APPENDIX A – INITIAL SOURCE SCREENING WORKBOOKS

Appendix A – Initial Source Screening Workbooks

This appendix contains individual water supply source information used in preliminary screening. The following tables are located in this appendix.

- Individual supply source comparison
- Lake Thunderbird
- Garber-Wellington Aquifer Active wells with centralized treatment
- Garber-Wellington Aquifer Inactive wells with centralized treatment
- New Garber-Wellington Aquifer well with centralized treatment
- Purchase treated water from Oklahoma City (wholesale)
- Lake Thunderbird augmentation (indirect potable reuse)
- Additional Non-potable reuse
- Stormwater capture and reuse
- Canadian River diversion, option 1
- Canadian River diversion, option 2
- Canadian River diversion, option 3
- Lake Thunderbird spillage
- Groundwater recharge (indirect potable reuse)
- Co-owner with Oklahoma City for Southeast Oklahoma treated water
- Co-owner with Oklahoma City for Southeast Oklahoma raw water
- Scissortail Reservoir
- Parker Reservoir
- Kaw Lake
- Assumption Tables

Revision Date: 12/17/2012

(1)	(2)		(17)	(3)	(4)	(5)
Source Category	**Source Name**	**Source Description**	**Status**	**Firm Yield Available to Norman (mgd)**	**Firm yield available to Norman as % of 2060 demand**	Can the source meet at least 20% of Norman's 2060 demand (assuming pending permit amounts are granted)?
Existing	Lake Thunderbird	Project Description: Pump water from Lake Thunderbird and treat at Norman WTP.	Source automatically passes first round of screening and will be evaluated in the second round of screening.	6.10	21%	21%
Existing	Garber-Wellington Aquifer active wells with centralized treatment	Project Description: Pump water from existing, active Garber-Wellington Aquifer Wells to new north side WTP. This option assumes that CR(VI) regulations limit MCL to 10 ppb. 7 of the southern wells would be piped to the existing Norman WTP to be blended with treated surface water to reduce CR(VI) concentrations to less than 10 ppb.	Source automatically passes first round of screening and will be evaluated in the second round of screening.	6.00	21%	21%
Existing	Garber-Wellington Aquifer inactive wells with centralized treatment	Project Description: Pump water from existing, inactive Garber-Wellington Aquifer Wells directly into Norman water distribution system. Treatment for AS is addressed individually at each well. This option assumes that AS MCL is regulated at 10 ug/L and that CR(VI) concentration levels are not regulated.	Source automatically passes first round of screening and will be evaluated in the second round of screening.	2.09	7%	7%
Existing	One new Garber-Wellington Aquifer well with centralized treatment	Project Description: This option involves adding additional capacity to the well field. This option is characterized on a per well basis, assuming that a new well will not require arsenic treatment, but will be pumped to a new north side treatment plant to be treated for chromium VI and chlorination. This option assumes that CR(VI) regulations limit MCL to 10 ppb.	Source automatically passes first round of screening and will be evaluated in the second round of screening.	0.17	1%	1%
Existing	Purchase treated water from Oklahoma City (wholesale)	Project Description: Purchase bulk finished water from Oklahoma City through exisitng agreement.	Source automatically passes first round of screening and will be evaluated in the second round of screening.	12.00	41%	41%
New Local	Lake Thunderbird Augmentation		Awaiting the completion of the COMCD reuse study.	15.00	52%	52%
New Local	Non-potable Reuse		Draft complete for City review.	1.52	5%	5%
New Local	Stormwater Capture and Reuse		Draft complete for City review.	5.80	20%	20%
New Local	Canadian River Diversion Option #1		Draft complete for City review.	6.00	21%	21%
New Local	Canadian River Diversion Option #2		Draft complete for City review.	6.00	21%	21%
New Local	Canadian River Diversion Option #3		Draft complete for City review.	6.00	21%	21%
New Local	Lake Thunderbird Spillage		Draft complete for City review.	5.80	20%	20%
New Local	Groundwater Recharge		Draft complete for City review.	10.20	35%	35%
Outside	Co-owner with Oklahoma City for Southeast Oklahoma Treated Water		Draft complete for City review.	29.06	100%	100%

Outside	Co-owner with Oklahoma City for Southeast Oklahoma Raw Water		Draft complete for City review.	29.06	100%	100%
Outside	Scissortail Reservoir		Draft complete for City review.	19.87	68%	68%
Outside	Parker Reservoir		Draft complete for City review.	29.06	100%	100%
Outside	Kaw Lake		Draft complete for City review.	29.06	100%	100%

Revision Date: 12/17/2012

(1)	(2)	(6)	(7)		(8)	(9)
Source Category	**Source Name**	**Percent of excess/surplus water that Norman is proposing to take**	**Frequency of shortages in source category in basin of origin**	**Reliability Considerations**	Long-term reliability of the source (measured by projected frequency and magnitude of shortages in the source basin per the 2012 OCWP Regional Reports, or other acceptable measure)	**Notes on implementation status and issues**
Existing	Lake Thunderbird	7%	0%		4	
Existing	Garber-Wellington Aquifer active wells with centralized treatment	7%	0%		4	
Existing	Garber-Wellington Aquifer inactive wells with centralized treatment	2%	0%		3	
Existing	One new Garber-Wellington Aquifer well with centralized treatment	0%	0%		4	
Existing	Purchase treated water from Oklahoma City (wholesale)	N/A	N/A		4	
New Local	Lake Thunderbird Augmentation	17%	0%		5	
New Local	Non-potable Reuse	NA	NA	Source basin information less relevant, using treated effluent - 4	4	Traditional notpotable reuses, rules available, largely in our control to implement - 5
New Local	Stormwater Capture and Reuse	6%	21%	Source basin information less relevant - If you can capture, it is reliable, however if stormwater period is longer than what we modeled (3 years, not as rigorous as reservoir yield model) - 2	2	OWRB has not yet modeled or approved the capture of this stormwater that would otherwise flow into the Canadian River. - Unproven for DEQ and OWRB approvals - 2
New Local	Canadian River Diversion Option #1	7%	21%	1	1	Permitting issues, still needs more study, reservoir location - 2
New Local	Canadian River Diversion Option #2	7%	21%	1	1	Permitting issues, still needs more study, reservoir location - 2
New Local	Canadian River Diversion Option #3	7%	21%	1	1	Permitting issues, still needs more study, reservoir location - 2
New Local	Lake Thunderbird Spillage	NA	NA	Source basin information less relevant because this is not an interbasin transfer - but some similarity to reliability of stormwater - 2	2	OWRB is in the process of modeling the requested withdrawal to determine if there will be any downstream impacts. - Not studied, not permitted, no location for reservoir - 1
New Local	Groundwater Recharge	NA	NA	Source basin information less relevant, using treated effluent to recharge - 4	4	No groundwater model, no permitting process for ASR yet, fewer issues finding suitable location - 1
Outside	Co-owner with Oklahoma City for Southeast Oklahoma Treated Water	5%	0%	5	5	Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes - very well studied, actively being pursued - 4

Outside	Co-owner with Oklahoma City for Southeast Oklahoma Raw Water	5%	0%	5	5	Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes - very well studied, actively being pursued - 4
Outside	Scissortail Reservoir	14%	59%	Guernsey report shows firm yield available, however there are significant shortages in the basin - 3	3	Identified as a potential water supply reservoir by the OWRB in 1980; feasibility study completed in 2009. - 3
Outside	Parker Reservoir	11%	0%	Need more information on firm yield, but source basin information shows physical availability - 4	4	Identified as a potential water supply reservoir by the OWRB - 3
Outside	Kaw Lake	3%	0%	5	5	Already built reservoir - better than Scissortail or Parker for that reason - 4

Revision Date: 12/17/2012

(1)	(2)	(10)	(11)	(18)	(12)	(13)	(14)	(15)	(16)
Source Category	**Source Name**	Implementation status and issues (relative ranking, considering the degree to which project has been studied and permitted)	**Supply source unit cost ($/AFY)**	**Percentage from average**	Estimated capital, unit cost (dollars per af of firm delivery)	**Pipeline Unit Cost ($/in/LF)**	**Pump Station Unit Cost ($/hp)**	**Treatment Unit Cost ($/gal)**	**Source Development Unit Cost ($/AF)**
Existing	Lake Thunderbird	5	$ -	-	$ -	$ -	$ -	$ -	$ -
Existing	Garber-Wellington Aquifer active wells with centralized treatment	5	$ 8,379	28%	$ 8,379	$ -	$ -	$ 1.98	$ -
Existing	Garber-Wellington Aquifer inactive wells with centralized treatment	5	$ 4,330	14%	$ 4,330	$ -	$ -	$ 4,850,717.70	$ -
Existing	One new Garber-Wellington Aquifer well with centralized treatment	4	$ 11,966	40%	$ 11,966	$ -	$ -	$ 1.98	$ -
Existing	Purchase treated water from Oklahoma City (wholesale)	5	$ 2,095	7%	$ 2,095	$ 35.00	$ -	$ 1.20	$ 2,095
New Local	Lake Thunderbird Augmentation	3		0%	$ 8,191	$ 61.79	$ 3,700	$ 3.01	$ -
New Local	Non-potable Reuse	5	$ 22,041	74%	$ 22,000	$ 14.38	$ 3,700	$ 1.13	$ -
New Local	Stormwater Capture and Reuse	2	$ 188,486	629%	$ 188,000	$ 17.90	$ 3,700	$ 4.50	$ -
New Local	Canadian River Diversion Option #1	2	$ 39,302	131%	$ 39,000	$ 12.44	$ 3,700	$ 4.50	$ -
New Local	Canadian River Diversion Option #2	2	$ 43,698	146%	$ 44,000	$ 16.50	$ 3,700	$ 4.50	$ -
New Local	Canadian River Diversion Option #3	2	$ 41,440	138%	$ 41,000	$ 17.90	$ 3,700	$ 4.34	$ -
New Local	Lake Thunderbird Spillage	1	$ 78,503	262%	$ 79,000	$ 16.91	$ 3,700	$ 2.00	$ -
New Local	Groundwater Recharge	1	$ 31,843	106%	$ 32,000	$ 14.46	$ 3,700	$ 8.67	$ -
Outside	Co-owner with Oklahoma City for Southeast Oklahoma Treated Water	4	$ 12,499	42%	$ 12,000	$ 20.40	$ 3,700	$ 1.85	$ -

Outside	Co-owner with Oklahoma City for Southeast Oklahoma Raw Water	4	$ 13,538	45%	$ 14,000	$ 20.90	$ 3,700	$ 1.85	$ -
Outside	Scissortail Reservoir	3	$ 18,300	61%	$ 18,000	$ 17.00	$ 3,700	$ 2.00	$ 801
Outside	Parker Reservoir	3	$ 19,332	65%	$ 19,000	$ 17.00	$ 3,700	$ 2.00	$ 800
Outside	Kaw Lake	4	$ 18,621	62%	$ 19,000	$ 16.81	$ 3,700	$ 2.00	$ -

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - Existing
Source: Lake Thunderbird
Revision Date: 11/8/2012
Project Description: Pump water from Lake Thunderbird and treat at Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	21,600	MGD	19.27	COMCD Lake Thunderbird Conjunctive Yield.	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .
Firm yield already permitted to or designated for others	AFY	12,139	MGD	10.83		AFY	8,767	MGD	7.82	
Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
Firm yield available to Norman	AFY	9,461	MGD	8.44	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.
Firm yield available to Norman as % of 2060 demand	%	29%	%			%	21%	%		
Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No	No			
If yes, what is existing permitted amount?	AFY	N/A				AFY	N/A			
If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		62								
Excess/surplus water in source category in basin of origin	AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	9%					7%			
Frequency of shortages in source category in basin of origin		0%			BGW shortage.					
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	5,439								
Storage size overall	AF	105,838								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	105,838								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	24								
Pipeline Length	mi	7	ft	36,960						
Pipeline dedicated for Norman's use only?	Yes/ No	Yes								
Terminal storage available?	Yes/ No	No								
Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak								
Design flow rate for pipe	mgd									
Max velocity in pipeline	ft/sec									
Friction Loss (estimated)	ft	0								
Source elevation	ft MSL									
Norman terminus elevation	ft MSL									
TDH	ft	0								
Pump Station(s)										
Number of pump stations										
Capacity per pump station	mgd	184								
Horsepower	HP									
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	GW				SW/ GW	GW			
Major constituents of concern										
Treatment process						Conventional with softening				
Peak treatment capacity	mgd	16.04			Estimated using PF * amount available to Norman - check or replace with data from reference materials	mgd	11.59			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars									
Norman's portion of source capital costs	2012 dollars									
Construction Contingency Included? Amount?	Yes/ No	No	%							
Engineering Allowance included? Amount?	Yes/ No	No	%							
Easement acquisition allowance included? Amount	Yes/ No	No	%							
Source annual costs (total)		$ -								

2060 SWSP Source Category Local - Existing
Source Lake Thunderbird
Revision Date 11/8/2012
Project Description: Pump water from Lake Thunderbird and treat at Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Norman's portion of source annual costs		$ -								
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ -								
Norman's portion of raw water conveyance project	2012 dollars	$ -								
Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -						
Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -						
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars							
Construction Contingency Included? Amount?	Yes/ No	No	%							
Engineering Allowance included? Amount?	Yes/ No	No	%							
Easement acquisition allowance included? Amount?	Yes/ No	No	%							
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A								
Terminal Storage Cost (total)	2012 dollars	N/A								
Norman's portion of terminal storage project	2012 dollars	N/A								
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Treatment Costs										
Treatment Project Cost (total)	2012 dollars									
Norman's portion of treatment project	2012 dollars									
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Operation and Maintenance Costs										
Total Operation and Maintenance Costs	2012 dollars	$ 3,780,500			Based on FY 2011 actual costs. FY 2011 Lake Thunderbird withdrawal is 7.4 MGD average.	2012 dollars	$ 3,488,966			Based on FY 2011 actual costs. Adjusted to reflect 6.1 MGD average.
Variable Power Costs	2012 dollars	$ 258,500			Based on FY 2011 actual costs. FY 2011 Lake Thunderbird withdrawal is 7.4 MGD average. Includes costs for WTP, WTP Administration, and	2012 dollars	$ 213,088			Based on FY 2011 actual costs. Adjusted to reflect 6.1 MGD average. Includes costs for WTP, WTP Administration, and Laboratory.
Variable Chemical Costs	2012 dollars	$ 1,401,000			Based on FY 2011 actual costs. FY 2011 Lake Thunderbird withdrawal is 7.4 MGD average. Includes costs for WTP, WTP Administration, and	2012 dollars	$ 1,154,878			Based on FY 2011 actual costs. Adjusted to reflect 6.1 MGD average. Includes costs for WTP, WTP Administration, and Laboratory.
Fixed Labor Costs	2012 dollars	$ 996,000			Includes costs for WTP, WTP Administration, and Laboratory.	2012 dollars	$ 996,000			Includes costs for WTP, WTP Administration, and Laboratory.
Maintenance Costs	2012 dollars	$ 1,125,000			Includes costs for WTP, WTP Administration, and Laboratory.	2012 dollars	$ 1,125,000			Includes costs for WTP, WTP Administration, and Laboratory.
Unit cost from supply source										
Combined capital costs	2012 dollars	$ -				2012 dollars	$ -			
Supply source unit cost	$/AFY	$ -				$/AFY	$ -			
Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ -			
Pump station unit cost	$/hp	$ -				$/hp	$ -			
Treatment unit cost	$/gal	$ -				$/gal	$ -			
Operation and Maintenance Costs	$/mgd	$ 448,000				$/mgd	$ 572,000			
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - Existing

Source: Garber-Wellington Aquifer Active Wells with Centralized Treatment

Revision Date: 3/19/2013

Project Description: Pump water from existing, active Garber-Wellington Aquifer Wells to new north side WTP. This option assumes that CR(VI) regulations limit MCL to 10 ppb. 7 of the southern wells would be piped to the existing Norman WTP to be blended with treated surface water to reduce CR(VI) concentrations to less than 10 ppb.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	5,008	MGD	4.47	2011 actual usage. Used for cost purposes.	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
Firm yield available to Norman	AFY	5,008	MGD	4.47		AFY	6,721	MGD	6.0	
Firm yield available to Norman as % of 2060 demand	%	15%	%			%	21%	%		
Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
If yes, what is existing permitted amount?	AFY					AFY				
If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		62								
Excess/surplus water in source category in basin of origin	AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	5%					7%			
Frequency of shortages in source category in basin of origin		0%			BGW shortage. Also 0% in Bain 58					
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A								
Storage size overall	AF	-								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	-								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	Varies				in	13.12			Average Diameter
Pipeline Length	mi	Varies	ft	Varies		mi	34.2	ft	180,576	
Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
Terminal storage available?	Yes/ No	No				Yes/ No	No			
Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
Design flow rate for pipe	mgd	Varies				mgd	Varies			
Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
Friction Loss (estimated)	ft	N/A				ft	N/A			
Source elevation	ft MSL	Varies				ft MSL	Varies			
Norman terminus elevation	ft MSL	Varies				ft MSL	Varies			
TDH	ft	N/A				ft	N/A			
Pump Station(s)										
Number of pump stations		36								
Capacity per pump station	mgd	0.25								
Horsepower	HP									
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	GW				SW/ GW	GW			
Major constituents of concern										
Treatment process					Arsenic and chromium-6 removal plus chlorination					
Peak treatment capacity	mgd	0.0			Currently no treatment of well water.	mgd	7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ -								

2060 SWSP Source Category Local - Existing

Source Garber-Wellington Aquifer Active Wells with Centralized Treatment

Revision Date 3/19/2013

Project Description: Pump water from existing, active Garber-Wellington Aquifer Wells to new north side WTP. This option assumes that CR(VI) regulations limit MCL to 10 ppb. 7 of the southern wells would be piped to the existing Norman WTP to be blended with treated surface water to reduce CR(VI) concentrations to less than 10 ppb.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Norman's portion of source capital costs	2012 dollars	$ -								
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Source annual costs (total)		$ -								
Norman's portion of source annual costs		$ -								
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 41,464,988			
Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 41,464,988			
Raw water conveyance project capital cost (pipeline only)	Yes/ No	$ -	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
Raw water conveyance project capital cost (pump stations only)	Yes/ No	$ -	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
Raw water conveyance project capital cost (interconnections only)	Yes/ No	$ -	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	10.0%	
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A								
Terminal Storage Cost (total)	2012 dollars	$ -								
Norman's portion of terminal storage project	2012 dollars	$ -								
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 26,850,000			
Norman's portion of treatment project	2012 dollars	$ -				2012 dollars	$ 26,850,000			
Construction Contingency Included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	N/A	%			Yes/ No	Yes	%	5.0%	
Operation and Maintenance Costs										
Total Operation and Maintenance Costs	2012 dollars	$ 792,500			2011 actual costs	2012 dollars	$ 1,260,416			
Variable Power Costs	2012 dollars	$ 493,500			2011 actual costs based on 4.47 MGD average.	2012 dollars	$ 662,416			Modified to reflect 6.0 MGD average.
Variable Chemical Costs	2012 dollars	$ -				2012 dollars	$ -			
Fixed Labor Costs	2012 dollars	$ 101,000			2011 actual costs	2012 dollars	$ 202,000			
Maintenance Costs	2012 dollars	$ 198,000			2011 actual costs	2012 dollars	$ 396,000			
Unit cost from supply source										
Combined capital costs	2012 dollars	$ -				2012 dollars	$ 68,314,988			
Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,165			
Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ -			
Pump station unit cost	$/hp	$ -				$/hp	$ -			
Treatment unit cost	$/gal	$ -				$/gal	$ 3.58			
Operation and Maintenance Costs	$/mgd	$ 177,293.00			2011 actual costs based on 4.47 MGD average.	$/mgd	$ 210,069.00			Modified to reflect 6.0 MGD average.
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - Existing

Source: One new Garber-Wellington Aquifer well with centralized treatment

Revision Date: 3/19/2013

Project Description: This option involves adding additional capacity to the well field. This option is characterized on a per well basis, assuming that a new well will not require arsenic treatment, but will be pumped to a new north side treatment plant to be treated for chromium VI and chlorination. This option assumes that CR(VI) regulations limit MCL to 10 ppb.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	187	MGD	0.17	Firm yield for the addition of one well. Assumes average withdrawal rate of 116 GPM. (6.0 MGD / 36 active wells)					
Firm yield already permitted to or designated for others	AFY	-	MGD	0						
Pending water right request total amount	AFY		MGD	0						
Firm yield available to Norman	AFY	187	MGD	0.17						
Firm yield available to Norman as % of 2060 demand	%	1%	%							
Do existing water rights exceed firm yield?	Yes/ No									
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A					
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		62								
Excess/surplus water in source category in basin of origin	AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	0%					0%			
Frequency of shortages in source category in basin of origin		0%			BGW shortage. Also 0% in Bain 58					
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A								
Storage size overall	AF	-								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	-								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	12			Average Diameter					
Pipeline Length	mi	1.0	ft	5,280	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.					
Pipeline dedicated for Norman's use only?	Yes/ No	Yes								
Terminal storage available?	Yes/ No	No								
Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak								
Design flow rate for pipe	mgd	Varies								
Max velocity in pipeline	ft/sec	N/A								
Friction Loss (estimated)	ft	N/A								
Source elevation	ft MSL	Varies								
Norman terminus elevation	ft MSL	Varies								
TDH	ft	N/A								
Pump Station(s)										
Number of pump stations		1								
Capacity per pump station	mgd	0.25								
Horsepower	HP									
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	GW								
Major constituents of concern										
Treatment process	hromium-6 removal plus chlorination									
Peak treatment capacity	mgd	0.25			Treatment of Chromium VI					
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ 630,000			Exploratory Wells: $80,000 - $125,000 ea. (75% success rate); Water Wells: $195,000 - $320,000 ea; Well Houses: $95,000 - $130,000 ea; Borehole Pugging: $20,000 ea; Temporary Easement: $1,000 ea; Permanent Easesment: $10,000 ea. Additional 20% Implementation **Average Well Cost: $630,000**					
Norman's portion of source capital costs	2012 dollars	$ 630,000								

2060 SWSP Source Category: Local - Existing

Source: One new Garber-Wellington Aquifer well with centralized treatment

Revision Date: 3/19/2013

Project Description: This option involves adding additional capacity to the well field. This option is characterized on a per well basis, assuming that a new well will not require arsenic treatment, but will be pumped to a new north side treatment plant to be treated for chromium VI and chlorination. This option assumes that CR(VI) regulations limit MCL to 10 ppb.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	10.0%						
Source annual costs (total)		$ 50,400.00								
Norman's portion of source annual costs		$ 50,400.00								
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 1,108,927								
Norman's portion of raw water conveyance project	2012 dollars	$ 1,108,927								
Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 1,108,927	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.					
Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -						
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -						
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%						
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A								
Terminal Storage Cost (total)	2012 dollars	N/A								
Norman's portion of terminal storage project	2012 dollars	N/A								
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 895,000			Arsenic, Chromium VI Treatment and Chlorination only.					
Norman's portion of treatment project	2012 dollars	$ 895,000								
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%						
Operation and Maintenance Costs										
Total Operation and Maintenance Costs	2012 dollars	$ 18,768								
Variable Power Costs	2012 dollars	$ 18,768			Modified to reflect 0.17 MGD average.					
Variable Chemical Costs	2012 dollars	$ -								
Fixed Labor Costs	2012 dollars	$ -			Costs are accounted for in costs for active wells.					
Maintenance Costs	2012 dollars	$ -			Costs are accounted for in costs for active wells.					
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 2,633,927								
Supply source unit cost	$/AFY	$ 14,109								
Pipeline unit cost	$/in/LF	$ -								
Pump station unit cost	$/hp	$ -								
Treatment unit cost	$/gal	$ 3.58								
Operation and Maintenance Costs	$/mgd	$ 110,403			Modified to reflect 0.17 MGD average.					
Source development unit cost	$/AF	$ -								

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside

Source: Purchase Treated Water from Oklahoma City (wholesale)

Revision Date: 12/6/2012

Project Description: Purchase bulk finished water from Oklahoma City through exisitng agreement.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	6,726	MGD	6.0		AFY	13,451	MGD	12.0	
Firm yield already permitted to or designated for others		-	MGD	0			-	MGD	0	
Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
Firm yield available to Norman	AFY	6,726	MGD	6.0		AFY	13,451	MGD	12.0	
Firm yield available to Norman as % of 2060 demand	%	21%				%	41%			
Do existing water rights exceed firm yield?	Yes/ No	N/A				Yes/ No	N/A			
If yes, what is existing permitted amount?	AFY					AFY				
If yes, by how much do existing WR exceed firm yield?	AFY	0				AFY	0			
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		N/A								
Excess/surplus water in source category in basin of origin	AFY	N/A	MGD	N/A						
Percent of excess/surplus water that Norman is proposing to take	%	N/A								
Frequency of shortages in source category in basin of origin		N/A								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A								
Storage size overall	AF	N/A								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	N/A								
RAW WATER CONVEYANCE		Not Applicable			**Notes**					
Pipeline										
Pipeline Diameter	in	24				in	24			
Pipeline Length	mi	3.0	ft	15,840		mi	6.0	ft	31,680	Construction of an additional connection to the Oklahoma City
Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
Terminal storage available?	Yes/ No	No				Yes/ No	No			
Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
Design flow rate for pipe	mgd	6.0				mgd	12.0			
Max velocity in pipeline	ft/sec	2.95			Back pressure on system limits flow	ft/sec	2.95			Back pressure on system limits flow
Friction Loss (estimated)	ft	22			Estimated using Hazen-Williams equation and c=120	ft	22			Estimated using Hazen-Williams equation and c=120
Source elevation	ft MSL	N/A				ft MSL	N/A			
Norman terminus elevation	ft MSL	N/A				ft MSL	N/A			
TDH	ft	N/A				ft	N/A			
Pump Station(s)										
Number of pump stations		N/A					N/A			
Capacity per pump station	mgd	N/A				mgd	N/A			
Horsepower for Pump Station 1 - Intake to Terminal Storage	HP	N/A			Overall 65% wire to water efficiency assumed	HP	N/A			Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		-								
Horsepower	HP	0.0								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern		N/A			List or NA					
Treatment process					CAROLLO					
Peak treatment capacity	mgd	N/A			Estimated using PF * amount available to Norman - check or					
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ -								
Norman's portion of source capital costs	2012 dollars	$ -								
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Source annual costs (total)		$ -								
Norman's portion of source annual costs		$ -								
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 14,093,341			

2060 SWSP Source Category Outside

Source Purchase Treated Water from Oklahoma City (wholesale)

Revision Date 12/6/2012

Project Description: Purchase bulk finished water from Oklahoma City through exisitng agreement.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 14,093,341			
Raw water conveyance project capital cost (pipeline only)	Yes/ No	$ -	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 13,307,121	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and
Raw water conveyance project capital cost (pump stations only)	Yes/ No	$ -	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
Raw water conveyance project capital cost (interconnections only)	Yes/ No	$ -	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 786,220	Vault and flow meters
Construction Contingency Included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	N/A	%			Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	N/A	%			Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A								
Terminal Storage Area	AC	N/A								
Terminal Storage Cost (total)	2012 dollars	$ -								
Norman's portion of terminal storage project	2012 dollars	$ -								
Construction Contingency Included? Amount?	Yes/ No	N/A								
Engineering Allowance included? Amount?	Yes/ No	N/A								
Easement acquisition allowance included? Amount	Yes/ No	N/A								
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ -								
Norman's portion of treatment project	2012 dollars	$ -								
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount?	Yes/ No	N/A	%							
Unit cost from supply source										
Combined capital costs	2012 dollars	$ -				2012 dollars	$ 14,093,341			
Supply source unit cost	$/AFY	$ -				$/AFY	$ 2,095			
Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 35.00			
Pump station unit cost	$/hp	$ -				$/hp	$ -			
Water rate unit cost (Demand Service Contract)	$/1000 gal.	$ 4.66	2012 dollars	$ 10,214,000	Assumes Demand Service Plan with 2012 rates and 6.0 MGD usage.	$/1000 gal.	$ 4.66	2012 dollars	$ 20,397,680	Assumes Demand Service Plan with 2012 rates and 12.0 MGD usage.
Water rate unit cost (Take-or-Pay Contract)	$/1000 gal.	$ 2.10	2012 dollars	$ 4,608,000	Assumes Demand Service Plan with 2012 rates and 6.0 MGD usage. Peaking Capacity of 2.5 times	$/1000 gal.	$ 2.10	2012 dollars	$ 9,185,000	Assumes Demand Service Plan with 2012 rates and 12.0 MGD usage. Peaking Capacity of 2.5 times
Water rate unit cost (Service Availability Contract)	$/1000 gal.	$ 1.20	2012 dollars	$ 2,621,000	Assumes Service Availability Plan with 2012 rates and 6.0 MGD usage. No Peaking Capacity. Beyond Monthly Capacity Reservation, rates revert to Demand Service Rate, and	$/1000 gal.	$ 1.20	2012 dollars	$ 5,243,000	Assumes Service Availability Plan with 2012 rates and 12.0 MGD usage. No Peaking Capacity. Beyond Monthly Capacity Reservation, rates revert to Demand Service Rate, and
Operation and Maintenance Costs	$/mgd	$ -				$/mgd	$ -			
Source development unit cost	$/AF	$ -				$/AF	$ 2,095			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New
Source: Additional Non-potable Reuse
Revision Date: **9/18/2012**

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	19,056	MGD	17	17 mgd identified in *Phase II Wastewater Treatment Plant Improvements* Report (dated Nov 2011) as the build out of south basin					
Firm yield already permitted to or designated for others	AFY	1,681	MGD	1.5	Onsite reuse at WWTP (based on 4/2009 to 2/2010 plant data)					
Pending water right request total amount	AFY		MGD	0						
Firm yield available to Norman	AFY	17,375	MGD	15.5		AFY	1,700	MGD	1.52	Approximately 850 AFY of demand plus 850 AFY of excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe
Firm yield available to Norman as % of 2060 demand	%	53%	%			%	5%			
Do existing water rights exceed firm yield?	Yes/ No									
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A					
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		62								
Excess/surplus water in source category in basin of origin	AFY	283,461	MGD	252.88	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	6%				%	1%			
Frequency of shortages in source category in basin of origin		0%			BGW shortage.					
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A			Existing 500,000 gallon EWST will be converted for storage of reuse water					
Storage size overall	AF	N/A								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	#VALUE!								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in						42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm
Pipeline Length	mi						7.84	ft	41,400	
Pipeline dedicated for Norman's use only?	Yes/ No						Yes			
Terminal storage available?	Yes/ No						No			
Is pipeline designed to meet average demand or peak demand?	Yes/ No						peak			
Design flow rate for pipe	mgd						31.46			
Max velocity in pipeline	ft/sec						5.06			
Friction Loss (estimated)	ft						83			
Source elevation	ft MSL						1093			
Norman terminus elevation	ft MSL						Varies			Varies between 1090 and 1312
TDH	ft						Varies			
Pump Station(s)										
Number of pump stations							3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH
Capacity per pump station	mgd									
Horsepower	HP						800			
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								

2060 SWSP Source Category Local - New
Source Additional Non-potable Reuse
Revision Date 9/18/2012
Project Description: The use of effluent from existing WWTP for irrigation purposes.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Major constituents of concern										
Treatment process	WW treatment to meet Cat 2 reuse									
Peak treatment capacity	mgd	17			Assumed that onsite reuse may need to be treated to Cat II reuse also	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ -								
Norman's portion of source capital costs	2012 dollars	$ -								
Construction Contingency Included? Amount?	Yes/ No	No	%							
Engineering Allowance included? Amount?	Yes/ No	No	%							
Easement acquisition allowance included? Amount	Yes/ No	No	%							
Source annual costs (total)		$ -								
Norman's portion of source annual costs		$ -								
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	27,960,000			
Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 27,960,000			
Raw water conveyance project capital cost (pipeline only)	2012 dollars	No	2012 dollars	$ -		2012 dollars	Yes		$ 25,000,000	
Raw water conveyance project capital cost (pump stations only)	2012 dollars	No	2012 dollars	$ -		2012 dollars	Yes		$ 2,960,000	
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A						MG	6.5	
Terminal Storage Cost (total)	2012 dollars	$ -					$6,500,000.00			
Norman's portion of terminal storage project	2012 dollars	$ -					$6,500,000.00			
Construction Contingency Included? Amount?	Yes/ No	N/A								
Engineering Allowance included? Amount?	Yes/ No	N/A								
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 19,244,168			Designed for peak flow of 36.4 mgd - Costs for bulk liquid sodium hypochlorite (NaOCL) and effluent filtration (AquaDiamond ® surface) taken from *Phase II Wastewater Treatment Plant Improvements Report (dated Nov 2011)*	2012 dollars	$ 3,010,320			
Norman's portion of treatment project	2012 dollars	$ 19,244,168					$ 3,010,320			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	Direct costs pulled from Appendix A, 25% construction contingency and 20% engineering allowance added					
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	Direct costs pulled from Appendix A, 25% construction contingency and 20% engineering allowance added					
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%						
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 19,244,168				2012 dollars	$ 37,470,320			
Supply source unit cost	$/AFY	$ 1,108				$/AFY	$ 22,041			
Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 14.38			
Pump station unit cost	$/hp	$ -				$/hp	$ 3,700			
Treatment unit cost	$/gpd	$ 1.13				$/gpd	$ 1.13			Same unit cost used
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New

