired maximum level is 100 mg/L. The estimated TDS value, based on conductivity conversion, is 1,930 mg/L, while the secondary maximum constituent level is 500 mg/L. The concentration of sulfate was measured at 1,813 mg/L, while the desired maximum level is 250 mg/L.

Table 4.1. Washita Alluvium Water Quality

Constituent	Washita Alluvium Value	Desired Maximum Level
Hardness	1,743 mg/L	100 mg/L
TDS	1,930 mg/L	500 mg/L
Sulfate	1,813 mg/L	250 mg/L

4.1.3 Rush Springs Aquifer

The Rush Springs Aquifer is an unconfined (water-table) aquifer that runs from NW to SE between the Canadian River and Washita River in western Oklahoma. In general, the aquifer is east of the City of Clinton, but the City's ACME Park wells are in the Rush Springs Aquifer. A water resources investigation (WRI Report 03-4024) by the USGS (Abbott, Tortorelli, Becker, & Trombley, 2003) included significant amounts of information on the Rush Springs Aquifer, specifically the area bordered by the Canadian River (north border), 98° west longitude (east border), the Washita River (south border), and 98°40' west longitude (west border). However, as the study was focused on the entire area, the groundwater water quality results do not separate values for the Rush Springs Aquifer from the values for the alluvium areas adjacent to the Canadian and Washita Rivers. Findings that are pertinent to the analysis of the Rush Springs Aquifer as an alternative water resource for the City of Clinton are as follows:

- Mean discharge from 89 irrigation wells in the Rush Springs Aquifer was 209 gpm, with a range of 11 to 850 gpm
- Acidity of the water was measured by pH, which ranged from 6.5 to 8.4 in groundwater samples
- Alkalinity ranged from 10 to 472 mg/L for groundwater samples, with concentrations for the interquartile (between the 25^{th} and 75^{th} percentiles) between 132 and 232 mg/L
- Dissolved solids concentrations ranged from 52 to 9,040 mg/L, with the interquartile between 264 and 574 mg/L for groundwater samples

Additionally, the following properties of the Rush Springs Aquifer were presented in WRI Report 03-4024:

- Specific capacity for the 89 wells ranged from 0.7 to 15 gpm per foot of drawdown, with a mean value of 2.3 gpm/ft
- Trasmissivity values are reported, based on two studies, to be 670 to 1,870 feet squared per day (Davis, 1955; Tanaka and Davis, 1963)
- Storage coefficients were calculated in a range from 0.0035 to 0.02
- Specific yields from core samples had a mean value of 0.25, with a range from 0.13 to 0.34 (Tanaka and Davis, 1963)
- Hydraulic conductivities were estimated from both slug and pumping tests at a site in Weatherford, OK; based on the slug tests, the mean hydraulic conductivity was 2.30 feet per day (range from 1.05 to 5.62 feet per day), while the range of hydraulic conductivities based on the pumping tests was 3.84 to 4.41 feet per day
- Hydraulic conductivity is variable through the Rush Springs Aquifer, and is dependent on the degree of cementation
- Recharge, resulting from infiltration of precipitation, is estimated as 1.80 inches per year (Becker and Runkle, 1998)

Additional information about the water quality of the Rush Springs Aquifer was obtained from *Hydrogeology, Water Quality, and Geochemistry of the Rush Springs Aquifer, Western Oklahoma* (Becker & Runkle, 1998). The study included analysis of sixty-four water samples from wells throughout the Rush Springs Aquifer. Unfortunately, the study area did not include wells in the immediate vicinity of

Clinton. Generally, the water is very hard, and treatment may be necessary to mitigate water quality issues:

1. The mean total dissolved solids concentration of 589 mg/L exceeded the recommended level for drinking water of 500 mg/L
2. Sulfate levels exceeded the recommended maximum of 250 mg/L in ten of sixty-four samples
3. The median nitrate concentration was 11 mg/L, which is in excess of the drinking water standard of 10 mg/L; specifically, more than half of the samples tested did not meet the drinking water standard for nitrate

The water from the Rush Springs Aquifer may be suitable for direct injection into the distribution system with only minor treatment. Additional, well-specific, water quality information for the Rush Springs Aquifer is necessary before a definitive recommendation can be made. Pending additional water quality testing, it is assumed that water from the Rush Springs Aquifer is of sufficient quality for direct injection and/or treatment at the current Clinton WTP following impoundment in Clinton Lake.

4.2 Summary of Plan Alternatives

Eight alternatives were developed utilizing raw water from Foss Reservoir, the Washita Alluvium, or the Rush Springs Aquifer to supplement production from the two current sources. The following alternatives utilize water from the Washita River that has been detained in Foss Reservoir:

- **Alternative 1A – Treated Foss Water as Primary Source ("Do Nothing").** In Alternative 1A, the two existing water resources would be utilized in their current form, as shown in Figure 4.1. However, there would be a shift in water resource management practices. Specifically, the existing Foss WTP would be used as the primary source of finished water for the City. Water from the Clinton WTP would be used, when necessary, to supplement finished water from Foss. This alternative does not involve any capital improvements.

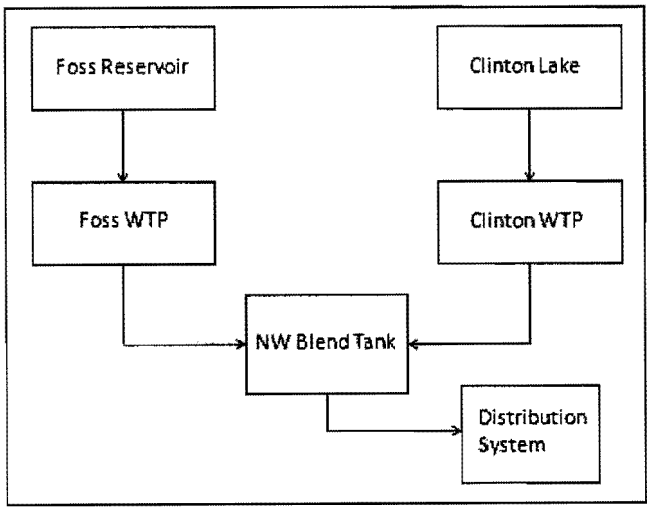


Figure 4.1. Schematic diagram for Alternative 1A – Treated Foss Water as Primary Source.

- **Alternative 1B – Foss WTP Expansion.** For Alternative 1B, the same finished water resources are used: treated water from Foss and Clinton Lake. The schematic diagram for Alternative 1b is shown in Figure 4.2. The main component of Alternative 1B is an expansion/upgrade of the Foss WTP so that it can supply maximum daily demand to the City of Clinton, in the event that Clinton Lake is unreliable in the future. Expansion of the Foss WTP would remove restrictions on the use of Clinton Lake water. That is, Clinton Lake could continue to serve as the primary water source (above the minimum contractual obligation of finished water from Foss) when water is available in Clinton Lake. When water levels in Clinton Lake are low, the full City demand will be met with finished water from Foss.

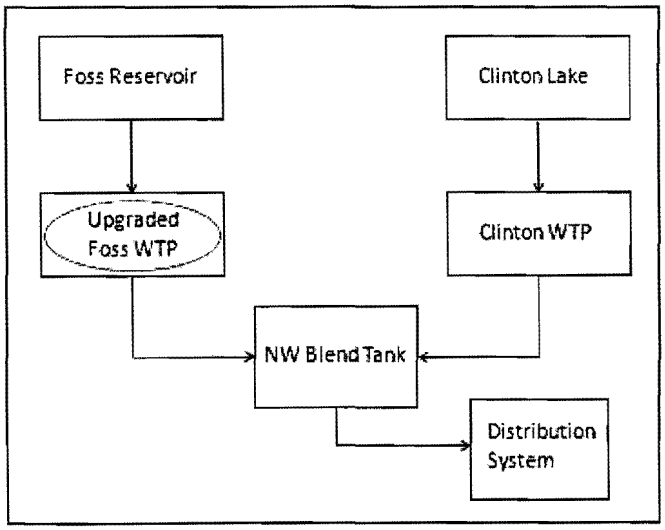


Figure 4.2. Schematic diagram for Alternative 1B – Foss WTP Expansion.

- **Alternative 2A – Raw Foss Water with Clinton Lake as Terminal Reservoir ("Raw Foss Terminal").** In Alternative 2A, raw water from Foss Reservoir would be pumped to Clinton Lake, as shown in Figure 4.3. Clinton Lake would serve as a terminal reservoir, and the treatment plant at Clinton Lake would be upgraded to include treatment to remove dissolved solids, as the total dissolved solids (TDS) values for water from Foss Reservoir exceed the secondary MCL for TDS. With Alternative 2A, Clinton Lake would serve as the primary water resource for the City, while treated water from Foss Reservoir would be utilized at the minimum contractual obligation.

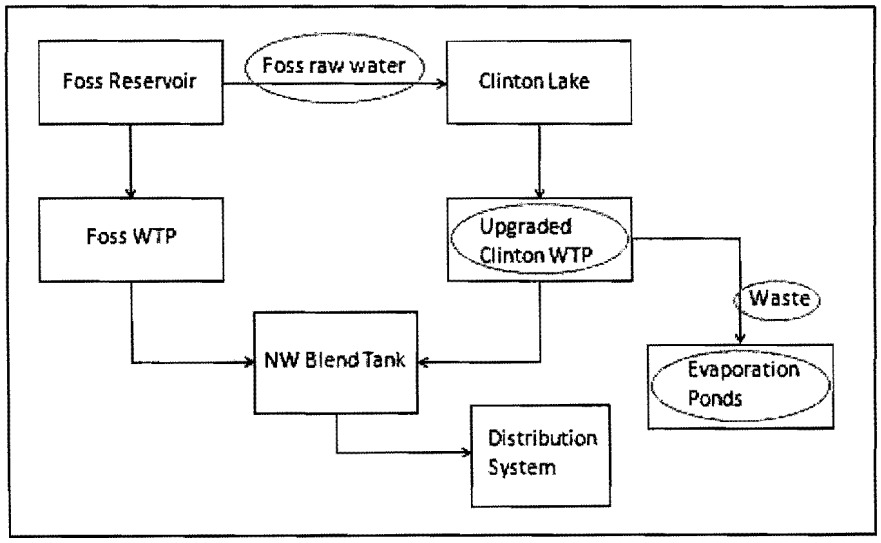


Figure 4.3. Schematic diagram for Alternative 2A – Raw Foss Water with Clinton Lake as Terminal Reservoir.

- **Alternative 2B – Raw Foss Water to Clinton WTP On-Demand.** In Alternative 2B, raw water from Foss Reservoir would be pumped to an upgraded WTP at Clinton Lake directly, as shown in Figure 4.4. Clinton Lake would not serve as a terminal reservoir for raw water from Foss Reservoir. The treatment plant upgrade at Clinton Lake would be equivalent to the upgrade under Alternative 2B. However, Alternative 2B requires a larger conveyance capacity in the pump infrastructure and water line from Foss Reservoir to meet peak demands as needed. With Alternative 2B, Clinton Lake would serve as the primary water resource for the City, while treated water from Foss Reservoir would be utilized at the minimum contractual obligation.

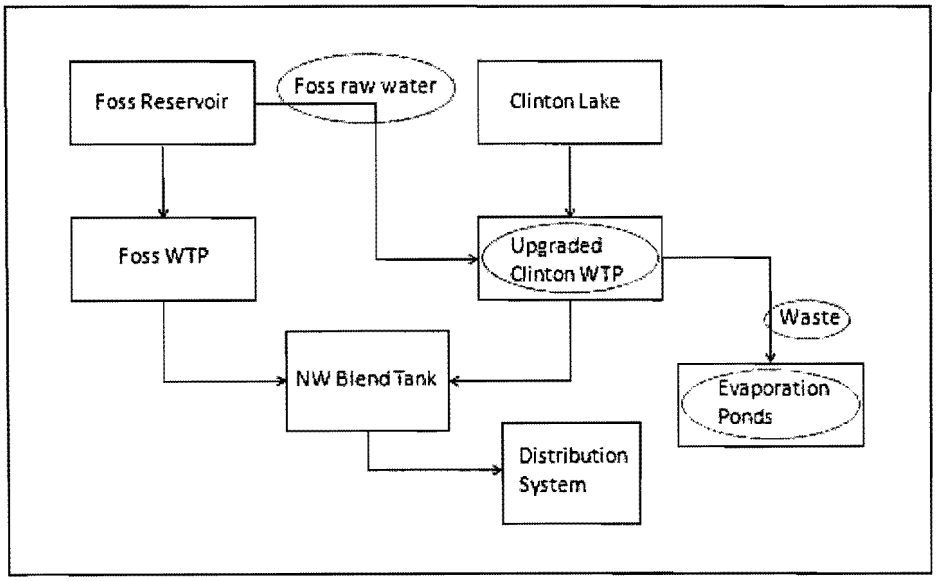


Figure 4.4. Schematic diagram for Alternative 2B – Raw Foss Water On-Demand.

There are two alternatives that utilize ground water from the Washita Alluvium:

- **Alternative 3A – Washita Alluvium to Clinton Lake.** In Alternative 3A, raw water from the Washita Alluvium would be pumped to Clinton Lake, as shown in Figure 4.5. Clinton Lake would serve as a terminal reservoir, and the Clinton WTP would be upgraded to include treatment to reduce TDS values. This alternative is very similar to Alternative 2A; the difference between the two alternatives is the raw water source. With Alternative 3A, Clinton Lake would serve as the primary water resource for the City, while treated water from Foss would be utilized at the minimum contractual obligation. The wells in the Washita Alluvium would be operated to maintain levels in Clinton Lake.

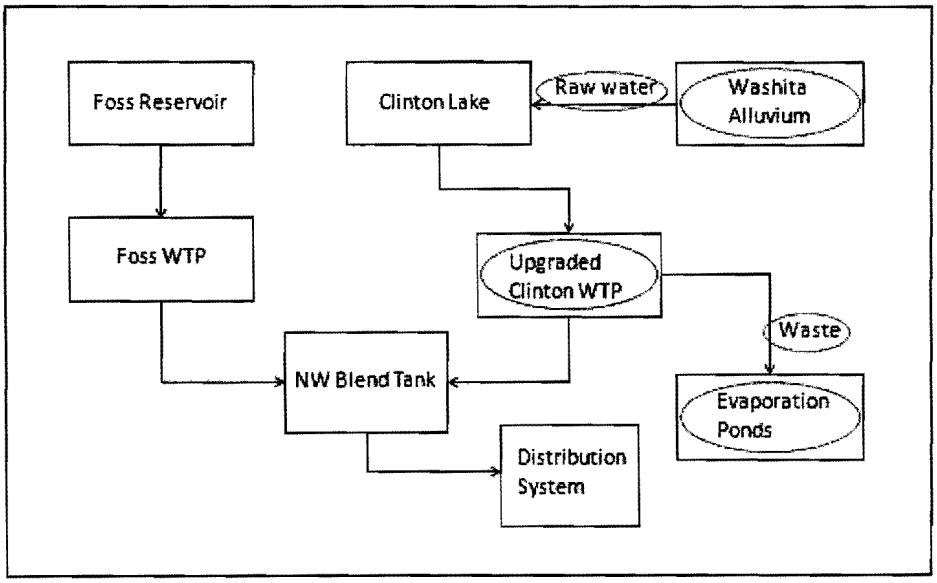


Figure 4.5. Schematic diagram for Alternative 3A – Washita Alluvium to Clinton Lake.

- **Alternative 3B – New In-Town WTP for Washita Alluvium.** The Washita River runs very close to the City of Clinton. Alternative 3B capitalizes on the City's proximity to the Washita Alluvium. As shown in Figure 4.6, in Alternative 3B, a new WTP in the City of Clinton is utilized to treat ground water from the Washita Alluvium. This local water treatment will minimize the amount of pipeline required. The waste stream from the treatment processes will, most likely, be handled using evaporation ponds. Other alternatives for waste stream handling include discharge to the Washita River and deep well injection. With Alternative 3B, the City would utilize Foss treated water at the minimum contractual obligation. The management of the two City-owned WTP facilities would be balanced to maintain water levels in Clinton Lake to ensure adequate water resource availability at peak times. Note that discharge of the waste stream to the Washita River may require dilution to limit the TDS values in the river. The City may be able to come to an agreement with Foss Reservoir regarding release of additional raw water to the Washita River for dilution purposes.

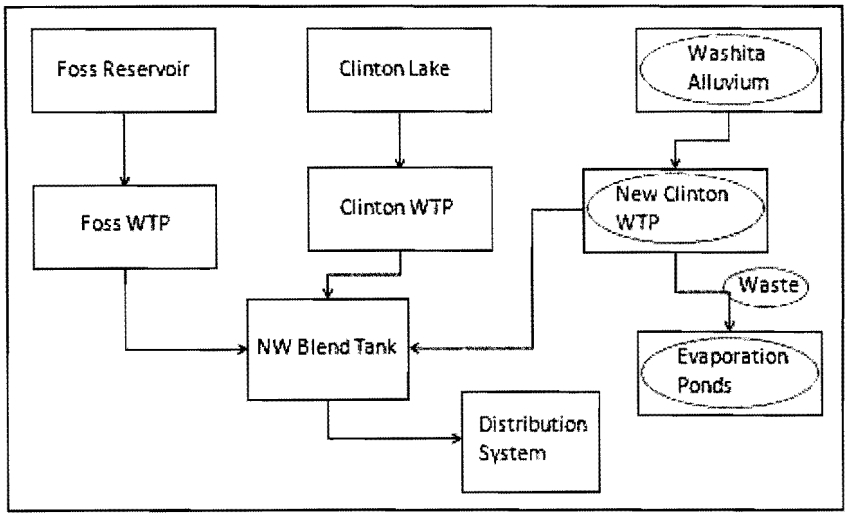


Figure 4.6. Schematic diagram for Alternative 3B – New In-Town WTP for Washita Alluvium.

Additionally, the Rush Springs Aquifer underlies the City of Clinton, as well as areas east of the City. Two alternatives, similar to the two for water from the Washita Alluvium, were analyzed that utilize ground water from the Rush Springs Aquifer:

- **Alternative 4A – Rush Springs Aquifer to Clinton Lake.** In Alternative 4A, raw water from the Rush Springs Aquifer would be pumped to Clinton Lake. The schematic diagram for this alternative is shown in Figure 4.7. Clinton Lake would serve as a terminal reservoir. It is assumed that the Rush Springs Aquifer water quality is sufficient that the existing Clinton WTP could be utilized. With Alternative 4A, Clinton Lake would serve as the primary water resource for the City, while treated water from Foss would be utilized at the minimum contractual obligation. The wells in the Rush Springs Aquifer would be operated to maintain levels in Clinton Lake.

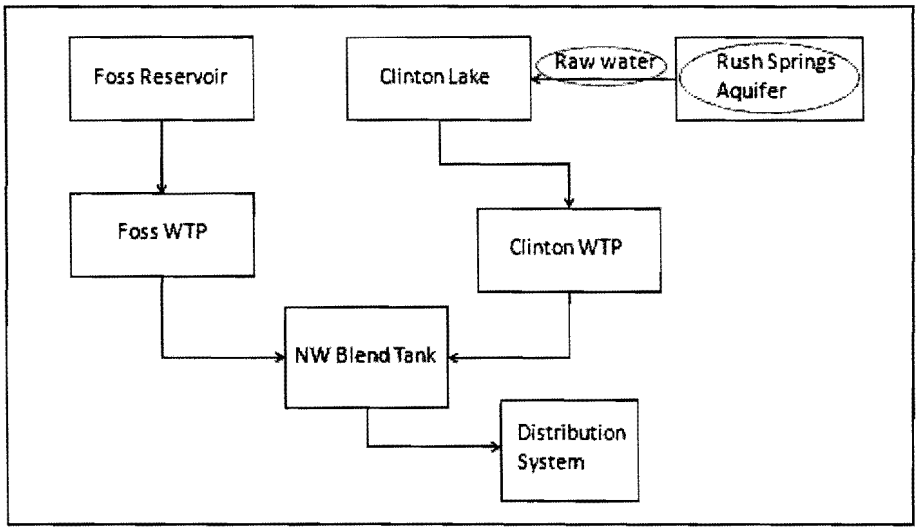


Figure 4.7. Schematic diagram for Alternative 4A – Rush Springs Aquifer to Clinton Lake.

- **Alternative 4B – Rush Springs Aquifer Direct Injection.** Alternative 4B injects water from wells in the Rush Springs Aquifer directly into the distribution system with only minor wellhead treatment, as shown in Figure 4.8. The Rush Springs water will supplement treated water from Clinton Lake and the minimum contractual obligation of treated water from Foss.

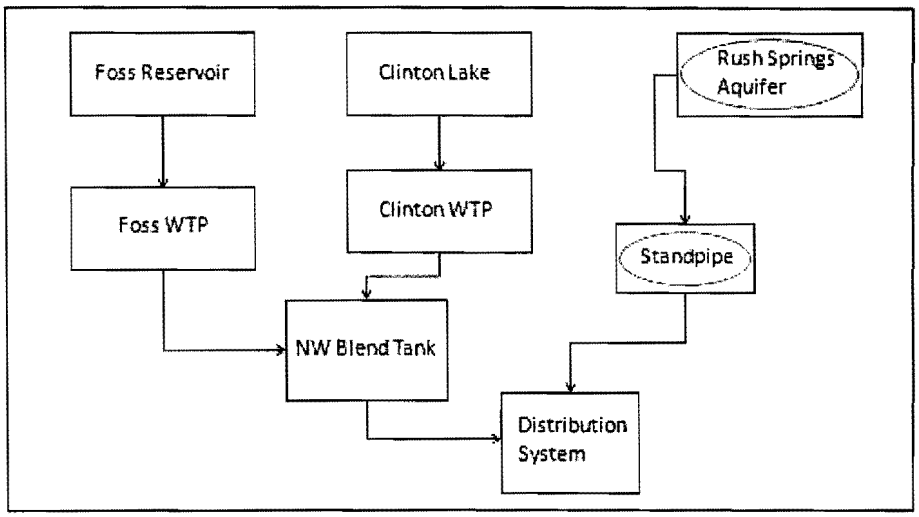


Figure 4.8. Schematic diagram for Alternative 4B – Rush Springs Aquifer Direct Injection.

4.3 Evaluation Process

The following values were used in the water quantity evaluation for each of the alternatives:

- Demand information
  - Current average daily demand, 2.13 MGD
  - 25-year horizon (2037) average daily demand, 2.16 MGD
  - 50-year horizon (2062) average daily demand, 2.17 MGD
  - Current maximum daily demand, 4.35 MGD
  - 25-year horizon (2037) maximum daily demand, 4.40 MGD
  - 50-year horizon (2062) maximum daily demand, 4.42 MGD
- Foss water treatment
  - Foss WTP production capacity varies throughout the year because the treatment process is influenced by temperature
  - Minimum contractual obligation for Foss treated water, 0.686 MGD
- Clinton Lake
  - Average Clinton Lake yield (raw water), 1.34 MGD
  - Average Clinton Lake yield (finished water), 1.27 MGD
  - Safe yield of Clinton Lake, 0.0 MGD
  - Additional evaporative loss from Clinton Lake due to use as terminal reservoir for Foss, Washita Alluvium, or Rush Springs Aquifer raw water, 0.1 MGD
- Treatment disposal
  - Reject water for RO treatment of raw Washita Alluvium or Foss Reservoir water, 33%

- Reject water for treatment of combined Foss raw or Washita Alluvium raw blended at Clinton Lake, 25%
- Reject water at Clinton Lake WTP if Clinton Lake is used as a terminal reservoir for Rush Springs Aquifer water, 5%

The water quantity evaluation consists of two scenarios for each alternative. The first scenario is based on average conditions, which characterizes the general operational state of the alternative. For the second scenario, the safe yield from Clinton Lake (0.0 MGD – pending a yield study) is used instead of the average yield. This characterizes the alternative during the worst-case conditions that may occur.

Water quality analysis was a secondary concern for this study because all of the options provide the City with water quality equal to or exceeding the current water quality. The infrastructure specified for alternatives with new or improved water treatment plants is reverse osmosis technology that removes all TDS and hardness, resulting in greatly improved water quality. For alternatives that do not include improved treatment, the water quality will be consistent with current water quality.

An annual average value of 1.75 MGD was assumed for finished water from Foss. The maximum allocation was calculated to be 2.19 MGD, based on 48.6% of the rated capacity of 4.5 MGD. Based on the operational capacity of 3.8 MGD, the maximum allocation is 1.824 MGD. As seen in Figure 3.1, during the course of the year, there are periods when the demand of the City of Clinton is less than the maximum allocation (even the de-rated allocation of 1.824 MGD). The 1.75 MGD value was the result of a calculation that assessed the maximum average annual Foss finished water usage given the parameters of the system.

4.4 Water Supply Alternative Evaluation

4.4.1 Average Day Scenario

The results from the water quantity analysis under average conditions are presented in Table 4.2. The demand is the average day demand for 2062, 2.17 MGD. For this demand scenario, the production from Clinton Lake and the minimum allocation from Foss account for all but 0.21 MGD of the demand. Thus, for each of the alternatives that consist of adding a supplemental raw water source (Alternatives 2A – 4B), the average finished water demand associated with the supplemental source is only 0.21 MGD.

Table 4.2. Finished Water Quantity Analysis for Average Conditions (all units MGD)

Alternative		Demand	Supply				
			Clinton Lake	Foss Treated	Foss Raw to CL	Washita Alluvium	Rush Spr. Aquifer
1A	Do Nothing	2.17	0.42	1.75			
1B	Expand Foss	2.17	1.27	0.9			
2A	Foss Raw Terminal	2.17	1.27	0.69	0.21		
2B	Foss Raw On-Demand	2.17	1.27	0.69	0.21		
3A	Wash. Allu. Terminal	2.17	1.27	0.69		0.21	
3B	Wash. Allu. In-town	2.17	1.27	0.69		0.21	
4A	Rush Spr. Terminal	2.17	1.27	0.69			0.21
4B	Rush Spr. Direct Inj.	2.17	1.27	0.69			0.21

The average amount of raw water necessary to meet the finished water demand of 0.21 MGD varies across the alternatives, due to loss of water to evaporation and during the treatment process:

- Alternative 2A: 0.56 MGD
- Alternative 2B: 0.51 MGD
- Alternative 3A: 0.56 MGD
- Alternative 3B: 0.51 MGD
- Alternative 4A: 0.32 MGD
- Alternative 4B: 0.21 MGD

The largest losses are associated with the alternatives which require treatment with reverse osmosis to remove TDS and hardness.

The second analysis was performed with the yield of Clinton Lake set to zero, which is the assumed safe yield of the reservoir pending a yield study. The results for this analysis are presented in Table 4.2. For this analysis, it is assumed that the maximum annual availability of finished water from Foss (without a plant upgrade) is 1.75 MGD. It is assumed that, if Clinton Lake is dry, the City will use the maximum from Foss. This assumption allows for reasonable development of supplemental sources.

Table 4.3. Safe Yield Finished Water Quantity Analysis (all units MGD)

Alternative		Demand	Supply				
			Clinton Lake	Foss Treated	Foss Raw to CL	Washita Alluvium	Rush Spr. Aquifer
1A	Do Nothing	2.17	**0.42**[1]	1.75			
1B	Expand Foss	2.17	0	2.17			
2A	Foss Raw Terminal	2.17	0	1.75	0.42		
2B	Foss Raw On-Demand	2.17	0	1.75	0.42		
3A	Wash. Allu. Terminal	2.17	0	1.75		0.42	
3B	Wash. Allu. In-town	2.17	0	1.75		0.42	
4A	Rush Spr. Terminal	2.17	0	1.75			0.42
4B	Rush Spr. Direct Inj.	2.17	0	1.75			0.42

[1] The red number indicates that 0.42 MGD is necessary from Clinton Lake to meet average demand, but that quantity of water is not available based on the assumption that the safe yield of Clinton Lake is zero.

From an annual water budget perspective, the results presented in Table 4.3 are not dramatically worse than those presented in Table 4.2. The finished water demands for the supplemental sources in Alternatives 2A -4B are 0.42 MGD instead of 0.21 MGD. This minimal increase in average demand from the supplemental sources is due to the large increase (1.06 MGD) in average utilization of finished water from Foss. The only alternative that does not meet supply under this scenario is Alternative 1A. The bold, red 0.42 MGD number for Clinton Lake highlights the deficit the City will face if the average annual demand is 2.17 MGD and the only source is treated water from Foss, with an average annual production of 1.75 MGD.

4.4.2 Maximum Day Scenario

In general, water supply evaluations are concerned with average day demands. However, the maximum day demand scenario is important for this study because the maximum allocation from Foss does not supply enough water for the City to meet maximum day demands. Therefore, it was important to consider maximum day demands to size the infrastructure associated with the different alternatives, based on the worst-case scenario of zero yield for Clinton Lake. For this analysis, it is assumed that when the yield of Clinton Lake is zero (i.e., during drought conditions), the City will utilize the maximum allocation available from Foss Reservoir. It is assumed that one a maximum day basis, the Foss WTP is capable of reaching its rated capacity of 4.5 MGD. This is consistent with record values. However, this production level cannot be achieved for an extended period.

The impact of zero yield for Clinton Lake is much more dramatic when maximum day demand conditions are analyzed. The results from this analysis are shown in Table 4.4. The maximum day demand for 2062 was used in these computations. However, as the difference between the maximum day demands for 2037 and 2062 is only 0.02 MGD, the results are applicable to 2037, as well. For Alternative 1B, the

entire demand is met with finished water from Foss, which is possible because the Foss treatment plant has been upgraded and expanded. For the other seven alternatives, the maximum allocation of finished water from Foss is 2.19 MGD. Therefore, there is a 2.23 MGD shortfall that must be made up with supplemental sources.