Source: Stormwater Capture and Reuse

Revision Date: 9/18/2012

Project Description: The capture and storage of stormwater from Basin 58 in a retention pond for reuse or augmentation purposes.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield						AFY	6,497	MGD	5.8	
Firm yield already permitted to or designated for others						AFY	-	MGD	0	
Pending water right request total amount						AFY		MGD	0	
Firm yield available to Norman						AFY	6,497	MGD	5.8	Stormwater diversions are capped at 1800 AF/mo.
Firm yield available to Norman as % of 2060 demand						%	20%	%		
Do existing water rights exceed firm yield?						Yes/ No	No			
If yes, what is existing permitted amount?						AFY	N/A			
If yes, by how much do existing WR exceed firm yield?						AFY	0			N/A
Source Basin Excess/Surplus Water - Carollo										
Basin of origin							58			
Excess/surplus water in source category in basin of origin						AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman
Percent of excess/surplus water that Norman is proposing to take						%	6%			
Frequency of shortages in source category in basin of origin							21%			BGW shortage.
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area						Ac	N/A			
Storage size overall						AF	N/A			
Portion of storage allocated to existing users						AF				
Portion of storage available for Norman						AF	N/A			
RAW WATER CONVEYANCE					**Notes**					
Pipeline										Pipeline (in.-ft.)
Pipeline Diameter						in	108			
Pipeline Length						mi	6.4	ft	33,776	3,647,808
Pipeline Diameter						in	108			
Pipeline Length						mi	7.8	ft	41,105	4,439,340
Pipeline Diameter						in	120			
Pipeline Length						mi	8.6	ft	45,188	5,422,560
Pipeline Diameter						in	108			
Pipeline Length						mi	10.0	ft	52,972	5,720,976
Pipeline Diameter						in	108			
Pipeline Length						mi	8.0	ft	42,418	4,581,144
Pipeline Diameter						in	108			
Pipeline Length						mi	9.9	ft	52,106	5,627,448
Pipeline Diameter						in	96			
Pipeline Length						mi	8.4	ft	44,089	4,232,544
Pipeline Diameter						in	96			
Pipeline Length						mi	10.6	ft	55,875	5,364,000
Pipeline Diameter						in	96			
Pipeline Length						mi	7.3	ft	38,698	3,715,008
Pipeline Diameter						in	108			
Pipeline Length						mi	8.7	ft	45,931	4,960,548
Pipeline Diameter						in	108			
Pipeline Length						mi	10.1	ft	53,438	5,771,304
Pipeline dedicated for Norman's use only?						Yes/ No	Yes			
Terminal storage available?						Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?						Yes/ No	average			
Design flow rate for pipe						mgd	303			
Max velocity in pipeline						ft/sec	5.97			
Friction Loss (estimated)						ft	45			
Source elevation						ft MSL	1115			Average Intake Elevation
Norman terminus elevation						ft MSL	1150			East Side Terminal Storage Reservoir
TDH						ft	80			
Pump Station(s)										
Number of pump stations							11			
Capacity per pump station						mgd	346			
Horsepower						HP	10,068			
Interconnections										
Number of interconnection points							0			
Capacity of interconnection point							0			
TREATMENT					**Notes**					
Source water type						SW/ GW	SW			
Major constituents of concern										
Treatment process							Blend of Conventional and RO (new WTP)			
Peak treatment capacity						mgd	11.02			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					

2060 SWSP Source Category Local - New
Source Stormwater Capture and Reuse
Revision Date 9/18/2012
Project Description: The capture and storage of stormwater from Basin 58 in a retention pond for reuse or augmentation purposes.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Description										OWRB has not yet modeled and approved the capture of this stormwater that would otherwise flow into the Canadian River.
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)						2012 dollars	$ 163,430,100			11 Intake structures totaling 3800 MGD intake.
Norman's portion of source capital costs						2012 dollars	$ 163,430,100			
Construction Contingency Included? Amount?						Yes/ No	yes	%		
Engineering Allowance included? Amount?						Yes/ No	yes	%		
Easement acquisition allowance included? Amount						Yes/ No	yes	%		
Source annual costs (total)										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)						2012 dollars	$ 994,482,927			
Norman's portion of raw water conveyance project						2012 dollars	$ 994,482,927			
Raw water conveyance project capital cost (pipeline only)						Yes/ No	Yes	2012 dollars	$ 957,233,007	
Raw water conveyance project capital cost (pump stations only)						Yes/ No	Yes	2012 dollars	$ 37,249,921	
Raw water conveyance project capital cost (interconnections only)						Yes/ No	No	2012 dollars		
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume						AF	3,100			
Terminal Storage Area						AC	194			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)						2012 dollars	$17,050,000			
Norman's portion of terminal storage project						2012 dollars	$17,050,000			
Construction Contingency Included? Amount?						Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)						2012 dollars	$ 49,590,000			
Norman's portion of treatment project						2012 dollars	$ 49,590,000			
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs						2012 dollars	$ 1,224,553,027			
Supply source unit cost						$/AFY	$ 188,486			
Pipeline unit cost						$/in/LF	$ 17.90			
Pump station unit cost						$/hp	$ 3,700			
Treatment unit cost						$/gpd	$ 4.50			
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost						$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New
Source: Canadian River Diversion Option #1
Revision Date: 9/18/2012
Project Description: Construction of Canadian River diversion and conveyance system to new West Side Reservoir. Construction of new WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	11,204	MGD	10.0	2040 Study estimate	AFY	6,721	MGD	6.0	Assumes that withdrawal will only occur when the Canadian River is flowing at >100 MGD. The firm yield was capped at 20% of Norman's projected 2060 demand in order to minimize pipeline diameter, terminal storage volume, and overall costs as much as possible.
Firm yield already permitted to or designated for others	AFY		MGD	0		AFY		MGD	0	OWRB is in the process of providing all current water rights for the Canadian River near Norman.
Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	OWRB is in the process of providing all pending water rights for the Canadian River near Norman.
Firm yield available to Norman	AFY	11,204	MGD	10.0		AFY	6,721	MGD	6.0	
Firm yield available to Norman as % of 2060 demand	%	34%				%	21%			
Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
If yes, what is existing permitted amount?	AFY					AFY				
If yes, by how much do existing WR exceed firm yield?	AFY	0				AFY	0			
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		58								
Excess/surplus water in source category in basin of origin	AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	11%				%	7%			
Frequency of shortages in source category in basin of origin		21%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A								
Storage size overall	AF	-								
Portion of storage allocated to existing users	AF	-								
Portion of storage available for Norman	AF	-								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	48				in	36			
Pipeline Length	mi	1	ft	5,280		mi	1	ft	5,280	
Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
Terminal storage available?	Yes/ No	Yes				Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average				Yes/ No	average			
Design flow rate for pipe	mgd	50				mgd	21.4			
Max velocity in pipeline	ft/sec	6.16				ft/sec	4.69			
Friction Loss (estimated)	ft	13			Estimated using Hazen-Williams equation and c=120	ft	11			Estimated using Hazen-Williams equation and c=120
Source elevation	ft MSL	1,135				ft MSL	1135			
Norman terminus elevation	ft MSL	1,150			West Side Terminal Storage Reservoir	ft MSL	1150			West Side Terminal Storage Reservoir
TDH	ft	28				ft	26			
Pump Station(s)										
Number of pump stations		1					1			
Capacity for Pump Station 1	mgd	50				mgd	21			
Horsepower for Pump Station 1 - Intake to Terminal Storage	HP	378			From intake structure to West Side Terminal Storage Reservoir. Overall 65% wire to water efficiency assumed	HP	150			From intake structure to West Side Terminal Storage Reservoir. Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		N/A								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW				SW/ GW	SW			
Major constituents of concern					List or NA					List or NA
Treatment process					CAROLLO		Blend of Conventional and RO (new WTP)			CAROLLO
Peak treatment capacity	mgd	19.0			Estimated using PF * amount available to Norman - check or replace with data from reference materials	mgd	11.4			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ 13,881,605			Water rights, intake structure, and pumping facility.	2012 dollars	$ 921,313			Low head intake structure only.

2060 SWSP Source Category Local - New
Source Canadian River Diversion Option #1
Revision Date 9/18/2012
Project Description: Construction of Canadian River diversion and conveyance system to new West Side Reservoir. Construction of new WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Norman's portion of source capital costs	2012 dollars	$ 13,881,605				2012 dollars	$ 921,313			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Source annual costs (total)										
Norman's portion of source annual costs										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 5,164,613			50 MGD Conveyance Capacity	2012 dollars	$ 2,920,682			Updated to reflect established conveyance unit costs.
Norman's portion of raw water conveyance project	2012 dollars	$ 5,164,613				2012 dollars	$ 2,920,682			
Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 5,136,210		Yes/ No	Yes	2012 dollars	$ 2,364,595	
Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 556,087	
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume	AF	8,400				AF	38000			
Terminal Storage Area	AC	540			Assumes 13.5' Operational depth and 16' Average depth	AC	2375			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	$28,104,784.66				2012 dollars	$209,000,000.00			
Norman's portion of terminal storage project	2012 dollars	$28,104,784.66				2012 dollars	$209,000,000.00			
Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%		Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%		Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%		Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 58,040,411			Membrane WTP with 22 MGD Treatment Capacity	2012 dollars	$ 51,300,000			Adjusted to match established treatment unit cost.
Norman's portion of treatment project	2012 dollars	$ 58,040,411				2012 dollars	$ 51,300,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 105,191,413				2012 dollars	$ 264,141,996			
Supply source unit cost	$/AFY	$ 9,389				$/AFY	$ 39,302			
Pipeline unit cost	$/in/LF	$ 20.27				$/in/LF	$ 12.44			
Pump station unit cost	$/hp	$ -				$/hp	$ 3,700			
Treatment unit cost	$/gpd	$ 3.05				$/gpd	$ 4.50			
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New
Source: Canadian River Diversion Option #2
Revision Date: 9/18/2012
Project Description: Construction of Canadian River diversion and conveyance system to new West Side Intermediate Storage Reservoir. Construction of conveyance system to new East Side Terminal Storage Reservoir. Expansion to the City of Norman's existing WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	11,204	MGD	10	2040 Study estimate	AFY	6,721	MGD	6.0	Assumes that withdrawal will only occur when the Canadian River is flowing at >100 MGD. The firm yield was capped at 20% of Norman's projected 2060 demand in order to minimize pipeline diameter, terminal storage volume, and overall costs as much as possible.
Firm yield already permitted to or designated for others	AFY		MGD	0		AFY		MGD	0	OWRB is in the process of providing all current water rights for the Canadian River near Norman.
Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	OWRB is in the process of providing all pending water rights for the Canadian River near Norman.
Firm yield available to Norman	AFY	11,204	MGD	10		AFY	6,721	MGD	6.0	
Firm yield available to Norman as % of 2060 demand	%	34%				%	21%			
Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
If yes, what is existing permitted amount?	AFY					AFY				
If yes, by how much do existing WR exceed firm yield?	AFY	0				AFY	0			
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		58								
Excess/surplus water in source category in basin of origin	AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	11%				%	7%			
Frequency of shortages in source category in basin of origin		21%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A								
Storage size overall	AF	-								
Portion of storage allocated to existing users	AF	-								
Portion of storage available for Norman	AF	-								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	48				in	36			
Pipeline Length	mi	1	ft	5,280		mi	1	ft	5,280	
Pipeline Diameter	in	24				in	24			
Pipeline Length	mi	12	ft	63,360		mi	12	ft	63,360	
Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
Terminal storage available?	Yes/ No	Yes				Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average				Yes/ No	average			
Design flow rate for pipe	mgd	50			50 MGD for 48" Pipeline; 10 MGD for 24" Pipeline - From 2040 Study	mgd	21.4			21.4 MGD for 36" Pipeline; 11.4 MGD (6.0 *1.9) for 24" Pipeline.
Max velocity in pipeline	ft/sec	6.16				ft/sec	4.69			
Friction Loss (estimated)	ft	13			Estimated using Hazen-Williams equation and c=120	ft	11			Estimated using Hazen-Williams equation and c=120
Source elevation	ft MSL	1,135				ft MSL	1135			
Norman terminus elevation	ft MSL	1,150			Elevation of both the West Intermediate Storage Reservoir and East Side Terminal Storage Reservoir	ft MSL	1150			Elevation of both the West Intermediate Storage Reservoir and East Side Terminal Storage Reservoir
TDH	ft	28				ft	26			
Pump Station(s)										
Number of pump stations		2					2			
Capacity Pump Station 1	mgd	50				mgd	21			
Capacity Pump Station 2	mgd	19				mgd	10			
Horsepower for Pump Station 1 - Intake to Terminal Storage	HP	378			From intake structure to West Side Intermediate storage reservoir. Overall 65% wire to water efficiency assumed	HP	150			From intake structure to West Side Intermediate storage reservoir. Overall 65% wire to water efficiency assumed
Horsepower for Pump Station 2 - Terminal Storage to WTP	HP	1,261			From West Side Intermediate Storage Reservoir to East Side Terminal Storage Reservoir. Overall 65% wire to water efficiency assumed	HP	664			From West Side Intermediate Storage Reservoir to East Side Terminal Storage Reservoir. Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		N/A								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW				SW/ GW	SW			
Major constituents of concern					List or NA					List or NA
Treatment process					CAROLLO					CAROLLO
Peak treatment capacity	mgd	19.0			Estimated using PF * amount available to Norman - check or replace with data from reference materials	mgd	11.4			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					

2060 SWSP Source Category Local - New
Source Canadian River Diversion Option #2
Revision Date 9/18/2012
Project Description: Construction of Canadian River diversion and conveyance system to new West Side Intermediate Storage Reservoir. Construction of conveyance system to new East Side Terminal Storage Reservoir. Expansion to the City of Norman's existing WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ 13,805,264			Water rights, intake structure, and pumping facility.	2012 dollars	$ 2,150,000			Low head intake structure only.
Norman's portion of source capital costs	2012 dollars	$ 13,805,264				2012 dollars	$ 2,150,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Source annual costs (total)										
Norman's portion of source annual costs										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 18,248,493			Includes 50 MGD Piping Capacity from Canadian River to West Side Reservoir and 10 MGD Piping Capacity from West Side Reservoir to East Side Reservoir.	2012 dollars	$ 31,237,853			Includes 21.4 MGD Piping Capacity from Canadian River to West Side Reservoir and 11.4 MGD (6.0 *1.9) Piping Capacity from West Side Reservoir to East Side Reservoir.
Norman's portion of raw water conveyance project	2012 dollars	$ 18,248,493				2012 dollars	$ 31,237,853			
Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 18,248,493		Yes/ No	Yes	2012 dollars	$ 28,226,120	
Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -	Cost included with intake structure.	Yes/ No	No	2012 dollars	$ 3,011,734	
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
West Terminal Storage Volume	AF	4,400				AF	34800			
West Terminal Storage Area	AC	320			Assumes 13.5' Operational depth and 16' Average depth	AC	2578			Assumes 13.5' Operational depth and 16' Average depth
East Terminal Storage Volume	AF	3,200				AF	3200			
East Terminal Storage Area	AC	200			Assumes 16' Operational depth and 20' Average depth	AC	200			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	$35,111,025.27				2012 dollars	$209,000,000.00			
Norman's portion of terminal storage project	2012 dollars	$35,111,025.27				2012 dollars	$209,000,000.00			
Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%		Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%		Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%		Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 51,253,401			Expansion to existing Norman WTP consisting of Membrane Treatment Train with 22 MGD Treatment	2012 dollars	$ 51,300,000			Adjusted to match projected treatment unit cost.
Norman's portion of treatment project	2012 dollars	$ 51,253,401				2012 dollars	$ 51,300,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 118,418,183				2012 dollars	$ 293,687,853			
Supply source unit cost	$/AFY	$ 10,569				$/AFY	$ 43,698			
Pipeline unit cost	$/in/LF	$ 72.00				$/in/LF	$ 16.50			
Pump station unit cost	$/hp	$ -				$/hp	$ 3,700			
Treatment unit cost	$/gpd	$ 2.70				$/gpd	$ 4.50			
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New

Source: Canadian River Diversion Option #3

Revision Date: 9/18/2012

Project Description: Construction of Canadian River diversions downstream of the City of Norman, alluvial wells, and conveyance infrastructure to a new East Side Terminal Storage Reservoir.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield						AFY	6,721	MGD	6.0	Assumes that withdrawal will only occur when the Canadian River is flowing at >100 MGD. The firm yield was capped at 20% of Norman's projected 2060 demand in order to minimize pipeline diameter, terminal storage volume, and overall costs as much as possible.
Firm yield already permitted to or designated for others										OWRB is in the process of providing all current water rights for the Canadian River near Norman.
Pending water right request total amount										OWRB is in the process of providing all pending water rights for the Canadian River near Norman.
Firm yield available to Norman						AFY	6,721	MGD	6.0	
Firm yield available to Norman as % of 2060 demand						%	21%			
Do existing water rights exceed firm yield?						Yes/ No				
If yes, what is existing permitted amount?						AFY				
If yes, by how much do existing WR exceed firm yield?						AFY	0			
Source Basin Excess/Surplus Water - Carollo										
Basin of origin							58			
Excess/surplus water in source category in basin of origin						AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman
Percent of excess/surplus water that Norman is proposing to take						%	7%			
Frequency of shortages in source category in basin of origin							21%			
RAW WATER SOURCE STORAGE					**Notes**					**Notes**
Max Surface Area						Ac	N/A			
Storage size overall						AF	-			
Portion of storage allocated to existing users						AF	-			
Portion of storage available for Norman						AF	-			
RAW WATER CONVEYANCE					**Notes**					**Notes**
Pipeline										
Pipeline Diameter						in	32			
Pipeline Length						mi	9	ft	47,520	
Pipeline dedicated for Norman's use only?						Yes/ No	Yes			
Terminal storage available?						Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?						Yes/ No	average			
Design flow rate for pipe						mgd	19.9			Design based on minimum available water (either from source or from excess in basin)
Max velocity in pipeline						ft/sec	5.51			
Friction Loss (estimated)						ft	152			Estimated using Hazen-Williams equation and c=120
Source elevation						ft MSL	1,070			
Norman terminus elevation						ft MSL	1,150			East Side Terminal Storage Reservoir Elevation
TDH						ft	232			
Pump Station(s)										
Number of pump stations							1			
Capacity per pump station						mgd	20			
Horsepower for Pump Station 1 - Intake to Terminal Storage						HP	1,246			Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points							0			
Capacity of interconnection point							N/A			
TREATMENT					**Notes**					**Notes**
Source water type						SW/ GW	SW			
Major constituents of concern										List or NA
Treatment process										CAROLLO
Peak treatment capacity						mgd	11.4			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					**Notes**
Description										
CAPITAL COSTS					**Notes**					**Notes**
Raw Water Source Storage Costs										

2060 SWSP Source Category Local - New

Source Canadian River Diversion Option #3

Revision Date 9/18/2012

Project Description: Construction of Canadian River diversions downstream of the City of Norman, alluvial wells, and conveyance infrastructure to a new East Side Terminal Storage Reservoir.

	Project as described in reference materials									
Source capital costs (total)						2012 dollars	$ 855,700			Low head intake structure only.
Norman's portion of source capital costs						2012 dollars	$ 855,700			
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes	%	20.0%	
Source annual costs (total)										
Norman's portion of source annual costs										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)						2012 dollars	$ 31,825,044			
Norman's portion of raw water conveyance project						2012 dollars	$ 31,825,044			
Raw water conveyance project capital cost (pipeline only)						Yes/ No	Yes	2012 dollars	$ 27,216,415	
Raw water conveyance project capital cost (pump stations only)						Yes/ No	No	2012 dollars	$ 4,608,629	
Raw water conveyance project capital cost (interconnections only)						Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume						AF	35,700			
Terminal Storage Area						AC	2,231			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)						2012 dollars	$196,350,000.00			
Norman's portion of terminal storage project						2012 dollars	$196,350,000.00			
Construction Contingency Included? Amount?						Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)						2012 dollars	$ 49,476,000			
Norman's portion of treatment project						2012 dollars	$ 49,476,000			
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?						Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs						2012 dollars	$ 278,506,744			
Supply source unit cost						$/AFY	$ 41,440			
Pipeline unit cost						$/in/LF	$ 17.90			
Pump station unit cost						$/hp	$ 3,700			
Treatment unit cost						$/gpd	$ 4.34			
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost						$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New

Source: Lake Thunderbird Spillage

Revision Date: 9/18/2012

Project Description: The capture and conveyance of controlled releases from Lake Thunderbird to a terminal storage reservoir located on the east side of the City of Norman.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	2,576	MGD	2.3		AFY	6,497	MGD	5.8	The firm yield was capped at 20% of Norman's projected 2060 demand in order to minimize pipeline diameter, terminal storage volume, and overall costs as much as possible.
Firm yield already permitted to or designated for others	AFY	-	MGD	0						
Pending water right request total amount	AFY		MGD	0	OWRB has stated that all additional withdrawals must be after the water has spilled over the dam, which eliminates the project decribed in Norman's 2040 SWSP as a possibility.					
Firm yield available to Norman	AFY	2,576	MGD	2.3		AFY	6,497	MGD	5.8	
Firm yield available to Norman as % of 2060 demand	%	8%				%	20%			
Do existing water rights exceed firm yield?	Yes/ No									According to historical data, 60% of months have had 0 MGD released.
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0								
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		62								
Excess/surplus water in source category in basin of origin	AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	3%				%	6%			
Frequency of shortages in source category in basin of origin		0%			BGW shortage.					
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A								
Storage size overall	AF	-								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	-								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	24				in	72			61% of months will yield 0 MGD, which leads to a relatively large conveyance system.
Pipeline Length	mi	3	ft	15,840		mi	7	ft	36,960	
Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
Terminal storage available?	Yes/ No	Yes				Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average				Yes/ No	average			
Design flow rate for pipe	mgd	10			From 2040 Surplus Analysis. Table 3-25.	mgd	107.1			Design flow rate is based on peak flow characteristics of source.
Max velocity in pipeline	ft/sec	4.92				ft/sec	5.86			
Friction Loss (estimated)	ft	58			Estimated using Hazen-Williams equation and c=120	ft	52			Estimated using Hazen-Williams equation and c=120
Source elevation	ft MSL	1037			Lake Thunderbird Conservation Elevation	ft MSL	960			Lake Thunderbird Outlet Elevation
Norman terminus elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation
TDH	ft	171				ft	242			
Pump Station(s)										
Number of pump stations		1			Number of pump stations		1			
Capacity for Pump Station 1	mgd	10			Capacity for Pump Station 1	mgd	107.1			
Horsepower for Pump Station 1 - Intake to Terminal Storage	HP	461			Overall 65% wire to water efficiency assumed	HP	6,994			Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern					List or NA					
Treatment process					CAROLLO		Conventional with softening			
Peak treatment capacity	mgd	4.37			Estimated using PF * amount available to Norman - check or replace with data from reference materials	mgd	11.0			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					
Description										OWRB is in the process of modeling the requested withdrawal to determine if there will be any downstream impacts.
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										

2060 SWSP Source Category Local - New
Source Lake Thunderbird Spillage
Revision Date 9/18/2012
Project Description: The capture and conveyance of controlled releases from Lake Thunderbird to a terminal storage reservoir located on the east side of the City of Norman.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Source capital costs (total)	2012 dollars	$ 2,049,450			Intake system.	2012 dollars	$ 4,606,567			Intake structure only.
Norman's portion of source capital costs	2012 dollars	$ 2,049,450				2012 dollars	$ 4,606,567			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Source annual costs (total)										
Norman's portion of source annual costs										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 8,134,719				2012 dollars	$ 70,873,664			
Norman's portion of raw water conveyance project	2012 dollars	$ 8,134,719				2012 dollars	$ 70,873,664			
Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ 6,427,745		Yes/ No	Yes	2012 dollars	$ 44,994,217	
Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ 1,706,974		Yes/ No	Yes	2012 dollars	$ 25,879,447	
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume	AF	3200				AF	75,000			Terminal storage is sized to provide the estimated yield. 61% of months will yield 0 MGD, which leads to a relatively large terminal storage reservoir.
Terminal Storage Area	AC	200			Assumes 16' Operational depth and 20' Average depth	AC	4,688			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	$15,936,519.60			Estimate for Lake Campbell (East Side Terminal Storage Reservoir) from 2040 Study. Table 3-28.	2012 dollars	$412,500,000			
Norman's portion of terminal storage project	2012 dollars	$15,936,519.60				2012 dollars	$412,500,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	20.0%		Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 8,740,000				2012 dollars	$ 22,040,000			
Norman's portion of treatment project	2012 dollars	$ 8,740,000				2012 dollars	$ 22,040,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 34,860,688				2012 dollars	$ 510,020,231			
Supply source unit cost	$/AFY	$ 13,533				$/AFY	$ 78,503			
Pipeline unit cost	$/in/LF	$ 16.91				$/in/LF	$ 16.91			
Pump station unit cost	$/hp	$ 3,700				$/hp	$ 3,700			
Treatment unit cost	$/gal	$ 2.00				$/gal	$ 2.00			
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Local - New

Source: Groundwater Recharge

Revision Date: 9/18/2012

Project Description: Aquifer recharge through existing wells using source waters that are intermittently available or intermittently in excess of demand.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield						AFY	11,431	MGD	10.2	17 mgd identified in *Phase II Wastewater Treatment Plant Improvements* Report (dated Nov 2011) as the build out of south basin. Recapture rate assumed to be 60%.
Firm yield already permitted to or designated for others						AFY	-	MGD	0	
Pending water right request total amount						AFY		MGD	0	
Firm yield available to Norman						AFY	11,431	MGD	10.2	
Firm yield available to Norman as % of 2060 demand						%	35%	%		
Do existing water rights exceed firm yield?						Yes/ No	No			
If yes, what is existing permitted amount?						AFY	N/A			
If yes, by how much do existing WR exceed firm yield?						AFY	0			N/A
Source Basin Excess/Surplus Water - Carollo										
Basin of origin							62			
Excess/surplus water in source category in basin of origin						AFY	101,062	MGD	90.16	Excess exceeds amount of yield available to Norman
Percent of excess/surplus water that Norman is proposing to take						%	11%			
Frequency of shortages in source category in basin of origin							0%			BGW shortage.
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area						Ac	N/A			
Storage size overall						AF	-			
Portion of storage allocated to existing users						AF				
Portion of storage available for Norman						AF	-			
RAW WATER CONVEYANCE					**Notes**					
Pipeline										Pipeline (in.-ft.)
Pipeline Diameter						in	24			
Pipeline Length						mi	26.0	ft	137,500	3,300,000
Pipeline Diameter						in	20			
Pipeline Length						mi	3.7	ft	19,600	392,000
Pipeline Diameter						in	16			
Pipeline Length						mi	8.4	ft	44,400	710,400
Pipeline Diameter						in	12			
Pipeline Length						mi	17.8	ft	93,800	1,125,600
Pipeline Diameter						in	8			
Pipeline Length						mi	33.3	ft	175,800	1,406,400
Pipeline dedicated for Norman's use only?						Yes/ No	Yes			
Terminal storage available?						Yes/ No	No			
Is pipeline designed to meet average demand or peak demand?						Yes/ No	peak			
Design flow rate for pipe						mgd	10.8			
Max velocity in pipeline						ft/sec	5.3			
Friction Loss (estimated)						ft	574			
Source elevation						ft MSL	1100			WWTP Elevation
Norman terminus elevation						ft MSL	1150			Approximate GW Well Surface Elevation
TDH						ft	624			
Pump Station(s)										
Number of primary pump stations							3			
Capacity per primary pump stations						mgd	10.8			
Horsepower						HP	1,813			
Number of well head pump stations							40			
Capacity per well head pump station						mgd	0.25			
Horsepower						HP	20			
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type						SW/ GW	SW			
Major constituents of concern										
WWTP Treatment process							Single pass RO with UV disinfection			Prior to recharge - single pass RO with UV disinfection;
WWTP Peak treatment capacity						mgd	17			For recharge, treat average supply only. 17 mgd (no PF)
WTP Treatment process										Chlorination prior to distribution.

2060 SWSP Source Category Local - New
Source Groundwater Recharge
Revision Date 9/18/2012
Project Description: Aquifer recharge through existing wells using source waters that are intermittently available or intermittently in excess of demand.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
WTP Peak treatment capacity						mgd	19.38			For distribution, treat peak demand. 10.2 mgd * 1.9.
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)						2012 dollars	$ 93,240,000			Assuming an average injection rate of 100 GPM, we need 120 new wells to inject 17 MGD. Assuming an average withdrawl rate of 170 GPM, we need an additional 28 new wells to withdraw a total of 16.2 MGD (6 MGD firm yield, 9.3 MGD max yield: 10.2 MGD + 6.0 MGD - 9.3 MGD = 6.9 MGD remaining / 170 GPM = 28 new wells).
Norman's portion of source capital costs						2012 dollars	$ 93,240,000			Exploratory Wells: $80,000 - $125,000 ea (75% success rate); Water Wells: $195,000 - $320,000 ea; Well Houses: $95,000 - $130,000 ea; Borehole Pugging: $20,000 ea; Temporary Easement: $1,000 ea; Permanent Easesment: $10,000 ea. Additional 20% Implementation **Average Well Cost: $630,000**
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20%	
Easement acquisition allowance included? Amount						Yes/ No	Yes	%	20%	
Source annual costs (total)						2012 dollars	$ -			
Norman's portion of source annual costs						2012 dollars	$ -			
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)						2012 dollars	$ 123,389,110			
Norman's portion of raw water conveyance project						2012 dollars	$ 123,389,110			
Raw water conveyance project capital cost (pipeline only)						Yes/ No	Yes	2012 dollars	$ 100,274,891	
Raw water conveyance project capital cost (pump stations only)						Yes/ No	Yes	2012 dollars	$ 23,114,219	
Raw water conveyance project capital cost (interconnections only)						Yes/ No	No	2012 dollars	$ -	
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes	%	20.0%	
Terminal Storage Costs										
Terminal Storage Volume						AF	N/A			
Terminal Storage Area						AC	N/A			
Terminal Storage Cost (total)						2012 dollars	$ -			
Norman's portion of terminal storage project						2012 dollars	$ -			
Construction Contingency Included? Amount?						Yes/ No		%		
Engineering Allowance included? Amount?						Yes/ No		%		
Easement acquisition allowance included? Amount						Yes/ No		%		
Treatment Costs										
Treatment Project Cost (total)						2012 dollars	$ 147,356,000			There is the potential that Arsenic and Chromium treatment would be needed also. However, this treatment has not been accounted for in the costs.
Norman's portion of treatment project						2012 dollars	$ 147,356,000			Single pass RO with UV disinfection prior to injection and chlorination when withdrawn, includes concentrate injection wells for disposal
Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount						Yes/ No	Yes	%	5.0%	
Unit cost from supply source										

2060 SWSP Source Category Local - New

Source Groundwater Recharge

Revision Date 9/18/2012

Project Description: Aquifer recharge through existing wells using source waters that are intermittently available or intermittently in excess of demand.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Combined capital costs						2012 dollars	$ 363,985,110			
Supply source unit cost						$/AFY	$ 31,843			
Pipeline unit cost						$/in/LF	$ 14.46			
Pump station unit cost						$/hp	$ 3,700			
Treatment unit cost						$/gpd	$ 8.67			Single pass RO with UV disinfection; chlorination
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost						$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside
Source: Co-owner with Oklahoma City for Southeast Oklahoma Treated Water
Revision Date: 9/7/2012
Project Description: Purchase bulk water from SE Oklahoma; raw water is conveyed from southeast Oklahoma via the existing Atoka Pipeline and a new, parallel Atoka Pipeline to Stanley Draper Lake, treated at a new regional Draper WTP, and conveyed to Norman as finished water. Withdrawal is through existing Oklahoma City connection location, but additional meter connections will be required.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	303,467	MGD	270.72	Includes pending Lake Sardis permit of 80,000 AFY					
Firm yield already permitted to or designated for others		353,029	MGD	314.94	Includes Norman's allocation.					
Pending water right request total amount	AFY		MGD	0						
Firm yield available to Norman	AFY	26,514	MGD	23.67	Norman's allocation in the current study was 23.67 MGD.	AFY	32,551	MGD	29.06	Additional water (pipeline capacity) available if water rights can be obtained in the future.
Firm yield available to Norman as % of 2060 demand	%	81%	%			%	100%			
Do existing water rights exceed firm yield?	Yes/ No	No			223467					
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A					
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		6								
Excess/surplus water in source category in basin of origin	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	4%				%	5%			Calculates based on modified project size
Frequency of shortages in source category in basin of origin		0%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A			Includes multiple sources					
Storage size overall	AF	N/A								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	N/A								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	108.2			Equivalent Size(new 90" + exist 60")					
Pipeline Length	mi	100	ft	528,000						
Pipeline dedicated for Norman's use only?	Yes/ No	No								
Terminal storage available?	Yes/ No	Yes			Lake Stanley Draper					
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average								
Design flow rate for pipe	mgd	184								
Max velocity in pipeline	ft/sec	< 6.0								
Friction Loss (estimated)	ft	276			Estimated using Hazen-Williams equation and c=120					
Source elevation	ft MSL	460			Estimation of Moyer's crossing elevation					
Norman terminus elevation	ft MSL	1191			Lake Stanley Draper Surface Elevation					
TDH	ft	1007								
Pump Station(s)										
Number of pump stations		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.					
Capacity per pump station	mgd	184								
Horsepower	HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study. Overall 65% wire to water efficeincy assumed.					
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern										
Treatment process							conventional			
Peak treatment capacity	mgd	44.97			Estimated using PF * amount available to Norman - check or replace with data from reference materials		55.21			
PERMITTING / PLANNING STATUS					**Notes**					
Description					Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes					
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5					
Norman's portion of source capital costs	2012 dollars	$ 10,846,792			Sardis Debt Service, Table 10-5		$ 13,316,763			Increased to reflect Norman's larger portion of supply
Construction Contingency Included? Amount?	Yes/ No	No	%							
Engineering Allowance included? Amount?	Yes/ No	No	%							
Easement acquisition allowance included? Amount	Yes/ No	No	%							
Source annual costs (total)		$5,634,697								
Norman's portion of source annual costs		867,743								
Raw Water Conveyance Costs										

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside
Source: Co-owner with Oklahoma City for Southeast Oklahoma Treated Water
Revision Date: 9/7/2012

Project Description: Purchase bulk water from SE Oklahoma; raw water is conveyed from southeast Oklahoma via the existing Atoka Pipeline and a new, parallel Atoka Pipeline to Stanley Draper Lake, treated at a new regional Draper WTP, and conveyed to Norman as finished water. Withdrawal is through existing Oklahoma City connection location, but additional meter connections will be required.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 1,420,838,383			Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs for Norman only.					
Norman's portion of raw water conveyance project	2012 dollars	$ 237,358,799			Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs for Norman only.		$ 291,408,817			Increased to reflect Norman's larger portion of supply
Raw water conveyance project capital cost (pipeline only) - entire project	Yes/ No	Yes	2012 dollars	$ 969,616,383	Includes pipeline costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 pipeline costs for Norman only.					
Raw water conveyance project capital cost (pipeline only) - Norman's portion	Yes/ No	Yes	2012 dollars	$ 161,979,703	Includes pipeline costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 pipeline costs for Norman only.		$ 198,864,815			Increased to reflect Norman's larger portion of supply
Raw water conveyance project capital cost (pump stations only) - entire project	Yes/ No	Yes	2012 dollars	$ 293,501,009	Includes pump station costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 pump station costs for Norman only.					
Raw water conveyance project capital cost (pump stations only) - Norman's portion	Yes/ No	Yes	2012 dollars	$ 49,030,944	Includes pump station costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 pump station costs for Norman only.		$ 60,195,996			Increased to reflect Norman's larger portion of supply
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars							
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
Easement acquisition allowance included? Amount?	Yes/ No	No	%							
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A								
Terminal Storage Area	AC	N/A								
Terminal Storage Cost (total)	2012 dollars	N/A								
Norman's portion of terminal storage project	2012 dollars	N/A								
Construction Contingency Included? Amount?	Yes/ No	N/A								
Engineering Allowance included? Amount?	Yes/ No	N/A								
Easement acquisition allowance included? Amount	Yes/ No	N/A								
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 754,212,258			Treatment at Draper WTP					
Norman's portion of treatment project	2012 dollars	$ 114,319,955				2012 dollars	$ 102,138,500			Adjusted to reflect better estimates of treatment costs
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	15.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 362,525,545				2012 dollars	$ 406,864,080			
Supply source unit cost	$/AFY	$ 13,673			Based on Norman's portion of cost and storage	$/AFY	$ 12,499			Adjusted to include revised treatment costs
Pipeline unit cost	$/in/LF	$ 20.40			Calculated pipeline unit cost using only new 90" - based on entire project cost	$/in/LF	$ 20.40			No change from original study
Pump station unit cost	$/hp	$ 3,676			Based on entire project costs	$/hp	$ 3,700			No change from original study
Treatment unit cost	$/gpd	$ 2.54				$/gpd	$ 1.85			Adjusted to reflect better estimates of treatment costs
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside

Source: Co-owner with Oklahoma City for Southeast Oklahoma Raw Water

Revision Date: 9/7/2012

Project Description: Purchase bulk raw water from SE Oklahoma; raw water is conveyed from SE oklahoma via the existing Atoka Pipeline and a new, parallel Atoka Pipeline to Lake Thunderbird and is treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	303,467	MGD	270.72	Includes pending Lake Sardis permit of 80,000 AFY					
Firm yield already permitted to or designated for others	AFY	353,029	MGD	314.94	Includes Norman's allocation.					
Pending water right request total amount	AFY		MGD	0						
Firm yield available to Norman	AFY	26,514	MGD	23.65	Norman's allocation in the current study was 23.67 MGD.	AFY	32,551	MGD	29.06	Additional water (pipeline capacity) available if water rights can be obtained in the future.
Firm yield available to Norman as % of 2060 demand	%	81%	%	81%					100%	
Do existing water rights exceed firm yield?	Yes/ No	No			223467					
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A					
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		6								
Excess/surplus water in source category in basin of origin	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	4%				%	5%			Calculates based on modified project size
Frequency of shortages in source category in basin of origin		0%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	N/A			Includes multiple sources					
Storage size overall	AF	N/A								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	#VALUE!								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	108.2			Equivalent Size(new 90" + exist 60")					
Pipeline Length	mi	100	ft	528,000						
Pipeline dedicated for Norman's use only?	Yes/ No	No								
Terminal storage available?	Yes/ No	Yes			Lake Stanley Draper					
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average								
Design flow rate for pipe	mgd	184								
Max velocity in pipeline	ft/sec	<6								
Friction Loss (estimated)	ft	276			Estimated using Hazen-Williams equation and c=120					
Source elevation	ft MSL	460			Estimation of Moyer's crossing elevation					
Norman terminus elevation	ft MSL	1039			Lake Thunderbird Surface Elevation	ft MSL	1150			Ease Side Terminal Storage Reservoir Elevation
TDH	ft	855				ft	966			
Pump Station(s)										
Number of pump stations		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.					
Capacity per pump station	mgd	184								
Horsepower	HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study - *May adjust based on going to new terminal reservoir*					
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point		0								
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern										
Treatment process							conventional			
Peak treatment capacity	mgd	47.34			From Central Oklahoma Study Table 9.17		55.21			Estimated using PF * amount available to Norman - check or replace with data from reference materials
PERMITTING / PLANNING STATUS					**Notes**					
Description					Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes					
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										

2060 SWSP Source Category: Outside
Source: Co-owner with Oklahoma City for Southeast Oklahoma Raw Water
Revision Date: 9/7/2012
Project Description: Purchase bulk raw water from SE Oklahoma; raw water is conveyed from SE oklahoma via the existing Atoka Pipeline and a new, parallel Atoka Pipeline to Lake Thunderbird and is treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Source capital costs (total)	2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5					
Norman's portion of source capital costs	2012 dollars	$ 10,846,792			Sardis Debt Service, Table 10-5		$ 13,328,024			Increased to reflect Norman's larger portion of supply
Construction Contingency Included? Amount?	Yes/ No	No	%							
Engineering Allowance included? Amount?	Yes/ No	No	%							
Easement acquisition allowance included? Amount	Yes/ No	No	%							
Source annual costs (total)		$ 5,634,697.12			Projected Annual Debt Service, Table 10-11					
Norman's portion of source annual costs		$ 867,743.36			Projected Annual Debt Service, Table 10-11					
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 1,420,838,383			Includes all costs from Moyer's Crossing to Lake Thunderbird, and includes distribution - D3 costs for Norman only.					
Norman's portion of raw water conveyance project	2012 dollars	$ 237,358,799			Includes all costs from Moyer's Crossing to Lake Thunderbird, and includes distribution - D3 costs for Norman only.		$ 291,655,251			Increased to reflect Norman's larger portion of supply
Raw water conveyance project capital cost (pipeline only) - entire project	Yes/ No	Yes	2012 dollars	$ 992,962,834	Includes pipeline costs from Moyer's Crossing to Lake Thunderbird, and includes distribution - D3 pipeline costs for Norman only.					
Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 165,879,855	Includes pipeline costs from Moyer's Crossing to Lake Thunderbird, and includes distribution - D3 pipeline costs for Norman only.		$ 203,825,311			Increased to reflect Norman's larger portion of supply
Raw water conveyance project capital cost (pump stations only) - entire project	Yes/ No	Yes	2012 dollars	$ 300,821,128	Includes pump station costs from Moyer's Crossing to Lake Thunderbird, and includes distribution - D3 pump station costs for Norman only.					
Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 50,253,810	Includes pump station costs from Moyer's Crossing to Lake Thunderbird, and includes distribution - D3 pump station costs for Norman only.		$ 61,749,501			Increased to reflect Norman's larger portion of supply
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars							
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
Easement acquisition allowance included? Amount?	Yes/ No	No	%							
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A				AF	6100			
Terminal Storage Area	AC	N/A				AC	$ 381			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	N/A				2012 dollars	$ 33,550,000			
Norman's portion of terminal storage project	2012 dollars	N/A				2012 dollars	$ 33,550,000			
Construction Contingency Included? Amount?	Yes/ No	N/A				Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?	Yes/ No	N/A				Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount	Yes/ No	N/A				Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 754,212,258								
Norman's portion of treatment project	2012 dollars	$ 114,319,955				2012 dollars	$ 102,138,500			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	15.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 362,525,545				2012 dollars	$ 440,671,775			
Supply source unit cost	$/AFY	$ 13,673			Based on Norman's portion of cost and storage	$/AFY	$ 13,538			Adjusted to include new terminal storage and revised treatment costs
Pipeline unit cost	$/in/LF	$ 20.90			Calculated pipeline unit cost using only new 90" - based on entire project cost	$/in/LF	$ 20.90			No change from original study
Pump station unit cost	$/hp	$ 3,767			Based on entire project costs	$/hp	$ 3,700			No change from original study
Treatment unit cost	$/gpd	$ 2.41				$/gpd	$ 1.85			Adjusted to reflect better estimates of treatment costs
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			

2060 SWSP Source Category Outside

Source Co-owner with Oklahoma City for Southeast Oklahoma Raw Water

Revision Date 9/7/2012

Project Description: Purchase bulk raw water from SE Oklahoma; raw water is conveyed from SE oklahoma via the existing Atoka Pipeline and a new, parallel Atoka Pipeline to Lake Thunderbird and is treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Source development unit cost	$/AF	$ -				$/AF	$ -			

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside

Source: Scissortail Reservoir

Revision Date: 9/7/2012

Project Description: Construction of a new reservoir 3 miles west of Ada, OK; raw water is conveyed from Scissortail Reservoir via a new pipeline to a new terminal reservoir on the east side of Norman, and treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	32,000	MGD	28.55						
Firm yield already permitted to or designated for others		9,728	MGD	8.68	Assumes a moderate demand scenario for Ada (source)					
Pending water right request total amount	AFY		MGD	0						
Firm yield available to Norman	AFY	22,272	MGD	19.87						
Firm yield available to Norman as % of 2060 demand	%	68%								
Do existing water rights exceed firm yield?	Yes/ No	No								
If yes, what is existing permitted amount?	AFY	N/A								
If yes, by how much do existing WR exceed firm yield?	AFY	0								
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		56								
Excess/surplus water in source category in basin of origin	AFY	156,479	MGD	139.59	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	14%								
Frequency of shortages in source category in basin of origin		59%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	7,027								
Storage size overall	AF	177,524								
Portion of storage allocated to existing users	AF	-			The Scissortail Review MD011411 document does not mention storage allocation.					
Portion of storage available for Norman	AF	177,524								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	36								
Pipeline Length	mi	60	ft	316,800						
Pipeline dedicated for Norman's use only?	Yes/ No	Yes								
Terminal storage available?	Yes/ No	Yes			The Scissortail Review MD011411 document does not mention terminal storage.					
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average			Estimated based on whether terminal storage is available - needs to be checked against reference materials					
Design flow rate for pipe	mgd	19.87			Design based on minimum available water (either from source or from excess in basin)					
Max velocity in pipeline	ft/sec	4.35								
Friction Loss (estimated)	ft	571			Estimated using Hazen-Williams equation and c=120					
Source elevation	ft MSL	905								
Norman terminus elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation					
TDH	ft	816								
Pump Station(s)										
Number of pump stations		2			Scissortail Review MD011411					
Capacity per pump station	mgd	20								
Horsepower	HP	4,374			Overall 65% wire to water efficiency assumed					
Interconnections										
Number of interconnection points		1			The Scissortail Review MD011411 document does not mention interconnection points. Possibly 1 interconnection point at Ada.					
Capacity of interconnection point										
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern										
Treatment process							Conventional with softening			
Peak treatment capacity	mgd	37.75			Estimated using PF * amount available to Norman - check or replace with data from reference		37.75			No change in project size
PERMITTING / PLANNING STATUS					**Notes**					
Description					Identified as a potential water supply reservoir by the OWRB in 1980; feasibility study completed in 2009.					
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ 142,120,000								
Norman's portion of source capital costs	2012 dollars	$ 98,915,520								
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	Percentage of reservoir construction cost only.					
Engineering Allowance included? Amount?	Yes/ No	Yes	%	18.7%	Percentage of reservoir construction, plus contingency, plus easement acquisition allowance.					
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	82.7%	Percentage of reservoir construction cost plus contingency.					
Source annual costs (total)										
Norman's portion of source annual costs		0								
Raw Water Conveyance Costs										

2060 SWSP Source Category Outside

Source Scissortail Reservoir

Revision Date 9/7/2012

Project Description: Construction of a new reservoir 3 miles west of Ada, OK; raw water is conveyed from Scissortail Reservoir via a new pipeline to a new terminal reservoir on the east side of Norman, and treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 212,850,000					$ 210,067,000			
Norman's portion of raw water conveyance project	2012 dollars	$ 212,850,000					$ 210,067,000			Adjusted based on ratio of new pipeline/pump station costs to original study equivalent costs
Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 115,595,411		Yes/ No	Yes	2012 dollars	$ 193,881,600	Adjusted to be consistent with other source unit cost
Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 21,900,417		Yes/ No	Yes	2012 dollars	$ 16,185,224	Adjusted to be consistent with other source unit cost
Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars		
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	Percentage of pipeline and pump station construction cost only.	Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	Percentage of pipeline and pump station construction plus	Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	7.9%	Percentage of pipeline and pump station construction plus	Yes/ No	Yes	%	7.9%	
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A				AF	4200			
Terminal Storage Area	AC	N/A				AC	263			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	N/A				2012 dollars	$23,100,000.00			
Norman's portion of terminal storage project	2012 dollars	N/A				2012 dollars	$23,100,000.00			
Construction Contingency Included? Amount?	Yes/ No	N/A				Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?	Yes/ No	N/A				Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount	Yes/ No	N/A				Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 114,000,000				2012 dollars	$ 75,500,000			
Norman's portion of treatment project	2012 dollars	$ 114,000,000				2012 dollars	$ 75,500,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	15.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 425,765,520				2012 dollars	$ 407,582,520			
Supply source unit cost	$/AFY	$ 19,117				$/AFY	$ 18,300			Adjusted to include new terminal storage, revised pipeline unit costs, revised pump station unit costs, and revised treatment costs
Pipeline unit cost	$/in/LF	$ 10.14			Seems low compared to 2009 Central OK Study	$/in/LF	$ 17.00			Adjusted to be consistent with other source unit cost
Pump station unit cost	$/hp	$ 5,007			Seems high compared to 2009 Central OK study	$/hp	$ 3,700			Adjusted to be consistent with other source unit cost
Treatment unit cost	$/gpd	$ 3.02				$/gpd	$ 2.00			Adjusted to reflect better estimates of treatment costs
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ 801				$/AF	$ 801			No change from original study

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside

Source: Parker Reservoir

Revision Date: 9/7/2012

Project Description: Construction of a new reservoir 15 miles east of Ada, OK; raw water is conveyed from Scissortail Reservoir via a new pipeline to a new terminal reservoir on the east side of Norman, and treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	45,900	MGD	40.95						
Firm yield already permitted to or designated for others		-	MGD	0						
Pending water right request total amount	AFY	-	MGD	0						
Firm yield available to Norman	AFY	32,551	MGD	29.06						
Firm yield available to Norman as % of 2060 demand	%	100%								
Do existing water rights exceed firm yield?	Yes/ No	No								
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0								
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		8								
Excess/surplus water in source category in basin of origin	AFY	283,461	MGD	252.88	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	11%								
Frequency of shortages in source category in basin of origin		0%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	9,420								
Storage size overall	AF	220,240								
Portion of storage allocated to existing users	AF									
Portion of storage available for Norman	AF	220,240								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in					in	42			Pipeline sized to achieve 5-6 fps in pipeline
Pipeline Length	mi		ft	-		mi	75	ft	396,000	
Pipeline dedicated for Norman's use only?	Yes/ No					Yes/ No	Yes			
Terminal storage available?	Yes/ No					Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?	Yes/ No					Yes/ No	average			
Design flow rate for pipe	mgd					mgd	29.06			
Max velocity in pipeline	ft/sec					ft/sec	4.67			
Friction Loss (estimated)	ft					ft	681			Estimated using Hazen-Williams equation and c=120
Source elevation	ft MSL					ft MSL	890			
Norman terminus elevation	ft MSL					ft MSL	1150			East Side Terminal Storage Reservoir Elevation
TDH	ft					ft	941			
Pump Station(s)										
Number of pump stations							3			
Capacity per pump station	mgd					mgd	29			
Horsepower	HP					HP	7,378			Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points		0								
Capacity of interconnection point	AFY		MGD							
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern										
Treatment process							Conventional with softening			
Peak treatment capacity	mgd				Estimated using PF * amount available to Norman - check or replace with data from reference	mgd	55.21			
PERMITTING / PLANNING STATUS					**Notes**					
Description										
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ 96,336,000								
Norman's portion of source capital costs	2012 dollars	$ 96,336,000					$ 176,358,810			Adjusted to be consistent with other source unit cost
Construction Contingency Included? Amount?	Yes/ No	N/A	%							
Engineering Allowance included? Amount?	Yes/ No	N/A	%							
Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
Source annual costs (total)										
Norman's portion of source annual costs										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars					2012 dollars				
Norman's portion of raw water conveyance project	2012 dollars					2012 dollars	$ 310,041,063			

2060 SWSP Source Category Outside
Source Parker Reservoir
Revision Date 9/7/2012
Project Description: Construction of a new reservoir 15 miles east of Ada, OK; raw water is conveyed from Scissortail Reservoir via a new pipeline to a new terminal reservoir on the east side of Norman, and treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Raw water conveyance project capital cost (pipeline only)	Yes/ No		2012 dollars			Yes/ No	Yes	2012 dollars	$ 282,744,000	Calculated using pipeline unit cost of $17/in/LF
Raw water conveyance project capital cost (pump stations only)	Yes/ No		2012 dollars			Yes/ No	Yes	2012 dollars	$ 27,297,063	Calculated using oump station unit cost of $3000/hp
Raw water conveyance project capital cost (interconnections only)	Yes/ No		2012 dollars			Yes/ No	No	2012 dollars		
Construction Contingency Included? Amount?	Yes/ No		%			Yes/ No	Yes	%	25.0%	Percentage of pipeline and pump station construction cost only.
Engineering Allowance included? Amount?	Yes/ No		%			Yes/ No	Yes	%	20.0%	Percentage of pipeline and pump station construction plus contingency.
Easement acquisition allowance included? Amount?	Yes/ No		%			Yes/ No	No	%		
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A				AF	5900			
Terminal Storage Area	AC	N/A				AC	369			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	N/A				2012 dollars	$32,450,000.00			
Norman's portion of terminal storage project	2012 dollars	N/A				2012 dollars	$32,450,000.00			
Construction Contingency Included? Amount?	Yes/ No	N/A				Yes/ No	Yes		25.0%	
Engineering Allowance included? Amount?	Yes/ No	N/A				Yes/ No	Yes		20.0%	
Easement acquisition allowance included? Amount	Yes/ No	N/A				Yes/ No	Yes		20.0%	
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 114,000,000				2012 dollars	$ 110,420,000			
Norman's portion of treatment project	2012 dollars	$ 114,000,000				2012 dollars	$ 110,420,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No		%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	15.0%		Yes/ No		%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%		Yes/ No		%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 210,336,000				2012 dollars	$ 629,269,873			Adjusted to include revised source development costs, new conveyance cost, new terminal storage and revised treatment costs
Supply source unit cost	$/AFY	$ 6,462				$/AFY	$ 19,332			
Pipeline unit cost	$/in/LF	N/A				$/in/LF	$ 17.00			Assumed unit cost
Pump station unit cost	$/hp	N/A				$/hp	$ 3,700			Assumed unit cost
Treatment unit cost	$/gpd	N/A				$/gpd	$ 2.00			Adjusted to reflect better estimates of treatment costs
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ 437				$/AF	$ 800			Assumed unit cost

CHECKLIST FOR SOURCE SCREENING COMPLETENESS/CONSISTENCY

2060 SWSP Source Category: Outside

Source: Kaw Lake

Revision Date: 9/7/2012

Project Description: Raw water is conveyed from Kaw Reservoir via a new pipeline to a new terminal reservoir on the east side of Norman, and treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
YIELD AND FLOW					**Notes**					
Firm Yield	AFY	187,040	MGD	166.86						
Firm yield already permitted to or designated for others		141,403	MGD	126.15						
Pending water right request total amount	AFY	64,050	MGD	57.14						
Firm yield available to Norman	AFY	-	MGD	24.0		AFY	32,551	MGD	29.06	
Firm yield available to Norman as % of 2060 demand	%	0%			No supply available to Norman if pending water right applications are granted. For puprose of comparing to other sources on other evaluation criteria, "firm yield available to Norman" does not include pending water rights applications.	%	100%			
Do existing water rights exceed firm yield?	Yes/ No	No								
If yes, what is existing permitted amount?	AFY									
If yes, by how much do existing WR exceed firm yield?	AFY	0								
Source Basin Excess/Surplus Water - Carollo										
Basin of origin		72								
Excess/surplus water in source category in basin of origin	AFY	1,202,486	MGD	1072.74	Excess exceeds amount of yield available to Norman					
Percent of excess/surplus water that Norman is proposing to take	%	0%			Calculates based on modified project size	%	3%			Calculates based on modified project size
Frequency of shortages in source category in basin of origin		0%								
RAW WATER SOURCE STORAGE					**Notes**					
Max Surface Area	Ac	17,040								
Storage size overall	AF	428,600								
Portion of storage allocated to existing users	AF	323,375								
Portion of storage available for Norman	AF	105,225								
RAW WATER CONVEYANCE					**Notes**					
Pipeline										
Pipeline Diameter	in	60				in	54			
Pipeline Length	mi	52	ft	274,560	Kaw Lake to Stillwater (inaccurate)	mi	46	ft	242,880	Kaw Lake to Stillwater
Pipeline Diameter	in	48				in	48			
Pipeline Length	mi	37	ft	195,360	Stillwater to Edmond	mi	0	ft	-	
Pipeline Diameter	in	36				in	36			
Pipeline Length	mi	46	ft	242,880	Edmond to Norman	mi	83	ft	438,240	Stillwater to Norman
Pipeline dedicated for Norman's use only?	Yes/ No	No				Yes/ No	No			
Terminal storage available?	Yes/ No	Yes				Yes/ No	Yes			
Is pipeline designed to meet average demand or peak demand?	Yes/ No	average				Yes/ No	average			
Design flow rate for pipe	mgd	70			Design based on minimum available water (either from source or from excess in basin)	mgd	56.1			Adjusted to account for increase in Norman demand and to acount for Edmond not participating in project
Max velocity in pipeline	ft/sec	5.52				ft/sec	5.45			No change in pipe size required
Friction Loss (estimated)	ft	424			Estimated using Hazen-Williams equation and c=120	ft	415			
Source elevation	ft MSL	888				ft MSL	888			
Norman terminus elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation
TDH	ft	686				ft	677			
Pump Station(s)										
Number of pump stations		3								
Capacity per pump station	mgd	24.0					29.0			
Horsepower	HP	12,955			Overall 65% wire to water efficiency assumed		10,239			Overall 65% wire to water efficiency assumed
Interconnections										
Number of interconnection points		2			Stillwater, Edmond		1			Stillwater
Capacity of interconnection point										
TREATMENT					**Notes**					
Source water type	SW/ GW	SW								
Major constituents of concern										
Treatment process					CAROLLO		Conventional with softening			
Peak treatment capacity	mgd	45.6			Estimated using PF * amount available to Norman - check or replace with data from reference	mgd	55.21			
PERMITTING / PLANNING STATUS					**Notes**					
Description					No supply available to Norman if pending water right applications are granted. For puprose of comparing to other sources on other evaluation criteria, "firm yield available to Norman" does not include pending water rights applications.					
CAPITAL COSTS					**Notes**					
Raw Water Source Storage Costs										
Source capital costs (total)	2012 dollars	$ -				2012 dollars	$ 13,796,634			

2060 SWSP Source Category Outside
Source Kaw Lake
Revision Date 9/7/2012
Project Description: Raw water is conveyed from Kaw Reservoir via a new pipeline to a new terminal reservoir on the east side of Norman, and treated at an expanded Norman WTP.

	Project as described in reference materials					Project modified so as to be comparable to other supply sources (if applicable)				
Norman's portion of source capital costs	2012 dollars	$ -				2012 dollars	$ 13,796,634			$185 per AF. Norman's allocation would be equal to 29.06 MGD/167 MGD or 17.4% of the storage volume of the reservoir (428,600 AF)
Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	No	%	0.0%	Reservoir already constructed
Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	No	%	0.0%	
Easement acquisition allowance included? Amount	Yes/ No	No	%			Yes/ No	No	%	0.0%	
Source annual costs (total)										
Norman's portion of source annual costs										
Raw Water Conveyance Costs										
Raw Water Conveyance Project Cost (total)	2012 dollars	$ 749,010,000				2012 dollars	$559,739,000			
Norman's portion of raw water conveyance project	2012 dollars	$ 444,009,000				2012 dollars	$448,357,000			Adjusted based on ratio of new pipeline/pump station costs to original study equivalent costs
Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 379,970,392		Yes/ No	Yes	2012 dollars	$398,063,000	
Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 47,783,970		Yes/ No	Yes	2012 dollars	$ 47,939,000	Adjusted to be consistent with other source unit cost
Raw water conveyance project capital cost (interconnections only)	Yes/ No	Yes	2012 dollars	$ 2,851,495		Yes/ No	Yes	2012 dollars	$ 2,354,706	
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	3.8%		Yes/ No	Yes	%	5.1%	
Terminal Storage Costs										
Terminal Storage Volume	AF	N/A				AF	6100			
Terminal Storage Area	AC	N/A				AC	381			Assumes 16' Operational depth and 20' Average depth
Terminal Storage Cost (total)	2012 dollars	N/A				2012 dollars	$33,550,000			
Norman's portion of terminal storage project	2012 dollars	N/A				2012 dollars	$33,550,000			
Construction Contingency Included? Amount?	Yes/ No	N/A				Yes/ No	Yes			
Engineering Allowance included? Amount?	Yes/ No	N/A				Yes/ No	Yes			
Easement acquisition allowance included? Amount	Yes/ No	N/A				Yes/ No	Yes			
Treatment Costs										
Treatment Project Cost (total)	2012 dollars	$ 113,616,000				2012 dollars	$ 110,420,000			
Norman's portion of treatment project	2012 dollars	$ 113,616,000				2012 dollars	$ 110,420,000			
Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
Engineering Allowance included? Amount?	Yes/ No	Yes	%	15.0%		Yes/ No	Yes	%	20.0%	
Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%		Yes/ No	Yes	%	5.0%	
Unit cost from supply source										
Combined capital costs	2012 dollars	$ 557,625,000				2012 dollars	$ 606,123,634			
Supply source unit cost	$/AFY					$/AFY	$ 18,621			Adjusted to include new terminal storage, revised pump station unit costs, and revised treatment costs
Pipeline unit cost	$/in/LF	$ 23.07			Seems reasonable compared to 2009 Central OK Study	$/in/LF	$ 16.81			Adjusted to exclude the City of Edmond from project participation.
Pump station unit cost	2012 dollars	$ 3,688			Seems high compared to 2009 Central OK study	$/hp	$ 3,700			Adjusted to be consistent with other source unit cost
Treatment unit cost	$/gpd	$ 2.49				$/gpd	$ 2.00			Adjusted to reflect better estimates of treatment costs
Operation and Maintenance Costs	$/mgd	#DIV/0!				$/mgd	#DIV/0!			
Source development unit cost	$/AF	$ -			Reservoir already constructed	$/AF	$ -			No change from original study

Norman 2060 Demand	AFY	32,546	MGD	29.06

Conveyance Peaking Factor (PF)	1.9	Treatment Peaking Factor (PF)	1.9

"Standard" Unit Costs

Pipeline, open cut in rural area	$/inLF	$12.44	2009 Central Oklahoma Study	Includes implementation costs
Pipeline, open cut in urban area	$/inLF	$14.42	2009 Central Oklahoma Study	Includes implementation costs
Pipeline, tunneling	$/inLF	$88.19	2009 Central Oklahoma Study	Includes implementation costs
Pipeline, river crossings	$/inLF	$20.11	2009 Central Oklahoma Study	Includes implementation costs
Pump station, hp	$/hp	$3,700.00	2009 Central Oklahoma Study, adjusted	Includes implementation costs
Reservoir construction, storage available	$/AF	$5,500.00	2040 SWSP	Includes implementation costs
Low head intake structure	$/MGD	$43,000.00	SE OK Raw Water Study	Includes implementation costs
Storage tank at WWTP	$/gal	$1.00		
direct filtration	$/gpd			
conventional	$/gpd	$1.85		
Conventional with softening	$/gpd	$2.00	($1.85 to expand existing WTP)	
Presedimentation and Conventional	$/gpd	$2.25		
MF	$/gpd			
RO	$/gpd	$6.00		
IX	$/gpd			
Blend of Conventional and RO (new WTP)	$/gpd	$4.50		
Blend of Conventional and RO (expand WTP)	$gpd	$4.34		
Chlorination only (wells)	$/gpd	$0.20	2040 SWSP, adjusted to 2012 dollars	
Arsenic removal	$/gpd	$4.97	Well head Arsenic Removal Project, adjusted to 2012 dollars	
Arsenic removal	$/gal	$1.60	Centralized arsenic removal (CH2 2002 study adjusted to 2012 dollars)	
Chromium removal	$/gpd	$1.78	CR(VI) Treatment Options and Costs, adjusted to 2012 dollars	
Single pass RO with UV disinfection	$/gpd	$ 8.44		
Arsenic and Chromium Treatment Expansion	$/gpd	$ 2.51		
IPR treatment (BNR, ozone, biofiltration, continued UV	$/gpd	$ 2.78		

Basin of origin	Basin ID	Excess/Surplus
Southeast OK Water	6	713617
Parker	8	283461
Scissortail	56	156479
Westside (Canadian)	58	101062
Eastside (Canadian)	58	101062
Kaw	72	1202486

Wire to water efficiency 0.65

APPENDIX B – PORTFOLIO SCREENING WORKBOOKS

Appendix B – Portfolio Screening Workbooks

This appendix contains water supply portfolio information used in evaluation. The following tables are located in this appendix.