Table 4.4. Maximum Day Demand Analysis (all units MGD)

Alternative		Demand	Supply				
			Clinton Lake	Foss Treated	Foss Raw to CL	Washita Alluvium	Rush Spr. Aquifer
1A	Do Nothing	4.42	2.23[1]	2.19			
1B	Expand Foss	4.42	0	4.42			
2A	Foss Raw Terminal	4.42	0	2.19	2.23		
2B	Foss Raw On-Demand	4.42	0	2.19	2.23		
3A	Wash. Allu. Terminal	4.42	0	2.19		2.23	
3B	Wash. Allu. In-town	4.42	0	2.19		2.23	
4A	Rush Spr. Terminal	4.42	0	2.19			2.23
4B	Rush Spr. Direct Inj.	4.42	0	2.19			2.23

[1] The red number indicates that 2.23 MGD is necessary from Clinton Lake to meet average demand, but that quantity of water is not available based on the assumption that the safe yield of Clinton Lake is zero.

As noted previously, if the yield of Clinton Lake is zero, Alternative 1A will not provide sufficient water resources to meet demands. For this reason, with Alternative 1A, use of water from Foss is prioritized in order to preserve resources in Clinton Lake to minimize the potential for drought periods to impair Clinton Lake as a water supply source. For Alternatives 2A – 4B, the supplemental source is required to account for 2.23 MGD during maximum day demand conditions.

While each of the six alternatives that involves an additional raw water source has the same finished water requirement to meet maximum day demand conditions, the maximum raw water production necessary for the alternatives that utilize Clinton Lake as a terminal reservoir are significantly less than the production capacities required if Clinton Lake is not used as a terminal reservoir. Use of Clinton Lake as a terminal reservoir allows raw water production at an approximately constant rate throughout the year, and the peak finished water demands do not have an immediate, high impact on the production rates. However, for the alternatives that do not use Clinton Lake as a terminal reservoir, the raw water production rates are tied directly to the City's finished water demands, as seen in Table 4.5.

Table 4.5. Maximum Raw Water Production Capacity

Alternative		Raw Water Source	Terminus	Design Flow	Raw Water Infra. Cap. (MGD)
2A	Foss Raw Terminal	Foss Reservoir	Clinton Lake	Avg.	0.69
2B	Foss Raw On-Demand	Foss Reservoir	Clinton WTP	Peak	2.97
3A	Wash. Allu. Terminal	Washita Alluvium	Clinton Lake	Avg.	0.69
3B	Wash. Allu. In-town	Washita Alluvium	In-town WTP	Peak	2.97
4A	Rush Spr. Terminal	Rush Springs Aquifer	Clinton Lake	Avg.	0.55
4B	Rush Spr. Direct Inj.	Rush Springs Aquifer	Direct Inject	Peak	2.31

Note: Raw water infrastructure capacity differs from supply in Table 4.4 due to water losses during treatment.

4.5 Infrastructure Alternatives Evaluation

Each of the alternatives described herein proposes use of a different quality or quantity of raw water. As such, the type and extent of treatment infrastructure varies according to the raw water supply. For each alternative, the finished water quality criteria for select constituents summarized in Table 4.6 were used to establish the level of treatment needed.

Table 4.6. Finished Water Quality Criteria

Constituent	Desired Maximum Level	Evaluation Criterion[1]
pH	6.5-8.5	Secondary MCL
Hardness	100	>500, extremely hard
Total Dissolved Solids	500	Secondary MCL
Nitrate	10	Primary MCL
Sulfate	250	Secondary MCL
Iron	0.3	Secondary MCL
Manganese	0.05	Secondary MCL

[1] Evaluation criteria are based on Safe Drinking Water Act.

The following sections describe the treatment infrastructure required for each alternative to meet the criteria established in the above table. Additionally, an overview of the conveyance infrastructure necessary for each alternative is provided.

4.5.1 Alternative 1A – Treated Foss Water as Primary Source ("Do Nothing")

As described previously, this alternative proposes continued use of the Clinton WTP to treat Clinton Lake raw water and purchase of Foss treated water. The current conventional treatment practiced at the Clinton WTP is sufficient for the quality of Clinton Lake water, while advanced treatment processes at the Foss WTP will continue to be necessary for treatment of Foss raw water. No new treatment infrastructure or conveyance infrastructure is anticipated for this alternative.

4.5.2 Alternative 1B – Foss WTP Expansion

4.5.2.1 Conveyance

The conveyance infrastructure for Alternative 1B consists of a new raw water intake structure at Foss Reservoir to provide water to the new portion of the WTP. Additionally, an additional 24", parallel water line is necessary to convey finished water from Foss Reservoir to the NW Blend tank in the City of Clinton. The parallel transmission line is necessary to increase the capacity of finished water from Foss from the current maximum allocation value of 2.19 MGD to the future maximum daily demand of approximately 4.4 MGD.

4.5.2.2 Treatment

This alternative proposes an expansion to the Foss WTP to provide additional finished water from the Foss Reservoir water supply. For the purposes of this evaluation, it is assumed that the existing Foss EDR WTP will continue to operate and distribute finished water to area municipalities as currently practiced. The high total dissolved solids (TDS) content of the Foss Reservoir raw water requires an advanced treatment process. TDS are made up of compounds that dissociate in water to form ions, which cannot be removed by conventional filtration. A new, parallel, 2.2-MGD reverse osmosis WTP is proposed to serve the additional finished water demands of the City of Clinton.

A process flow diagram of the proposed expansion to the Foss WTP is shown in Figure 4.9. As can be seen in the figure, raw water pumps will convey water from the reservoir to the pre-treatment clarification process. Pretreatment is necessary to reduce the solids load to the low pressure microfiltration/ultrafiltration (MF/UF) membranes in order to extend the life and operability of the membranes.

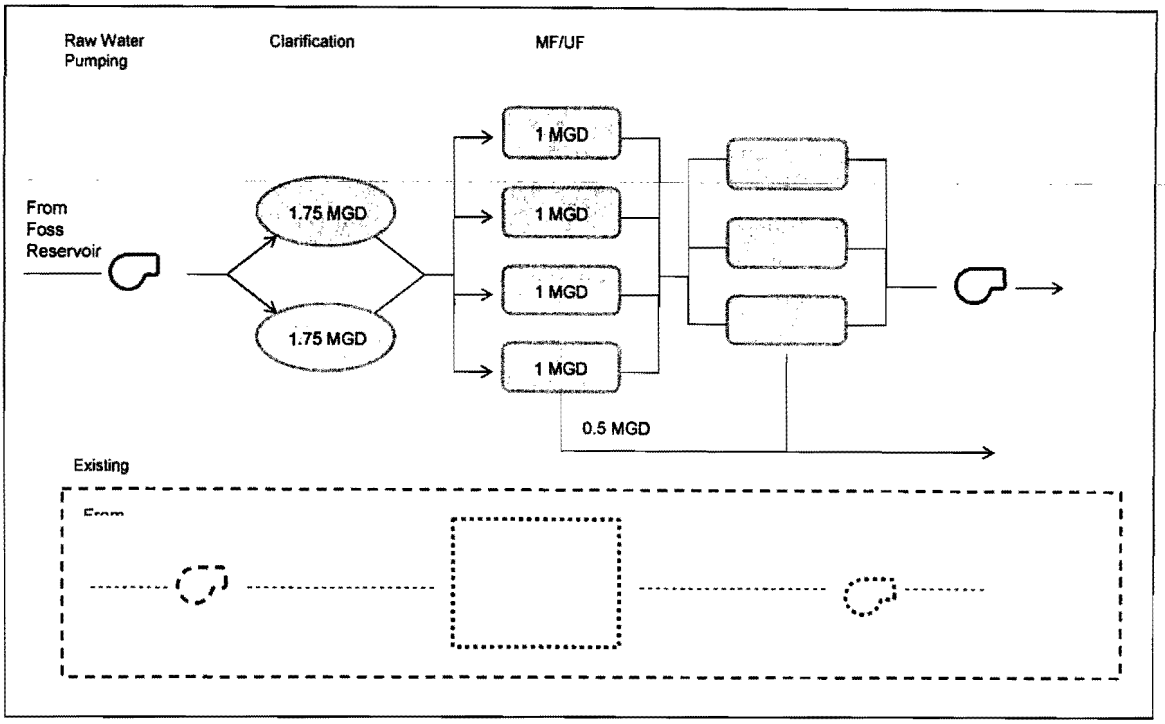


Figure 4.9. Treatment process flow diagram for Alternative 1B – Foss WTP Expansion.

Two solids contact clarifiers, each with a 1.75 MGD treatment capacity, are recommended for pretreatment because of their small footprint and operational flexibility. Clarified water will be pumped through a low pressure membrane treatment process. The low pressure membrane process is required to remove the particulates in the flow stream before dissolved constituents can be removed through the high pressure reverse osmosis (RO) membranes. MF/UF membranes will be provided in skid-mounted units. For the purpose of this evaluation, it was assumed four (4) 1-MGD skids would be required, which is a typical configuration for MF/UF membrane manufacturers.

Low pressure membrane permeate will be pumped from the MF/UF units to the RO units. The RO filtration system would be a pressure-driven process that utilizes a semi-permeable membrane to target the removal of dissolved contaminants via a diffusion-controlled separation process. When high pressure in excess of the natural osmotic gradient of the system is applied to the feed side of the membrane, water is forced through the molecular structure of the membrane surface while the dissolved solids are rejected. Like the low-pressure membranes, RO systems are provided in skid-mounted modular systems. It is assumed that three (3) 1.1-MGD skids would be required, which is a typical configuration for RO membrane manufacturers. RO treated water would be pumped through the new infrastructure to the City.

4.5.3 Alternative 2A – Foss Raw Water to Clinton Lake

4.5.3.1 Conveyance

The conveyance infrastructure for Alternative 2A consists of a new raw water intake structure at Foss Reservoir, a 0.75 MGD pump station, a 12" water line from Foss Reservoir, and an exit structure at

Clinton Lake. Additionally, evaporation ponds will be necessary adjacent to the Clinton WTP to handle waste generated during the RO process.

4.5.3.2 Treatment

This alternative proposes blending raw water from Foss Reservoir with raw water from Clinton Lake in Clinton Lake. The blended raw water will be treated with an upgraded Clinton WTP. Because of the high TDS concentration in Foss raw water, advanced treatment processes would be required to treat the blended water. This alternative proposes converting the existing conventional plant into a pretreatment facility for new reverse osmosis filtration, as shown in the process flow diagram in Figure 4.10.

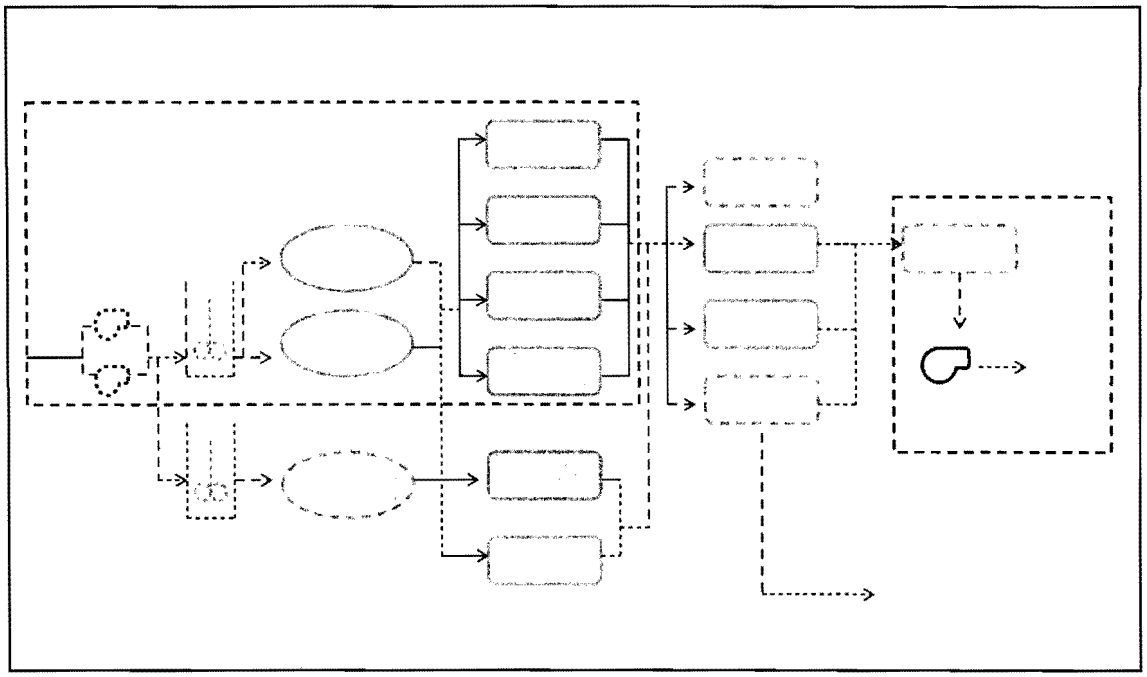


Figure 4.10. Treatment process flow diagram for Alternative 2A – Foss Raw Water to Clinton Lake.

As can be seen in the figure, an additional 2-MGD clarifier and two (2) additional 0.7-MGD filters would be required to provide the total RO feed water required under this scenario. Filtered water will be combined and pumped through four (4) RO skids, each with a 1.25-mgd treatment capacity. The RO skids will be nearly identical to those described in Alternative 1B. RO permeate will be disinfected in the existing clearwell and pumped with existing high service pumps to distribution. Finished water quality will easily meet the water quality goals described in Table 4.6.

4.5.4 Alternative 2B – Foss Raw Water to Clinton WTP (On-Demand)

4.5.4.1 Conveyance

The conveyance infrastructure for Alternative 2B is similar to the infrastructure for Alternative 2A. The main difference is that the infrastructure is larger for Alternative 2B, which is a consequence of providing water on-demand to the Clinton WTP, rather than using Clinton Lake as a terminal reservoir. Specifically, the conveyance infrastructure necessary for Alternative 2B is a new raw water intake structure at Foss Reservoir, a 3.0-MGD pump station, a 24" water line from Foss Reservoir, and a 200,000-gallon storage tank adjacent to the WTP at Clinton Lake. Additionally, telemetry is required to allow for communication between the WTP and the pumps at Foss Reservoir. As with Alternative 2A, evaporation ponds will be necessary adjacent to the Clinton WTP to handle waste generated during the RO process.

4.5.4.2 Treatment

In Alternative 2B, raw water from Foss Reservoir would be pumped to an upgraded WTP at Clinton Lake directly. Clinton Lake would not serve as a terminal reservoir for raw water from Foss Reservoir. This would allow the City to treat water from Clinton Lake through their existing conventional plant, and only use the advance treatment processes when required. However, in order to make use of as much existing infrastructure as possible and reduce costs, the existing plant will still be used as a pretreatment process if Foss water is being treated. Therefore, the required treatment infrastructure is identical to that proposed for Alternative 2A, shown in Figure 4.10.

4.5.5 Alternative 3A – Washita Alluvium to Clinton Lake

4.5.5.1 Conveyance

The conveyance infrastructure for Alternative 3A is two (2) production wells in the Washilta Alluvium, well houses, approximately eight (8) miles of slip-lining of the abandoned 16" pipe with 12" pipe, an exit structure at Clinton Lake, and evaporation ponds adjacent to the Clinton WTP.