- Portfolio evaluation table – raw data used as input to decision support software
- Portfolio 1 – Maximize local sources
- Portfolio 2 – Minimize capital cost
- Portfolio 3 – Regional option with Oklahoma City for Southeast Oklahoma treated water
- Portfolio 4 – Regional option with Oklahoma City for Southeast Oklahoma raw water
- Portfolio 5 – Regional option with new reservoir
- Portfolio 6 – Regional option with Kaw Lake
- Portfolio 7 – Hybrid portfolio with Oklahoma City for treated water (no groundwater)
- Portfolio 8 – Hybrid portfolio with Lake Thunderbird augmentation
- Portfolio 9 – Hybrid portfolio maximizing groundwater use
- Portfolio 10 – Hybrid portfolio with Parker Reservoir
- Portfolio 11 – Hybrid portfolio with Oklahoma City for Southeast Oklahoma treated water (includes groundwater)
- Portfolio 12 – Hybrid portfolio with Scissortail Reservoir
- Portfolio 13 – Hybrid portfolio with Oklahoma City for Southeast Oklahoma raw water
- Portfolio 14 – Hybrid portfolio with new wells and Lake Thunderbird augmentation
- Assumption Tables

Objectives Weighting							Raw Scores for Portfolios									
Objective	**Objective Description**	**Sub-objective**	**Performance Measures**	**Combined Ranking Percentage**	**Units for Raw Score**	**Higher Raw Score is Better/ Worse?**	**P1 Maximize local sources with add'l cons/full reuse**	**P2 Low capital cost**	**P3 Maximize outside sources - OKC Treated**	**P4 Maximize outside sources - OKC Raw**	**P5 Maximize outside sources - New OOB Reservoir**	**P6 Maximize outside sources - Kaw**	**P7 LTB, Conservation , DNPR, OKC (owner)**	**P11 P2 but OKC (owner) instead of OKC (wholesale)**	**P13 OKC (co-owner, raw water)**	**P14 New wells + IPR**
Affordability	What will it cost to reliably provide treated water?	Minimize capital cost	Unit capital cost including diversion, transmission, and treatment ($/AFY	6%	$/AFY	Worse	$7,672	$4,367	$12,494	$13,538	$18,952	$19,155	$9,712	$9,266	$10,337	$8,326
		Minimize life-cycle cost	2060 O&M cost (meeting total demand, $M/yr in 2012 dollars)	6%	$M/yr	Worse	$21.3	$53.0	$23.6	$23.8	$25.5	$25.7	$21.7	$22.5	$22.8	$21.7
Long-Term Supply Reliability	Will we be able to reliably meet our demand?	Minimize supply shortages	Weighted average of 2060 shortages	3%	% proba-	Worse	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
			Supply diversity in terms of number of sources and types of sources	3%	1-5 score	Better	5	4	1	1	1	1	3	4	4	5
			Percent of supply portfolio coming	3%	%	Better	29%	29%	0%	0%	0%	0%	0%	29%	29%	36%
		Infrastructure reliability	Raw water transmission distance	2%	mi	Worse	68	63	100	100	75	135	116	157	157	80
			Transmission complexity, considering length of pipeline and	2%	1-5 score	Better	5	3	1	1	2	1	3	3	3	5
			Treatment complexity (qualitative)	2%	1-5	Better	1	3	5	4	4	4	3	3	2	1
			Degree of redundancy (qualitative)	2%	1-5	Better	4	5	1	1	1	1	3	5	5	4
Phasing Potential	Can we defer capital and increase the supply over time?	Defer capital cost	Ability to phase implementation and	4%	1-5	Better	5	5	3	2	1	2	2	3	3	5
		Provide for future needs	Ability to access additional supplies beyond projected 2060 demands (qualitative)	4%	1-5 score	Better	5	3	3	3	4	1	3	3	3	5
Timely Implemen-tation and Certainty	Are we certain we can bring the supply online by the time it is needed?	Reduce institutional complexity and increase local control	Number of agency/utility partners (facility owners and/or project co-	2%	1-5 score	Better	4	3	3	3	5	1	3	3	3	4
			Percent of supply sourced in Norman	2%	%	Better	100%	53%	0%	0%	0%	0%	25%	53%	53%	100%
			Public/political acceptability	2%	1-5	Better	3	5	2	2	2	4	3	3	4	4
			Vulnerability to potential future changes in water rights allocations	2%	1-5 score	Better	1	3	5	4	4	3	3	3	4	1
		Timely implementation	Project development status in 2012 for new supplies in portfolio	4%	1-5 score	Better	2	5	4	4	3	4	4	4	4	2
			Amount and ease of environmental permitting, water rights acquisition,	4%	1-5 score	Better	1	5	3	3	2	3	3	3	2	1
Efficient Use of Water Resources	Are we making the best use of the available resources?	Maximize water use efficiency	Percent of total demand met by new direct non-potable reuse in 2060	6%	%	Better	2.8%	2.8%	0%	0%	0%	0%	3%	3%	3%	3%
			Percent of total demand met by indirect reuse (supply augmentation)	6%	%	Better	47%	0%	0%	0%	0%	0%	0%	0%	0%	40%
			Percent reduction from baseline demand due to additional	6%	%	Better	4%	4%	0%	0%	0%	0%	4%	4%	4%	4%
Environmental Stewardship	Are we preserving our environmental resources?	Minimize energy consumption	Pumping head per unit supply	3%	ft/1,000	Worse	23.0	41.0	31.0	30.0	29.0	22.0	46.0	46.0	44.0	23.0
		Minimize temporary construction	Amount of land disturbed during	3%	ac	Worse	495	458	727	1108	914	1363	844	1142	1142	582
		Minimize permanent ecosystem	Environmental impacts (qualitative)	3%	1-5	Better	4	5	3	3	1	3	3	3	3	3
		Increase use of renewable resources	Renewable supply score for portfolio	3%	1-5	Better	2	3	5	5	5	5	4	4	4	2
Treated Water Quality Aesthetics	Will our customers be satisfied with the quality of the water we deliver?	Achieve secondary MCLs	Blended average conductivity (uS/cm)	5%	uS/cm	Worse	511	337	98	98	392	1,233	179	337	337	524
		Minimize taste and odor potential	Percent of supply originating from surface water sources	5%	%	Worse	68%	68%	100%	100%	100%	100%	100%	68%	68%	61%
Community Values (recreation, aesthetics, and property rights)	Will our community gain value from this alternative, while protecting property rights?	Impact on non-water supply benefits	Perceived impacts to recreation and aesthetics (qualitative)	4%	1-5 score	Better	4	3	3	3	3	3	3	3	3	4
		Protection of property rights	Potential impact to property rights (qualitative)	4%	1-5 score	Better	3	4	5	2	1	2	3	4	4	3

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**1 Maximize local sources with add'l cons/full reuse**									
2		**Lake Thunderbird**					**Garber-Wellington Aquifer Wells - Active**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in	13.12			Average Diameter
25	Pipeline Length	mi	8.5	ft	44,880		mi	34.2	ft	180,576	
26											
27											

	A	B	C	D	E	F	G	H	I	J	K
2					Lake Thunderbird			Garber-Wellington Aquifer Wells - Active			
28	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
29	Terminal storage available?	Yes/ No	No				Yes/ No	No			
30	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
31	Design flow rate for pipe	mgd	6.1				mgd	Varies			
32	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
33	Friction Loss (estimated)	ft	2				ft	N/A			
34	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL	Varies			
35	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL	Varies			
36	TDH	ft	177				ft	N/A			
37	***Pump Station(s)***										
38	Number of pump stations		1					1			HSPS at WTP - sized to handle full WTP capacity
39	Capacity per pump station	mgd					mgd	11.2			
40	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP	1418			Assumed 60 psi distribution system pressure
41	***Interconnections***										
42	Number of interconnection points		0								
43	Capacity of interconnection point		0								
44	**TREATMENT**					**Notes**					
45	Source water type	SW/ GW	GW								
46	Major constituents of concern										
47	Treatment process										
48	Peak treatment capacity	mgd	17					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
49	**PERMITTING / PLANNING STATUS**					**Notes**					
50	Description										
51	**CAPITAL COSTS**					**Notes**					
52	***Raw Water Source Storage Costs***										
53	Source capital costs (total)	2012 dollars									
54	Norman's portion of source capital costs	2012 dollars									
55	Construction Contingency Included? Amount?	Yes/ No	No	%							
56	Engineering Allowance included? Amount?	Yes/ No	No	%							
57	Easement acquisition allowance included? Amount	Yes/ No	No	%							
58	Source annual costs (total)		$ -								
59	Norman's portion of source annual costs		$ -								
60	***Raw Water Conveyance Costs***										
61	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 46,712,548			
62	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 46,712,548			

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
63	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
64	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 5,247,560	Finished water pumping
65	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
66	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
67	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
68	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
69	***Terminal Storage Costs***										
70	Terminal Storage Volume	AF	N/A								
71											
72	Terminal Storage Cost (total)	2012 dollars	N/A								
73	Norman's portion of terminal storage project	2012 dollars	N/A								
74	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
75	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
76	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
77	***Treatment Costs***										
78	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
79											
80	Norman's portion of treatment project	2012 dollars					2012 dollars	$ 23,100,000			
81	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
82	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
83	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
84	***Operation and Maintenance Costs***										
85	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 5,559,012			
86	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab	2060 $	$ 15,235,258	2012 $	$3,686,914.28	Unit treatment cost per references
87	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut	2060 $	$ 1,713,438		1.0%	
88	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency	2060 $	$ 542,106		2.5%	
89	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
90	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
91	Pumping Energy	2060 $	$ 1,402,529				2060 $	$ 605,842			energy for HSPS
92	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above plus distribution pressure				138.6	

	A	B	C	D	E	F	G	H	I	J	K
2					Lake Thunderbird			Garber-Wellington Aquifer Wells - Active			
93	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
94	***Unit cost from supply source***										
95	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 69,812,548			
96	Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,387			
97	Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 17.50			
98	Pump station unit cost	$/hp	0				$/hp	3700			
99	Treatment unit cost	$/gal	$ -				$/gal	$ 3.08			
100											
101											
102											
103	Operation and Maintenance Costs										
104	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter	in				
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.	mi		ft	-	
26											
27											

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
28	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
29	Terminal storage available?	Yes/ No	No				Yes/ No				
30	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
31	Design flow rate for pipe	mgd	Varies				mgd				
32	Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
33	Friction Loss (estimated)	ft	N/A				ft	N/A			
34	Source elevation	ft MSL	Varies				ft MSL				
35	Norman terminus elevation	ft MSL	Varies				ft MSL				
36	TDH	ft	N/A				ft	N/A			
37	***Pump Station(s)***										
38	Number of pump stations		16								
39	Capacity per pump station	mgd	0.25				mgd				
40	Horsepower	HP					HP				
41	***Interconnections***										
42	Number of interconnection points										
43	Capacity of interconnection point										
44	**TREATMENT**										
45	Source water type	SW/ GW	GW				SW/ GW				
46	Major constituents of concern										
47	Treatment process										
48	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd				
49	**PERMITTING / PLANNING STATUS**										
50	Description										
51	**CAPITAL COSTS**										
52	***Raw Water Source Storage Costs***										
53	Source capital costs (total)										
54	Norman's portion of source capital costs										
55	Construction Contingency Included? Amount?										
56	Engineering Allowance included? Amount?										
57	Easement acquisition allowance included? Amount										
58	Source annual costs (total)										
59	Norman's portion of source annual costs										
60	***Raw Water Conveyance Costs***										
61	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	$ -			
62	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ -			

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
63	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	2012 dollars		
64	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
65	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
66	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
67	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
68	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	10.0%	
69	***Terminal Storage Costs***										
70	Terminal Storage Volume										
71											
72	Terminal Storage Cost (total)										
73	Norman's portion of terminal storage project										
74	Construction Contingency Included? Amount?										
75	Engineering Allowance included? Amount?										
76	Easement acquisition allowance included? Amount										
77	***Treatment Costs***										
78	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars				
79											
80	Norman's portion of treatment project	2012 dollars	$ 8,316,000				2012 dollars	$ -			
81	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
82	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
83	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
84	***Operation and Maintenance Costs***										
85	Total Operation and Maintenance Costs	2012 $/yr	$ 1,818,336				2012 $/yr	$ 150,000			
86	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$1,284,275.14	Unit treatment cost per references		$ -			
87	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%			$ -		1.0%	
88	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost		$ -		2.5%	
89	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
90	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	
91	Pumping Energy	2060 $	$ 211,035			energy for HSPS		$ -			
92	Pump Head				138.6						

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
93	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy	2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
94	***Unit cost from supply source***										
95	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ -			
96	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ -			
97	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	#DIV/0!			
98	Pump station unit cost	$/hp	#DIV/0!				$/hp	#DIV/0!			
99	Treatment unit cost	$/gal	$ 3.08				$/gal	#DIV/0!			
100											
101											
102											
103	Operation and Maintenance Costs										
104	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Direct non-potable reuse					Lake Thunderbird Augmentation				
3	**YIELD AND FLOW**										
4	Firm Yield						AFY	14,684	MGD	13.1	
5	Firm yield already permitted to or designated for others						AFY	-	MGD	0	
6	Pending water right request total amount						AFY		MGD	0	
7	Firm yield available to Norman	AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe	AFY	14,684	MGD	13.1	
8	Firm yield available to Norman as % of 2060 demand	%	3%				%	45%			
9	Do existing water rights exceed firm yield?						Yes/ No				
10	If yes, what is existing permitted amount?						AFY				
11	If yes, by how much do existing WR exceed firm yield?						AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%				%	50%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										**Notes**
18	Max Surface Area						Ac	N/A			
19	Storage size overall						AF	-			
20	Portion of storage allocated to existing users						AF				
21	Portion of storage available for Norman						AF	-			
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm	in	30			Pipeline from the Norman WWTP to Dave Blue Creek.
25	Pipeline Length		7.84	ft	41,400		mi	3.87	ft	20,450	Pipeline from the Norman WWTP to Dave Blue Creek.
26							in	36.00			Pipeline from Lake Thunderbird to the Norman WTP.
27							mi	7.00	ft	36,960	Pipeline from Lake Thunderbird to the Norman WTP.

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Lake Thunderbird Augmentation				
28	Pipeline dedicated for Norman's use only?		Yes				Yes/ No	Yes			Pipeline from Lake Thunderbird to the Norman WTP.
29	Terminal storage available?		No				Yes/ No	No			Pipeline from Lake Thunderbird to the Norman WTP.
30	Is pipeline designed to meet average demand or peak demand?		peak				Yes/ No	Peak			Pipeline from Lake Thunderbird to the Norman WTP.
31	Design flow rate for pipe		31.46				mgd	20.5			Pipeline from Lake Thunderbird to the Norman WTP.
32	Max velocity in pipeline		5.06				ft/sec	4.49			Pipeline from Lake Thunderbird to the Norman WTP.
33	Friction Loss (estimated)		83				ft	95			Estimated using Hazen-Williams equation and c=120
34	Source elevation		1093				ft MSL	960			Lake Thunderbird Conservation Elevation
35	Norman terminus elevation		1312			Varies between 1090 and 1312	ft MSL	1150			Norman WTP Elevation
36	TDH		302				ft	285			Pipeline from Lake Thunderbird to the Norman WTP.
37	***Pump Station(s)***										
38	Number of pump stations		3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH		2			
39	Capacity per pump station						mgd	20.5			Pump Station for the Pipeline from Lake Thunderbird to the Norman WTP.
40	Horsepower		800				HP	4153			Overall 65% wire to water efficiency assumed. 2,807 HP for Pump Station from Lake Thunderbird to Norman WTP.
41	***Interconnections***										
42	Number of interconnection points										
43	Capacity of interconnection point										
44	**TREATMENT**										
45	Source water type						SW/ GW	SW			
46	Major constituents of concern							N/A			
47	Treatment process							Conventional with softening			
48	Peak treatment capacity	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent	mgd	20.5			
49	**PERMITTING / PLANNING STATUS**										
50	Description										
51	**CAPITAL COSTS**										
52	***Raw Water Source Storage Costs***										
53	Source capital costs (total)						2012 dollars	$ 112,750			Low head intake structure only.
54	Norman's portion of source capital costs						2012 dollars	$ 112,750			
55	Construction Contingency Included? Amount?						Yes/ No	No	%	0.25	
56	Engineering Allowance included? Amount?						Yes/ No	No	%	0.2	
57	Easement acquisition allowance included? Amount						Yes/ No	No	%	0.2	
58	Source annual costs (total)										
59	Norman's portion of source annual costs										
60	***Raw Water Conveyance Costs***										
61	Raw Water Conveyance Project Cost (total)	2012 dollars	27,960,000				2012 dollars	49,388,921			
62	Norman's portion of raw water conveyance project	2012 dollars	$ 27,960,000				2012 dollars	$ 49,388,921			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Lake Thunderbird Augmentation				
63	Raw water conveyance project capital cost (pipeline only)	2012 dollars	Yes		$ 25,000,000		Yes/ No	Yes	012 dolla	$ 34,024,921	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
64	Raw water conveyance project capital cost (pump stations only)	2012 dollars	Yes		$ 2,960,000		Yes/ No	Yes	012 dolla	$ 15,364,000	
65	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
66	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
67	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
68	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
69	***Terminal Storage Costs***										
70	Terminal Storage Volume			MG	6.5						
71											
72	Terminal Storage Cost (total)		$6,500,000.00								
73	Norman's portion of terminal storage project		$6,500,000.00								
74	Construction Contingency Included? Amount?										
75	Engineering Allowance included? Amount?										
76	Easement acquisition allowance included? Amount										
77	***Treatment Costs***										
78	Treatment Project Cost (total)	2012 dollars	$ 3,010,320				2012 dollars	$ 36,418,000			Includes only the WWTP upgrades
79							2012 dollars	$41,000,000			Includes only the WTP upgrades.
80	Norman's portion of treatment project		$ 3,010,320				2012 dollars	$ 77,418,000			
81	Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
82	Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
83	Easement acquisition allowance included? Amount						Yes/ No	Yes	%	5.0%	
84	***Operation and Maintenance Costs***										
85	Total Operation and Maintenance Costs	2012 $/yr	$ 441,954				2012 $/yr	$ 9,387,151			
86	Treatment O&M Costs	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration	2060 $	$ 28,315,164	2012 $	$6,852,235.69	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab
87	Pipe Maintenance - 1% of Capital	2060 $	$ 1,033,063		1.0%		2060 $	$ 1,405,995		1.0%	COMCD_Final_Water_Reuse_Feasibility_Study_October_201
88	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%		2060 $	$ 1,587,198		2.5%	
89	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
90	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 268,596		1.0%			$ -		1.0%	
91	Pumping Energy	2060 $	$ 167,211				2060 $	$ 2,719,951			
92	Pump Head				302					285	

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Lake Thunderbird Augmentation				
93	Other						2060 $	$ 4,761,765			WRF Additional treatment costs
94	***Unit cost from supply source***										
95	Combined capital costs	2012 dollars	$ 37,470,320				2012 dollars	$ 126,919,671			
96	Supply source unit cost	$/AFY	$ 44,083				$/AFY	$ 8,643			
97	Pipeline unit cost	$/in/LF	$ 14.38				$/in/LF	$ 55.46			
98	Pump station unit cost	$/hp	3700				$/hp	3699.923064			
99	Treatment unit cost	$/gal	$ 1.13				$/gal	$ 3.78			
100											
101											
102											
103	Operation and Maintenance Costs						$/mgd				
104	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**2 Low capital cost (OKC wholesale)**									
2		**Lake Thunderbird**					**Garber-Wellington Aquifer Wells - Active**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in	13.12			Average Diameter
25	Pipeline Length	mi	8.5	ft	44,880		mi	34.2	ft	180,576	
26											
27											

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
33	Design flow rate for pipe	mgd	6.1				mgd	Varies			
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL	Varies			
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL	Varies			
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations							1			HSPS at WTP - sized to handle full WTP capacity
41	Capacity per pump station	mgd	184				mgd	10.2			
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP	1381			Assumed 60 psi distribution system pressure
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW								
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 46,574,373			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 46,574,373			

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 5,109,385	finished water pumping
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ 23,100,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 5,555,558			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$3,190,735.70	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab	2060 $	$ 15,235,258	2012 $	$3,686,914.28	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut	2060 $	$ 1,713,438		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency	2060 $	$ 527,832		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529				2060 $	$ 605,842			energy for HSPS
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above				138.6	
95	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 69,674,373			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,367			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	0				$/hp	3700			
101	Treatment unit cost	$/gal	$ -				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter	in				
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.	mi		ft	-	
26											
27											

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	Varies				mgd				
34	Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
35	Friction Loss (estimated)	ft	N/A				ft	N/A			
36	Source elevation	ft MSL	Varies				ft MSL				
37	Norman terminus elevation	ft MSL	Varies				ft MSL				
38	TDH	ft	N/A				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		16								
41	Capacity per pump station	mgd	0.25				mgd				
42	Horsepower	HP					HP				
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd				
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ -			

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	2012 dollars		
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume										
73											
74	Terminal Storage Cost (total)										
75	Norman's portion of terminal storage project										
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars	$ 8,316,000				2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 1,818,336				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$1,284,275	Unit treatment cost per references		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%			$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	
93	Pumping Energy	2060 $	$ 211,035			energy for HSPS		$ -			
94	Pump Head				138.6						
95	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy	2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
97	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 3.08				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Direct non-potable reuse					Bulk treated water from OKC ($/1000 gal)				
3	**YIELD AND FLOW**										
4	Firm Yield						AFY	13,451	MGD	12.0	
5	Firm yield already permitted to or designated for others							-	MGD	0	
6	Pending water right request total amount						AFY		MGD	0	
7	Firm yield available to Norman	AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe	AFY	13,451	MGD	12.0	
8	Firm yield available to Norman as % of 2060 demand	%	3%				%	41%			
9	Do existing water rights exceed firm yield?						Yes/ No	N/A			
10	If yes, what is existing permitted amount?						AFY				
11	If yes, by how much do existing WR exceed firm yield?						AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					6			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%				%	2%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm	in	24			
25	Pipeline Length		7.84	ft	41,400		mi	6.0	ft	31,680	Construction of an additional connection to the Oklahoma City distribution network.
26											
27											

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk treated water from OKC ($/1000 gal)				
28											
29											
30	Pipeline dedicated for Norman's use only?		Yes				Yes/ No	Yes			
31	Terminal storage available?		No				Yes/ No	No			
32	Is pipeline designed to meet average demand or peak demand?		peak				Yes/ No	peak			
33	Design flow rate for pipe		31.46				mgd	22.8			
34	Max velocity in pipeline		5.06				ft/sec	5.61			Back pressure on system limits flow rate by 50%.
35	Friction Loss (estimated)		83				ft	74			Estimated using Hazen-Williams equation and c=120
36	Source elevation		1093				ft MSL	460			Estimation of Moyer's crossing elevation
37	Norman terminus elevation		1312			Varies between 1090 and 1312	ft MSL	1191			Lake Stanley Draper Surface Elevation
38	TDH		302				ft	805			
39	***Pump Station(s)***										
40	Number of pump stations		3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH		0			
41	Capacity per pump station						mgd				
42	Horsepower		800				HP				Overall 65% wire to water efficiency assumed
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type										
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent					
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	27,960,000				2012 dollars	14,093,341			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 27,960,000				2012 dollars	$ 14,093,341			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk treated water from OKC ($/1000 gal)				
65	Raw water conveyance project capital cost (pipeline only)	2012 dollars	Yes		$ 25,000,000		Yes/ No	Yes	012 dolla	$ 13,307,121	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	2012 dollars	Yes		$ 2,960,000		Yes/ No	No	012 dolla	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 786,220	Vault and flow meters
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume			MG	6.5						
73											
74	Terminal Storage Cost (total)		$6,500,000.00								
75	Norman's portion of terminal storage project		$6,500,000.00								
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 3,010,320								
81											
82	Norman's portion of treatment project		$ 3,010,320								
83	Construction Contingency Included? Amount?										
84	Engineering Allowance included? Amount?										
85	Easement acquisition allowance included? Amount										
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 441,954				2012 $/yr	$ 41,150,092			
88	Treatment O&M Costs	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration	2060 $	$ 169,460,173		2012 rates of $2.36/1000gal, assumed escalation of 6% per year	pw:\\PHX-POP-PW.Carollo.local:Carollo\Documents\Client\OK\Norman\8956A00\Reference Material\Client\Norman Comparison of OKC Water Contracts.xlsx
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,033,063		1.0%		2060 $	$ 582,372		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%			$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 268,596		1.0%			$ -		1.0%	
93	Pumping Energy	2060 $	$ 167,211					$ -			part of OKC rate.
94	Pump Head				302		feet			805	see above TDH
95	Other										
96	***Unit cost from supply source***										

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk treated water from OKC ($/1000 gal)				
97	Combined capital costs	2012 dollars	$ 37,470,320				2012 dollars	$ 14,093,341			
98	Supply source unit cost	$/AFY	$ 44,083				$/AFY	$ 1,048			
99	Pipeline unit cost	$/in/LF	$ 14.38				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	3700				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 1.13				$/gal	#DIV/0!			
102							$/1000 gal.	$ 4.66	012 dolla	$ 20,397,680	Assumes Demand Service Plan with 2012 rates and 12.0 MGD usage.
103							$/1000 gal.	$ 2.10	012 dolla	$ 9,184,880	Assumes Demand Service Plan with 2012 rates and 12.0 MGD usage. Peaking Capacity of 2.5 times Subscribed Monthly Usage.
104							$/1000 gal.	$ 1.20	012 dolla	$ 5,242,880	Assumes Service Availability Plan with 2012 rates and 12.0 MGD usage. No Peaking Capacity. Beyond Monthly Capacity Reservation, rates revert to Demand Service Rate, and water availability is subject to Demand Service terms.
105	Operation and Maintenance Costs						$/mgd	$ -			
106	Source development unit cost	$/AF	#DIV/0!				$/AF	$ 2,095.44			

	A	B	C	D	E	F
1	**Porfolio Evaluation Matrix**	**3 Maximize outside sources - OKC Treated (owner)**				
2		**Bulk treated water from OKC**				
3	**YIELD AND FLOW**					**Notes**
4	Firm Yield					
5	Firm yield already permitted to or designated for others					
6	Pending water right request total amount					
7	Firm yield available to Norman	AFY	32,551	MGD	29.06	Additional water (pipeline capacity) available if water rights can be obtained in the future.
8	Firm yield available to Norman as % of 2060 demand	%	100%			
9	Do existing water rights exceed firm yield?					
10	If yes, what is existing permitted amount?					
11	If yes, by how much do existing WR exceed firm yield?					
12	***Source Basin Excess/Surplus Water - Carollo***					
13	Basin of origin		6			
14	Excess/surplus water in source category in basin of origin	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	5%			
16	Frequency of shortages in source category in basin of origin		0%			
17	**RAW WATER SOURCE STORAGE**					
18	Max Surface Area					
19	Storage size overall					
20	Portion of storage allocated to existing users					
21	Portion of storage available for Norman					
22	**RAW WATER CONVEYANCE**					
23	***Pipeline***					
24	Pipeline Diameter	in	108.2			Equivalent Size(new 90" + exist 60")
25	Pipeline Length	mi	100	ft	528,000	
26						
27						
28						
29						
30	Pipeline dedicated for Norman's use only?	Yes/ No	No			
31	Terminal storage available?	Yes/ No	Yes			Lake Stanley Draper
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	average			
33	Design flow rate for pipe	mgd	184			
34	Max velocity in pipeline	ft/sec	< 6.0			
35	Friction Loss (estimated)	ft	276			Estimated using Hazen-Williams equation and c=120
36	Source elevation	ft MSL	460			Estimation of Moyer's crossing elevation
37	Norman terminus elevation	ft MSL	1191			Lake Stanley Draper Surface Elevation
38	TDH	ft	1007			
39	***Pump Station(s)***					
40	Number of pump stations		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.
41	Capacity per pump station	mgd	184			
42	Horsepower	HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study. Overall 65% wire to water efficeincy assumed.
43	***Interconnections***					
44	Number of interconnection points		0			
45	Capacity of interconnection point		0			
46	**TREATMENT**					**Notes**
47	Source water type	SW/ GW	SW			
48	Major constituents of concern					
49	Treatment process					

	A	B	C	D	E	F
2		Bulk treated water from OKC				
50	Peak treatment capacity	mgd	55.21			Estimated using PF * amount available to Norman - check or replace with data from reference materials
51	**PERMITTING / PLANNING STATUS**					**Notes**
52	Description					Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes
53	**CAPITAL COSTS**					
54	***Raw Water Source Storage Costs***					
55	Source capital costs (total)	2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5
56	Norman's portion of source capital costs	2012 dollars	$ 13,133,657			Increased to reflect Norman's larger portion of supply
57	Construction Contingency Included? Amount?	Yes/ No	No	%		
58	Engineering Allowance included? Amount?	Yes/ No	No	%		
59	Easement acquisition allowance included? Amount	Yes/ No	No	%		
60	Source annual costs (total)		$5,634,697			
61	Norman's portion of source annual costs		1,050,693			
62	***Raw Water Conveyance Costs***					
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 1,420,838,383			Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs for Norman only.
64	Norman's portion of raw water conveyance project	2012 dollars	$ 291,408,817			Increased to reflect Norman's larger portion of supply
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 198,864,815	Increased to reflect Norman's larger portion of supply
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 60,195,996	Increased to reflect Norman's larger portion of supply
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars		
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%		
71	***Terminal Storage Costs***					
72	Terminal Storage Volume					
73						
74	Terminal Storage Cost (total)					
75	Norman's portion of terminal storage project					
76	Construction Contingency Included? Amount?					
77	Engineering Allowance included? Amount?					
78	Easement acquisition allowance included? Amount					
79	***Treatment Costs***					
80	Treatment Project Cost (total)					
81						
82	Norman's portion of treatment project	2012 dollars	$102,138,500			Adjusted to reflect better estimates of treatment costs
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%	
86	***Operation and Maintenance Costs***					
87	Total Operation and Maintenance Costs	2012 $/yr	$ 23,554,611			
88	Treatment O&M Costs	2060 $	$ 58,101,203	2012 $	$14,060,421	assumes unit Norman 2012 treatment cost, adjusted by ratio of conventional to conventional with softening
89	Pipe Maintenance - 1% of Capital	2060 $	$ 8,217,595		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 6,218,625		2.5%	

	A	B	C	D	E	F
2		Bulk treated water from OKC				
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 542,716		1.0%	
93	Pumping Energy	2060 $	$ 24,253,448			
94	Pump Head	feet			1145.6	see above TDH
95	Other					
96	***Unit cost from supply source***					
97	Combined capital costs	2012 dollars	$ 406,680,974			
98	Supply source unit cost	$/AFY	$ 12,494			
99	Pipeline unit cost	$/in/LF	$ 20.40			Based on total project pipeline cost, not just Norman's portion
100	Pump station unit cost	$/hp	3676			Based on total project pump station cost, not just Norman's portion
101	Treatment unit cost	$/gal	$ 1.85			
102						
103						
104						
105	Operation and Maintenance Costs	$/mgd	$ -			
106	Source development unit cost	$/AF	#DIV/0!			

	A	B	C	D	E	F
1	**Porfolio Evaluation Matrix**	**3 Maximize outside sources - OKC Treated (owner)**				
2		**Bulk raw water from OKC**				
3	**YIELD AND FLOW**					**Notes**
4	Firm Yield	AFY	303,467	MGD	270.72	Includes pending Lake Sardis permit of 80,000 AFY
5	Firm yield already permitted to or designated for others	AFY	353,029	MGD	314.94	Includes Norman's allocation.
6	Pending water right request total amount	AFY		MGD	0	
7	Firm yield available to Norman	AFY	32,551	MGD	29.06	Additional water (pipeline capacity) available if water rights can be obtained in the future.
8	Firm yield available to Norman as % of 2060 demand		100%			
9	Do existing water rights exceed firm yield?	Yes/ No	No			
10	If yes, what is existing permitted amount?	AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***					
13	Basin of origin		6			
14	Excess/surplus water in source category in basin of origin	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	5%			
16	Frequency of shortages in source category in basin of origin		0%			
17	**RAW WATER SOURCE STORAGE**					
18	Max Surface Area					
19	Storage size overall					
20	Portion of storage allocated to existing users					
21	Portion of storage available for Norman					
22	**RAW WATER CONVEYANCE**					
23	***Pipeline***					
24	Pipeline Diameter	in	108.2			Equivalent Size(new 90" + exist 60")
25	Pipeline Length	mi	100	ft	528,000	
26	Pipeline dedicated for Norman's use only?	Yes/ No	No			
27	Terminal storage available?	Yes/ No	Yes			Lake Stanley Draper
28	Is pipeline designed to meet average demand or peak demand?	Yes/ No	average			
29	Design flow rate for pipe	mgd	184			
30	Max velocity in pipeline	ft/sec	<6			
31	Friction Loss (estimated)	ft	276			Estimated using Hazen-Williams equation and c=120
32	Source elevation	ft MSL	460			Estimation of Moyer's crossing elevation
33	Norman terminus elevation	ft MSL	1150			Ease Side Terminal Storage Reservoir Elevation
34	TDH	ft	966			
35	***Pump Station(s)***					
36	Number of pump stations		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.
37	Capacity per pump station	mgd	184			
38	Horsepower	HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study - *May adjust based on going to new terminal reservoir*
39	***Interconnections***					
40	Number of interconnection points		0			
41	Capacity of interconnection point		0			
42	**TREATMENT**					**Notes**
43	Source water type	SW/ GW				
44	Major constituents of concern					
45	Treatment process		conventional			
46	Peak treatment capacity	mgd	55.21			Estimated using PF * amount available to Norman - check or replace with data from reference materials
47	**PERMITTING / PLANNING STATUS**					**Notes**

	A	B	C	D	E	F
2		Bulk raw water from OKC				
48	Description					Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes
49	**CAPITAL COSTS**					
50	***Raw Water Source Storage Costs***					
51	Source capital costs (total)	2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5
52	Norman's portion of source capital costs	2012 dollars	$ 13,328,024			Increased to reflect Norman's larger portion of supply
53	Construction Contingency Included? Amount?	Yes/ No	No	%		
54	Engineering Allowance included? Amount?	Yes/ No	No	%		
55	Easement acquisition allowance included? Amount	Yes/ No	No	%		
56	Source annual costs (total)		$ 5,634,697.12			Projected Annual Debt Service, Table 10-11
57	Norman's portion of source annual costs		$ 1,066,241.92			Projected Annual Debt Service, Table 10-11
58	***Raw Water Conveyance Costs***					
59	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 1,420,838,383			Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs for Norman only.
60	Norman's portion of raw water conveyance project	2012 dollars	$ 291,655,251			Increased to reflect Norman's larger portion of supply
61	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 203,825,311	Increased to reflect Norman's larger portion of supply
62	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 61,749,501	Increased to reflect Norman's larger portion of supply
63	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars		
64	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
65	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
66	Easement acquisition allowance included? Amount?	Yes/ No	No	%		
67	***Terminal Storage Costs***					
68	Terminal Storage Volume	AF	6100			
69	Terminal Storage Area	AC	$ 381			Assumes 16' Operational depth and 20' Average depth
70	Terminal Storage Cost (total)	2012 dollars	$ 33,550,000			
71	Norman's portion of terminal storage project	2012 dollars	$ 33,550,000			
72	Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%	
73	Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%	
74	Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%	
75	***Treatment Costs***					
76	Treatment Project Cost (total)					
77						
78	Norman's portion of treatment project	2012 dollars	$ 102,138,500			Adjusted to reflect better estimates of treatment costs
79	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
80	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
81	Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%	
82	***Operation and Maintenance Costs***					
83	Total Operation and Maintenance Costs	2012 $/yr	$ 23,770,440			
84	Treatment O&M Costs	2060 $	$ 58,101,203	2012 $	$ 14,060,421	assumes unit Norman 2012 treatment cost, adjusted by ratio of conventional to conventional with softening
85	Pipe Maintenance - 1% of Capital	2060 $	$ 8,422,575		1.0%	
86	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 6,379,112		2.5%	

	A	B	C	D	E	F
2		Bulk raw water from OKC				
87	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	
88	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 1,937,118		1.0%	
89	Pumping Energy	2060 $	$ 23,385,438			
90	Pump Head	feet			1104.6	see above TDH
91	Other					
92	***Unit cost from supply source***					
93	Combined capital costs	2012 dollars	$ 440,671,775			
94	Supply source unit cost	$/AFY	$ 13,538			
95	Pipeline unit cost	$/in/LF	$ 20.90			Based on total project pipeline cost, not just Norman's portion
96	Pump station unit cost	$/hp	3767			Based on total project pump station cost, not just Norman's portion
97	Treatment unit cost	$/gal	$ 1.85			
98						
99						
100						
101	Operation and Maintenance Costs	$/mgd	$ -			
102	Source development unit cost	$/AF	$ 1,922.15			

	A	B	C	D	E	F
1	**Porfolio Evaluation Matrix**	**3 Maximize outside sources - OKC Treated (owner)**				
2		**New out of basin reservoir**				
3	**YIELD AND FLOW**					**Notes**
4	Firm Yield	AFY	45,900	MGD	40.95	
5	Firm yield already permitted to or designated for others		-	MGD	0	
6	Pending water right request total amount	AFY	-	MGD	0	
7	Firm yield available to Norman	AFY	32,551	MGD	29.06	
8	Firm yield available to Norman as % of 2060 demand	%	100%			
9	Do existing water rights exceed firm yield?	Yes/ No	No			
10	If yes, what is existing permitted amount?	AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***					
13	Basin of origin		8			
14	Excess/surplus water in source category in basin of origin	AFY	283,461	MGD	252.88	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	11%			
16	Frequency of shortages in source category in basin of origin		0%			
17	**RAW WATER SOURCE STORAGE**					
18	Max Surface Area	Ac	9,420			
19	Storage size overall	AF	220,240			
20	Portion of storage allocated to existing users	AF				
21	Portion of storage available for Norman	AF	220,240			
22	**RAW WATER CONVEYANCE**					
23	***Pipeline***					
24	Pipeline Diameter	in	42			Pipeline sized to achieve 5-6 fps in pipeline
25	Pipeline Length	mi	75	ft	396,000	
26						
27						
28						
29						
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	Yes			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	average			
33	Design flow rate for pipe	mgd	29.06			
34	Max velocity in pipeline	ft/sec	4.67			
35	Friction Loss (estimated)	ft	681			Estimated using Hazen-Williams equation and c=120
36	Source elevation	ft MSL	890			
37	Norman terminus elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation
38	TDH	ft	941			
39	***Pump Station(s)***					
40	Number of pump stations		3			
41	Capacity per pump station	mgd	29			
42	Horsepower	HP	22,087			Overall 65% wire to water efficiency assumed
43	***Interconnections***					
44	Number of interconnection points		0			
45	Capacity of interconnection point		0			
46	**TREATMENT**					**Notes**
47	Source water type	SW/ GW				
48	Major constituents of concern					
49	Treatment process		Conventional with softening			
50	Peak treatment capacity	mgd	55.21			Estimated using PF * amount available to Norman
51	**PERMITTING / PLANNING STATUS**					**Notes**
52	Description					
53	**CAPITAL COSTS**					
54	***Raw Water Source Storage Costs***					
55	Source capital costs (total)	2012 dollars	$ 176,192,000			Adjusted to be consistent with other source unit cost

	A	B	C	D	E	F
2		New out of basin reservoir				
56	Norman's portion of source capital costs	2012 dollars	$ 125,033,932			Portion of Norman's cost based on anticipated average use
57	Construction Contingency Included? Amount?	Yes/ No	Yes	%		
58	Engineering Allowance included? Amount?	Yes/ No	Yes	%		
59	Easement acquisition allowance included? Amount	Yes/ No	Yes	%		
60	Source annual costs (total)					
61	Norman's portion of source annual costs					
62	***Raw Water Conveyance Costs***					
63	Raw Water Conveyance Project Cost (total)	2012 dollars				
64	Norman's portion of raw water conveyance project	2012 dollars	$ 349,005,169			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 282,744,000	Calculated using pipeline unit cost of $17/in/LF
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 66,261,169	Calculated using oump station unit cost of $3000/hp
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars		
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	Percentage of pipeline and pump station construction cost only.
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	Percentage of pipeline and pump station construction plus contingency.
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%		
71	***Terminal Storage Costs***					
72	Terminal Storage Volume	AF	5900			
73	Terminal Storage Area	AC	369			Assumes 16' Operational depth and 20' Average depth
74	Terminal Storage Cost (total)	2012 dollars	$32,450,000.00			
75	Norman's portion of terminal storage project	2012 dollars	$32,450,000.00			
76	Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%	
77	Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%	
78	Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%	
79	***Treatment Costs***					
80	Treatment Project Cost (total)	2012 dollars	$ 110,420,000			
81						
82	Norman's portion of treatment project	2012 dollars	$ 110,420,000			
83	Construction Contingency Included? Amount?	Yes/ No		%	25.0%	Adjusted to reflect better estimates of treatment costs
84	Engineering Allowance included? Amount?	Yes/ No		%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No		%	5.0%	
86	***Operation and Maintenance Costs***					
87	Total Operation and Maintenance Costs	2012 $/yr	$ 25,540,089			
88	Treatment O&M Costs	2060 $	$ 62,812,112	2012 $	$15,200,455.67	assumes unit Norman 2012 treatment cost
89	Pipe Maintenance - 1% of Capital	2060 $	$ 11,683,694		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 6,845,196		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 1,340,916		1.0%	
93	Pumping Energy	2060 $	$ 22,856,164			
94	Pump Head	feet			1079.6	see above TDH
95	Other					
96	***Unit cost from supply source***					
97	Combined capital costs	2012 dollars	$ 616,909,101			
98	Supply source unit cost	$/AFY	$ 18,952			

	A	B	C	D	E	F
2		New out of basin reservoir				
99	Pipeline unit cost	$/in/LF	$ 17.00			
100	Pump station unit cost	$/hp	3000			
101	Treatment unit cost	$/gal	$ 2.00			
102						
103						
104						
105	Operation and Maintenance Costs	$/mgd				
106	Source development unit cost	$/AF	$ 567.72			

	A	B	C	D	E	F
1	**Porfolio Evaluation Matrix**	**3 Maximize outside sources - OKC Treated (owner)**				
2		**Kaw Lake**				
3	**YIELD AND FLOW**					**Notes**
4	Firm Yield	AFY	187,040	MGD	166.86	
5	Firm yield already permitted to or designated for others		141,403	MGD	126.15	
6	Pending water right request total amount	AFY	64,050	MGD	57.14	
7	Firm yield available to Norman	AFY	32,551	MGD	29.06	No supply available to Norman if pending water right applications are granted. For puprose of comparing to other sources on other evaluation criteria, "firm yield available to Norman" does not include pending water rights applications.
8	Firm yield available to Norman as % of 2060 demand	%	100%			
9	Do existing water rights exceed firm yield?	Yes/ No	No			
10	If yes, what is existing permitted amount?	AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***					
13	Basin of origin		72			
14	Excess/surplus water in source category in basin of origin	AFY	1,202,486	MGD	1072.74	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%			
16	Frequency of shortages in source category in basin of origin		0%			
17	**RAW WATER SOURCE STORAGE**					
18	Max Surface Area	Ac	17,040			
19	Storage size overall	AF	428,600			
20	Portion of storage allocated to existing users	AF				
21	Portion of storage available for Norman	AF	428,600			
22	**RAW WATER CONVEYANCE**					
23	***Pipeline***					
24	Pipeline Diameter	in	54			
25	Pipeline Length	mi	52	ft	274,560	
26	Pipeline Diameter	in	48			
27	Pipeline Length	mi	0	ft	-	
28	Pipeline Diameter	in	36			
29	Pipeline Length	mi	83	ft	438,240	
30	Pipeline dedicated for Norman's use only?	Yes/ No	No			
31	Terminal storage available?	Yes/ No	Yes			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	average			
33	Design flow rate for pipe	mgd	56.1			Adjusted to account for increase in Norman demand and to acount for Edmond not participating in project
34	Max velocity in pipeline	ft/sec	5.45			No change in pipe size required
35	Friction Loss (estimated)	ft	469			
36	Source elevation	ft MSL	888			
37	Norman terminus elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation
38	TDH	ft	731			
39	***Pump Station(s)***					
40	Number of pump stations		3			
41	Capacity per pump station	mgd	29			
42	Horsepower	HP	17,158			Overall 65% wire to water efficiency assumed
43	***Interconnections***					
44	Number of interconnection points		1			
45	Capacity of interconnection point					
46	**TREATMENT**					**Notes**
47	Source water type	SW/ GW				
48	Major constituents of concern					
49	Treatment process		Conventional with softening			
50	Peak treatment capacity	mgd	55.21			Estimated using PF * amount available to Norman

	A	B	C	D	E	F
2		Kaw Lake				
51	**PERMITTING / PLANNING STATUS**					**Notes**
52	Description					No supply available to Norman if pending water right applications are granted. For puprose of comparing to other sources on other evaluation criteria, "firm yield available to Norman" does not include pending water rights applications.
53	**CAPITAL COSTS**					
54	***Raw Water Source Storage Costs***					
55	Source capital costs (total)	2012 dollars				Reservoir already constructed - *Water right costs to be determined*
56	Norman's portion of source capital costs	2012 dollars				
57	Construction Contingency Included? Amount?	Yes/ No	Yes	%		
58	Engineering Allowance included? Amount?	Yes/ No	Yes	%		
59	Easement acquisition allowance included? Amount	Yes/ No	Yes	%		
60	Source annual costs (total)					
61	Norman's portion of source annual costs					
62	***Raw Water Conveyance Costs***					
63	Raw Water Conveyance Project Cost (total)	2012 dollars				
64	Norman's portion of raw water conveyance project	2012 dollars	$ 479,538,706			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$413,700,000	
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 63,484,000	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ 2,354,706	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%	4.8%	
71	***Terminal Storage Costs***					
72	Terminal Storage Volume	AF	6100			
73	Terminal Storage Area	AC	381			Assumes 16' Operational depth and 20' Average depth
74	Terminal Storage Cost (total)	2012 dollars	$33,550,000.00			
75	Norman's portion of terminal storage project	2012 dollars	$33,550,000.00			
76	Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%	
77	Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%	
78	Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%	
79	***Treatment Costs***					
80	Treatment Project Cost (total)	2012 dollars	$ 110,420,000			
81						
82	Norman's portion of treatment project	2012 dollars	$ 110,420,000			
83	Construction Contingency Included? Amount?	Yes/ No		%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No		%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No		%	5.0%	
86	***Operation and Maintenance Costs***					
87	Total Operation and Maintenance Costs	2012 $/yr	$ 25,738,864			
88	Treatment O&M Costs	2060 $	$ 62,812,112	2012 $	$15,200,455.67	assumes unit Norman 2012 treatment cost
89	Pipe Maintenance - 1% of Capital	2060 $	$ 17,192,428		1.0%	

	A	B	C	D	E	F
2		Kaw Lake				
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 6,558,297		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 1,386,371		1.0%	
93	Pumping Energy	2060 $	$ 18,410,264			
94	Pump Head				869.6	see above TDH
95	Other					
96	***Unit cost from supply source***					
97	Combined capital costs	2012 dollars	$ 623,508,706			
98	Supply source unit cost	$/AFY	$ 19,155			
99	Pipeline unit cost	$/in/LF	$ 16.81			Adjusted to exclude the City of Edmond from project participation.
100	Pump station unit cost	$/hp	$ 3,700			Adjusted to be consistent with other source unit cost
101	Treatment unit cost	$/gal	$ 2.00			
102						
103						
104						
105	Operation and Maintenance Costs	$/mgd				
106	Source development unit cost	$/AF	$ -			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**7 No GW or TB Aug; OKC Treated (as owner)**									
2		**Lake Thunderbird**					**Conservation - additional**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in				
25	Pipeline Length	mi	8.5	ft	44,880		mi		ft	-	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	6.1				mgd				
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL				

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL				
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations										
41	Capacity per pump station	mgd	184				mgd				
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP				
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17				mgd				
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut		$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529					$ -			
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above					
95	Other						2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	0				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ -				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Direct non-potable reuse					Bulk treated water from OKC				
3	**YIELD AND FLOW**										
4	Firm Yield						AFY	23,764	MGD	21.2	
5	Firm yield already permitted to or designated for others							-	MGD	0	
6	Pending water right request total amount						AFY		MGD	0	
7	Firm yield available to Norman	AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe	AFY	23,764	MGD	21.2	
8	Firm yield available to Norman as % of 2060 demand	%	3%				%	73%			
9	Do existing water rights exceed firm yield?						Yes/ No	N/A			
10	If yes, what is existing permitted amount?						AFY				
11	If yes, by how much do existing WR exceed firm yield?						AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					6			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%				%	3%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm	in	108.2			Equivalent Size(new 90" + exist 60")
25	Pipeline Length		7.84	ft	41,400		mi	100.0	ft	528,000	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?		Yes				Yes/ No	No			
31	Terminal storage available?		No				Yes/ No	Yes			Lake Stanley Draper
32	Is pipeline designed to meet average demand or peak demand?		peak				Yes/ No	average			
33	Design flow rate for pipe		31.46				mgd	184			
34	Max velocity in pipeline		5.06				ft/sec	< 6.0			
35	Friction Loss (estimated)		83				ft	276			Estimated using Hazen-Williams equation and c=120
36	Source elevation		1093				ft MSL	460			Estimation of Moyer's crossing elevation

	A	L	M	N	O	P	Q	R	S	T	U
2		Direct non-potable reuse					Bulk treated water from OKC				
37	Norman terminus elevation		1312			Varies between 1090 and 1312	ft MSL	1191			Lake Stanley Draper Surface Elevation
38	TDH		302				ft	1007			
39	***Pump Station(s)***										
40	Number of pump stations		3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.
41	Capacity per pump station						mgd	184			
42	Horsepower		800				HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study. Overall 65% wire to water efficeincy assumed.
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type						SW/ GW	SW			
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent	mgd	32.2			
51	**PERMITTING / PLANNING STATUS**										
52	Description										Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)						2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5
56	Norman's portion of source capital costs						2012 dollars	$ 9,581,272			Modified to reflect portfolio supply amount
57	Construction Contingency Included? Amount?						Yes/ No	No	%		
58	Engineering Allowance included? Amount?						Yes/ No	No	%		
59	Easement acquisition allowance included? Amount						Yes/ No	No	%		
60	Source annual costs (total)							$5,634,697			
61	Norman's portion of source annual costs							766,502			
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	27,960,000				2012 dollars	1,546,597,578			Modified to reflect portfolio supply amount - Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs - Table 9-18
64	Norman's portion of raw water conveyance project	2012 dollars	$ 27,960,000				2012 dollars	209,665,598			Modified to reflect portfolio supply amount - Table 9-18
65	Raw water conveyance project capital cost (pipeline only)	2012 dollars	Yes		$ 25,000,000		Yes/ No	Yes	012 dolla	$ 143,081,156	
66	Raw water conveyance project capital cost (pump stations only)	2012 dollars	Yes		$ 2,960,000		Yes/ No	No	012 dolla	$ 43,310,390	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume			MG	6.5						
73											

	A	L	M	N	O	P	Q	R	S	T	U
2		Direct non-potable reuse					Bulk treated water from OKC				
74	Terminal Storage Cost (total)		$6,500,000.00								
75	Norman's portion of terminal storage project		$6,500,000.00								
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 3,010,320								
81											
82	Norman's portion of treatment project		$ 3,010,320				2012 dollars	$59,570,000			Conventional Treatment - Adjusted from Central OK Study to reflect better estimates of treatment costs
83	Construction Contingency Included? Amount?										
84	Engineering Allowance included? Amount?										
85	Easement acquisition allowance included? Amount										
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 441,954				2012 $/yr	$ 17,148,527			
88	Treatment O&M Costs	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration	2060 $	$ 42,386,016	2012 $	$10,257,365.08	assumes unit Norman 2012 treatment cost, adjusted by ratio of conventional to conventional with softening
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,033,063		1.0%		2060 $	$ 5,912,474		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%		2060 $	$ 4,474,236		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 268,596		1.0%		2060 $	$ 395,922		1.0%	
93	Pumping Energy	2060 $	$ 167,211				2060 $	$ 17,693,386			
94	Pump Head				302		feet			1145.6	see above TDH
95	Other										
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 37,470,320				2012 dollars	$ 278,816,869			
98	Supply source unit cost	$/AFY	$ 44,083				$/AFY	$ 11,733			
99	Pipeline unit cost	$/in/LF	$ 14.38				$/in/LF	$ 2.50			
100	Pump station unit cost	$/hp	3700				$/hp	542.3968692			
101	Treatment unit cost	$/gal	$ 1.13				$/gal	$ 1.85			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**8 P7 plus Max. TB Aug, less OKC (wholesale)**									
2		**Lake Thunderbird**					**Conservation - additional**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in				
25	Pipeline Length	mi	8.5	ft	44,880		mi		ft	-	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	6.1				mgd				
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL				
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL				
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations										

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
41	Capacity per pump station	mgd	184				mgd				
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP				
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17				mgd				
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$3,190,735.70	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut		$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529					$ -			
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above					
95	Other						2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	0				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ -				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Bulk treated water from OKC ($/1000 gal)					Lake Thunderbird Augmentation				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	5,605	MGD	5		AFY	19,056	MGD	17	
5	Firm yield already permitted to or designated for others		-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	5,605	MGD	5		AFY	19,056	MGD	17	
8	Firm yield available to Norman as % of 2060 demand	%	17%				%	59%			
9	Do existing water rights exceed firm yield?	Yes/ No	N/A				Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0				AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		6					62			
14	Excess/surplus water in source category in basin of origin	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	1%				%	65%			
16	Frequency of shortages in source category in basin of origin		0%					0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										**Notes**
18	Max Surface Area						Ac	N/A			
19	Storage size overall						AF	-			
20	Portion of storage allocated to existing users						AF				
21	Portion of storage available for Norman						AF	-			
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	18				in	30			Pipeline from the Norman WWTP to Dave Blue Creek.
25	Pipeline Length	mi	6.0	ft	31,680	Construction of an additional connection to the Oklahoma City distribution network.	mi	3.87	ft	20,450	Pipeline from the Norman WWTP to Dave Blue Creek.
26							in	42.00			Pipeline from Lake Thunderbird to the Norman WTP.
27							mi	7.00	ft	36,960	Pipeline from Lake Thunderbird to the Norman WTP.
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			Pipeline from Lake Thunderbird to the Norman WTP.
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			Pipeline from Lake Thunderbird to the Norman WTP.
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	Peak			Pipeline from Lake Thunderbird to the Norman WTP.
33	Design flow rate for pipe	mgd	9.5				mgd	29.3			Pipeline from Lake Thunderbird to the Norman WTP.
34	Max velocity in pipeline	ft/sec	4.16			Back pressure on system limits flow rate by 50%.	ft/sec	4.71			Pipeline from Lake Thunderbird to the Norman WTP.
35	Friction Loss (estimated)	ft	59			Estimated using Hazen-Williams equation and c=120	ft	184			Estimated using Hazen-Williams equation and c=120
36	Source elevation	ft MSL	460			Estimation of Moyer's crossing elevation	ft MSL	960			Lake Thunderbird Conservation Elevation
37	Norman terminus elevation	ft MSL	1191			Lake Stanley Draper Surface Elevation	ft MSL	1150			Norman WTP Elevation
38	TDH	ft	790				ft	374			Pipeline from Lake Thunderbird to the Norman WTP.
39	***Pump Station(s)***										
40	Number of pump stations		0					2			

	A	L	M	N	O	P	Q	R	S	T	U
2		Bulk treated water from OKC ($/1000 gal)					Lake Thunderbird Augmentation				
41	Capacity per pump station	mgd					mgd	29.3			Pump Station for the Pipeline from Lake Thunderbird to the Norman WTP.
42	Horsepower	HP				Overall 65% wire to water efficiency assumed	HP	6913			Overall 65% wire to water efficiency assumed. 2,807 HP for Pump Station from Lake Thunderbird to Norman WTP.
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type						SW/ GW	SW			
48	Major constituents of concern							N/A			
49	Treatment process							Conventional with softening			
50	Peak treatment capacity		7.5				mgd	29.3			
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)						2012 dollars	$ 161,150			Low head intake structure only.
56	Norman's portion of source capital costs						2012 dollars	$ 161,150			
57	Construction Contingency Included? Amount?						Yes/ No	No	%	0.25	
58	Engineering Allowance included? Amount?						Yes/ No	No	%	0.2	
59	Easement acquisition allowance included? Amount						Yes/ No	No	%	0.2	
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	10,766,560				2012 dollars	63,484,165			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 10,766,560				2012 dollars	$ 63,484,165			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	012 dolla	$ 9,980,340	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	012 dolla	$ 37,906,165	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	012 dolla	$ -		Yes/ No	Yes	012 dolla	$ 25,578,000	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	Yes	2012 dollars	$ 786,220	Vault and flow meters	Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume										
73											
74	Terminal Storage Cost (total)										
75	Norman's portion of terminal storage project										
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)						2012 dollars	$ 47,260,000			Includes only the WWTP upgrades
81							2012 dollars	$58,600,000			Includes only the WTP upgrades.
82	Norman's portion of treatment project						2012 dollars	$ 105,860,000			
83	Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	

	A	L	M	N	O	P	Q	R	S	T	U
2		Bulk treated water from OKC ($/1000 gal)					Lake Thunderbird Augmentation				
84	Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount						Yes/ No	Yes	%	5.0%	
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 17,194,815				2012 $/yr	$ 12,527,061			
88	Treatment O&M Costs	2060 $	$ 70,608,406		2012 rates of $2.36/1000gal, assumed escalation of 6% per year	pw:\\PHX-POP-PW.Carollo.local:Carollo\Documents\Client\OK\Norman\8956A00\Reference Material\Client\Norman Comparison of OKC Water Contracts.xlsx	2060 $	$ 36,744,869	2012 $	$8,892,214.26	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab
89	Pipe Maintenance - 1% of Capital	2060 $	$ 444,901		1.0%	Calculated hypothetical capital costs for maintenance estimation - assumes use of existing OKC connection	2060 $	$ 1,566,378		1.0%	COMCD_Final_Water_Reuse_Feasibility_Study_October_2012.pdf
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%		2060 $	$ 2,642,368		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	
93	Pumping Energy		$ -			part of OKC rate.	2060 $	$ 4,631,966			
94	Pump Head	feet			790	see above TDH				374	
95	Other						2060 $	$ 6,179,390			WRF Additional treatment costs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 10,766,560				2012 dollars	$ 169,505,315			
98	Supply source unit cost	$/AFY	$ 1,921				$/AFY	$ 8,895			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	$ 61.79			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	3700.056187			
101	Treatment unit cost	$/gal	$ -				$/gal	$ 3.61			
102		$/1000 gal.	$ 4.66	012 dolla	$ -	Assumes Demand Service Plan with 2012 rates and 12.0 MGD usage.					
103		$/1000 gal.	$ 2.10	012 dolla	$ -	Assumes Demand Service Plan with 2012 rates and 12.0 MGD usage. Peaking Capacity of 2.5 times Subscribed Monthly Usage.					
104		$/1000 gal.	$ 1.20	012 dolla	$ -	Assumes Service Availability Plan with 2012 rates and 12.0 MGD usage. No Peaking Capacity. Beyond Monthly Capacity Reservation, rates revert to Demand Service Rate, and water availability is subject to Demand Service terms.					
105	Operation and Maintenance Costs	$/mgd	$ -				$/mgd				
106	Source development unit cost	$/AF	$ 3,841.77				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**9 Max GW use**									
2		**Lake Thunderbird**					**Garber-Wellington Aquifer Wells - Active**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in	13.12			Average Diameter
25	Pipeline Length	mi	8.5	ft	44,880		mi	34.2	ft	180,576	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
33	Design flow rate for pipe	mgd	6.1				mgd	Varies			
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL	Varies			
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL	Varies			
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations							1			HSPS at WTP - sized to handle full WTP capacity
41	Capacity per pump station	mgd	184				mgd	30.70			HSPS at WTP - sized to handle full WTP capacity
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP	2146			Assumed 60 psi distribution system pressure
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW								
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 49,406,961			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 49,406,961			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 7,941,973	finished water pumping
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ 23,100,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 6,011,232			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab	2060 $	$ 15,235,258	2012 $	$ 3,686,914	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut	2060 $	$ 1,713,438		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency	2060 $	$ 820,456		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529				2060 $	$ 2,196,177			energy for HSPS
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above				138.6	
95	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 72,506,961			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,788			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	0				$/hp	3700			
101	Treatment unit cost	$/gal	$ -				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter	in				
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.	mi		ft	-	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	Varies				mgd				
34	Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
35	Friction Loss (estimated)	ft	N/A				ft	N/A			
36	Source elevation	ft MSL	Varies				ft MSL				
37	Norman terminus elevation	ft MSL	Varies				ft MSL				
38	TDH	ft	N/A				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		16								
41	Capacity per pump station	mgd	0.25				mgd				
42	Horsepower	HP					HP				
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd				
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	2012 dollars		
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	10.0%	

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
71	***Terminal Storage Costs***										
72	Terminal Storage Volume										
73											
74	Terminal Storage Cost (total)										
75	Norman's portion of terminal storage project										
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars	$ 8,316,000				2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 1,767,265				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$ 1,284,275	Unit treatment cost per references		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%			$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	
93	Pumping Energy		$ -			energy for HSPS included in GW Active		$ -			
94	Pump Head										
95	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy	2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 3.08				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Direct non-potable reuse					Garber-Wellington Aquifer Wells -New				
3	**YIELD AND FLOW**										
4	Firm Yield						AFY	15,309	MGD	13.66	Firm yield for the addition of one well. Assumes average withdrawal rate of 116 GPM. (6.0 MGD / 36 active wells)
5	Firm yield already permitted to or designated for others						AFY	-	MGD	0	
6	Pending water right request total amount						AFY		MGD	0	
7	Firm yield available to Norman	AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe	AFY	15,309	MGD	13.66	
8	Firm yield available to Norman as % of 2060 demand	%	3%				%	47%	%		
9	Do existing water rights exceed firm yield?						Yes/ No				
10	If yes, what is existing permitted amount?						AFY				
11	If yes, by how much do existing WR exceed firm yield?						AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%				%	52%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										**Notes**
18	Max Surface Area						Ac	N/A			
19	Storage size overall						AF	-			
20	Portion of storage allocated to existing users						AF				
21	Portion of storage available for Norman						AF	-			
22	**RAW WATER CONVEYANCE**										**Notes**
23	***Pipeline***										
24	Pipeline Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm	in	12			Average Diameter
25	Pipeline Length		7.84	ft	41,400		mi	82.0	ft	432,960	Assumes approximately 1 mile of piping per well
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?		Yes				Yes/ No	Yes			
31	Terminal storage available?		No				Yes/ No	No			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Garber-Wellington Aquifer Wells -New				
32	Is pipeline designed to meet average demand or peak demand?		peak				Yes/ No	peak			
33	Design flow rate for pipe		31.46				mgd	Varies			
34	Max velocity in pipeline		5.06				ft/sec	N/A			
35	Friction Loss (estimated)		83				ft	N/A			
36	Source elevation		1093				ft MSL	Varies			
37	Norman terminus elevation		1312			Varies between 1090 and 1312	ft MSL	Varies			
38	TDH		302				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH		82			Assumes one new pump per well
41	Capacity per pump station						mgd	20.5			
42	Horsepower		800				HP				
43	***Interconnections***										
44	Number of interconnection points							0			
45	Capacity of interconnection point							0			
46	**TREATMENT**										**Notes**
47	Source water type						SW/ GW	GW			
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent	mgd	20.50			Assumes 0.25 peak capacity per new well
51	**PERMITTING / PLANNING STATUS**										**Notes**
52	Description										
53	**CAPITAL COSTS**										**Notes**
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)						2012 dollars	$ 51,660,000			Assumes average well cost of $630,000
56	Norman's portion of source capital costs						2012 dollars	$ 51,660,000			
57	Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
58	Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
59	Easement acquisition allowance included? Amount						Yes/ No	Yes	%	10.0%	
60	Source annual costs (total)							$ 4,132,800.00			RYAN - what is this?
61	Norman's portion of source annual costs							$ 4,132,800.00			
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	27,960,000				2012 dollars	$ 90,931,991			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 27,960,000				2012 dollars	$ 90,931,991			
65	Raw water conveyance project capital cost (pipeline only)	2012 dollars	Yes		$ 25,000,000		Yes/ No	Yes	2012 dollars	$ 90,931,991	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	2012 dollars	Yes		$ 2,960,000		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	10.0%	

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Garber-Wellington Aquifer Wells -New				
71	***Terminal Storage Costs***										
72	Terminal Storage Volume			MG	6.5		AF	N/A			
73											
74	Terminal Storage Cost (total)		$6,500,000.00				2012 dollars	N/A			
75	Norman's portion of terminal storage project		$6,500,000.00				2012 dollars	N/A			
76	Construction Contingency Included? Amount?						Yes/ No	N/A	%		
77	Engineering Allowance included? Amount?						Yes/ No	N/A	%		
78	Easement acquisition allowance included? Amount						Yes/ No	N/A	%		
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 3,010,320				2012 dollars	$ 63,140,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project		$ 3,010,320				2012 dollars	$ 63,140,000			
83	Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount						Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 441,954				2012 $/yr	$ 11,988,856			
88	Treatment O&M Costs	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration	2060 $	$ 34,685,605	2012 $	$8,393,874.84	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,033,063		1.0%		2060 $	$ 3,757,539		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%			$ -		2.5%	included in active wells cost
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 268,596		1.0%			$ -		1.0%	
93	Pumping Energy	2060 $	$ 167,211					$ -			energy for HSPS included in GW Active
94	Pump Head				302						
95	Other						2060 $	$ 11,097,827			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 37,470,320				2012 dollars	$ 205,731,991			
98	Supply source unit cost	$/AFY	$ 44,083				$/AFY	$ 13,439			
99	Pipeline unit cost	$/in/LF	$ 14.38				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	3700				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 1.13				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**10 TB + OOB (Parker)**									
2		**Lake Thunderbird**					**Conservation - additional**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in				
25	Pipeline Length	mi	8.5	ft	44,880		mi		ft	-	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	6.1				mgd				
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL				
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL				
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations										
41	Capacity per pump station	mgd	184				mgd				
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP				
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17				mgd				
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut		$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529					$ -			
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above					
95	Other						2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	0				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ -				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		New out of basin reservoir - Parker					Garber-Wellington Aquifer Wells - Active				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	45,900	MGD	40.95		AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others		-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY	-	MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	14,674	MGD	13.1		AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	45%				%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0				AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		8					62			
14	Excess/surplus water in source category in basin of origin	AFY	283,461	MGD	252.88	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	5%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%					0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area	Ac	9,420								
19	Storage size overall	AF	220,240								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	220,240								
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	30			Pipeline sized to achieve 5-6 fps in pipeline	in	13.12			Average Diameter
25	Pipeline Length	mi	75	ft	396,000		mi	34.2	ft	180,576	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	Yes				Yes/ No	No			

	A	L	M	N	O	P	Q	R	S	T	U
2		New out of basin reservoir - Parker					Garber-Wellington Aquifer Wells - Active				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	average				Yes/ No	peak			
33	Design flow rate for pipe	mgd	13.1				mgd	Varies			
34	Max velocity in pipeline	ft/sec	4.13				ft/sec	N/A			
35	Friction Loss (estimated)	ft	802			Estimated using Hazen-Williams equation and c=120	ft	N/A			
36	Source elevation	ft MSL	890				ft MSL	Varies			
37	Norman terminus elevation	ft MSL	1150			East Side Terminal Storage Reservoir Elevation	ft MSL	Varies			
38	TDH	ft	1062				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		3					1			HSPS at WTP - sized to handle full WTP capacity
41	Capacity per pump station	mgd	13				mgd	10.20			HSPS at WTP - sized to handle full WTP capacity
42	Horsepower	HP	11,174			Overall 65% wire to water efficiency assumed	HP	1381			Assumed 60 psi distribution system pressure
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW									
48	Major constituents of concern										
49	Treatment process		Conventional with softening								
50	Peak treatment capacity	mgd	20.5					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars	$ 176,192,000			Adjusted to be consistent with other source unit cost					
56	Norman's portion of source capital costs	2012 dollars	$ 56,364,230			Portion of Norman's cost based on anticipated average use					
57	Construction Contingency Included? Amount?	Yes/ No	Yes	%							
58	Engineering Allowance included? Amount?	Yes/ No	Yes	%							
59	Easement acquisition allowance included? Amount	Yes/ No	Yes	%							
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars					2012 dollars	$ 46,574,373			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 235,482,727				2012 dollars	$ 46,574,373			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 201,960,000	Calculated using pipeline unit cost of $17/in/LF	Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 33,522,727	Calculated using oump station unit cost of $3000/hp	Yes/ No	Yes	2012 dollars	$ 5,109,385	finished water pumping
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	Percentage of pipeline and pump station construction cost only.	Yes/ No	Yes	%	25.0%	