4.5.5.2 Treatment

This alternative proposes blending raw water from the Washita Alluvium with raw water from Clinton Lake in Clinton Lake. The blended raw water will be treated with an upgraded Clinton WTP. Because of the high TDS concentration in Washita Alluvium raw water, advanced treatment processes would be required to treat the blended water. This alternative proposes converting the existing conventional plant into a pretreatment facility for new reverse osmosis filtration, as previously shown in the process flow diagram in Figure 4.10. The treatment process upgrade would be identical to that described in Alternative 2A.

4.5.6 Alternative 3B – New In-Town WTP for Washita Alluvium

4.5.6.1 Conveyance

The conveyance infrastructure for Alternative 3B is six (6) production wells in the Washilta Alluvium, well houses, approximately three (3) miles of new 24" pipe, and evaporation ponds near the new WTP.

If land is available, placement of the new WTP between the Washita River and the NW Blend Tank will help minimize infrastructure costs.

4.5.6.2 Treatment

This alternative proposes treatment of the Washita Alluvium water at a new site adjacent to the Washita River. The new advanced WTP will be similar to the Foss WTP upgrade described in Alternative 1B. Alluvial groundwater will be pumped into a rapid mix basin and then split between two (2) 1.75-MGD solids contact clarifiers. Clarified water will be pumped to four (4) 1-MGD low pressure MF/UF membrane skids. Low pressure membrane permeate will be pumped to three (3) 1.1-MGD RO skids. The RO permeate will be pumped to the northwest blend tank for distribution to the City. All reject will be treated in new evaporation ponds. The proposed process flow diagram is shown in Figure 4.11.

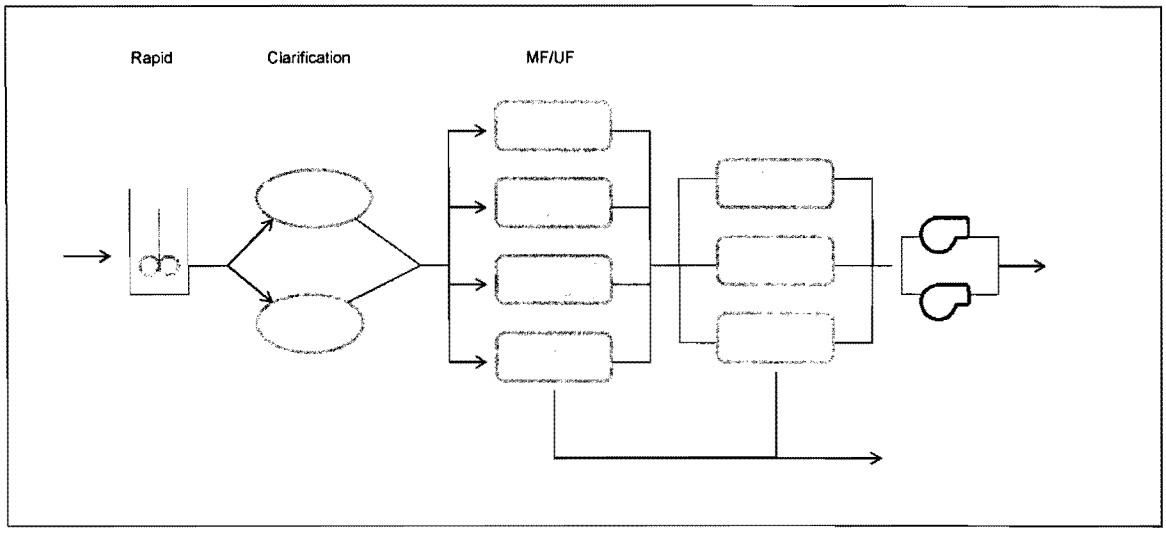


Figure 4.11. Treatment process flow diagram for Alternative 3B – New In-Town WTP for Washita Alluvium.

4.5.7 Alternative 4A – Rush Springs Aquifer to Clinton Lake

4.5.7.1 Conveyance

The conveyance infrastructure for Alternative 4A is five (5) production wells in the Rush Springs Aquifer, well houses, approximately twelve (12) miles of slip-lining of the abandoned 16" pipe with 12" pipe, and an exit structure at Clinton Lake.

4.5.7.2 Treatment

This alternative proposes blending raw water from the Rush Springs aquifer with raw water from Clinton Lake in Clinton Lake. As proposed, the blended water would be treated through the existing conventional WTP. Because the Rush Springs water does not contain elevated levels of dissolved solids, the water is suitable to be treated by conventional filtration. As such, no treatment infrastructure improvements are necessary for this alternative.

4.5.8 Alternative 4B – Rush Springs Aquifer Direct Injection

4.5.8.1 Conveyance

For Alternative 4B, the conveyance infrastructure consists of eighteen (18) production wells in the Rush Springs Aquifer, well houses, and approximately three (3) miles new 24" line.

4.5.8.2 Treatment

This alternative proposes direct injection of Rush Springs Aquifer water into the distribution system to satisfy the finished water demand deficit during periods of peak demands. It is assumed that the groundwater is of high enough quality that it is suitable for direct injection with only minor treatment. The water from the eighteen wells will be blended in a standpipe, where chlorine will be added for disinfection purposes.

5.0 Monetary Evaluation

5.1 Monetary Evaluation Introduction

The monetary evaluation consisted of estimation of the capital, O&M, and finished water costs over the 25-year planning horizon. The net interest rate (inflation rate subtracted from the interest rate for capital improvements) was assumed to be 3% for the evaluation period. This rate was used to convert annual O&M and finished water costs back to an equivalent present-day value. Then, the total 25-year cost was divided by the total water demand for the 25-year period to develop the cost per thousand gallons. The 25-year period is used for the monetary evaluation because 25 years is the average life expectancy of conveyance and treatment infrastructure. This evaluation is based on average day demands, with average yield conditions for Clinton Lake.

5.2 Monetary Evaluation Results

The monetary evaluation of each alternative is presented in Sections 5.2.1-5.2.8. Then, the results from the individual alternatives are compared in Section 5.2.9. For each alternative, the monetary costs were divided into one-time, capital costs for infrastructure improvements and annual costs. The capital costs include upgrades for water treatment plants, well fields, and conveyance infrastructure. The annual costs consist of O&M and treatment for the City-owned WTPs, well fields, and piping, as well as the cost of purchasing finished water from Foss.

5.2.1 Alternative 1A - Do Nothing

There are no infrastructure improvements for Alternative 1A. Therefore, the capital improvements are zero in Table 5.1. The 25-year total for the annual costs is slightly more than $33 M. This cost is based on maximizing purchase of finished water from Foss, as described under "Alternative 1A" of Section 4.2 and depicted in Table 4.2. Therefore, the total, present-day value of the total costs for Alternative 1A is $33.16 M.

Table 5.1. Cost Estimate for Alternative 1A

Description	25-Year Cost
Capital Improvements	$0
O&M, Treatment, and Water Purchase	$33,155,025
Total	**$33,155,025**

5.2.2 Alternative 1B - Foss WTP Expansion

The capital costs for Alternative 1B are shown in detail in Table D.1 of the Appendix. As shown in Table 5.2, the total is approximately $39.6 M, with two-thirds of the costs being associated with the Foss WTP expansion and the other third resulting from the addition of a parallel finished water transmission line. The annual costs for Alternative 1B are approximately $26 M, which results in a total 25-year cost of $65.62 M, as shown in Table 5.2. The annual costs are based on full utilization of the average Clinton Lake yield, as outlined in Section 4.2.

Table 5.2. Cost Estimate for Alternative 1B

Description	25-Year Cost
Capital Improvements	$39,574,730
O&M, Treatment, and Water Purchase	$26,049,242
Total	**$65,623,972**

5.2.3 Alternative 2A – Foss Raw Water to Clinton Lake

The capital costs for Alternative 2A, which are presented in detail in Table D.2 in the Appendix, total about $32 M. The majority of the costs are associated with improvements to the Clinton WTP to treat the raw water from Foss Reservoir, which requires advanced treatment to remove TDS. Additionally, there are considerable capital costs associated with both the raw water conveyance infrastructure from Foss Reservoir to Clinton Lake and evaporation ponds necessary for handling the waste stream generated from the reverse osmosis treatment. The 25-year total for the annual costs exceeds $36 M, so the total cost over the planning horizon is $68.52 M, as shown in Table 5.3.

Table 5.3. Cost Estimate for Alternative 2A

Description	25-Year Cost
Capital Improvements	$32,133,660
O&M, Treatment, and Water Purchase	$36,391,222
Total	**$68,524,882**

5.2.4 Alternative 2B – Foss Raw Water to Clinton WTP (On-Demand)

A detailed breakdown of the capital costs for Alternative 2A are shown in Table D.3 in the Appendix. The total is about $36.3 M. The treatment costs for Alternatives 2A and 2B are the same. However, the costs for the raw water conveyance infrastructure from Foss Reservoir to Clinton Lake are greater for Alternative 2B because the peak flow rate is higher, which requires larger infrastructure. The 25-year total for the annual costs exceeds $36 M, so the total cost over the planning horizon is $72.66 M, as shown in Table 5.4.

Table 5.4. Cost Estimate for Alternative 2B

Description	25-Year Cost
Capital Improvements	$36,341,760
O&M, Treatment, and Water Purchase	$36,321,016
Total	**$72,662,776**

5.2.5 Alternative 3A – Washita Alluvium to Clinton Lake

The capital costs for Alternative 3A are shown in detail in Table D.4 in the Appendix, while the total costs for the 25-year planning horizon are shown in Table 5.5. The estimate for the capital improvements is almost $32.3 M. The majority of the capital costs are associated with the Clinton WTP upgrade, and the

conveyance costs are minimized by slip-lining the abandoned 16-inch line to Clinton Lake. Over the design horizon, the annual costs are approximately $36.5 M. The total 25-year cost for Alternative 3A is $68.76 M.

Table 5.5. Cost Estimate for Alternative 3A

Description	25-Year Cost
Capital Improvements	$32,294,210
O&M, Treatment, and Water Purchase	$36,470,740
Total	**$68,764,950**

5.2.6 Alternative 3B – New In-Town WTP for Washita Alluvium

The detailed capital costs for Alternative 3B are shown in Table D.5 in the Appendix, while the total costs for the 25-year planning horizon are shown in Table 5.6. The estimate for the capital improvements is around $38 M. The majority of the capital costs are associated with construction of a new WTP in-town. Over the design horizon, the annual costs are almost $28 M. The total 25-year cost for Alternative 3B is $65.70 M.

Table 5.6. Cost Estimate for Alternative 3B

Description	25-Year Cost
Capital Improvements	$37,926,980
O&M, Treatment, and Water Purchase	$27,769,681
Total	**$65,696,661**

5.2.7 Alternative 4A – Rush Springs Aquifer to Clinton Lake

The capital costs for Alternative 4A are shown in detail in the Appendix in Table D.6, while the total costs for the 25-year planning horizon are shown in Table 5.7. The estimate for the capital improvements is less than $10.2 M. The majority of the capital costs are associated with rehabilitation of the abandoned, 16-inch transmission line by slip-lining with new 12-inch pipe. The capital costs are low, compared to other alternatives, because no new water treatment infrastructure is required. Over the design horizon, the annual costs are almost $26.5 M. The total 25-year cost for Alternative 4A is $36.49 M.

Table 5.7. Cost Estimate for Alternative 4A

Description	25-Year Cost
Capital Improvements	$10,140,000
O&M, Treatment, and Water Purchase	$26,349,279
Total	**$36,489,279**

5.2.8 Alternative 4B – Rush Springs Aquifer Direct Injection

The capital costs for Alternative 4B are shown in detail in Table D.7 in the Appendix, while the total costs for the 25-year planning horizon are shown in Table 5.8. The estimate for the capital improvements is

about $17.1 M. The majority of the capital costs are associated with exploratory and production well drilling, as well as construction of the well houses. The capital costs are higher than for Alternative 4A because the quantity of wells is so much greater. The large number of wells is necessary to meet peak demands; only five wells are needed for Alternative 4A because use of Clinton Lake as a terminal reservoir allows the well field to withdraw a moderate, approximately constant amount of raw water from the aquifer. The capital costs are low, compared to Alternatives 1B-3B, because it is assumed that only minor wellhead treatment is required for water from the Rush Springs Aquifer. Over the design horizon, the annual costs are approximately $27 M. The total 25-year cost for Alternative 4A is $44.17 M.

Table 5.8. Cost Estimate for Alternative 4B

Description	25-Year Cost
Capital Improvements	$17,089,280
O&M, Treatment, and Water Purchase	$27,084,687
Total	**$44,173,967**

5.2.9 Alternatives Monetary Comparison

The results of the monetary evaluation are presented in Table 5.9. The total 25-year costs developed for each of the alternatives were used, along with the cumulative demand, to calculate the cost per thousand gallons for each of the alternatives.

Table 5.9. Monetary Evaluation

	Alternative	Total 25-Year Costs	Total Flow (Thousand Gallons)	Cost per Thousand Gallons
1A	Do Nothing	$33,156,000	19,619,000	$1.69
1B	Expand Foss	$65,623,972	19,619,000	$3.34
2A	Foss Raw Terminal	$68,524,882	19,619,000	$3.49
2B	Foss Raw On-Demand	$72,662,776	19,619,000	$3.70
3A	Wash. Allu. Terminal	$68,764,950	19,619,000	$3.51
3B	Wash. Allu. In-town	$65,696,661	19,619,000	$3.35
4A	Rush Spr. Terminal	$36,489,279	19,619,000	$1.86
4B	Rush Spr. Direct Inj.	$44,173,967	19,619,000	$2.25

5.3 Monetary Evaluation Summary

The most cost-effective alternative is Alternative 1A, which is the "Do Nothing" alternative from a water source standpoint. Alternative 1A is not the lowest cost annually, as far as O&M and finished water costs. However, the lack of capital costs covers the additional expense of finished water purchase from Foss over the 25-year evaluation period.

The second most cost-effective alternative is Alternative 4A. The costs for Alternative 4A are low because it utilizes significant amounts of existing infrastructure. Alternative 4A does not require any

treatment plant upgrades, and the conveyance costs are minimized through rehabilitation of the abandoned 16-inch pipe between the City of Clinton and Clinton Lake.

Alternative 4B has the third lowest costs. The cost of Alternative 4B is greater than the cost of Alternative 4A because of the number of wells necessary to meet the peak production capacity when Clinton Lake is not used as a terminal reservoir. The initial capital investment, as well as maintenance on the wells, associated with Alternative 4B makes Alternative 4A more appealing from a cost standpoint.

The other five alternatives (1B, 2A, 2B, 3A and 3B) are all significantly more expensive. The difference, in cost per thousand gallons, between Alternatives 1B and 4B is $1.09, which equals more than $21 M in present-day value when accumulated over the planning horizon. The five most expensive options all require significant capital investments to expand or upgrade water treatment facilities with advanced technology.