	A	L	M	N	O	P	Q	R	S	T	U
2		New out of basin reservoir - Parker					Garber-Wellington Aquifer Wells - Active				
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	Percentage of pipeline and pump station construction plus contingency.	Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	5900								
73		AC	369			Assumes 16' Operational depth and 20' Average depth					
74	Terminal Storage Cost (total)	2012 dollars	$32,450,000.00								
75	Norman's portion of terminal storage project	2012 dollars	$32,450,000.00								
76	Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%						
77	Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%						
78	Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%						
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 41,000,000				2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars	$ 41,000,000				2012 dollars	$ 23,100,000			
83	Construction Contingency Included? Amount?	Yes/ No		%	25.0%	Adjusted to reflect better estimates of treatment costs	Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No		%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No		%	5.0%		Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 12,807,262				2012 $/yr	$ 5,606,628			
88	Treatment O&M Costs	2060 $	$ 28,315,164	2012 $	$ 6,852,236	assumes unit Norman 2012 treatment cost	2060 $	$ 15,235,258	2012 $	$3,686,914	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 8,345,496		1.0%		2060 $	$ 1,713,438		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 3,463,109		2.5%		2060 $	$ 527,832		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 1,340,916		1.0%			$ -		1.0%	
93	Pumping Energy	2060 $	$ 11,458,150				2060 $	$ 816,877			energy for HSPS
94	Pump Head	feet			1200.6	see above TDH				138.6	
95	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 365,296,957				2012 dollars	$ 69,674,373			
98	Supply source unit cost	$/AFY	$ 24,894				$/AFY	$ 10,367			
99	Pipeline unit cost	$/in/LF	$ 17.00				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	3000				$/hp	3700			
101	Treatment unit cost	$/gal	$ 2.00				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs	$/mgd									
106	Source development unit cost	$/AF	$ 255.92				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Direct non-potable reuse				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.					
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0						
6	Pending water right request total amount	AFY		MGD	0						
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	3%			
9	Do existing water rights exceed firm yield?	Yes/ No									
10	If yes, what is existing permitted amount?	AFY									
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A					
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	3%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.		7.84	ft	41,400	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes					Yes			
31	Terminal storage available?	Yes/ No	No					No			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Garber-Wellington Aquifer Wells - Inactive					Direct non-potable reuse				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak					peak			
33	Design flow rate for pipe	mgd	Varies					31.46			
34	Max velocity in pipeline	ft/sec	N/A					5.06			
35	Friction Loss (estimated)	ft	N/A					83			
36	Source elevation	ft MSL	Varies					1093			
37	Norman terminus elevation	ft MSL	Varies					1312			Varies between 1090 and 1312
38	TDH	ft	N/A					302			
39	***Pump Station(s)***										
40	Number of pump stations		16					3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH
41	Capacity per pump station	mgd	0.25								
42	Horsepower	HP						800			
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type	SW/ GW	GW								
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	27,960,000			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ 27,960,000			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	2012 dollars	Yes		$ 25,000,000	
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		2012 dollars	Yes		$ 2,960,000	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Garber-Wellington Aquifer Wells - Inactive					Direct non-potable reuse				
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume								MG	6.5	
73											
74	Terminal Storage Cost (total)							$6,500,000.00			
75	Norman's portion of terminal storage project							$6,500,000.00			
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars	$ 3,010,320			
81											
82	Norman's portion of treatment project	2012 dollars	$ 8,316,000					$ 3,010,320			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%							
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 1,767,265				2012 $/yr	$ 441,954			
88	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$1,284,275	Unit treatment cost per references	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration
89	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%		2060 $	$ 1,033,063		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost	2060 $	$ 305,787		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%		2060 $	$ 268,596		1.0%	
93	Pumping Energy					energy for HSPS included in GW Active	2060 $	$ 167,211			
94	Pump Head									302	
95	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy					
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ 37,470,320			
98	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ 44,083			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	$ 14.38			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	3700			
101	Treatment unit cost	$/gal	$ 3.08				$/gal	$ 1.13			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**11 P2 but OKC (owner) instead of OKC (wholesale)**									
2		**Lake Thunderbird**					**Garber-Wellington Aquifer Wells - Active**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in	13.12			Average Diameter
25	Pipeline Length	mi	8.5	ft	44,880		mi	34.2	ft	180,576	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
33	Design flow rate for pipe	mgd	6.1				mgd	Varies			
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL	Varies			
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL	Varies			
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations							1			HSPS at WTP - sized to handle full WTP capacity
41	Capacity per pump station	mgd	184				mgd	10.2			
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP	1381			Assumed 60 psi distribution system pressure
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW								
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 46,574,373			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 46,574,373			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 5,109,385	finished water pumping
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ 23,100,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 5,606,628			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab	2060 $	$ 15,235,258	2012 $	$ 3,686,914	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut	2060 $	$ 1,713,438		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency	2060 $	$ 527,832		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529				2060 $	$ 816,877			energy for HSPS
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above				138.6	
95	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 69,674,373			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,367			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	0				$/hp	3700			
101	Treatment unit cost	$/gal	$ -				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter	in				
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.	mi		ft	-	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	Varies				mgd				
34	Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
35	Friction Loss (estimated)	ft	N/A				ft	N/A			
36	Source elevation	ft MSL	Varies				ft MSL				
37	Norman terminus elevation	ft MSL	Varies				ft MSL				
38	TDH	ft	N/A				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		16								
41	Capacity per pump station	mgd	0.25				mgd				
42	Horsepower	HP					HP				
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd				
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	2012 dollars		

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume										
73											
74	Terminal Storage Cost (total)										
75	Norman's portion of terminal storage project										
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars	$ 8,316,000				2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 1,767,265				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$ 1,284,275	Unit treatment cost per references		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%			$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	
93	Pumping Energy					energy for HSPS included in GW Active		$ -			
94	Pump Head										
95	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy	2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 3.08				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Direct non-potable reuse					Bulk treated water from OKC				
3	**YIELD AND FLOW**										
4	Firm Yield						AFY	14,684	MGD	13.1	
5	Firm yield already permitted to or designated for others							-	MGD	0	
6	Pending water right request total amount						AFY		MGD	0	
7	Firm yield available to Norman	AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe	AFY	14,684	MGD	13.1	
8	Firm yield available to Norman as % of 2060 demand	%	3%				%	45%			
9	Do existing water rights exceed firm yield?						Yes/ No	N/A			
10	If yes, what is existing permitted amount?						AFY				
11	If yes, by how much do existing WR exceed firm yield?						AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					6			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%				%	2%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm	in	108.2			Equivalent Size(new 90" + exist 60")
25	Pipeline Length		7.84	ft	41,400		mi	100.0	ft	528,000	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?		Yes				Yes/ No	No			
31	Terminal storage available?		No				Yes/ No	Yes			Lake Stanley Draper

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk treated water from OKC				
32	Is pipeline designed to meet average demand or peak demand?		peak				Yes/ No	average			
33	Design flow rate for pipe		31.46				mgd	184			
34	Max velocity in pipeline		5.06				ft/sec	< 6.0			
35	Friction Loss (estimated)		83				ft	276			Estimated using Hazen-Williams equation and c=120
36	Source elevation		1093				ft MSL	460			Estimation of Moyer's crossing elevation
37	Norman terminus elevation		1312			Varies between 1090 and 1312	ft MSL	1191			Lake Stanley Draper Surface Elevation
38	TDH		302				ft	1007			
39	***Pump Station(s)***										
40	Number of pump stations		3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.
41	Capacity per pump station						mgd	184			
42	Horsepower		800				HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study. Overall 65% wire to water efficeincy assumed.
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type						SW/ GW	SW			
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent	mgd	23.5			
51	**PERMITTING / PLANNING STATUS**										
52	Description										Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)						2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5
56	Norman's portion of source capital costs						2012 dollars	$ 5,920,358			Modified to reflect portfolio supply amount
57	Construction Contingency Included? Amount?						Yes/ No	No	%		
58	Engineering Allowance included? Amount?						Yes/ No	No	%		
59	Easement acquisition allowance included? Amount						Yes/ No	No	%		
60	Source annual costs (total)							$5,634,697			
61	Norman's portion of source annual costs							473,629			
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	27,960,000				2012 dollars	1,546,597,578			Modified to reflect portfolio supply amount - Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs - Table 9-18
64	Norman's portion of raw water conveyance project	2012 dollars	$ 27,960,000				2012 dollars	129,554,353			Modified to reflect portfolio supply amount - Table 9-18
65	Raw water conveyance project capital cost (pipeline only)	2012 dollars	Yes		$ 25,000,000		Yes/ No	Yes	012 dolla	$ 88,411,197	

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk treated water from OKC				
66	Raw water conveyance project capital cost (pump stations only)	2012 dollars	Yes		$ 2,960,000		Yes/ No	No	012 dolla	$ 26,761,899	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume			MG	6.5						
73											
74	Terminal Storage Cost (total)		$6,500,000.00								
75	Norman's portion of terminal storage project		$6,500,000.00								
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 3,010,320								
81											
82	Norman's portion of treatment project		$ 3,010,320				2012 dollars	$43,475,000			Conventional Treatment - Adjusted from Central OK Study to reflect better estimates of treatment costs
83	Construction Contingency Included? Amount?										
84	Engineering Allowance included? Amount?										
85	Easement acquisition allowance included? Amount										
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 441,954				2012 $/yr	$ 10,596,237			
88	Treatment O&M Costs	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration	2060 $	$ 26,190,720	2012 $	$6,338,122.74	assumes unit Norman 2012 treatment cost, adjusted by ratio of conventional to conventional with softening
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,033,063		1.0%		2060 $	$ 3,653,373		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%		2060 $	$ 2,764,673		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 268,596		1.0%		2060 $	$ 244,644		1.0%	
93	Pumping Energy	2060 $	$ 167,211				2060 $	$ 10,932,910			
94	Pump Head				302		feet			1145.6	see above TDH
95	Other										
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 37,470,320				2012 dollars	$ 178,949,711			
98	Supply source unit cost	$/AFY	$ 44,083				$/AFY	$ 12,187			
99	Pipeline unit cost	$/in/LF	$ 14.38				$/in/LF	$ 1.55			
100	Pump station unit cost	$/hp	3700				$/hp	335.1521473			
101	Treatment unit cost	$/gal	$ 1.13				$/gal	$ 1.85			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**12 TB + OOB (Scissortail)**									
2		**Lake Thunderbird**					**Conservation - additional**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in				
25	Pipeline Length	mi	8.5	ft	44,880		mi		ft	-	
26											
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				
31	Terminal storage available?	Yes/ No	No				Yes/ No				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	6.1				mgd				
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL				
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL				
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations										
41	Capacity per pump station	mgd	184				mgd				

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP				
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17				mgd				
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Conservation - additional				
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut		$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529					$ -			
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above					
95	Other						2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	0				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ -				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P
1	**Porfolio Evaluation Matrix**					
2		New out of basin reservoir - Scissortail				
3	**YIELD AND FLOW**					
4	Firm Yield	AFY	32,000	MGD	28.55	
5	Firm yield already permitted to or designated for others		7,339	MGD	6.55	Yield above Norman's need could be used by Ada - this is lower than Ada's projected need (ranges from 6.7 mgd to 11.9 mgd)
6	Pending water right request total amount	AFY		MGD	0	
7	Firm yield available to Norman	AFY	24,661	MGD	22	
8	Firm yield available to Norman as % of 2060 demand	%	76%			
9	Do existing water rights exceed firm yield?	Yes/ No	No			
10	If yes, what is existing permitted amount?	AFY	N/A			
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***					
13	Basin of origin		56			
14	Excess/surplus water in source category in basin of origin	AFY	156,479	MGD	139.59	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	16%			
16	Frequency of shortages in source category in basin of origin		59%			
17	**RAW WATER SOURCE STORAGE**					
18	Max Surface Area	Ac	7,027			
19	Storage size overall	AF	177,524			
20	Portion of storage allocated to existing users	AF	-			The Scissortail Review MD011411 document does not mention storage allocation.
21	Portion of storage available for Norman	AF	177,524			
22	**RAW WATER CONVEYANCE**					
23	***Pipeline***					
24	Pipeline Diameter	in	36			
25	Pipeline Length	mi	60	ft	316,800	
26						
27						
28						
29						
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	Yes			The Scissortail Review MD011411 document does not mention terminal storage.
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	average			Estimated based on whether terminal storage is available - needs to be checked against reference materials
33	Design flow rate for pipe	mgd	22			Design based on minimum available water (either from source or from excess in basin)
34	Max velocity in pipeline	ft/sec	4.81			
35	Friction Loss (estimated)	ft	690			Estimated using Hazen-Williams equation and c=120
36	Source elevation	ft MSL	1005			
37	Norman terminus elevation	ft MSL	1180			East Side Terminal Storage Reservoir Elevation
38	TDH	ft	865			
39	***Pump Station(s)***					
40	Number of pump stations		2			Scissortail Review MD011411
41	Capacity per pump station	mgd	22			

	A	L	M	N	O	P
2		New out of basin reservoir - Scissortail				
42	Horsepower	HP	10,268			Overall 65% wire to water efficiency assumed
43	***Interconnections***					
44	Number of interconnection points		1			The Scissortail Review MD011411 document does not mention interconnection points. Possibly 1 interconnection point at Ada.
45	Capacity of interconnection point		0			
46	**TREATMENT**					**Notes**
47	Source water type	SW/ GW				
48	Major constituents of concern					
49	Treatment process		Conventional with softening			
50	Peak treatment capacity	mgd	36.8			
51	**PERMITTING / PLANNING STATUS**					**Notes**
52	Description					
53	**CAPITAL COSTS**					
54	***Raw Water Source Storage Costs***					
55	Source capital costs (total)	2012 dollars	$ 142,019,200			Adjusted to be consistent with other source unit cost
56	Norman's portion of source capital costs	2012 dollars	$ 109,436,862			Portion of Norman's cost based on anticipated average use
57	Construction Contingency Included? Amount?	Yes/ No	Yes	%		
58	Engineering Allowance included? Amount?	Yes/ No	Yes	%		
59	Easement acquisition allowance included? Amount	Yes/ No	Yes	%		
60	Source annual costs (total)					
61	Norman's portion of source annual costs					
62	***Raw Water Conveyance Costs***					
63	Raw Water Conveyance Project Cost (total)	2012 dollars				
64	Norman's portion of raw water conveyance project	2012 dollars	$ 224,686,443			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 193,881,600	Calculated using pipeline unit cost of $17/in/LF
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ 30,804,843	Calculated using oump station unit cost of $3000/hp
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars		
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	Percentage of pipeline and pump station construction cost only.
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	Percentage of pipeline and pump station construction plus contingency.
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%		
71	***Terminal Storage Costs***					
72	Terminal Storage Volume	AF	4200			
73		AC	263			Assumes 16' Operational depth and 20' Average depth
74	Terminal Storage Cost (total)	2012 dollars	$23,100,000.00			
75	Norman's portion of terminal storage project	2012 dollars	$23,100,000.00			
76	Construction Contingency Included? Amount?	Yes/ No	Yes		25.0%	
77	Engineering Allowance included? Amount?	Yes/ No	Yes		20.0%	
78	Easement acquisition allowance included? Amount	Yes/ No	Yes		20.0%	
79	***Treatment Costs***					
80	Treatment Project Cost (total)	2012 dollars	$ 73,600,000			
81						
82	Norman's portion of treatment project	2012 dollars	$ 73,600,000			
83	Construction Contingency Included? Amount?	Yes/ No		%	25.0%	Adjusted to reflect better estimates of treatment costs

	A	L	M	N	O	P
2		New out of basin reservoir - Scissortail				
84	Engineering Allowance included? Amount?	Yes/ No		%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No		%	5.0%	
86	***Operation and Maintenance Costs***					
87	Total Operation and Maintenance Costs	2012 $/yr	$ 18,340,123			
88	Treatment O&M Costs	2060 $	$ 47,552,184	2012 $	$ 11,507,571	assumes unit Norman 2012 treatment cost
89	Pipe Maintenance - 1% of Capital	2060 $	$ 8,011,676		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 3,182,334		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 954,550		1.0%	
93	Pumping Energy	2060 $	$ 16,085,264			
94	Pump Head	feet			1003.6	see above TDH
95	Other					
96	***Unit cost from supply source***					
97	Combined capital costs	2012 dollars	$ 430,823,305			
98	Supply source unit cost	$/AFY	$ 17,470			
99	Pipeline unit cost	$/in/LF	$ 17.00			
100	Pump station unit cost	$/hp	3000			
101	Treatment unit cost	$/gal	$ 2.00			
102						
103						
104						
105	Operation and Maintenance Costs	$/mgd				
106	Source development unit cost	$/AF	$ 616.46			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**11 P2 but OKC (owner) instead of OKC (wholesale)**									
2		**Lake Thunderbird**					**Garber-Wellington Aquifer Wells - Active**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in	13.12			Average Diameter
25	Pipeline Length	mi	8.5	ft	44,880		mi	34.2	ft	180,576	
26	Pipeline Diameter										
27	Pipeline Length										
28	Design flow rate for pipe										
29	Max velocity in pipeline										
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
33	Design flow rate for pipe	mgd	6.1				mgd	Varies			
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL	Varies			
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL	Varies			
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations							1			HSPS at WTP - sized to handle full WTP capacity
41	Capacity per pump station	mgd	184				mgd	10.2			
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP	1381			Assumed 60 psi distribution system pressure
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW								
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 46,574,373			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 46,574,373			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 5,109,385	finished water pumping
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ 23,100,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 5,606,628			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab	2060 $	$ 15,235,258	2012 $	$ 3,686,914	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut	2060 $	$ 1,713,438		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency	2060 $	$ 527,832		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	
93	Pumping Energy	2060 $	$ 1,402,529				2060 $	$ 816,877			energy for HSPS
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above				138.6	
95	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 69,674,373			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,367			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	0				$/hp	3700			
101	Treatment unit cost	$/gal	$ -				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	1,121	MGD	1.0	
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	3%	%		
9	Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	4%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter	in				
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.	mi		ft	-	
26	Pipeline Diameter										
27	Pipeline Length										
28	Design flow rate for pipe										
29	Max velocity in pipeline										
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No				

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
31	Terminal storage available?	Yes/ No	No				Yes/ No				
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No				
33	Design flow rate for pipe	mgd	Varies				mgd				
34	Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
35	Friction Loss (estimated)	ft	N/A				ft	N/A			
36	Source elevation	ft MSL	Varies				ft MSL				
37	Norman terminus elevation	ft MSL	Varies				ft MSL				
38	TDH	ft	N/A				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		16								
41	Capacity per pump station	mgd	0.25				mgd				
42	Horsepower	HP					HP				
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type	SW/ GW	GW				SW/ GW				
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd				
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	$ -			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ -			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	2012 dollars		

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Conservation - additional				
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume										
73											
74	Terminal Storage Cost (total)										
75	Norman's portion of terminal storage project										
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars				
81											
82	Norman's portion of treatment project	2012 dollars	$ 8,316,000				2012 dollars	$ -			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 1,767,265				2012 $/yr	$ 150,000			
88	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$ 1,284,275	Unit treatment cost per references		$ -			
89	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%			$ -		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost		$ -		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	
93	Pumping Energy					energy for HSPS included in GW Active		$ -			
94	Pump Head										
95	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy	2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ -			
98	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ -			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	#DIV/0!			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 3.08				$/gal	#DIV/0!			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Direct non-potable reuse					Bulk raw water from OKC				
3	**YIELD AND FLOW**										
4	Firm Yield						AFY	14,684	MGD	13.1	
5	Firm yield already permitted to or designated for others							-	MGD	0	
6	Pending water right request total amount						AFY		MGD	0	
7	Firm yield available to Norman	AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe	AFY	14,684	MGD	13.1	
8	Firm yield available to Norman as % of 2060 demand	%	3%				%	45%			
9	Do existing water rights exceed firm yield?						Yes/ No	N/A			
10	If yes, what is existing permitted amount?						AFY				
11	If yes, by how much do existing WR exceed firm yield?						AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					6			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	713,617	MGD	636.62	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	3%				%	2%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter		42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm	in	108.2			Equivalent Size(new 90" + exist 60")
25	Pipeline Length		7.84	ft	41,400		mi	100	ft	528,000	
26	Pipeline Diameter						in	30			Pipe from Draper to northside of Norman (new WTP)
27	Pipeline Length						mi	3	ft	15,840	
28	Design flow rate for pipe						mgd	13.1			
29	Max velocity in pipeline						ft/sec	4.1			
30	Pipeline dedicated for Norman's use only?		Yes				Yes/ No	No			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk raw water from OKC				
31	Terminal storage available?		No				Yes/ No	Yes			Lake Stanley Draper
32	Is pipeline designed to meet average demand or peak demand?		peak				Yes/ No	average			
33	Design flow rate for pipe		31.46				mgd	184			
34	Max velocity in pipeline		5.06				ft/sec	<6			
35	Friction Loss (estimated)		83				ft	276			Estimated using Hazen-Williams equation and c=120
36	Source elevation		1093				ft MSL	460			Estimation of Moyer's crossing elevation
37	Norman terminus elevation		1312			Varies between 1090 and 1312	ft MSL	1150			Ease Side Terminal Storage Reservoir Elevation
38	TDH		302				ft	966			
39	***Pump Station(s)***										
40	Number of pump stations		3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH		8			1 from Moyer's Crossing to Atoka Pipeline. 6 from Atoka Pipeline to Lake Stanley Draper. 1 from Lake Stanley Draper to Norman.
41	Capacity per pump station						mgd	184			
42	Horsepower		800				HP	79850			Sum of horsepower for new pump stations along route from Moyers Crossing to Draper from 2009 Central OK Study - *May adjust based on going to new terminal reservoir*
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type						SW/ GW	SW			
48	Major constituents of concern										
49	Treatment process							conventional			
50	Peak treatment capacity	mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent	mgd	20.5			
51	**PERMITTING / PLANNING STATUS**										
52	Description										Water rights allocations are dependent upon unresolved ownership discussions between the State and Tribes
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)						2012 dollars	$ 70,433,714			Sardis Debt Service, Table 10-5
56	Norman's portion of source capital costs						2012 dollars	$ 5,920,358			Modified to reflect portfolio supply amount
57	Construction Contingency Included? Amount?						Yes/ No	No	%		
58	Engineering Allowance included? Amount?						Yes/ No	No	%		
59	Easement acquisition allowance included? Amount						Yes/ No	No	%		
60	Source annual costs (total)							$5,634,697			
61	Norman's portion of source annual costs							473,629			
62	***Raw Water Conveyance Costs***										
63	Raw Water Conveyance Project Cost (total)	2012 dollars	27,960,000				2012 dollars	$ 1,420,838,383			Includes all costs from Moyer's Crossing to Lake Stanley Draper, and includes distribution - D1 costs for Norman only.
64	Norman's portion of raw water conveyance project	2012 dollars	$ 27,960,000				2012 dollars	136,406,737			Modified to reflect portfolio supply amount - Table 9-18 - Plus pipe from Draper to Norman
65	Raw water conveyance project capital cost (pipeline only)	2012 dollars	Yes		$ 25,000,000		Yes/ No	Yes	012 dolla	$ 95,263,581	

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Direct non-potable reuse					Bulk raw water from OKC				
66	Raw water conveyance project capital cost (pump stations only)	2012 dollars	Yes		$ 2,960,000		Yes/ No	No	012 dolla	$ 26,761,899	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars		
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume			MG	6.5		AF	6100			
73							AC	$ 381			Assumes 16' Operational depth and 20' Average depth
74	Terminal Storage Cost (total)		$6,500,000.00				2012 dollars	$ 33,550,000			
75	Norman's portion of terminal storage project		$6,500,000.00				2012 dollars	$ 33,550,000			
76	Construction Contingency Included? Amount?						Yes/ No	Yes		25.0%	
77	Engineering Allowance included? Amount?						Yes/ No	Yes		20.0%	
78	Easement acquisition allowance included? Amount						Yes/ No	Yes		20.0%	
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 3,010,320								
81											
82	Norman's portion of treatment project		$ 3,010,320				2012 dollars	$37,925,000			Conventional Treatment - Adjusted from Central OK Study to reflect better estimates of treatment costs
83	Construction Contingency Included? Amount?										
84	Engineering Allowance included? Amount?										
85	Easement acquisition allowance included? Amount										
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 441,954				2012 $/yr	$ 10,905,572			
88	Treatment O&M Costs	2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration	2060 $	$ 26,190,720	2012 $	$6,338,122.74	assumes unit Norman 2012 treatment cost, adjusted by ratio of conventional to conventional with softening
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,033,063		1.0%		2060 $	$ 3,936,531		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%		2060 $	$ 2,764,673		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital	2060 $	$ 268,596		1.0%		2060 $	$ 1,631,015		1.0%	
93	Pumping Energy	2060 $	$ 167,211				2060 $	$ 10,541,631			
94	Pump Head				302		feet			1104.6	see above TDH
95	Other										
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 37,470,320				2012 dollars	$ 213,802,095			
98	Supply source unit cost	$/AFY	$ 44,083				$/AFY	$ 14,560			
99	Pipeline unit cost	$/in/LF	$ 14.38				$/in/LF	$ 1.67			
100	Pump station unit cost	$/hp	3700				$/hp	335.1521473			
101	Treatment unit cost	$/gal	$ 1.13				$/gal	$ 1.85			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	B	C	D	E	F	G	H	I	J	K
1	**Porfolio Evaluation Matrix**	**1 Maximize local sources with add'l cons/full reuse**									
2							**Garber-Wellington Aquifer Wells - Active**				
3	**YIELD AND FLOW**					**Notes**					
4	Firm Yield	AFY	15,600	MGD	13.92	COMCD Lake Thunderbird Baseline Yield. Anticipated reduction from current conjunctive yield .	AFY	6,721	MGD	6.0	Historical flow data indicates that approximately 9.0 MGD can be achieved druing maximum withdrawal from the active wells. However, 6.0 MGD was determined to be the long-term sustainable yield based on experience during the summer of 2012 (second year of a two year drought). 6.0 MGD appears to be sustainable under the combined strain of drought conditions and after sustained maximum withdrawals for a period of one month.
5	Firm yield already permitted to or designated for others	AFY	8,767	MGD	7.82		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	6,833	MGD	6.1	Norman's portion (43.8%) of COMCD Lake Thunderbird Baseline Yield.	AFY	6,721	MGD	6.0	
8	Firm yield available to Norman as % of 2060 demand	%	21%	%			%	21%	%		
9	Do existing water rights exceed firm yield?	Yes/ No	No				Yes/ No				
10	If yes, what is existing permitted amount?	AFY	N/A				AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	23%				%	23%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**					
18	Max Surface Area	Ac	5,439								
19	Storage size overall	AF	105,838								
20	Portion of storage allocated to existing users	AF									
21	Portion of storage available for Norman	AF	105,838								
22	**RAW WATER CONVEYANCE**					**Notes**					
23	***Pipeline***										
24	Pipeline Diameter	in	48				in	13.12			Average Diameter
25	Pipeline Length	mi	8.5	ft	44,880		mi	34.2	ft	180,576	
26											

	A	B	C	D	E	F	G	H	I	J	K
2					Lake Thunderbird			Garber-Wellington Aquifer Wells - Active			
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
33	Design flow rate for pipe	mgd	6.1				mgd	Varies			
34	Max velocity in pipeline	ft/sec	0.8				ft/sec	N/A			
35	Friction Loss (estimated)	ft	2				ft	N/A			
36	Source elevation	ft MSL	1005			from COMCD email, 1/30/13	ft MSL	Varies			
37	Norman terminus elevation	ft MSL	1180			from COMCD email, 1/30/13	ft MSL	Varies			
38	TDH	ft	177				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		1					1			HSPS at WTP - sized to handle full WTP capacity
41	Capacity per pump station	mgd					mgd	11.2			
42	Horsepower	HP	1000			4 - 250 HP pumps - from COMCD email 1/30/13	HP	1418			Assumed 60 psi distribution system pressure
43	***Interconnections***										
44	Number of interconnection points		0								
45	Capacity of interconnection point		0								
46	**TREATMENT**					**Notes**					
47	Source water type	SW/ GW	GW								
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	17					7.5			Maximum daily withdrawal of active well field (9.0 MGD based on historical data) minus the assumed capacity from seven southern wells that are pumped to the existing Norman WTP to be blended with treated surface water.
51	**PERMITTING / PLANNING STATUS**					**Notes**					
52	Description										
53	**CAPITAL COSTS**					**Notes**					
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)	2012 dollars									
56	Norman's portion of source capital costs	2012 dollars									
57	Construction Contingency Included? Amount?	Yes/ No	No	%							
58	Engineering Allowance included? Amount?	Yes/ No	No	%							
59	Easement acquisition allowance included? Amount	Yes/ No	No	%							
60	Source annual costs (total)		$ -								
61	Norman's portion of source annual costs		$ -								
62	***Raw Water Conveyance Costs***										

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	$ 46,712,548			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 46,712,548			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 41,464,988	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ 5,247,560	Finished water pumping
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars			Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	No	%			Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume	AF	N/A								
73											
74	Terminal Storage Cost (total)	2012 dollars	N/A								
75	Norman's portion of terminal storage project	2012 dollars	N/A								
76	Construction Contingency Included? Amount?	Yes/ No	N/A	%							
77	Engineering Allowance included? Amount?	Yes/ No	N/A	%							
78	Easement acquisition allowance included? Amount	Yes/ No	N/A	%							
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars				Existing WTP can treat 17 mgd (approximately 5 mgd excess)	2012 dollars	$ 23,100,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars					2012 dollars	$ 23,100,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 3,914,787				2012 $/yr	$ 5,559,012			
88	Treatment O&M Costs	2060 $	$ 13,184,924	2012 $	$ 3,190,736	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab	2060 $	$ 15,235,258	2012 $	$3,686,914.28	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,283,649		1.0%	48-inch, 8.5 mile pipeline, assume urban open cut	2060 $	$ 1,713,438		1.0%	
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 305,787		2.5%	assume 800 HP based on 17 mgd, 190 feet head, 75% efficiency	2060 $	$ 542,106		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	n/a		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	n/a		$ -		1.0%	

	A	B	C	D	E	F	G	H	I	J	K
2		Lake Thunderbird					Garber-Wellington Aquifer Wells - Active				
93	Pumping Energy	2060 $	$ 1,402,529				2060 $	$ 605,842			energy for HSPS
94	Pump Head	feet			315.6	(source 960 ft, terminal 1150 ft) See HL calcs above plus distribution pressure				138.6	
95	Other						2060 $	$ 4,874,595			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 69,812,548			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ 10,387			
99	Pipeline unit cost	$/in/LF	$ -				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	0				$/hp	3700			
101	Treatment unit cost	$/gal	$ -				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	$ -				$/AF	#DIV/0!			

	A	L	M	N	O	P	Q	R	S	T	U
1	**Porfolio Evaluation Matrix**										
2		Garber-Wellington Aquifer Wells - Inactive					Garber-Wellington Aquifer Wells -New				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	2,341	MGD	2.1	Historical flow data indicates that approximately 2.7 MGD can be achieved druing maximum withdrawal from the inactive wells. However, 2.1 MGD was determined to be the long-term sustainable yield due to the minimal spacing of wells 10-18 along SH-77 that effectively reduces the yield from those wells.	AFY	2,240	MGD	2.00	Firm yield for the addition of one well. Assumes average withdrawal rate of 116 GPM. (6.0 MGD / 36 active wells)
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0		AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0		AFY		MGD	0	
7	Firm yield available to Norman	AFY	2,341	MGD	2.1		AFY	2,240	MGD	2.00	
8	Firm yield available to Norman as % of 2060 demand	%	7%	%			%	7%	%		
9	Do existing water rights exceed firm yield?	Yes/ No					Yes/ No				
10	If yes, what is existing permitted amount?	AFY					AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A	AFY	0			N/A
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	8%				%	8%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										**Notes**
18	Max Surface Area						Ac	N/A			
19	Storage size overall						AF	-			
20	Portion of storage allocated to existing users						AF				
21	Portion of storage available for Norman						AF	-			
22	**RAW WATER CONVEYANCE**										**Notes**
23	***Pipeline***										
24	Pipeline Diameter	in	12			Average Diameter	in	12			Average Diameter
25	Pipeline Length	mi	6.5	ft	34,320	Assumes that conveyance infrastructure for active wells is already in place and can be tied into.	mi	12.0	ft	63,360	Assumes approximately 1 mile of piping per well
26											

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Garber-Wellington Aquifer Wells -New				
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes				Yes/ No	Yes			
31	Terminal storage available?	Yes/ No	No				Yes/ No	No			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	peak				Yes/ No	peak			
33	Design flow rate for pipe	mgd	Varies				mgd	Varies			
34	Max velocity in pipeline	ft/sec	N/A				ft/sec	N/A			
35	Friction Loss (estimated)	ft	N/A				ft	N/A			
36	Source elevation	ft MSL	Varies				ft MSL	Varies			
37	Norman terminus elevation	ft MSL	Varies				ft MSL	Varies			
38	TDH	ft	N/A				ft	N/A			
39	***Pump Station(s)***										
40	Number of pump stations		16					12			Assumes one new pump per well
41	Capacity per pump station	mgd	0.25				mgd	3			
42	Horsepower	HP					HP				
43	***Interconnections***										
44	Number of interconnection points							0			
45	Capacity of interconnection point							0			
46	**TREATMENT**										**Notes**
47	Source water type	SW/ GW	GW				SW/ GW	GW			
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd	2.7			Maximum daily withdrawal of inactive well field (2.91 MGD based on historical data).	mgd	3.00			Assumes 0.25 peak capacity per new well
51	**PERMITTING / PLANNING STATUS**										**Notes**
52	Description										
53	**CAPITAL COSTS**										**Notes**
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)						2012 dollars	$ 7,560,000			Assumes average well cost of $630,000
56	Norman's portion of source capital costs						2012 dollars	$ 7,560,000			
57	Construction Contingency Included? Amount?						Yes/ No	Yes	%	25.0%	
58	Engineering Allowance included? Amount?						Yes/ No	Yes	%	20.0%	
59	Easement acquisition allowance included? Amount						Yes/ No	Yes	%	10.0%	
60	Source annual costs (total)							$ 604,800.00			RYAN - what is this?
61	Norman's portion of source annual costs							$ 604,800.00			
62	***Raw Water Conveyance Costs***										

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Garber-Wellington Aquifer Wells -New				
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ 7,208,024				2012 dollars	$ 13,307,121			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 7,208,024				2012 dollars	$ 13,307,121			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars	$ 7,208,024	Assumes that conveyance infrastructure for active wells is already in place and can be tied into. Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.	Yes/ No	Yes	2012 dollars	$ 13,307,121	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		Yes/ No	Yes	2012 dollars	$ -	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	10.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume						AF	N/A			
73											
74	Terminal Storage Cost (total)						2012 dollars	N/A			
75	Norman's portion of terminal storage project						2012 dollars	N/A			
76	Construction Contingency Included? Amount?						Yes/ No	N/A	%		
77	Engineering Allowance included? Amount?						Yes/ No	N/A	%		
78	Easement acquisition allowance included? Amount						Yes/ No	N/A	%		
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars	$ 8,316,000			Centralized chromium 6, arsenic, and chlorination treatment	2012 dollars	$ 9,240,000			Centralized chromium 6, arsenic, and chlorination treatment
81											
82	Norman's portion of treatment project	2012 dollars	$ 8,316,000				2012 dollars	$ 9,240,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%			Yes/ No	Yes	%		
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 1,818,336				2012 $/yr	$ 1,804,129			
88	Treatment O&M Costs	2060 $	$ 5,306,948	2012 $	$1,284,275.14	Unit treatment cost per references	2060 $	$ 5,078,419	2012 $	$1,228,971.43	Unit treatment cost per references
89	Pipe Maintenance - 1% of Capital	2060 $	$ 297,854		1.0%		2060 $	$ 549,884		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%	included in active wells cost		$ -		2.5%	included in active wells cost
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%			$ -		1.0%	

	A	L	M	N	O	P	Q	R	S	T	U
2		Garber-Wellington Aquifer Wells - Inactive					Garber-Wellington Aquifer Wells -New				
93	Pumping Energy	2060 $	$ 211,035			energy for HSPS	2060 $	$ 201,947			energy for HSPS
94	Pump Head				138.6					138.6	
95	Other	2060 $	$ 1,697,984			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy	2060 $	$ 1,624,865			Unit well maintenance cost, based on 2012 Norman Well costs per 1000 gal. Includes maint, labor, and energy
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ 15,524,024				2012 dollars	$ 30,107,121			
98	Supply source unit cost	$/AFY	$ 6,631				$/AFY	$ 13,439			
99	Pipeline unit cost	$/in/LF	$ 17.50				$/in/LF	$ 17.50			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	#DIV/0!			
101	Treatment unit cost	$/gal	$ 3.08				$/gal	$ 3.08			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
1	**Porfolio Evaluation Matrix**										
2		Conservation - additional					Direct non-potable reuse				
3	**YIELD AND FLOW**										
4	Firm Yield	AFY	1,121	MGD	1	Additional conservation assumed 1 mgd annual average (~3.5% of 2060 demand), consisting of approximately 0.75 mgd indoor for 12 mo/yr plus additional 0.75 mgd outdoor for 4 mo/yr, avg savings of 1 mgd					
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0						
6	Pending water right request total amount	AFY		MGD	0						
7	Firm yield available to Norman	AFY	1,121	MGD	1.0		AFY	850	MGD	0.76	Approximately 850 AFY of demand (Phase I project, no excess capacity - Demand developed using top 200 customer list, determining likely irrigation use for these customers, and which customers were likely to be served in Phase I of reuse piping project - Standard assumptions to determine irrigation demand were used if historical water use data was unavailalbe
8	Firm yield available to Norman as % of 2060 demand	%	3%	%			%	3%			
9	Do existing water rights exceed firm yield?	Yes/ No									
10	If yes, what is existing permitted amount?	AFY									
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			N/A					
12	***Source Basin Excess/Surplus Water - Carollo***										
13	Basin of origin		62					62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	4%				%	3%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**										
18	Max Surface Area										
19	Storage size overall										
20	Portion of storage allocated to existing users										
21	Portion of storage available for Norman										
22	**RAW WATER CONVEYANCE**										
23	***Pipeline***										
24	Pipeline Diameter	in						42			Equivalent pipe diamter - Leg 1: 24", 10700 LF, 8050 gpm Leg 2: 20", 5300 LF, 5000 gpm Leg 3: 12", 3200 LF, 1550 gpm Leg 4: 18", 16400 LF, 5750 gpm Leg 5: 16", 5800 LF, 2900 gpm
25	Pipeline Length	mi		ft	-			7.84	ft	41,400	
26											

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Conservation - additional					Direct non-potable reuse				
27											
28											
29											
30	Pipeline dedicated for Norman's use only?	Yes/ No						Yes			
31	Terminal storage available?	Yes/ No						No			
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No						peak			
33	Design flow rate for pipe	mgd						31.46			
34	Max velocity in pipeline	ft/sec	N/A					5.06			
35	Friction Loss (estimated)	ft	N/A					83			
36	Source elevation	ft MSL						1093			
37	Norman terminus elevation	ft MSL						1312			Varies between 1090 and 1312
38	TDH	ft	N/A					302			
39	***Pump Station(s)***										
40	Number of pump stations							3			3 pump stations: 1 - Variable speed serving legs 1, 2, and 3 - 5250 gpm, 290 TDH 2 - Constant speed serving leg 4 - 500 gpm, 300 TDH 3 - Variable speed serving leg 5 - 2900 gpm, 140 TDH
41	Capacity per pump station	mgd									
42	Horsepower	HP						800			
43	***Interconnections***										
44	Number of interconnection points										
45	Capacity of interconnection point										
46	**TREATMENT**										
47	Source water type	SW/ GW									
48	Major constituents of concern										
49	Treatment process										
50	Peak treatment capacity	mgd					mgd	2.664			Calculated design flow based on incorporating 6.5 MG storage for treated effluent
51	**PERMITTING / PLANNING STATUS**										
52	Description										
53	**CAPITAL COSTS**										
54	***Raw Water Source Storage Costs***										
55	Source capital costs (total)										
56	Norman's portion of source capital costs										
57	Construction Contingency Included? Amount?										
58	Engineering Allowance included? Amount?										
59	Easement acquisition allowance included? Amount										
60	Source annual costs (total)										
61	Norman's portion of source annual costs										
62	***Raw Water Conveyance Costs***										

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Conservation - additional					Direct non-potable reuse				
63	Raw Water Conveyance Project Cost (total)	2012 dollars	$ -				2012 dollars	27,960,000			
64	Norman's portion of raw water conveyance project	2012 dollars	$ -				2012 dollars	$ 27,960,000			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	2012 dollars			2012 dollars	Yes		$ 25,000,000	
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	2012 dollars	$ -		2012 dollars	Yes		$ 2,960,000	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -		Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%		Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%		Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	10.0%		Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***										
72	Terminal Storage Volume								MG	6.5	
73											
74	Terminal Storage Cost (total)							$6,500,000.00			
75	Norman's portion of terminal storage project							$6,500,000.00			
76	Construction Contingency Included? Amount?										
77	Engineering Allowance included? Amount?										
78	Easement acquisition allowance included? Amount										
79	***Treatment Costs***										
80	Treatment Project Cost (total)	2012 dollars					2012 dollars	$ 3,010,320			
81											
82	Norman's portion of treatment project	2012 dollars	$ -					$ 3,010,320			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%						
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%						
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%							
86	***Operation and Maintenance Costs***										
87	Total Operation and Maintenance Costs	2012 $/yr	$ 150,000				2012 $/yr	$ 441,954			
88	Treatment O&M Costs		$ -				2060 $	$ 51,607	2012 $	$ 12,489	Used flow weighted portion of O&M for UV and tertiary filtration
89	Pipe Maintenance - 1% of Capital		$ -		1.0%		2060 $	$ 1,033,063		1.0%	
90	Pump Station Maintenance - 2.5% of Capital		$ -		2.5%		2060 $	$ 305,787		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%			$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%		2060 $	$ 268,596		1.0%	

	A	V	W	X	Y	Z	AA	AB	AC	AD	AE
2		Conservation - additional					Direct non-potable reuse				
93	Pumping Energy		$ -				2060 $	$ 167,211			
94	Pump Head									302	
95	Other	2060 $	$ 619,838	2012 $	$ 150,000	Assumption: one FTE plus money to cover rebate/incentive programs					
96	***Unit cost from supply source***										
97	Combined capital costs	2012 dollars	$ -				2012 dollars	$ 37,470,320			
98	Supply source unit cost	$/AFY	$ -				$/AFY	$ 44,083			
99	Pipeline unit cost	$/in/LF	#DIV/0!				$/in/LF	$ 14.38			
100	Pump station unit cost	$/hp	#DIV/0!				$/hp	3700			
101	Treatment unit cost	$/gal	#DIV/0!				$/gal	$ 1.13			
102											
103											
104											
105	Operation and Maintenance Costs										
106	Source development unit cost	$/AF	#DIV/0!				$/AF	#DIV/0!			

	A	AF	AG	AH	AI	AJ
1	**Porfolio Evaluation Matrix**					
2		**Lake Thunderbird Augmentation**				
3	**YIELD AND FLOW**					
4	Firm Yield	AFY	12,443	MGD	11.1	
5	Firm yield already permitted to or designated for others	AFY	-	MGD	0	
6	Pending water right request total amount	AFY		MGD	0	
7	Firm yield available to Norman	AFY	12,443	MGD	11.1	
8	Firm yield available to Norman as % of 2060 demand	%	38%			
9	Do existing water rights exceed firm yield?	Yes/ No				
10	If yes, what is existing permitted amount?	AFY				
11	If yes, by how much do existing WR exceed firm yield?	AFY	0			
12	***Source Basin Excess/Surplus Water - Carollo***					
13	Basin of origin		62			
14	Excess/surplus water in source category in basin of origin	AFY	29,404	MGD	26.23	Excess exceeds amount of yield available to Norman
15	Percent of excess/surplus water that Norman is proposing to take	%	42%			
16	Frequency of shortages in source category in basin of origin		0%			AGW shortage, 52% frequency
17	**RAW WATER SOURCE STORAGE**					**Notes**
18	Max Surface Area	Ac	N/A			
19	Storage size overall	AF	-			
20	Portion of storage allocated to existing users	AF				
21	Portion of storage available for Norman	AF	-			
22	**RAW WATER CONVEYANCE**					
23	***Pipeline***					
24	Pipeline Diameter	in	30			Pipeline from the Norman WWTP to Dave Blue Creek.
25	Pipeline Length	mi	3.87	ft	20,450	Pipeline from the Norman WWTP to Dave Blue Creek.
26		in	42.00			Pipeline from Lake Thunderbird to the Norman WTP.

	A	AF	AG	AH	AI	AJ
2			Lake Thunderbird Augmentation			
27		mi	7.00	ft	36,960	Pipeline from Lake Thunderbird to the Norman WTP.
28						
29						
30	Pipeline dedicated for Norman's use only?	Yes/ No	Yes			Pipeline from Lake Thunderbird to the Norman WTP.
31	Terminal storage available?	Yes/ No	No			Pipeline from Lake Thunderbird to the Norman WTP.
32	Is pipeline designed to meet average demand or peak demand?	Yes/ No	Peak			Pipeline from Lake Thunderbird to the Norman WTP.
33	Design flow rate for pipe	mgd	18			Pipeline from Lake Thunderbird to the Norman WTP.
34	Max velocity in pipeline	ft/sec	2.89			Pipeline from Lake Thunderbird to the Norman WTP.
35	Friction Loss (estimated)	ft	75			Estimated using Hazen-Williams equation and c=120
36	Source elevation	ft MSL	960			Lake Thunderbird Conservation Elevation
37	Norman terminus elevation	ft MSL	1150			Norman WTP Elevation
38	TDH	ft	265			Pipeline from Lake Thunderbird to the Norman WTP.
39	***Pump Station(s)***					
40	Number of pump stations		2			
41	Capacity per pump station	mgd	18			Pump Station for the Pipeline from Lake Thunderbird to the Norman WTP.
42	Horsepower	HP	3574			Overall 65% wire to water efficiency assumed. 2,807 HP for Pump Station from Lake Thunderbird to Norman WTP.
43	***Interconnections***					
44	Number of interconnection points					
45	Capacity of interconnection point					
46	**TREATMENT**					
47	Source water type	SW/ GW	SW			
48	Major constituents of concern		N/A			
49	Treatment process		Conventional with softening			
50	Peak treatment capacity	mgd	18			
51	**PERMITTING / PLANNING STATUS**					
52	Description					
53	**CAPITAL COSTS**					
54	***Raw Water Source Storage Costs***					
55	Source capital costs (total)	2012 dollars	$ 99,000			Low head intake structure only.
56	Norman's portion of source capital costs	2012 dollars	$ 99,000			
57	Construction Contingency Included? Amount?	Yes/ No	No	%	0.25	
58	Engineering Allowance included? Amount?	Yes/ No	No	%	0.2	
59	Easement acquisition allowance included? Amount	Yes/ No	No	%	0.2	
60	Source annual costs (total)					
61	Norman's portion of source annual costs					
62	***Raw Water Conveyance Costs***					

	A	AF	AG	AH	AI	AJ
2				Lake Thunderbird Augmentation		
63	Raw Water Conveyance Project Cost (total)	2012 dollars	51,129,165			
64	Norman's portion of raw water conveyance project	2012 dollars	$ 51,129,165			
65	Raw water conveyance project capital cost (pipeline only)	Yes/ No	Yes	012 dolla	$ 37,906,165	Assumes 45% rural open cut, 45% urban open cut, 5% tunneling, and 5% river crossings.
66	Raw water conveyance project capital cost (pump stations only)	Yes/ No	Yes	012 dolla	$ 13,223,000	
67	Raw water conveyance project capital cost (interconnections only)	Yes/ No	No	2012 dollars	$ -	
68	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
69	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
70	Easement acquisition allowance included? Amount?	Yes/ No	Yes	%	20.0%	
71	***Terminal Storage Costs***					
72	Terminal Storage Volume					
73						
74	Terminal Storage Cost (total)					
75	Norman's portion of terminal storage project					
76	Construction Contingency Included? Amount?					
77	Engineering Allowance included? Amount?					
78	Easement acquisition allowance included? Amount					
79	***Treatment Costs***					
80	Treatment Project Cost (total)	2012 dollars	$ 30,858,000			Includes only the WWTP upgrades
81		2012 dollars	$36,000,000			Includes only the WTP upgrades.
82	Norman's portion of treatment project	2012 dollars	$ 66,858,000			
83	Construction Contingency Included? Amount?	Yes/ No	Yes	%	25.0%	
84	Engineering Allowance included? Amount?	Yes/ No	Yes	%	20.0%	
85	Easement acquisition allowance included? Amount	Yes/ No	Yes	%	5.0%	
86	***Operation and Maintenance Costs***					
87	Total Operation and Maintenance Costs	2012 $/yr	$ 8,010,734			
88	Treatment O&M Costs	2060 $	$ 23,992,238	2012 $	$5,806,092.84	MOR_costs.xls, 2012 FYE total, adjusted per unit treated per Assumption tables tab
89	Pipe Maintenance - 1% of Capital	2060 $	$ 1,566,378		1.0%	COMCD_Final_Water_Reuse_Feasibility_Study_October_201
90	Pump Station Maintenance - 2.5% of Capital	2060 $	$ 1,366,019		2.5%	
91	Tank Storage Maintenance - 2% of Capital		$ -		2.0%	
92	Terminal Storage Maintenance - 1% of Capital		$ -		1.0%	

	A	AF	AG	AH	AI	AJ
2		Lake Thunderbird Augmentation				
93	Pumping Energy	2060 $	$ 2,142,958			
94	Pump Head				265	
95	Other	2060 $	$ 4,034,778			WRF Additional treatment costs
96	***Unit cost from supply source***					
97	Combined capital costs	2012 dollars	$ 118,086,165			
98	Supply source unit cost	$/AFY	$ 9,490			
99	Pipeline unit cost	$/in/LF	$ 61.79			
100	Pump station unit cost	$/hp	3699.967605			
101	Treatment unit cost	$/gal	$ 3.71			
102						
103						
104						
105	Operation and Maintenance Costs	$/mgd				
106	Source development unit cost	$/AF	#DIV/0!			

			Source
Norman 2060 Demand	AFY	32,546	
	MGD	29.1	
Conveyance Peaking Factor (PF)	1.9		
Treatment Peaking Factor (PF)	1.9		

"Standard" Unit Costs

Pipeline, open cut in rural area	$/inLF	$12.44	2009 Central Oklahoma Study
Pipeline, open cut in urban area	$/inLF	$14.42	2009 Central Oklahoma Study
Pipeline, tunneling	$/inLF	$88.19	2009 Central Oklahoma Study
Pipeline, river crossings	$/inLF	$20.11	2009 Central Oklahoma Study
Pump station, hp	$/hp	$3,700.00	2009 Central Oklahoma Study, adjusted
Reservoir construction, storage available	$/AF	$5,500.00	2040 SWSP
Low head intake structure	$/MGD	$43,000	SE OK Raw Water Study
Storage tank at WWTP	$/gal	$1.00	
direct filtration	$/gpd		
conventional	$/gpd	$1.85	
Conventional with softening	$/gpd	$2.00	($1.85 to expand existing WTP)
Presedimentation and Conventional	$/gpd	$2.25	
MF	$/gpd		
RO	$/gpd	$6.00	
IX	$/gpd		
Blend of Conventional and RO (new WTP)	$/gpd	$4.50	
Blend of Conventional and RO (expand WTP)	$gpd	$4.34	
Chlorination only (wells)	$/gpd	$0.20	2040 SWSP, adjusted to 2012 dollars
Arsenic removal	$/gpd	$4.97	Well head Arsenic Removal Project, adjusted to 2012 dollars
Arsenic removal	$/gal	$1.60	Centralized arsenic removal (CH2 2002 study adjusted to 2012 dollars)
Chromium removal	$/gpd	$1.28	CR(VI) Treatment Options and Costs, adjusted to 2012 dollars
Single pass RO with UV disinfection	$/gpd	$ 8.44	
Arsenic and Chromium Treatment Expansion	$/gpd	$ 2.51	
Costs for bulk liquid sodium hypochlorite (NaOCL) and effluent filtration (AquaDiamond ® surface)	$/gpd	$ 1.13	taken from Phase II Wastewater Treatment Plant Improvements Report (dated Nov 2011) - adjusted to 2012 dollars
IPR treatment (BNR, ozone, biofiltration, continued UV disinfection)	$/gpd	$ 2.78	See *IPR unit costs.xls*

Basin of origin Basin ID Excess/Surplus

Southeast OK Water	6	713617
Parker	8	283461
Scissortail	56	156479
Westside (Canadian)	58	101062
Eastside (Canadian)	58	101062
Lake Thunderbird	62	29404
Kaw	72	1202486

O&M Costs				
Treatment Plant Operation				
Total Cost, 2012	$	$4,559,959	MOR_costs.xls	Without Wells cost
Total Production	1000 gal	3,181,946	2012 Water Production.xlsx	
O&M Unit Cost - Treatment and Administration	$/1000ga	**$1.43**		
Admin Cost, 2012		$968,187	MOR_costs.xls	
Wells Operation				
Total Cost, 2012	$	$856,917	MOR_costs.xls	Wells cost only
Total Production	1000 gal	1,590,857	2012 Water Production.xlsx	
O&M Unit Cost	$/1000ga	$0.54		
Wire to water efficiency	0.65			
Power cost	0.10	$/kwh		
Arsenic and Chromium Treatment O&M Costs			convert to 2012 dollars	
Arsenic treatment - CH App C	$0.49	$/1000gal	$0.68	
Chlorination		$/1000gal	$0.09	roughly ratio of capital costs from cl to As treatment
Chromium removal	$0.92	$/1000gal	$0.92	pw:\\PHX-POP-PW.Carollo.local:Carollo\Documents\Client\OK\Norman\8956A00\Data\Water Quality\Arsenic - Chromium Compiled Samples.xlsx Tab CrVI WRF Studies CELL AJ17
Total O&M Cost - Arsenic and Chromium Treatment		$/1000 gal	$1.68	
Total O&M Cost - Arsenic and Chromium Treatment		$/MG	**$1,684**	

IPR annual treatment costs	$ 0.24	$/gpd		See *IPR unit costs.xls*

Inflation	3%
Interest	6%
Baseline Costs at ENR (2012)	9412

n	48

APPENDIX C – REFERENCE INFORMATION – LAKE THUNDERBIRD

Appendix C – Lake Thunderbird

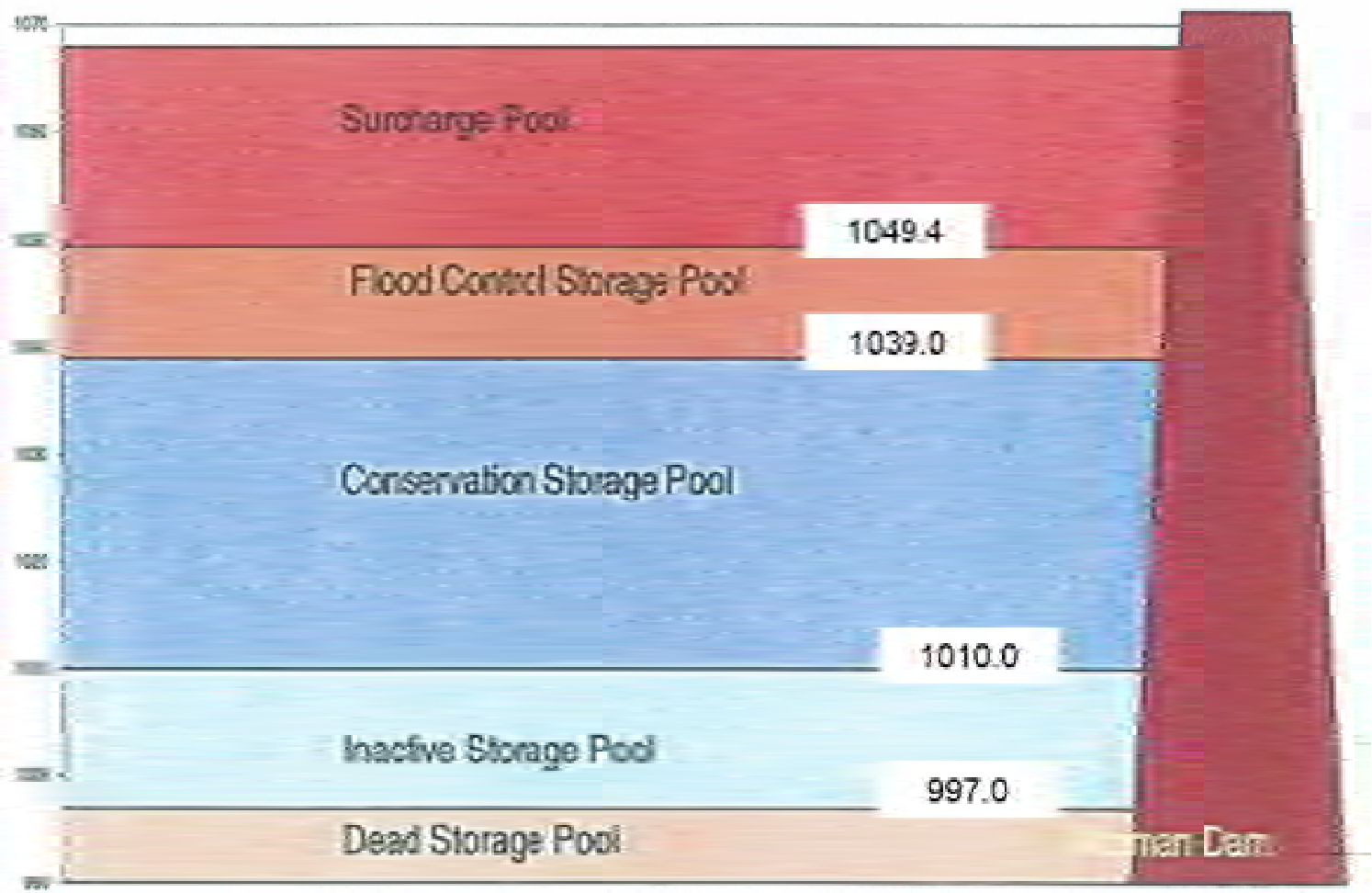
This appendix contains information on lake elevations and evaluation of raising the Norman dam.

Lake Level Information

In 2001, OWRB issued the Final Report titled Lake Thunderbird Capacity and Water Quality. This report estimated lake capacity at conservation pool elevation of 1039.0 feet based on bathymetric survey and concluded that since its original construction in 1965, the lake capacity has decreased approximately 11.6% due to silting. The average sedimentation rate was estimated at 393 acre-feet per year, which is in line with the 350 acre-feet per year rate estimated by the Bureau of Reclamation in 1965. The lake's current estimated yield assumes the average anticipated sedimentation over a 100-year period (year 2065). Figure C.1 illustrates the storage elevations for the reservoir.

Raising the Norman Dam

The attached memorandum describes findings of conceptual evaluation of raising the dam for Lake Thunderbird to increase storage.



LAKE THUNDERBIRD STORAGE ELEVATIONS

FIGURE C.1

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

TETRA TECH

119 N. Robinson Ave., Ste. 700
Oklahoma City, OK 73102
Phone: 405.606.8600 Fax: 405.606.8601

MEMORANDUM

TO: File

FROM: Ryan Smith

COPY:

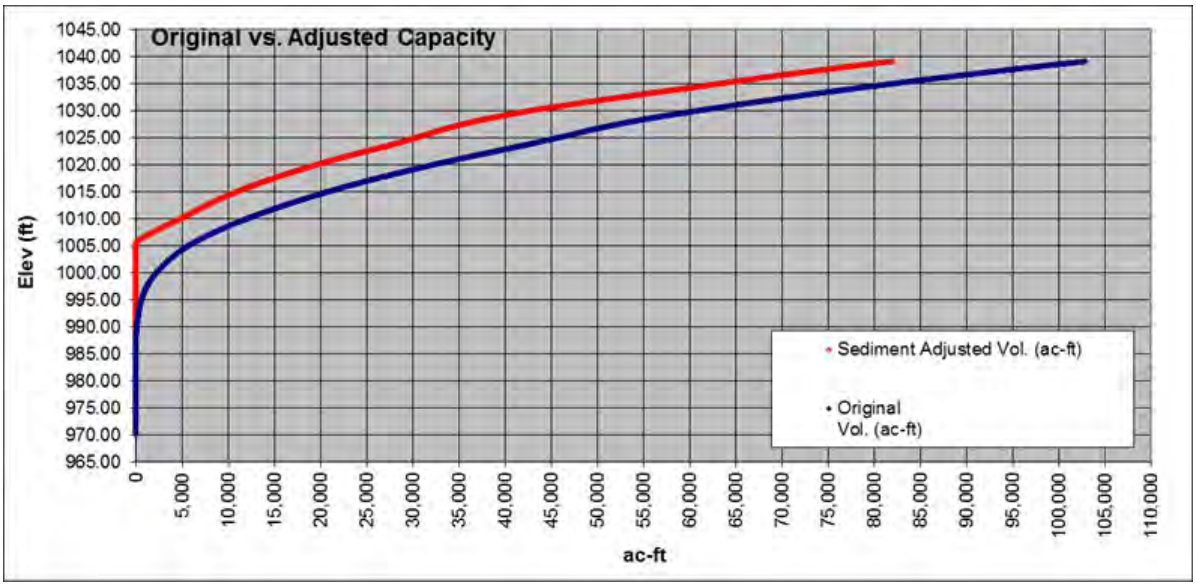
RE: The Feasibility of Raising the Norman Dam to Increase Capacity of Lake Thunderbird

DATE: Wednesday, October 3, 2012

The purpose of this memo is to evaluate the feasibility of raising the Norman Dam in order to increase the capacity of Lake Thunderbird for various water source alternatives that would require terminal storage.

For this analysis the Lake Thunderbird Spillage water source alternative was used to evaluate the feasibility of this proposed project. This option is ideal to consider for this analysis because it also serves as a good approximation of the independent firm yield that could be achieved for Lake Thunderbird by simply increasing the elevation of the dam. (?) For the Lake Thunderbird Spillage option, 75,000 AF of terminal storage are required in order to acquire a firm yield of 5.8 MGD.

By analyzing the capacity curve for Lake Thunderbird, shown below, it was possible to determine the elevation that would be required in order to achieve the desired capacity.



It was determined that for each foot of elevation gain, approximately 6,000 AF of storage could be gained. In order to achieve the additional 5.8 MGD of firm yield from the Lake Thunderbird Spillage option, the dam would have to be raised 12.5 feet. This would increase the Conservation Pool elevation from 1039' to 1051.5', and increase the Flood Pool elevation from 1049.4' to 1061.9'. This would expand the Lake Thunderbird extents as shown below. (coming soon)

The amount of infrastructure and property constructed within this proposed boundary becomes one of the biggest deterring factors to this option. Land acquisition, road and bridge reconstruction, and dam reconstruction inevitably cause this option to be cost ineffective.

APPENDIX D – REFERENCE INFORMATION – GARBER-WELLINGTON AQUIFER WELLS

Appendix D – Garber-Wellington Aquifer Wells

This appendix contains two related memoranda that address arsenic and chromium regulatory requirements and treatment.

TETRA TECH, INC.

INTEROFFICE MEMORANDUM

TO: Srini Sundaramoorthy, Tulsa
James Christopher, Orlando

FROM: David Schendel, Ann Arbor

DATE: September 13, 2012

SUBJECT: Norman OK 2060 SWSP Update
Arsenic & Chromium Regulatory Requirements (3.3) and Treatment (3.4)

Arsenic Regulatory Requirements

The Arsenic Rule was finalized in January 2001 and became fully effective in June 2006. The rule applies to all PWS regardless of size. The revised rule establishes an MCLG of zero and an enforceable MCL of 10 μg/L. For general compliance purposes, one sample of arsenic must be monitored annually, and compliance is based on a running annual average at each sampling point. Unless otherwise specified by the State, samples must be collected at each entry point to the distribution system. A system is subject to increased monitoring if a sampling point is above the MCL, and must collect quarterly samples until the system is reliably and consistently below the MCL. If monitoring results are below the MCL, ground water systems can collect samples every 3 years, and surface water systems annually. In general, a system using groundwater sources must demonstrate compliance with the MCL as specified by the State.

Chromium Regulatory Requirements

Trivalent chromium is often referred to as Chromium (III) and is an essential nutrient for the body. Hexavalent chromium, or Chromium (VI), is generally used or produced in industrial processes and has been demonstrated to be a human carcinogen when inhaled. Total chromium (sum of Cr(III) and Cr(VI)) is regulated by EPA with an MCL of 100 ug/L, and no specific limit has been set for Chromium (VI). Chromium (VI) may cause cancer in laboratory animals but the evidence of either widespread human exposure or carcinogenicity via ingestion are far from compelling. One study published by the National Toxicology Program (NTP) in 2007 concluded that hexavalent chromium is carcinogenic when ingested in

drinking water. In January 2012, conclusions from 13 industry-sponsored studies examining the potential human toxicological effects of chromium VI (Cr-VI) exposure were reviewed at the Toxicology Forum's annual winter meeting in Washington, D.C. Preliminary findings from this forum indicated that Cr-VI, which is carcinogenic at high doses, is efficiently broken down in chromium III, a harmless (and potentially beneficial) form of chromium in the human digestive system at low doses. EPA and public health officials are vigorously investigating the feasibility of reducing hexavalent chromium concentrations in drinking water. The findings of these recent studies have potential implications for EPA's Integrated Risk Information System (IRIS) assessment of Cr-VI currently under development. The oral assessment will be revised to address the peer review comments and combined with the inhalation assessment, which is currently in draft development. EPA anticipates that the draft assessment for hexavalent chromium (oral and inhalation) will be released for public comment and external peer review in 2013.

In July 2011, California revised their non-enforceable public health goal for Cr (VI) to 0.02 ug/L, and CA expects to release a new draft MCL by July 2013. It is far from clear that EPA will actually establish an MCL for Cr (VI), or at what level, even considering the significant political pressure to do so. At the present time it seems prudent to plan future treatment needs around Cr (VI) MCL or treatment requirement of 5 ug/L and 10 ug/L. Treatment process costs below are based on achieving these levels.

Arsenic Treatment

Treatment for As removal is fairly well understood, and numerous studies by EPA and others have shown that the the 10 ug/L MCL can be effectively meet using:

- Ion exchange (IX)
- Coagulation/filtration or Coagulation/MF
- Adsorptive media
- Nanofiltration including membrane softening.

As removal has been evaluated in Norman by CH2M-Hill in 2002, and pilot plant scale demonstration work was performed at Norman Well#31 by Garver in 2008-2009. Site specific cost analyses by CH2M-Hill concluded that adsorptive treatment using granular ferric hydroxide (GFH) was the least expensive feasible alternative for Norman's wells (in conjunction with some abandonment and blending scenarios). While GFH treatment was highly pH dependent, when optimized (pH = 7.4) GFH also appeared to produce the least amount of residuals for disposal. In 2010 Garver estimated the net present value of GFH treatment at $1.62-1.79 per 1000-gallons, including annual O&M and 20-year capital costs. Garver estimated that installation of GFH treatment and appurtenant equipment would cost approximately $800,000 per wellhead in 2009 dollars.