6.0 Non-Monetary Evaluation

Non-monetary evaluation criteria were evaluated to assess the non-monetary relative value for each alternative. The non-monetary factors identified for this project are listed below (in alphabetical order):

- Environmental Impacts – The plan should minimize environmental impacts, such as extreme land use changes (e.g., evaporation ponds, pipeline construction, well fields, and diminished Clinton Lake water quality).
- Flexibility – The plan should consider potential expandability for future unforeseen demand, leverage for developing new water resources, and ability for meeting increasingly stringent drinking water standards.
- Future Implications – The recommended plan must have the ability for expansion beyond the planning horizon.
- Implementability – The plan must have the ability to be integrated into the existing system infrastructure.
- Public Acceptance – Public acceptance is critical for implementation of any plan. The goal for public acceptance is development of a safe, reliable, and independent water supply system for the citizens of Clinton.
- Redundancy – The plan should include redundancy in the event that a source becomes temporarily impaired, e.g., due to drought or regulation.
- Reliability – The water resources yield must be sustainable for the planning horizon.
- Water Quality – The new plan must produce the best finished water quality.
- Water Rights – Water rights are an important issue, and the City would like to hold water rights to the future source that is recommended.

The importance of each of the non-monetary factors, as it pertains to evaluating alternatives for this study, is presented in Section 6.1. The weighting factors for each of the non-monetary factors developed in Section 6.1 are applied in Section 6.2. Additionally, in Section 6.2, the alternatives are ranked from most favorable to least favorable for each factor, and the final combined non-monetary rankings are calculated.

6.1 Ranking of Non-Monetary Factors

The nine non-monetary factors were weighted using a three-point scale, with the following classifications:

- 3 – highest variability between alternatives
- 2 – moderate variability between alternatives
- 1 – lowest variability between alternatives

This type of weighting scale was used because all of the non-monetary factors were deemed to be important.

The factors were divided into the three categories as follows:

- Highest variability: flexibility, reliability, and redundancy
- Moderate variability: future implications, public acceptance, and water quality
- Lowest variability: environmental impacts, implementability, and water rights

One of the factors that received the lowest weight is environmental impacts. This does not mean that environmental impacts are deemed to be unimportant for this project; rather, it indicates that none of the options have major environmental impacts (i.e., creation of a large reservoir, disruption of wetland habitat, etc.). Thus, the difference between the most and least favorable alternatives is less for the environmental impacts factor than for factors that have higher variability.

6.2 Non-Monetary Rankings

The non-monetary rankings are presented in Table 6.1. The ranking summation is a weighted average of the data presented in the table. The final non-monetary ranking is based on the ranking summation score. The alternative with the lowest value in the ranking summation is most favorable. The best possible score is 1.00 (most favorable on all factors), and the lowest possible score is 8.00 (least favorable on all factors).

Table 6.1. Non-Monetary Evaluation

Plan	Non-Monetary Evaluation Ranking: 1 = most favorable, 8 = least favorable Non-Monetary factors										
	Environmental Impacts	Flexibility	Future Implications	Implementability	Public Acceptance	Reliability	Redundancy	Water Quality	Water Rights	Ranking Summation	Final Non-Monetary Ranking
Weight	1	3	2	1	2	3	3	2	1		
1A	1	8	4	1	7	8	8	8	5	6.50	8
1B	3	7	8	7	8	5	7	5	6	6.39	7
2A	7	6	6	5	3	2	3.5	2	8	4.25	4
2B	5	5	5	6	4	1	5	2	7	4.06	3
3A	6	4	1	4	2	4	3.5	2	2	3.14	2
3B	8	3	7	8	6	6	2	4	1	4.67	6
4A	4	2	2	2	1	3	1	6	4	2.56	1
4B	2	1	3	3	5	7	6	7	3	4.44	5

The highest ranking alternatives, from a non-monetary standpoint, are Alternatives 4A and 3A. Both of these alternatives add an additional raw water source to the City's water resources, in the form of groundwater. Alternative 3A also includes reverse osmosis treatment that will improve the overall water quality.

The two alternatives that do not add a supplemental raw water source finish seventh (Alternative 1B) and eighth (Alternative 1A), respectively. The low finish of Alternatives 1A and 1B are due to limited flexibility, redundancy, and public acceptance related to relying on Clinton Lake's limited yield and Foss existing capacity.

7.0 Plan Alternatives Assembly

The optimal plan for the City moving forward is the alternative that provides the best combination of monetary and non-monetary value. The monetary and non-monetary rankings have been compiled in Table 7.1. The "Ranking Summation" is simply the sum of the monetary and non-monetary ranks for each alternative. The final ranking is based on the "Ranking Summation," with the lowest number corresponding to the best alternative.

Table 7.1. Plan Alternatives Combined Rankings

Plan Alternative		Monetary	Non-Monetary	Ranking Summation	Final Ranking
1A	Do Nothing	1	8	9	4
1B	Expand Foss	4.5	7	11.5	8
2A	Foss Raw Terminal	6.5	4	10.5	T-5
2B	Foss Raw On-Demand	8	3	11	7
3A	Wash. Allu. Terminal	6.5	2	8.5	3
3B	Wash. Allu. In-town	4.5	6	10.5	T-5
4A	Rush Spr. Terminal	2	1	3	1
4B	Rush Spr. Direct Inj.	3	5	8	2

Alternative 4A finishes with the best combined ranking, which is a result of strong performance in both the monetary and non-monetary analysis. Alternative 4B finishes second in the combined rankings, and it is the only alternative (besides Alternative 4A) to finish in the top 5 in both categories. Alternative 3A finishes third in the final rankings, based primarily on a high score in the non-monetary rankings. Alternative 1A finishes fourth in the final rankings, with a combination of the best monetary ranking and worst non-monetary ranking.

Alternatives 2A and 3B tied for fifth place. Alternative 2B is the most expensive option, which caused it to finish second-to-last. From a combined ranking standpoint, Alternative 1B is the worst option due to relatively high cost and a poor non-monetary ranking resulting from a heavy reliance on finished water from Foss.

8.0 Recommendations

The City should consider Alternative 4A, while in the interim pursuing Alternative 1A. Alternative 4A provides a low-cost, redundant water supply source that fits seamlessly within the existing water treatment and distribution infrastructure. However, the strong monetary ranking of Alternative 4A is contingent on the water quality of the water in the Rush Springs Aquifer. The capital costs are low because advanced treatment is not necessary. The water quality of raw water from the Rush Springs Aquifer should be evaluated before a final decision is made about which alternative to pursue.

Alternative 1A received low score on the non-monetary evaluation due to questions about the reliability of Clinton Lake as a main water source for the City of Clinton during periods of prolonged drought. Clinton Lake is not currently providing water for the City, and will likely not be reliable during future drought years. A detailed yield and drought response study of Clinton Lake would provide insight into the safe yield of the reservoir, as well as the management practices that will optimize use of water from Clinton Lake while also maintaining reserve capacity for drought periods.

Alternative 1A is currently available to the City, and this alternative has been implemented since the Clinton WTP was taken off-line last year. The City should continue to utilize as much finished water as possible from Foss. Utilization of water from Foss will maximize recovery of Clinton Lake. Water in Clinton Lake should be conserved and used only to meet peak, summer demands until water levels in Clinton Lake have recovered.

Finally, the City should immediately pursue water conservation efforts and advertising in order to reduce demands to levels that can be met with the water resources available for 2011. The average finished water use during July 2011 was 3.29 MGD. Therefore, if Clinton Lake is still unreliable during the summer of 2012, the conservation target is an average of 1.1 MGD. Conservation strategies should be employed to protect and preserve public health, welfare, and safety; therefore, the priorities for use of finished water are domestic water use, sanitation, and fire protection. The City should pursue both internal and external conservation efforts to reduce demand to a sustainable level during the summer of 2012. The internal conservation efforts are as follows:

- Water supply auditing (production vs. consumption)
- In-network leak detection and repair
- Review of City government irrigation and water use strategies (street cleaning, vehicle washing, park fountains, public pools, etc.)

The City should adopt a council-approved Drought Emergency Response Plan as one of the external conservation efforts, which are outlined below:

- Multi-staged water use restrictions
- Formalized Drought Emergency Response Plan
- Public awareness drive
- Adoption of ordinances or regulations to implement the plan, including determination of fines for violations.

If the appropriate water conservation practices are implemented, the City should be able to obtain sufficient treated water from Foss to cover basic water demand needs during 2012.

9.0 Appendices

Appendix A. Population Growth Estimate

Appendix B. Calculation of Underutilization of Foss Reservoir

Appendix C. Limitations of Water Budget Analysis for Clinton Lake

Appendix D. Capital Cost Estimates

Appendix E. References

Appendix A. Population Growth Estimate

Appendix A. Population Growth Estimate

The population growth of the City of Clinton is fit well with the equation for declining growth phase, (A.1) (Chin, 2006).

(A.1) $P(t) = P_{sat} - (P_{sat} - P_0)e^{-k_3 t}$, where P_0 is the population at time $t = 0$.

Optimization of the two parameters, P_{sat} and k_3, in the equation was performed through a minimization of the root mean square (RMS) error between the population data and the estimated population calculated with the expression. The equation for the root mean square error is given in (A.2).

(A.2) $RMS\ Error = \sqrt{\frac{1}{n}\sum(P_{act} - P_{est})^2}$, where n is the number of data points with actual (P_{act}) and estimated (P_{est}) populations

The data from 1910 was selected as the starting point. Therefore, $P_0 = 2781$ and t in Equation (1) refers to the number of years after 1910. The pair of values that minimize the RMS error between the census data and the population model is $P_{sat} = 9505$ and $k_3 = 0.03467$. Application of these values to Equation (1) results in the population estimates presented in Table A.1.

Table A.1. Population Estimate for the City of Clinton

Year	Population
2010	9295
2015	9329
2020	9357
2025	9380
2030	9400
2035	9417
2040	9431
2045	9443
2050	9453
2055	9461
2060	9468

The estimated population for 2010, in Table A.1, does not match the 2010 U.S. Census value reported in Table 2.1 because the coefficients in the equations were selected to generate the best match to the data through the entire period, rather than solely minimizing the error for 2010 data/estimate pair. The comparison of the population projection to the population data is shown in Figure A.1.

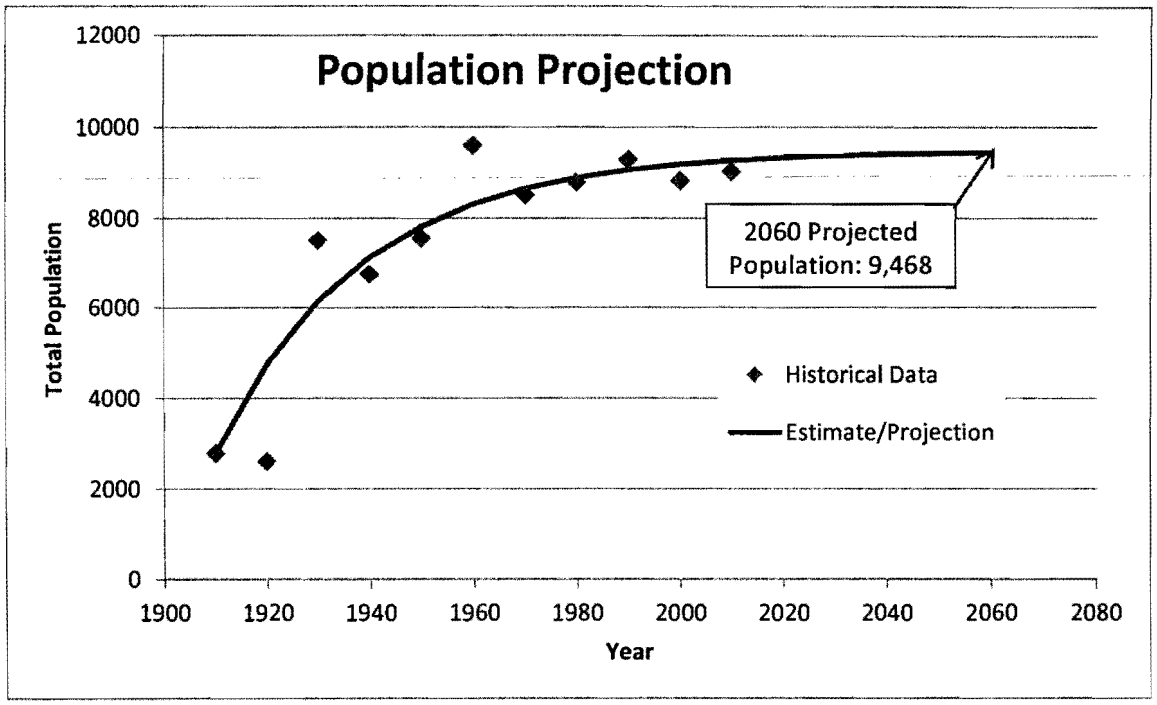


Figure A.1. Historical population for the City of Clinton, along with a population projection through the year 2060.

Appendix B. Calculation of Underutilization of Foss Reservoir

Appendix B. Calculation of Underutilization of Foss Reservoir

This section of the Appendix contains details on the methodology for calculation of the overutilization of Clinton Lake (or, underutilization of Foss Reservoir) in the two years preceding the summer of 2011 (i.e., July 2009 – June 2011). The steps for the analysis were as follows:

1. The total demand was calculated for each of the 24 months of the period of record, using (B.1).

   (B.1) $Q_T = \sum_{i=1}^{n}(Q_F^i + Q_C^i)$, where Q_T is the total monthly demand, Q_F^i is the amount of water used from Foss on day i, Q_C^i is the amount of water used from Clinton Lake on day i, and n is the number of days in the month.

2. The maximum amount of water that could be utilized from Foss was calculated as the lesser of a) the maximum allocation, 1.824 MGD, multiplied by the number of days in the month and b) the total monthly demand. The average daily demand in each month is shown in Figure B.1, along with the maximum Foss allocation. For example, during July 2009 (the first month shown), the value from Foss would be the maximum daily allocation multiplied by 31 days. However, for the period of October 2009 – April 2010, the average demand is less than the maximum Foss allocation, so the amount of water from Foss is set equal to the monthly demand.
3. The volume of water purchased from Foss was compared to the volume calculated in Step 2, which is the maximum amount that could have been purchased from Foss. The difference between the maximum ($Q_{F_{max}}$) and actual ($Q_{F_{act}}$)purchased amounts was computed as the Foss underutilization ($Q_{F_{under}}$), using (B.2).

   (B.2) $Q_{F_{under}} = Q_{F_{max}} - Q_{F_{act}}$

4. The amount Clinton Lake overutilization ($Q_{C_{over}}$) was set equal to the underutilization of water from Foss Reservoir, as shown in (B.3). This was done because the sum of the supply from Clinton Lake and Foss is the City demand. Thus, the underutilization from one source is equal to overutilization from another source.

   (B.3) $Q_{C_{over}} = Q_{F_{under}}$

5. The volume necessary from Clinton Lake ($Q_{C_{nec}}$) was computed as the difference between the total demand and the maximum volume from Foss, which was calculated in Step 2. The equation for this calculation is given as (B.4). Alternatively, the volume required from Clinton Lake is the difference between the Clinton Lake utilization and the overutilization of Clinton Lake.

   (B.4) $Q_{C_{nec}} = Q_T - Q_{F_{max}}$

6. The total volume of City demand, the total amount of Clinton Lake production, and the Clinton Lake production volume necessary, given maximum utilization of Foss supply, were each aggregated over the two-year period. The values are shown in Figure 3.2.

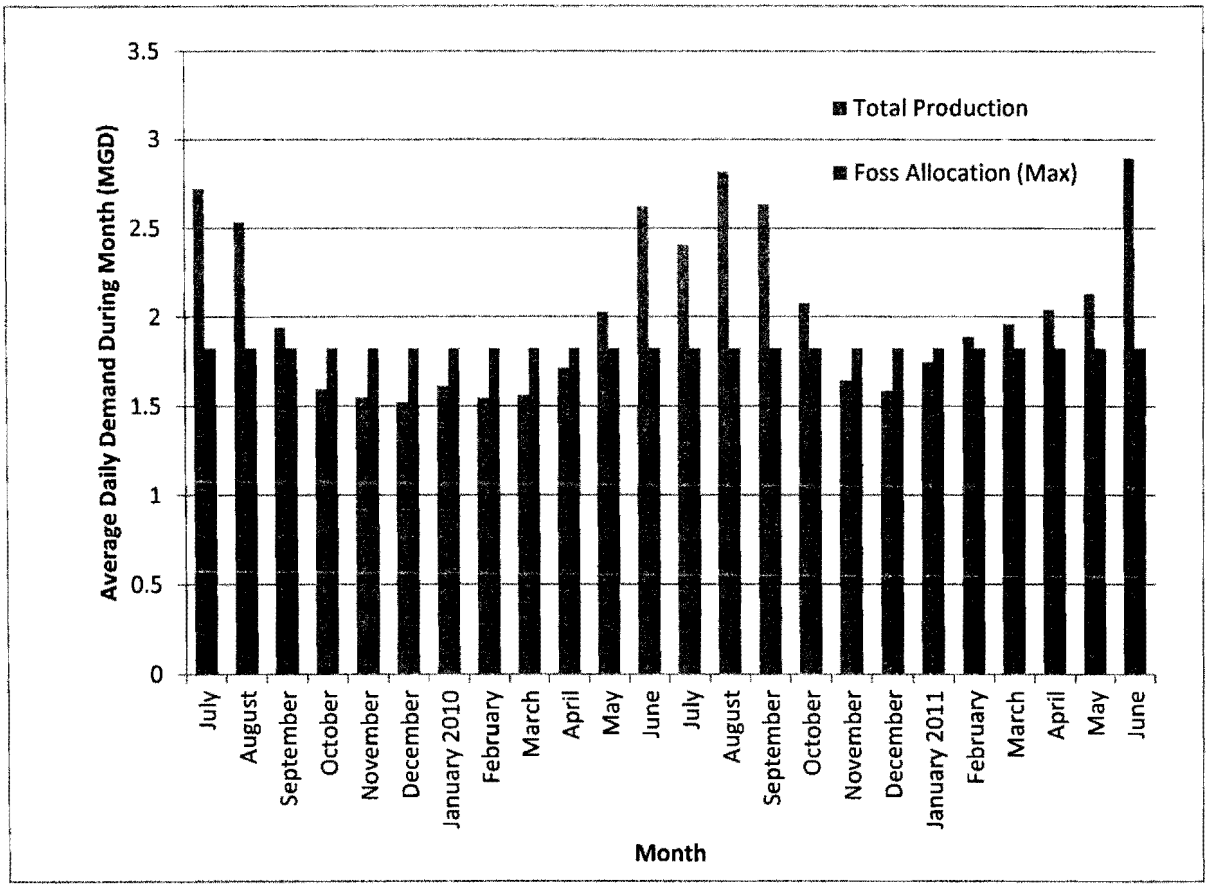


Figure B.1. Comparison of the City of Clinton's average daily demand on a monthly basis to the maximum treated water allocation from Foss Reservoir.

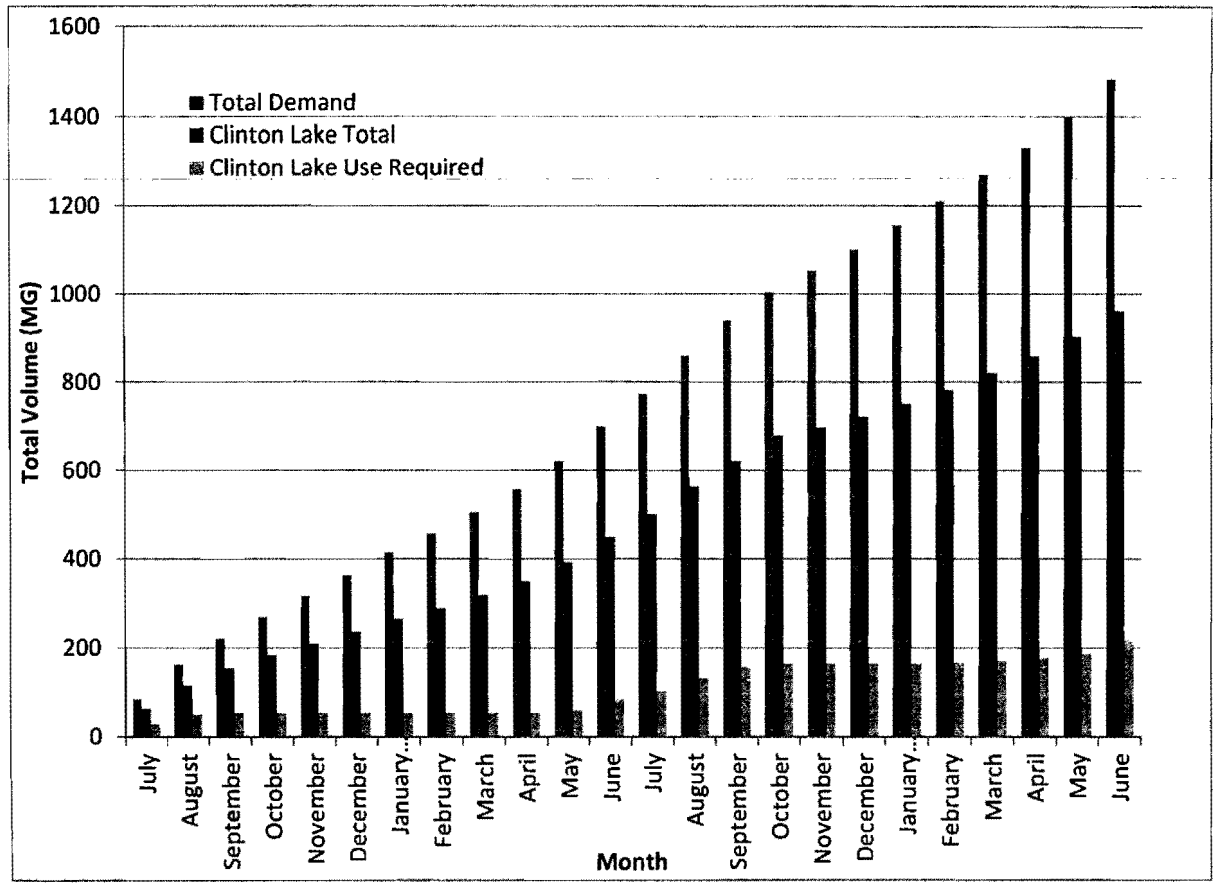


Figure B.2. Presentation of the aggregate total demand of the City of Clinton, total production from Clinton Lake, and Clinton Lake use required from July 2009 – June 2011. The difference between the total demand (blue) and the Clinton Lake total (red) is the treated supply volume from Foss, whereas the difference between the total demand and the Clinton Lake use required (greenish-gold) represents the total volume from Foss that could have been utilized.

Appendix C. Limitations of Water Budget Analysis for Clinton Lake

Appendix C. Limitations of Water Budget Analysis for Clinton Lake

C.1 Water Budget Introduction

Reservoirs are generally analyzed using the water budget (i.e., conservation of mass). The change in the amount of water in the reservoir (ΔS) is equal to the difference between inflows (I) and outflows (O), (C.1). The inflows include precipitation directly to the surface of the reservoir, direct run-off from surrounding areas, stream inflows, water conveyed to the reservoir from other locations (e.g., if raw water from Foss Reservoir was deposited in Clinton Lake), groundwater discharge from the ground into the water body, etc. For Clinton Lake, the inflows are precipitation, direct run-off, and stream inflows. Outflows for Clinton Lake are withdrawals for municipal use, evaporation from the water body surface, and infiltration. Some reservoirs also have outflows that are discharges to other surface water bodies, e.g., water is discharged from Foss Reservoir into the Washita River.

$$\textbf{(C.1)}\ \Delta S = I - 0$$

The numerical aspect of the analysis of reservoirs using a water budget approach is simple and straightforward. However, characterization of each of the different components can be somewhat difficult:

- Change in storage, ΔS, can be calculated in two ways:
    1. Directly using the change in volume of water in the reservoir, which can be computed based on the water level and reservoir geometry, but a volume vs. stage (i.e., water level) relationship must be developed based on the geometry.
    2. Using (C.1), which requires characterization of all of the components. The data availability of individual components is addressed in the following items.
- Inflows
    1. Precipitation can be estimated based on Mesonet data. However, the surface of the lake varies with water level, so computation of the volume of precipitation to the lake is reliant on an unknown quantity.
    2. Direct run-off is not measured and would have to be estimated using the catchment area for the lake and precipitation values.
    3. Stream inflows are not measured, so a model would have to be developed to characterize these inflows based on the available precipitation data.
- Outflow
    1. Withdrawals are recorded for reporting to OWRB, so this item is a known quantity.
    2. Infiltration from the lake into the groundwater is unknown. Infiltration can be estimated using soil properties, or through computations if all other quantities are known.
    3. Evaporation is similar to precipitation. The evaporation rates are recorded by the Oklahoma Mesonet. However, the total volume of evaporation is dependent on the surface area of the reservoir at a given time.

C.2 Limitations of Analysis of Clinton Lake Management

The main limitation of the analysis of the management of Clinton Lake is that precise quantification of the evaporative losses was not possible during this study. Prioritization of use of water from Foss Reservoir (over water from Clinton Lake) would result in additional evaporative losses that, ideally, should be accounted for in determining the overall impact of one management strategy versus another. The rationale for assuming more evaporation would occur, if use of Foss water is prioritized, is as follows:

- Prioritization of use of Foss water will result in less water use from Clinton Lake
- Lower withdrawal rates from Clinton Lake will result in more water being left in Clinton Lake
- A larger volume of water in Clinton Lake means the surface area of Clinton Lake will be greater
- The larger surface area of Clinton Lake is more surface area for water to evaporate from

However, the extra evaporation is related to the difference between the actual surface area of the lake and the surface area the lake would have if a different management strategy had been employed.

C.3 Recommendations for Data Collection at Clinton Lake

In the section C.1, the principles of application of a water budget to a reservoir were examined. Additionally, variables that are unknowns for Clinton Lake analyses were identified:

- Lake geometry and volume-stage relationship
- Stream flows and direct run-off
- Infiltration losses to groundwater

A simple data collection and monitoring protocol would provide significant data that would be invaluable in future studies:

1. Survey – Bathymetric (i.e., water depth) surveys can be conducted on bodies of water. However, the extremely low water levels in Clinton Lake make this an opportune time for normal surveying techniques to be employed. The volume-stage relationship can be developed from the survey data.
2. Water level monitoring – Daily recordings of water levels in Clinton Lake would be very useful in analysis of the reservoir. Monitoring of water level allows the change in volume in the reservoir to be computed directly (via the volume-stage relationship developed from the survey data). During dry periods when inflows are negligible, (C.1) could be used to estimate the infiltration rate. During wet periods, the stream flows and direct run-off could be estimated.

Over time, analysis of the data collected from the monitoring of water levels would provide all the variables needed to perform a yield study for the reservoir. However, in the short-term, analysis of the data collected would help calibrate models necessary to perform the yield study.

Appendix D. Capital Cost Estimates

Appendix D. Capital Cost Estimates

Table D.1. Capital Costs for Alternative 1B

Description	Quantity		Unit Cost	Item Total
Foss WTP Expansion				
Solids Contact Clarifiers	2	EA	$573,500	$1,147,000
Pretreatment Membrane Filtration	1	LS	$3,109,000	$3,109,000
Reverse Osmosis Membrane Filtration	1	LS	$3,030,000	$3,030,000
Chemical Systems	1	LS	$192,000	$192,000
Clearwell	1	LS	$594,000	$594,000
High Service Pumping	1	LS	$320,000	$320,000
Operations Building	1	LS	$900,000	$900,000
Site Civil (Grading/Paving)	1	LS	$465,000	$465,000
Site Civil (Yard Piping)	1	LS	$465,000	$465,000
Mechanical	1	LS	$929,000	$929,000
Electrical	1	LS	$1,858,000	$1,858,000
Instrumentation and Controls	1	LS	$1,858,000	$1,858,000
Raw Water Intake Structure	1	EA	$150,000	$150,000
24" Parallel Finished Water Transmission Line	80000	LF	$105	$8,400,000
			Subtotal	$23,417,000
			Survey (5%)	$1,170,850
			Engineering (15%)	$3,512,550
			Observation (10%)	$2,341,700
			Contingency (30%)	$9,132,630
			Total	**$39,574,730**

Table D.2. Capital Costs for Alternative 2A

Description	Quantity		Unit Cost	Item Total
Clinton WTP Upgrade				
Solids Contact Clarifier	1	EA	$637,000	$637,000
Rapid Sand Filters	2	EA	$300,000	$600,000
Reverse Osmosis Membrane Filtration	1	LS	$4,806,000	$4,806,000
Chemical Systems	1	LS	$231,000	$231,000
Operations Building	1	LS	$1,263,000	$1,263,000
Site Civil (Grading/Paving)	1	LS	$377,000	$377,000
Site Civil (Yard Piping)	1	LS	$377,000	$377,000
Mechanical	1	LS	$754,000	$754,000
Electrical	1	LS	$1,507,000	$1,507,000
Instrumentation and Controls	1	LS	$1,507,000	$1,507,000
Raw Water Intake Structure	1	EA	$150,000	$150,000
Exit Structure at Clinton Lake	1	EA	$50,000	$50,000
Open Trench 12-inch Line	50000	LF	$65	$3,250,000
Evaporation Ponds	40	AC	$80,000	$3,200,000
Site Electrical / I&C	1	EA	$50,000	$50,000
Telemetry	1	LS	$150,000	$150,000
Site Piping	0.75	MGD	$40,000	$30,000
Pump Station	0.75	MGD	$100,000	$75,000
			Subtotal	$19,014,000
			Survey (5%)	$950,700
			Engineering (15%)	$2,852,100
			Observation (10%)	$1,901,400
			Contingency (30%)	$7,415,460
			Total	**$32,133,660**

Table D.3. Capital Costs for Alternative 2B

Description	Quantity		Unit Cost	Item Total
New WTP at Clinton Lake				
Solids Contact Clarifier	1	EA	$637,000	$637,000
Rapid Sand Filters	2	EA	$300,000	$600,000
Reverse Osmosis Membrane Filtration	1	LS	$4,806,000	$4,806,000
Chemical Systems	1	LS	$231,000	$231,000
Operations Building	1	LS	$1,263,000	$1,263,000
Site Civil (Grading/Paving)	1	LS	$377,000	$377,000
Site Civil (Yard Piping)	1	LS	$377,000	$377,000
Mechanical	1	LS	$754,000	$754,000
Electrical	1	LS	$1,507,000	$1,507,000
Instrumentation and Controls	1	LS	$1,507,000	$1,507,000
Raw Water Intake Structure	1	EA	$150,000	$150,000
Open Trench 24-inch Line	50,000	LF	$105	$5,250,000
Evaporation Ponds	40	AC	$80,000	$3,200,000
Site Eletrical / I&C	1	EA	$50,000	$50,000
200,000 Gallon Storage Tank	1	EA	$225,000	$225,000
Telemetry	1	LS	$150,000	$150,000
Site Piping	3	MGD	$40,000	$120,000
Pump Station	3	MGD	$100,000	$300,000
			Subtotal	$21,504,000
			Survey (5%)	$1,075,200
			Engineering (15%)	$3,225,600
			Observation (10%)	$2,150,400
			Contingency (30%)	$8,386,560
			Total	**$36,341,760**

Table D.4. Capital Costs for Alternative 3A

Description	Quantity		Unit Cost	Item Total
Clinton WTP upgrade				
Solids Contact Clarifier	1	EA	$637,000	$637,000
Rapid Sand Filters	2	EA	$300,000	$600,000
Reverse Osmosis Membrane Filtration	1	LS	$4,806,000	$4,806,000
Chemical Systems	1	LS	$231,000	$231,000
Operations Building	1	LS	$1,263,000	$1,263,000
Site Civil (Grading/Paving)	1	LS	$377,000	$377,000
Site Civil (Yard Piping)	1	LS	$377,000	$377,000
Mechanical	1	LS	$754,000	$754,000
Electrical	1	LS	$1,507,000	$1,507,000
Instrumentation and Controls	1	LS	$1,507,000	$1,507,000
Exploratory Well Drilling and Testing	2	EA	$100,000	$200,000
Production Well Drilling (Pumps and Equipment)	2	EA	$250,000	$500,000
Well House (Complete)	2	EA	$75,000	$150,000
Exit Structure at Clinton Lake	2	EA	$50,000	$100,000
Telemetry	1	LS	$150,000	$150,000
Slip-Line Abandoned 16-inch line With 12-inch	50,000	LF	$55	$2,750,000
Evaporation Ponds	40	AC	$80,000	$3,200,000
			Subtotal	$19,109,000
			Survey (5%)	$955,450
			Engineering (15%)	$2,866,350
			Observation (10%)	$1,910,900
			Contingency (30%)	$7,452,510
			Total	**$32,294,210**

Table D.5. Capital Costs for Alternative 3B

Description	Quantity		Unit Cost	Item Total
New in-town WTP				
Solids Contact Clarifiers	2	EA	$573,500	$1,147,000
Pretreatment Membrane Filtration	1	LS	$3,109,000	$3,109,000
Reverse Osmosis Membrane Filtration	1	LS	$3,030,000	$3,030,000
Chemical Systems	1	LS	$192,000	$192,000
Clearwell	1	LS	$594,000	$594,000
High Service Pumping	1	LS	$320,000	$320,000
Operations Building	1	LS	$900,000	$900,000
Site Civil (Grading/Paving)	1	LS	$465,000	$465,000
Site Civil (Yard Piping)	1	LS	$465,000	$465,000
Mechanical	1	LS	$929,000	$929,000
Electrical	1	LS	$1,858,000	$1,858,000
Instrumentation and Controls	1	LS	$1,858,000	$1,858,000
Exploratory Well Drilling and Testing	6	EA	$100,000	$600,000
Production Well Drilling (Pumps and Equipment)	6	EA	$250,000	$1,500,000
Well Houses (Complete)	6	EA	$75,000	$450,000
Telemetry	1	LS	$250,000	$250,000
Open Trench 24-inch Line	15,000	LF	$105	$1,575,000
Evaporation Ponds	40	EA	$80,000	$3,200,000
			Subtotal	$22,442,000
			Survey (5%)	$1,122,100
			Engineering (15%)	$3,366,300
			Observation (10%)	$2,244,200
			Contingency (30%)	$8,752,380
			Total	**$37,926,980**

Table D.6. Capital Costs for Alternative 4A

Description	Quantity		Unit Cost	Item Total
Exploratory Well Drilling and Testing	5	EA	$100,000	$500,000
Production Well Drilling (Pumps and Equipment)	5	EA	$250,000	$1,250,000
Well House (Complete)	5	EA	$75,000	$375,000
Exit Structure at Clinton Lake	1	EA	$50,000	$50,000
Telemetry	1	LS	$250,000	$250,000
Slip-Line Abandoned 16-inch Line With 12-inch	65,000	LF	$55	$3,575,000
			Subtotal	$6,000,000
			Survey (5%)	$300,000
			Engineering (15%)	$900,000
			Observation (10%)	$600,000
			Contingency (30%)	$2,340,000
			Total	**$10,140,000**

Table D.7. Capital Costs for Alternative 4B

Description	Quantity		Unit Cost	Total
Wellhead Treatment	1	LS	$192,000	$192,000
Exploratory Well Drilling and Testing	18	EA	$100,000	$1,800,000
Production Well Drilling (Pumps and Equipment)	18	EA	$250,000	$4,500,000
Well Houses (Complete)	18	EA	$75,000	$1,350,000
Standpipe	1	EA	$95,000	$95,000
Telemetry	1	LS	$600,000	$600,000
Open Trench 24-inch Line	15,000	LF	$105	$1,575,000
			Subtotal	$10,112,000
			Survey (5%)	$505,600
			Engineering (15%)	$1,516,800
			Observation (10%)	$1,011,200
			Contingency (30%)	$3,943,680
			Total	**$17,089,280**

Appendix E. References

Appendix E. References

Abbott, M.M., Tortorelli, R.L., Becker, M.F., and Trombley, T.J., 2003, Overview of Water Resources in and Near Wichita and Affiliated Tribes Treaty Lands in Western Oklahoma: United States Geological Survey Water-Resources Investigations Report 03-4024, 57 p.

Becker, M.F., and Runkle, D.L., 1998, Hydrogeology, water quality, and geochemistry of the Rush Springs Aquifer, western Oklahoma: U.S. Geological Survey Water-Resources Investigations Report 98-4081, 37 p.

Chin, D.A., 2006, Water-Resources Engineering, Second Edition. Upper Saddle River, New Jersey: Pearson Prentice Hall.

Davis, L.V., 1955, Geology and groundwater resources of Grady and northern Stevens counties, Oklahoma: Oklahoma Geological Survey, Bulletin 73, 184 p.

Oklahoma Climatological Survey(OCS), 2011, Custer County Climate Summary: http//climate.ok.gov/county_climate/Products/QuickFacts/custer.pdf, Accessed 12/13/11.

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PUBLIC NOTICE OF A REGULAR MEETING
OF THE INDUSTRIAL AUTHORITY
TUESDAY, APRIL 17, 2012 AT 5:30 PM
CLINTON CITY HALL

AGENDA

Meeting status: Completed

1. Call to Order
2. Opening Prayer Father Rex Arnold, St. Mary's Catholic Church
3. Consent Agenda
    A. Consider Approval of Minutes of April 3, 2012
4. Action Items:
    A. Consider Real Estate Sales Agreement with Keaton Modi
    B. Consider Real Estate Sale Agreement with TAS Trucking
    C. Consider acceptance of property on South 5 th Street for future Fire Station site
5. City Manager's Report
6. Audience Participation
7. Adjournment

Filed this 13th Day of April, 2012. Posted on the bulletin board in the lobby of the Clinton City Hall on April 13, 2012 at 1:30 p.m.

IA040312

MINUTES OF THE CLINTON INDUSTRIAL AUTHORITY, APRIL 3, 2012

Minutes of a regular meeting of the Chairman and Trustees of the Clinton Industrial Authority of Clinton, Oklahoma, Custer County, held in the City Council Room, City Hall on Tuesday, April 3, 2012 at 5:30 p.m. A notice of this meeting with agenda was posted on the bulletin board in the lobby of Clinton City Hall on March 30, 2012.

Chairman Bryson called the meeting to order with the following present;

CHAIRMAN: Allen Bryson
TRUSTEES: Bob Marcy, Jason Hulin, Don Rodolph
ABSENT: Phyllis Smith
CITY MANAGER: Steve Hewitt
CITY CLERK: Lisa Anders
CITY TREASURER: Debra Blanchard
DEPUTY CLERK: Rhonda Williams
CITY ATTORNEY: Ryan Meacham
NEWS MEDIA: Gerald Green and Jarod Atha
OTHERS: David Crabtree, Arnold Adams, Jeremy Brush, L.R. Sights, Julie Menge, Narcy Smith, Matt Jett, Brian & Landon Aneshansley, Twila Brown, Kent Powell, Jimmy Johnson, Gene McCullough, Debbie & Nicole Bryson, Jeff Weiford and others.

Jarod Atha opened the meeting with prayer and Trustee Bob Marcy led the Pledge of Allegiance.

AGENDA ITEM NO. 3: CONSENT AGENDA

A. Minutes of March 20, 2012 meeting
B. Consider claims

Moved by Trustee Marcy and seconded by Trustee Hulin that Consent Agenda Item No. 3 (a-b) be approved.

Chairman put the motion to a roll call vote:

Aye: Marcy, Hulin, Rodolph, Bryson
Nay: None

Chairman declared the motion carried.

AGENDA ITEM NO. 4 ACTION ITEMS

4A. CONSIDER NEW MANAGEMENT PROPOSAL WITH CHAMBER OF COMMERCE FOR FRISCO CENTER OPERATIONS

City Manager Steve Hewitt introduced Chamber of Commerce Board members in attendance of the meeting. He said a proposal has been presented by the Chamber regarding the operations of the Frisco Center. He said it consolidates the responsibilities of the operation in an effort to be more efficient and he felt it would be to the city's benefit to consider the proposal.

Chamber President Julie Menge said she felt this is a good opportunity for the Chamber and the City

of Clinton.

Trustee Marcy asked what services the Chamber would be providing that they were not currently providing now.

Julie Menge said the Chamber would be responsible for the promotion and advertising of the Frisco Center. She said they would also be hiring additional part-time employees.

Matt Jett said the proposal does consolidate the operation of the Frisco Center. He said this would allow the Chamber to have all operations under one roof.

City Manager Steve Hewitt said that the maintenance would be conducted by a city staff member. He said the custodian would directly with the Chamber but would remain a city employee. He said the contract is proposed to go into effect July 1, 2012.

Motion was made by Trustee Rodolph and seconded by Trustee Hulin to approve the new management proposal with the Chamber of Commerce for Frisco Center operations effective July 1, 2012.

Chairman put the motion to a roll call vote:

Aye: Rodolph, Hulin, Marcy, Bryson
Nay: None

Chairman declared the motion carried.

4B. CONSIDER APPROVAL OF THE PRIVATE PLACEMENT MEMORANDUM REGARDING THE CONSTRUCTION OF A NEW FIRE STATION AND REHABILITATION OF THE EXISTING POLICE STATION

City Manager Steve Hewitt explained that the Private Placement Memorandum details the note with Oklahoma Bank & Trust for the funding of the construction of a new Fire Station and rehab of the existing Police Station.

Assistant City Attorney Ryan Meacham said this is the last document relating to the funding. He said at the time the document was prepared the cost of issuance had not been finalized. He said that $4,033 had been the cost of issuance and that Total line should read $4,004,033.00.

Trustee Marcy asked why this document is necessary.

Meacham said this document is required to be filed with the Secretary of State's Office pre state protocol.

Motion was made by Trustee Marcy and seconded by Trustee Hulin to approve the Private Placement Memorandum regarding the construction of a new Fire Station and rehabilitation of the existing Police Station.

Chairman put the motion to a roll call vote:

Aye: Marcy, Hulin, Rodolph, Bryson
Nay: None

Chairman declared the motion carried.

AGENDA ITEM NO .5: CITY MANAGER'S REPORT

City Manager Steve Hewitt expressed his appreciation to D'Lese Travis for the hard work and good job at the Frisco Center. He said this step is to make the operation of the Frisco Center more efficient. He said he would be working out the details of the agreement with the Chamber of Commerce.

AGENDA ITEM NO. 6: AUDIENCE PARTICIPATION

None

AGENDA ITEM NO. 7: ADJOURNMENT

Moved by Trustee Hulin and seconded by Trustee Marcy that the meeting adjourn.

Chairman put the motion to a roll call vote

Aye: Hulin, Marcy, Rodolph, Bryson
Nay: None

Chairman declared the meeting adjourned at 5:50 pm.

Clinton
Hub City of Western Oklahoma

Agenda Commentary

Item Title/ Subject: Keaton Modi, Land Sale for New Hotel

Staff Source: City Manager, Steve Hewitt

Date: April 12, 2012

History/Background Information:

Mr. Modi presented a proposal to Council hoping to purchase 9 acres for a new hotel. There was some question of the value of the land being valued more than the Authority has invested. Trustees agreed to allow staff to pursue value and a possible development agreement with Mr. Modi.

Subject Summary:

Staff had Jimmie Johnson Real Estate LLC provide a professional value (please see attached information) of the land. In his professional opinion the property is worth between $6500 and $8000 per acre, making it worth no more than $72,000.

Recommendation:

I have negotiated the following with Mr. Modi, pending the Trustees approval.

- Sale the full 9 acres for $71,000
- Construction of his hotel must begin within 18 months (or revert back to the Authority)
- Any future land portions (of the 9 acres) sold by Mr. Modi of the property, 50% of sale proceeds revert to the Authority.

If the Trustees agree to these terms, City Attorney will begin preparing sale contract with these provisions.

Again, this is a positive move for Clinton. Pays down the City's TIF investments quicker and adds sales tax, bed tax, and jobs to our community. I would recommend the agreement. I don't want to micro-manage this local investor, who wants to develop the area. I want to keep Clinton's reputation as "Pro-Business" and easy to work with. New develop helps all areas of our community, including the Hospital, Parks, Schools, etc. etc.

Price/Cost: $71,000 property reimbursement and future tax revenues.

Jimmie Johnson Real Estate LLC
115 N 5TH
Clinton OK 73601
Office- (580)-323-6470
Fax- (580)-323-0547

March 27, 2012

RE: 9 acres for the City of Clinton
Clinton OK 73601

To Steve Hewitt (City Manager):

Concerning the nine acres (mol) that the city owns on the corner of 28th and Chapman Road, this property in my professional opinion should be priced between $6500 and $8000 per acre.

My reasoning is as follows, only three pieces of ground have been sold any where around Clinton in the past ten years are, Tract 1 29.7 acres the city bought for $70000 in 2001 approximately $2350 per acre close to 183 with a rail spur.

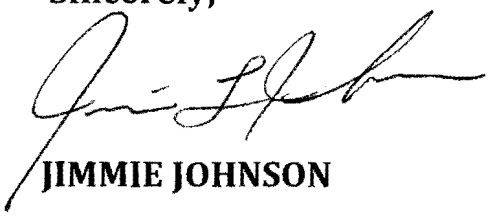
Tract 2 25.09 acres for $195,702 approximately $7800 per acre has much better I-40 access and is more visible.

Tract 3 38 acres sold for $300,768, approximately $7900 per acre. Once again it has much easier I-40 access and better visibility.

It is my opinion that considering the rail road on the east side and limited access the entire nine acres should go as one parcel. This is not an appraisal but a broker pricing opinion and if I were selling this piece of property for the reasons I have given I believe that the city is best served asking between $65000 and $72000 for this property.

One must also consider that the city is not in the retail land development business but in the creating jobs and adding to our tax base business.

Sincerely,



JIMMIE JOHNSON

JJ:tr

Clinton
Hub City of Western Oklahoma

Agenda Commentary

Item Title/ Subject: Sale of 5 acres located on Commerce Road

Staff Source: City Manager, Steve Hewitt

Date: April 12, 2012

History/Background Information:

Wheeler Lowry introduced me to TAS Trucking representatives. They want to expand business here in Clinton and build a facility before the end of the year. (see attached letter)

Subject Summary:

The 5 acres available were originally set aside for the Custer County Conservation. They were not able to build their facility at this location. This leaves the area open for development.

Recommendation:

Staff recommends the sale of the 5 acres for $10,000.

These proceeds will assist in the platting of the remaining area in the future. This also helps a local business.

Price/Cost: $10,000 sale price



April 11, 2012,

Clinton City Council & City Manager
Clinton, OK 73601

To Whom It May Concern:

My name is Tim A. Smith. I am the Owner/President of T.A.S. Trucking, Incorporated. We are an Oilfield Trucking company based out of Clinton, Oklahoma. We are requesting approval of the purchase of 5 acres of land from the City of Clinton in order to build a new facility to centralize our Administration and Maintenance operations.

We have been in business since 2004 and have operated from our Clinton location since inception. We currently employ approximately 50 individuals throughout our organization. The acquisition of this land and subsequent construction of our new facility will allow us to not only sustain our operations, but expand as well.

Upon execution of the purchase of this land, it is our intent to immediately commence construction of our facility. Our new facility will include multiple bays for repair services for our fleet, as well as housing our administration offices Our anticipated completion date is on or before December 31st, 2012.

In addition to the initial purchase, we would be interested in an option to purchase adjoining additional acreage in anticipation of future expansion.

You consideration in this matter is greatly appreciated.

Respectfully,

Tim A. Smith, President
T.A.S. Trucking, Inc
Clinton, OK

DARRELL McCARTHER
CERTIFICATE OF SURVEY

I, Darrell McCarther, a Registered Land Surveyor of the State of Oklahoma, hereby certify that I have m a careful survey of a tract of land described hereon below and that all the information shown on the p hereon below is true and correct and is strictly according to the field notes of said survey.

Signed and sealed this 1 day of MARCH, 2011

Darrell McCarther
Registered Professional Land Surveyor #1130

Subscribed and sworn to before me the undersigned, a Notary Public in and for the State of Oklahoma, this 1 da MARCH, 2011

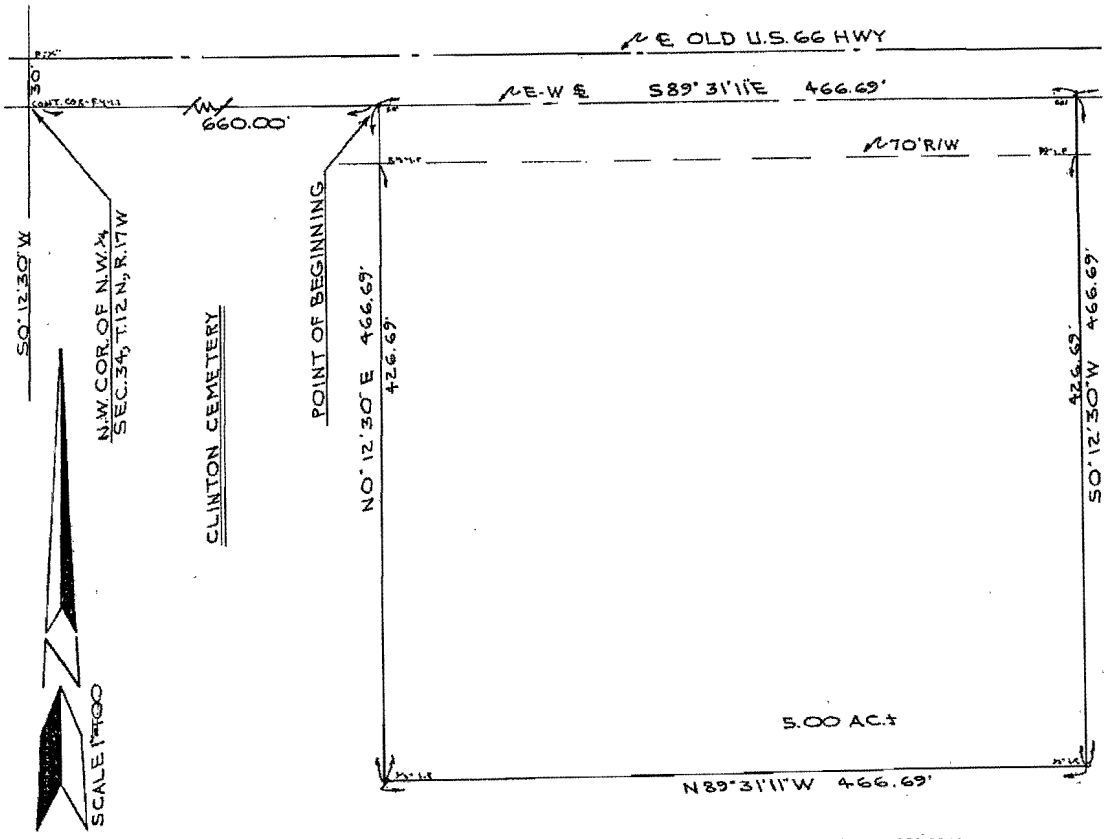
My Commission expires: 3-17-13

Carol M Cecil
Notary Public

LEGAL DESCRIPTION OF LAND SURVEYED

A tract of land lying in the NOrthwest Quarter (NW¼) of Section 34, Towns 12 Nporth, Range 17 West of the Indian Meridian, Custer County, Oklahoma, described by metes and bounds as follows: Beginning at a point 660.00 fee East of the Northwest Corner of said NW¼, said point being on the North l of said NW¼; thence S 89°31'11"E and along said North line a distance of 466.69 feet; thence S 0°12'30"E and parallel with the West line of said N a distance of 466.69 feet; thence N 89°31'11"W a distance of 466.69 feet; thence N 0°12'30"E and parallel with said West line a distance of 466.69 feet to the point of beginning, containing 5.00 acres more or less. (prepared by Darrell McCarther, RLS#1130).

Basis of Bearing- S 89°31'11"E on North line.



CERT. OF AUTH: 1686 EXPIRES 6-30-12
DARRELL McCARTHER SURVEYING
1113 Blackstone, Clinton, Oklahoma 73601
NOTE: THIS PLAT MEETS THE MIN. STANDARDS
LAST FIELD VISIT 3-1-11

Phone 323-0019

COP

Clinton
Hub City of Western Oklahoma

Agenda Commentary

Item Title/ Subject: Fire Station Property Transfer to the Industrial Authority

Staff Source: City Manager, Steve Hewitt

Date: April 13, 2012

History/Background Information:

City Council has purchased multiple properties for the new location of the Fire Department. OB&T has the financing for the new Fire Station, which is in the Industrial Authority.

Subject Summary:

The Fire Station Mortgage is in the Industrial Authority which requires the property to also be in the Industrial Authority. City Council needs to deed the property over to the Authority.

Recommendation:

Staff has confirmed this with the City Attorney. The document is not ready for the packet; City Attorney Meacham will have the docs ready for the meeting. This is required for the City to begin its draw of the funding.

Price/Cost:

PUBLIC NOTICE OF A REGULAR MEETING
OF THE CITY COUNCIL
TUESDAY, APRIL 17, 2012 AT 5:30 PM
CLINTON CITY HALL

AGENDA

Meeting status: Completed

1. Call to Order
2. Opening Prayer Father Rex Arnold, St. Mary's Catholic Church
3. Consent Agenda
    A. Consider Approval of Minutes on April 3, 2012
4. Action Items:
    A. Consider Proclamation for Knights of Columbus
    B. Consider acceptance of Clinic Property from the Clinton Hospital Authority
    C. Consider Quit Claim Deed to transfer property on South 5 th Street for future site of Fire Station to Clinton Industrial Authority
5. City Manager's Report
6. Audience Participation
7. Adjournment

Filed this 13th day of April, 2012. Posted on the bulletin board in the lobby of the Clinton City Hall on April 13, 2012 at 1:30 p.m.

RM040312

MINUTES OF THE CLINTON CITY COUNCIL
APRIL 3, 2012

Minutes of the regular meeting of the Mayor and City Council of the City of Clinton, Oklahoma, Custer County, held in the City Council Room, City Hall on Tuesday, April 3, 2012 at 5:30 p.m. A notice of this meeting with agenda was posted on the bulletin board in the lobby of Clinton City Hall on March 30, 2011.

Mayor Allen Bryson called the meeting to order with the following present;

MAYOR: Allen Bryson
COUNCIL: Don Rodolph, Bob Marcy, Jason Hulin
ABSENT: Phyllis Smith
CITY MANAGER: Steve Hewitt
CITY CLERK: Lisa Anders
CITY TREASURER: Debra Blanchard
DEPUTY CITY CLERK: Rhonda Williams
CITY ATTORNEY: Ryan Meacham
NEWS MEDIA: Gerald Green and Jarod Atha
OTHERS: Arnold Adams, Jeremy Brush, David Crabtree, L.R. Sights, Julie Menge, Patch McComas, Narcy Smith, Matt Jett, Jenny Newlik, Brian & Landon Aneshansley, Twila Brown, Kent Powell, Jimmy Johnson, Gene McCullough, Debbie & Nicole Bryson, Jeff Weiford, and others.

Jarod Atha opened the meeting with prayer and Councilman Bob Marcy led the Pledge of Allegiance.

AGENDA ITEM NO. 4: CONSENT AGENDA:

A. Minutes of Regular Meeting of March 20, 2012
B. Consider Claims

Moved by Councilman Hulin and seconded by Councilman Marcy, that Consent Agenda Item No. 3 (a-b) be approved.

Mayor put the motion to a roll call vote:

Aye: Hulin, Marcy, Rodolph, Bryson
Nay: None

Mayor declared the motion carried.

AGENDA ITEM NO. 4 ACTION ITEMS

4A. CONSIDER ORDINANCE NO. 831A REGARDING REPEALING OF ALL EXEMPTIONS ASSOCIATED WITH LODING TAX COLLECTIONS

City Manager Steve Hewitt said that he had received a request from City Treasurer Debra Blanchard to repeal all exemptions for Lodging Tax. He said other communities have already taken this step of eliminating exemptions.

City Treasurer Debra Blanchard explained the process of exemptions for lodging tax. She reported that there are eleven hotel/motels in Clinton. She said seven have been claiming exemptions. She said that over the past twelve months, $76,000.00 has been waived as lodging tax. She said a few of the hotel/motels do not understand the exemption process and the City has been working with them. She said they have also been exempting state, city and county taxes. She explained that with the approval of the ordinance the rate would be based on room rate with no exemptions.

City Manager Steve Hewitt said that the $76,000 could have been included in the budget for the Frisco Center had it not been waived. He said this could help with the need for funding technology needs at the Frisco Center.

Motion was made by Councilman Rodolph and seconded by Councilman Marcy to approve Ordinance No. 831A repealing all exemptions associated with Lodging Tax Collections effective May 1, 2012 with the emergency clause.

Mayor put the motion to a roll call vote:

Aye: Rodolph, Marcy, Hulin, Bryson
Nay: None

Mayor declared the motion carried.

5. CITY MANAGER'S REPORT

City Manager Steve Hewitt introduced Jeff Weiford of GLMV Architecture to give an update on the progress of the Fire and Police Station projects.

Mr. Weiford reported that the Notice to Proceed had been issued to Colony Construction for the rehab of the Police Station. He said the contract calls allows for 200 days of construction with the project set to be completed by November 19, 2012. He said the project would be in four phases to allow the daily operations of the police station during construction. He said the first progress meeting is scheduled for the first week in May. He also reported that a review of the 90% completed Fire Station plans were reviewed today. He said after the plans are finalized, bids would be ready in forty-five days.

City Manager Steve Hewitt said the final pieces of property should be completed in the next week and demolition of the structures would be scheduled at that time.

Mr. Weiford said if the Fire Station is bid in mid-May and construction time would be approximately one year, he estimated completion in July 2013.

AGENDA ITEM. 7 AUDIENCE PARTICIPATION

Mayor Bryson introduced Boy Scout Landon Aneshansley. Landon is working on obtaining Boy Scout badges and had been unable to attend the meeting previously with the troop.

AGENDA ITEM NO. 8: ADJOURNMENT

Moved by Councilman Hulin and seconded by Councilman Marcy to adjourn the meeting.

Mayor put the motion to a roll call vote:

Aye: Hulin, Marcy, Rodolph, Bryson
Nay: None

Mayor declared the meeting adjourned at 6:10 P.M.

PROCLAMATION

WHEREAS, the Knights of Columbus are conducting a statewide campaign to raise funds for the Center of Family Love for the adult developmentally disabled located in Okarche, Oklahoma and Western Oklahoma Special Olympics;

WHEREAS, this project is in its 35th year and has significantly helped in the establishment of the center as well as with the Western Oklahoma Special Olympics;

WHEREAS, St. Mary's Knights of Columbus Council 3101 would appreciate support to help make the 2012 campaign for developmentally disabled and Special Olympics a success by declaring May 1 through May 20, 2012 Knights of Columbus Tootsie Roll Fundraiser week for the developmentally disabled.

NOW, THEREFORE, I Allen Bryson, Mayor of Clinton, Oklahoma, do hereby proclaim the week of May 1, through May 20, 2012 Knights of Columbus Tootsie Roll Fundraiser week.

IT WITNESS WHEREOF, I have hereunto set my hand and caused the great seal of the City of Clinton, Oklahoma to be affixed.

_____

Allen Bryson, Mayor

ATTEST:

_____

Lisa Anders, City Clerk

Lisa,

I would like to request a Letter of Proclamation go before the City Council for the Knights of Columbus annual Tootsie Roll Fundraiser, for the period of 1 through 20 May. 2012. To help the Developmentally Challenged of Clinton and the State of Oklahoma by helping to fund the Special Olympians to the State Special Olympics Stillwater , and for those moving/living in the Center Family Love in Okarche, A Special Needs Facility. Last Year over $700 went to the Local Chapter in Clinton for the Special Olympics. Clinton has always been generous even during tough economic times Please authorize our Drive and let us help those who are in need of this assistance.

Thank You So Very Much

Michael Harris

Knights of Columbus

District Deputy