Chromium Treatment

The removal of Cr (III) and Cr (VI) is dependent upon a wide array of factors, and is much less straightforward than As removal. The specific source water chemistry and origins of the chromium are particularly important, as well as the potential for As (III) oxidation to occur in the distribution system. In situ source water treatment via oxidation may also be feasible under certain conditions.

Total Cr and Cr (IV) removal to concentrations less than 5 ug/L can be achieved using reductive coagulation/filtration (RCF), weak base anion (WBA) exchange, strong base anion (SBA) exchange and reverse osmosis (RO). RCF can be effective using either granular media or membrane filtration, and some recent data suggest that membrane filtration performs better than granular media filtration when pore sizes are optimized. In general, a Fe/Cr ratio of at least 25:1 is necessary to reduce Cr (VI) to less than 5 ug/L. Adsorptive processes, including GFH, are less effective because of poor selectivity for Cr (VI), poor performance at pH 7-9, and high regeneration costs. Softening or biologically-active filtration may also reduce Cr(III), although data on these processes are scarce.

Perhaps the most comprehensive treatment assessments to date are ongoing at Glendale Water & Power in California, including two projects funded by WaterRF. Based on this work and in combination with other cost analyses performed by Malcolm Pirnie/Arcadis, Cr (VI) treatment costs are expected to range from $360-720/AF, ($1.01-2.20/1000 gal) for WBA, and $130-430/AF ($0.40-1.32/1000 gal) for RCF. Residuals disposal for WBA treatment was also evaluated in Glendale CA by Blute et al., and this work suggests residuals disposal costs of $230-260 per acre-foot ($0.70-0.80/1000gal) - including annual O&M and capital costs over 20-years at a discount rate of 4.5%. Equivalent coats for RCF treatment were estimated to be $300-400/AF or $0.92-1.22 per 1000 gal. This assumed residuals would be non-hazardous RCRA and TENORM (radioactivity). Obviously, all these costs are significantly influenced by system size and future MCL levels.

Unless Norman has commissioned further demonstration work, based on available data it does not appear promising that GFH will be effective for removal of Cr (VI). At this time RCF or WBA appear to be the most promising treatment techniques for both As and Cr (VI).

TETRA TECH, INC.

INTEROFFICE MEMORANDUM

TO: Srini Sundaramoorthy, Tulsa

FROM: James Christopher, Orlando
Jon Bundy, Orlando

DATE: September 13, 2012

SUBJECT: Norman OK 2060 SWSP Update
Arsenic & Chromium Treatment (3.4)

The arsenic and chromium concentrations for the City's existing wells were reviewed. A summary of the available data, including the well ID, the well flow rate, the arsenic concentration, and the chromium concentration for the 52 wells is summarized in Table 1. Of the City's 52 wells, 15 are currently inactive due to arsenic concentration. The total combined capacity of the wells is 8,731 gpm (12.57 mgd) and the total active capacity of the wells is 6,056 gpm (8.72 mgd). The 15 inactive wells combine for an inactive capacity of 2,675 gpm (3.85 mgd). The effect of potential future MCLs for hexavalent chromium of 20 ppb, 10 ppb, and 5 ppb was investigated:

- A future MCL of 20 ppb would result in all but 4 of the existing active wells exceeding the MCL, or a potential loss of an additional 5,407 gpm (7.79 mgd).
- A future MCL of 10 ppb would result in all but 3 of the existing active wells exceeding the MCL, or a potential loss of an additional 5,704 gpm (8.21 mgd).
- A future MCL of 5 ppb would result in all of the existing active wells exceeding the MCL, or a potential loss of an additional 6,056 gpm (8.72 mgd).

In order to continue to utilize the wells as a groundwater supply source, the following alternatives were considered for the continued use of the existing wells (active and inactive):

- Treatment of the groundwater for arsenic and/or hexavalent chromium.
- Blending of well water with treated surface water to meet the MCL.
- Pumping of groundwater to natural tributaries to Lake Thunderbird for natural attenuation of heavy metals.
- Pumping of the groundwater to the existing treatment plant for blending with the surface water and treatment using the lime softening process.

Table 1 - Existing Well Data

Well #	Flow (gpm)	Arsenic Concentration (ppb)	Chromium Concentration (ppb)[2]
1	161	6.7	58.5
2	224	8.3	58.5
3A	121	3.6	43.0
4[(1)]	249	20-100	--
5	146	POE3	74.0
6	190	6.9	37.0
7[(1)]	159	15-30	--
8	225	6.1	55.0
10[(1)]	134	10-Apr	--
11[(1)]	112	45-90	--
12[(1)]	164	90-100	--
13[(1)]	190	30	--
14[(1)]	177	30-80	--
15[(1)]	215	15-50	--
16[(1)]	143	15-30	--
18[(1)]	136	10-20	--
19	191	4.5	23.0
20	144	8.7	32.5
21[(1)]	144	20-50	--
23[(1)]	160	40-100	--
25[(1)]	100	200	--
31	159	4.9	32.7
32[(1)]	182	20-40	--
33	214	6.4	65.0
34	162	<2	55.0
35	142	<2	51.5
36	82	<2	70.5
37	120	<2	52.5
38	189	<2	36.0
39	197	9.8	79.5
40	168	5	45.0
HP1[(1)]	100	<2	<2
HP3[(1)]	160	37	37
41	179	3.9	32.0
42	168	<2	28.7
43	173	<2	6.3
44	167	<2	91.8
45	146	<2	67.0
46	216	2.4	51.0
47	179	<2	9.0
48	145	8.8	94.3
49	202	5	89.2
51	150	<10	30.3
52	177	<10	18.0
54	117	<10	50.0
55	150	<10	27.7
56	120	<5	14.0
57	167	<10	47.7
58	150	<10	26.0
59	325	<10	45.3
60	240	<10	38.1
61	200	6	46.2

Notes:

1. Indicates inactive well due to arsenic levels. Arsenic level reported are include the range of arsenic samples presented in
2. Chromium data was not available for inactive wells.

Based on the number of wells that are projected to be over the future hexavalent chromium MCL and the amount that the wells would be over the projected MCL, the blending of groundwater with treated surface water to the MCL was not considered further.

Treatment of Groundwater

Options for the treatment of groundwater include individual treatment units at each well, grouping of wells for combined treatment at several locations, or grouping of all wells at a central location for treatment of all wells. The average well capacity is approximately 0.25 mgd with a maximum of nearly 0.5 mgd and a minimum of approximately 0.1 mgd. Treatment options for arsenic include ion exchange, coagulation/filtration, adsorptive media, and membrane softening while treatment options for hexavalent chromium include reductive coagulation/filtration and weak base anion exchange. As discussed in the treatment technology review, reductive coagulation/filtration and weak base ion exchange appear to the most promising treatment techniques to remove both arsenic and hexavalent chromium.

Treatment for arsenic at individual well sites via absorptive media or ion exchange is feasible. Costs were provided previously for use of granular ferric hydroxide media ($800,000 per well in 2009 dollars). However, with the anticipated MCLs for hexavalent chromium, future compliance of these wells would still be a concern. Because of the number of wells affected, the fact that multiple treatment technologies at individual well sites where both arsenic and hexavalent chromium require treatment, and the fact that the treatment technologies required for hexavalent chromium removal would require the addition of chemicals for pre and post treatment and residuals disposal, treatment at individual well sites was not considered further.

Grouping of wells geographically for treatment of multiple wells has the potential to work in areas where several wells are concentrated within an area. Some potential groupings would include wells 11 through 20 and wells 1-5, 37-40 along with several other smaller groupings. However, due to how spread out the remaining wells are this would lead to several treatment facilities which results in reduced economies of scale on construction costs as well as additional operators required to operate multiple treatment facilities.

A central treatment facility to treat all of the groundwater wells for hexavalent chromium and arsenic would require a treatment facility capacity of approximately 12.5 mgd. Based on the central location of the Norman WTP to the groundwater wells spread out around the City, treatment facilities for the groundwater located at the existing Norman WTP site would be recommended. Co-locating the treatment facilities there would also allow for post treatment blending with the surface water, which would provide a uniform water quality being pumped to the distribution system.

Treatment at the Surface Water Treatment Plant

The existing Norman WTP utilizes lime softening upflow clarifiers to treat the surface water supply. The existing WTP can be expanded to provide treatment of the groundwater wells. Arsenic would be removed through the lime softening process. This combined with blending with wells with lower arsenic and the surface water being treated, would result in arsenic levels below the MCL in the finished water. However, as in the treatment technology discussion, lime softening is not effective at removing hexavalent chromium. The use of the lime softening treatment plant to reduce hexavalent chromium would be limited to its ability to provide dilution via blending. This would restrict the total groundwater flow that could be used in the lime softening process. The amount of groundwater that could be used would ultimately depend on the future MCL of hexavalent chromium. The average chromium concentration found in the existing wells was approximately 50 ppb. Therefore, based on samples of chromium in the surface water being measured at <5 ppb and 9.2 ppb, this option would only be feasible if the future MCL is set at 20 ppb and would be limited to a groundwater flow of a third to a half of the surface water flow rate.

Cost

The costs for a treatment facility to remove arsenic and hexavalent chromium are based on a 12.5 mgd capacity and reductive coagulation/filtration treatment. A summary of the cost opinion is provided in Table 2

Table 2 – Cost Opinion for 12.5 MGD Groundwater Treatment Facilities at the Existing Norman WTP

Description	Cost Opinion
Conventional Treatment and Filtration	$14,800,000
Chemical Feed Systems	$2,700,000
Aeration	$5,700,000
Waste Handling Facilities	$3,700,000
Finished Water Storage and Pumping	$3,500,000
Subtotal – Treatment Facilities	*$31,400,000*
Raw Water Transmission Mains	$41,000,000
Total	**$71,400,000**

APPENDIX E – REFERENCE INFORMATION – CONSERVATION

Appendix E – Conservation

Estimates of potential conservation under two scenarios were developed on a county-level basis in the 2012 Update of the Oklahoma Comprehensive Water Plan. Raw data for Cleveland County from those analyses are included in this appendix. These data were used to validate water conservation savings goals for the 2060 SWSP expanded conservation supply option.

	Baseline Forecast																			
	Public Supply Residential Including					Public Supply Nonresidential Including					Self-Supplied Residential					Total				
COUNTY	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060
Cleveland	29,345	30,986	32,296	33,217	34,114	11,193	11,818	12,318	12,669	13,012	1,428	1,508	1,571	1,616	1,660	41,965	44,312	46,186	47,502	48,785

	Scenario I: Moderately Expanded Conservation Demands (AFY)																			
	Public Supply Residential Including					Public Supply Nonresidential Including					Self-Supplied Residential					Total Demands				
COUNTY	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060
Cleveland	25,353	25,327	26,398	27,151	27,884	10,553	10,837	11,295	11,617	11,931	1,260	1,249	1,302	1,339	1,375	37,166	37,413	38,995	40,107	41,190

	Scenario II: Substantially Expanded Conservation Demands (AFY)																			
	Public Supply Residential Including					Public Supply NonResidential					Self-Supplied Residential					Total Demands				
COUNTY	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060	2020	2030	2040	2050	2060
Cleveland	24,157	23,728	24,394	24,859	25,530	10,088	10,189	10,443	10,650	10,937	1,228	1,196	1,227	1,249	1,283	35,472	35,112	36,064	36,757	37,750

Summary Matrix of Water Conservation Efforts

UTILITIES IN CLEVELAND COUNTY				
Conservation Activities	**LEXINGTON**	**MOORE**	**NOBLE**	**NORMAN**
Education				
Customer Assistance Hotline				
Demonstration garden				
School programs				1
Information & Ads				1
Workshops for Landscaping Companies				
Workshops for Property Management				
Workshops for Residential Landscaping				
Conservation Tip Website				1
Leak detection				
Inspect distribution system for leaks				1
Leak Survey				
Utility Water loss (reporting leaks)				1
Audits				
Commercial Indoor audits				
Commercial landscape audits				
Residential audits				
Incentives:retrofits & rebates				
-Residential				
Air Conditioning Units				
Clothes washers				
Composting Toilets				
Dish washers				
Low-consumption toilets				
Replace self-regenerating water softener				
Point of use water heater & hot water system recirculation				
Showerhead & faucet replacement				
Landscaping Controllers & sensors				
Water Conservation Kits				1
-Commercial/Industrial				
Air Conditioning Units				
Clothes washers				
Cooling towers				
Dish washers				
Landscaping Controllers & sensors				
Low-consumption toilets				
Low-water using urinals				
Motion Sensor Faucets				
Metered Faucets				
Non-water using urinals				

Point of use water heater & hot water system recirculation				
Pre-rinsing spray valves (commercial dishwasing)				
Upgrade System				
Install Commercial Meters				1
Install Flow Meter at Source				1
Install Residential Meters				1
Replace/Repair distribution system				1
Replace Single Pass Cooling system				
Install Shut-off Valves on water lines				
Replace Meters				
Policies				
Water Supply Plan				1
Water Conservation Plan				1
Drought Managament Plan				1
Conservation rates				1
Cost Sharing for Water Efficiency Modifications				
Metering		1	1	1
-Daily master meter reading				1
Emergency Water Ordinance				1
Landscape ordinances				1
Regulate Private Wells				
Sub-metering				
Summer water use restrictions				
Tiered Rate		1		1
Water budgeting				
Water waste ordinance				
Reclaim Water Use				1
Centralized Irrg Control				
Drought Response				
Increased Rate Charge				
Watering restrictions				1
SOURCE OF INFORMATION:		SurveyResults_11-24-08.xls AND http://www.cityofmoore.com/uploaded/File/FeeSchedule_Feb_09.pdf	SurveyResults_11-24-08.xls	SurveyResults_11-24-08.xls AND http://www.normanok.gov/content/water-conservation-kits AND Water Conservation Plan

APPENDIX F – REFERENCE INFORMATION – PURCHASE TREATED WATER FROM OKLAHOMA CITY (WHOLESALE)

Appendix F – Purchase Treated Water from Oklahoma City (wholesale)

This appendix contains detailed information on the wholesale water delivery rate structures currently available from Oklahoma City, as well as notes describing the maximum flow capacity of the existing connection and notes from a meeting with Oklahoma City staff discussing the 2060 SWSP and long-term supply options.

DEMAND SERVICE PLAN

Under the *Demand Service Plan*, there is no minimum monthly usage the customer is obligated to use or pay for regardless of use, however water can be purchased only if Oklahoma City has water available (meaning that in times of drought, water may be unavailable for purchasing under this plan). *Demand Service* water rates for the period from October 1, 2012 through September 30, 2013 are as follows: The customer pays $13.22 (monthly base rate) times meter multiplier (104.61 for a 12 inch meter), plus $5.03 per thousand gallons used.

TAKE-OR-PAY PLAN

The *Take-or-Pay Plan* is designed as a bridge plan between the *Demand Service Plan* and the *Service Availability Plan.* In the *Take-or-Pay* service plan, the customer determines a subscribed monthly usage, which represents the minimum monthly usage the customer agrees to be charged by contract. This subscribed monthly usage is determined based on usage during a 12-month perfecting period. This usage must remain at least 15% of the customer's monthly usage from the date of contract, forward.

Take-or-Pay water rates for the period from October 1, 2012 through September 30, 2013 are as follows: The customer pays $13.22 (monthly base rate) times meter multiplier (104.61 for a 12 inch meter), plus $2.26 per thousand gallons for water usage up to 2.5 times subscribed monthly usage, plus $5.03 per thousand gallons for water usage in excess of 2.5 times subscribed monthly usage.

SERVICE AVAILABILITY PLAN

The *Service Availability Plan* is OKLAHOMA CITY's most affordable water service plan. The trade-off is that Oklahoma City asks their customers to purchase a relatively consistent amount of water each month so they can better estimate their demands and be better prepared to service their customers. Under the *Service Availability Plan*, the customer determines a monthly capacity reservation, which represents the minimum monthly usage the customer agrees to be charged by contract. This monthly capacity reservation is determined by the customer during a 12-month perfecting period. This reservation must remain at least 90% of the customer's maximum historical monthly usage from the date of contract.

Service Availability water rates for the period from October 1, 2012 through September 30, 2013 are as follows: The customer pays $13.22 (monthly base rate) times meter multiplier (104.61 for a 12 inch meter), plus $0.96 per thousand gallons for monthly capacity reservation charge, plus $0.35 per thousand gallons for water usage up to the subscribed monthly capacity reservation, plus $5.03 per thousand gallons for water usage in excess of subscribed monthly capacity reservation.

A comparison of Oklahoma City's three water service plans was developed for fiscal year 2011. The first comparison, Figure F.1, optimizes the *Subscribed Monthly Usage* and the *Subscribed Monthly Capacity Reservation* in order to minimize total costs. The second comparison, Figure F.2, optimizes the *Subscribed Monthly Usage* and the *Subscribed Monthly Capacity Reservation* in order to minimize unit costs. These comparisons are aided by hindsight, and thus the results for the *Take-or-Pay* and *Service Availability* contracts *would* likely not be quite as favorable in an actual scenario with these exact water usages.

The City of Oklahoma City recommends that their water customers have multiple connections to their treated water system if possible. This has several advantages, including:

- Ability to conduct maintenance on one connection and still maintain service through the other connection(s).
- Redundancy in the case of line failure on the Norman or Oklahoma City side.
- Ability to use smaller flow meters which are less expensive to replace.
- Multiple connections aids in alleviating bottlenecks within the distribution system both on the Norman and Oklahoma City side.
- Capacity is increased, which allows for the opportunity to increase supply as necessary.

Oklahoma City Treated Water Contract Comparison - FY 2011

(2012 Rates)

Total Costs Optimization

Monthly Base Rate:	$	12.22	
Meter Multiplier (12" Meter):	$	104.61	
Demand Service Contract			
Rate per 1,000 gallons:	$	4.65	
Take-or-Pay Contract			
Subscribed Monthly Usage (SMU)*:		9,380.40	1,000 gallons
2.5 times SMU:		23,451.00	1,000 gallons
Rate per 1,000 gallons for SMU:	$	2.09	
Rate for usage > SMU, but < 2.5*SMU:	$	2.09	
Rate for usage > 2.5*SMU:	$	4.65	
Service Availability Contract			
Subscribed Monthly Capacity Reservation (SMCR)*:		23,450.96	1,000 gallons
Monthly Capacity Reservation Charge:	$	0.88	
Rate per 1,000 gallons for usage up to SMCR:	$	0.31	
Rate per 1,000 gallons for usage > SMCR:	$	4.65	

Fiscal Year	Demand Service Contract		Take-or-Pay Contract		Service Availability Contract	
2011	*Actual Usage (1,000s of gal.)*	*Actual Costs*	*Hypothetical Usage (1,000s of gal.)*	*Hypothetical Costs*	*Hypothetical Usage (1,000s of gal.)*	*Hypothetical Costs*
Oct	1,062	$ 6,216.63	9,380	$ 20,883.37	23,451	$ 29,184.98
Nov	-	$ 1,278.33	9,380	$ 20,883.37	23,451	$ 29,184.98
Dec	-	$ 1,278.33	9,380	$ 20,883.37	23,451	$ 29,184.98
Jan	392	$ 3,101.13	9,380	$ 20,883.37	23,451	$ 29,184.98
Feb	-	$ 1,278.33	9,380	$ 20,883.37	23,451	$ 29,184.98
Mar	139	$ 1,924.68	9,380	$ 20,883.37	23,451	$ 29,184.98
Apr	-	$ 1,278.33	9,380	$ 20,883.37	23,451	$ 29,184.98
May	264	$ 2,505.93	9,380	$ 20,883.37	23,451	$ 29,184.98
Jun	23,451	$ 110,325.48	23,451	$ 50,290.93	23,451	$ 29,185.17
Jul	75,244	$ 351,162.93	75,244	$ 291,128.38	75,244	$ 286,078.45
Aug	52,358	$ 244,743.03	52,358	$ 184,708.48	52,358	$ 172,563.89
Sep	17,769	$ 83,904.18	17,769	$ 38,415.54	23,451	$ 29,184.98
Totals:	**170,679**	**$ 808,997.36**	**243,865**	**$ 731,610.28**	**362,112**	**$ 750,492.31**
Unit Cost:		**$ 4.74**		**$ 3.00**		**$ 2.07**

* Optimized to minimize ***Total Cost*** assuming *Actual Usage* is the minimum *Hypothetical Usage* for a given month.

COMPARISON OF OKLAHOMA CITY WHOLESALE RATES – TOTAL COSTS

FIGURE F.1

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo - TETRA TECH

Oklahoma City Treated Water Contract Comparison - FY 2011

(2012 Rates)

Unit Costs Optimization

Monthly Base Rate:	$	12.22	
Meter Multiplier (12" Meter):	$	104.61	
Demand Service Contract			
Rate per 1,000 gallons:	$	4.65	
Take-or-Pay Contract			
Subscribed Monthly Usage (SMU)*:		182,500.00	1,000 gallons
2.5 times SMU:		456,250.00	1,000 gallons
Rate per 1,000 gallons for SMU:	$	2.09	
Rate for usage > SMU, but < 2.5*SMU:	$	2.09	
Rate for usage > 2.5*SMU:	$	4.65	
Service Availability Contract			
Subscribed Monthly Capacity Reservation (SMCR)*:		182,500.00	1,000 gallons
Monthly Capacity Reservation Charge:	$	0.88	
Rate per 1,000 gallons for usage up to SMCR:	$	0.31	
Rate per 1,000 gallons for usage > SMCR:	$	4.65	

Fiscal Year	Demand Service Contract		Take-or-Pay Contract		Service Availability Contract	
2011	*Actual Usage (1,000s of gal.)*	*Actual Costs*	*Hypothetical Usage (1,000s of gal.)*	*Hypothetical Costs*	*Hypothetical Usage (1,000s of gal.)*	*Hypothetical Costs*
Oct	1,062	$ 6,216.63	182,500	$ 382,703.33	182,500	$ 218,453.33
Nov	-	$ 1,278.33	182,500	$ 382,703.33	182,500	$ 218,453.33
Dec	-	$ 1,278.33	182,500	$ 382,703.33	182,500	$ 218,453.33
Jan	392	$ 3,101.13	182,500	$ 382,703.33	182,500	$ 218,453.33
Feb	-	$ 1,278.33	182,500	$ 382,703.33	182,500	$ 218,453.33
Mar	139	$ 1,924.68	182,500	$ 382,703.33	182,500	$ 218,453.33
Apr	-	$ 1,278.33	182,500	$ 382,703.33	182,500	$ 218,453.33
May	264	$ 2,505.93	182,500	$ 382,703.33	182,500	$ 218,453.33
Jun	23,451	$ 110,325.48	182,500	$ 382,703.33	182,500	$ 218,453.33
Jul	75,244	$ 351,162.93	182,500	$ 382,703.33	182,500	$ 218,453.33
Aug	52,358	$ 244,743.03	182,500	$ 382,703.33	182,500	$ 218,453.33
Sep	17,769	$ 83,904.18	182,500	$ 382,703.33	182,500	$ 218,453.33
Totals:	**170,679**	**$ 808,997.36**	**2,190,000**	**$ 4,592,440.01**	**2,190,000**	**$ 2,621,440.01**
Unit Cost:		**$ 4.74**		**$ 2.10**		**$ 1.20**

* Optimized to minimize ***Unit Cost*** assuming *Hypothetical Usage* can not exceed maximum flow rate (Firm Yield) from existing connection of 6.0 MGD.

COMPARISON OF OKLAHOMA CITY WHOLESALE RATES – UNIT COSTS

FIGURE F.2

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo - TETRA TECH

TETRA TECH

119 North Robinson Avenue, Suite 700
Oklahoma City, OK 73102
Tel: 405.606.8600 Fax: 405.606.8601

City of Norman 2060 SWSP
Meeting with the City of Oklahoma City Water Utilities Department

ACTION ITEMS

- Norman will inform OKC of the pertinent details of their water supply needs and plan following the completion of the 2060 SWSP.
- Bret will email OKC's Raw Water Rates to meeting attendees.

DATE: October 4, 2012

TO: Attendees and File

FROM: Ryan Smith

SUBJECT: City of Norman's Water Service Plan through the City of Oklahoma City

PROJECT: City of Norman 2060 SWSP

ATTENDEES: Ken Komiske
Mark Daniels
Chris Mattingly
Bret Weingart
Larry Hare
Ryan Smith

A meeting was held on Thursday, October 4, 2012 at 9:00 am in Conference Room A at the City of Oklahoma City Water Utilities Department (Floor 5). The following are the minutes of the meeting.

DISCUSSION:

GENERAL:

- The City of Oklahoma City is in the process of constructing a pipeline from Stanley Draper to the Lake Hefner Treatment Plant.
    - It is still being analyzed as to whether this line will carry raw or treated water. Study is favoring treated water.
    - The general plan is to increase production from the Draper plant, possibly turn Overholser into a booster pump station, which will limit Lake Hefner withdrawal.
- The City of Oklahoma City is considering partnering with the private sector to fund water infrastructure improvements.
- The City of Oklahoma City prefers percentage based partnering with other water users as opposed to contracting for water purchase through a rate system.
- The City of Oklahoma City has rates established such that the base rate covers the cost of debt and the commodity rate provides a 2 to 1 coverage ratio, which allows them to achieve a AAA bond rating. This allows them to receive the best possible interest rates on the debt they issue.
- The City of Oklahoma City can't sell facilities that are under debt.

TETRA TECH

119 North Robinson Avenue, Suite 700
Oklahoma City, OK 73102
Tel: 405.606.8600 Fax: 405.606.8601

SCHEDULE ITEMS:

- **Current and future treated water rates under the take or pay, service availability, and the current demand service contracts**
  - Bret described the current rates for the Service Availability Plan in detail
    - OKC's most affordable high volume water service plan.
    - Cities that are on this plan typically use OKC water to cover their base water requirements, and supplement their peak needs with their own water supplies.
    - Historical Monthly Usage is initially determined by the customer
      - "12 Month Perfecting Period" is used to establish a more accurate value that will be used as the Historical Monthly Usage in the contract.
  - Future treated water rates are not known yet.
    - Bret has stated in previous emails that he anticipates increases in all rates will be approximately 4% to 7% per year through the year 2060 unless they are modified by the pending Cost Service Study.
  - Process will begin on Friday, October 5, 2012 with financial advisor to start work on an update to the City of OKC's financial plan to forecast future revenue requirements from now through 2060.
  - A Cost Service Study will be conducted by the City of Oklahoma City
    - Anticipated completion date is March, 2014
  - Bret stated that he anticipates it will be slightly cheaper for the City of Norman to team with or buy-in on a portion of any water project the City of Oklahoma City is pursuing, as opposed to simply buying water under the Service Availability plan (OKC's most affordable high volume water service plan).
    - Ownership versus leasing is the primary issue to consider.

- **Current and future raw water rates under the take or pay, service availability, and the current demand service contracts**
  - Information is not known exactly yet.
  - Bret has stated in previous emails that he anticipates increases in all rates to be approximately 4% to 7% per year through 2060 unless modified by the
  - Bret was unsure how O&M and treatment costs might vary between buying raw water as opposed to buying treated water.
  - Multiple 24" (or smaller) meters is preferable when buying raw water because the meter lifespan tends to be shorter when metering raw water.

- **Current availability of treated water under the take or pay, service availability options from existing OCWUT infrastructure and any ongoing work that might affect the available capacity**
  - Oklahoma City would perform a study to see what infrastructure improvements would be required to meet Norman's requested demand.

TETRA TECH

119 North Robinson Avenue, Suite 700
Oklahoma City, OK 73102
Tel: 405.606.8600 Fax: 405.606.8601

- Multiple meters is preferable

- **Update on proposed SE Oklahoma raw water line project**
  - The City of Oklahoma City expects to construct two additional parallel Atoka Pipelines and rehab or replace the existing line by 2060.
    - Pipe sizes between 60" and 84" are being analyzed. 66" pipe is expected to be most cost effective for the first parallel pipeline, given the anticipated demand.
  - Project will be constructed in multiple stages. Pump stations will be rehabilitated/expanded as demand increases.
  - Initial water source could be from the Kiamichi River at Moyers Crossing or the Highway 3 crossing.
  - McGee Creek Reservoir (a USCOE reservoir) will probably be bypassed by the Sardis water line to avoid federal regulations. Lake Atoka could serve as a storage reservoir.

- **Status/Viability of Oklahoma Regional Water Utilities Trust (ORWUT)**
  - Still a possibility, but likely would not be able to achieve better interest rates on bonds than OCWUT

- **Update on tribal water rights**
  - Marsha was planning to attend this meeting but could not attend due to the lawsuit
  - Specifics of the lawsuit cannot be discussed
  - Water rights at McGee Creek are underutilized
- Information the City of Oklahoma City needs from the City of Norman

DISTRIBUTED ITEMS:

- Ordinance No. 24,137 – City of Oklahoma City Sewer and Water rates
- Bret will email the City's raw water rates to the meeting attendees

The meeting was concluded at 10:30 am

If there are any misunderstandings or omissions to this report, please do not hesitate to contact the office of Tetra Tech, Inc.

The City of
OKLAHOMA CITY
WATER & WASTEWATER UTILITIES DEPARTMENT

September 3, 2010

Norman Utilities Authority
Steve Lewis, City Manager
P O Box 370
Norman, OK 73070

Dear Mr. Lewis:

As per past practice, we are providing your office written notification of recommended rate adjustments presented to the City Council on August 31, 2010. This proposed rate ordinance (as attached) will be considered for approval on September 14 and 28, 2010. If these rate adjustments are approved as recommended by the Oklahoma City Water Utilities Trust, rates are anticipated to become effective each October 1, 2010 through 2013.

These recommendations are being forwarded to the City Council for consideration due to significant cost increases and capital improvements required to sustain and enhance service. Should you have any questions concerning how this proposal may affect your organization, just contact me at telephone 297-2828 or by email bret.weingart@okc.gov.

Sincerely,

Bret Weingart
Assistant Director

Marsha Slaughter, Director
Craig Keith, Assistant Municipal Counselor
Peet Loessberg, Utility Customer Services Supt.

received
9-8-10

420 W. Main, Suite 500, Oklahoma City, OK 73102 • 405/297-2422 • FAX 405/297-3813

(Published in the Journal Record _____)

ORDINANCE NO. _____

AN ORDINANCE AMENDING THE OKLAHOMA CITY MUNICIPAL CODE, 2007, BY AMENDING CHAPTER 60, RELATING TO THE GENERAL SCHEDULE OF FEES, BY REPEALING SECTIONS 60-47-29, 60-47-30, 60-55-15, 60-55-16, 60-55-26, AND 60-55-28, REGARDING SANITARY SEWER AND WATER USER CHARGES, GENERALLY, AND BY ADOPTING NEW SECTION 60-47-29, REGARDING SANITARY SEWER USER CHARGES, NEW SECTION 60-47-30, REGARDING ADDITIONAL SURCHARGE FOR INDUSTRIAL USERS WITH ASSESSABLE CONCENTRATIONS, NEW SECTION 60-55-15, REGARDING HOUSEKEEPING UNIT CHARGES, NEW SECTION 60-55-16, REGARDING WATER USER CHARGES, MONTHLY, NEW SECTION 60-55-26, REGARDING DEDICATED PRIVATE FIRE LINE SERVICE CHARGES, NEW SECTION 60-55-28, REGARDING ADDITIONAL METER AND PRIVATE MONTHLY METER CHARGES; AND DECLARING AN EMERGENCY.

EMERGENCY ORDINANCE

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF OKLAHOMA CITY:

SECTION 1. That Sections 60-47-29, 60-47-30, 60-55-15, 60-55-16, 60-55-26, and 60-55-28 of Chapter 60 of the Oklahoma City Municipal Code, 2007, are hereby repealed.

SECTION 2. That new Sections 60-47-29, 60-47-30, 60-55-15, 60-55-16, 60-55-26, and 60-55-28 of Chapter 60 of the Oklahoma City Municipal Code, 2007, are hereby adopted to read:

CHAPTER 60

GENERAL SCHEDULE OF FEES

* * *

TITLE 47. SEWERS AND SEWAGE DISPOSAL

* * *

ARTICLE VIII. RATES, CHARGES, BILLING, COLLECTION PROCEDURES

* * *

Section 60-47-29. Sanitary sewer user charges.

The sanitary sewer users shall be charged and shall pay sanitary sewer user charges consisting of a sanitary sewer volume charge for sanitary sewer services and, wherever applicable, such surcharges, monthly service charges, and deduct meter charges as set forth in this article. The sanitary sewer volume charge shall be the volume of discharge into the Oklahoma City sanitary sewer system times the applicable sanitary sewer volume rate per thousand gallons for the user's customer class. In addition, users who are non-City water customers or whose discharge exceeds certain quality or composition standards shall be charged and shall pay surcharges as established in this Code. The sanitary sewer volume charges are based upon the following rates for each customer class:

(a) **Sanitary sewer volume charges – Inside City, Retail Rate.**

(1) Effective for utility bills issued through September 30, 2010:

$ 1.62 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.24 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :

$ 2.78 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.37 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 2.89 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.50 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 3.01 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.65 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 3.13 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.79 per thousand gallons.

(b) Sanitary sewer volume charges – Outside City, Unincorporated, Retail Rate.

Service provided to a retail customer outside the City for which a fee in lieu of franchise is not paid.

(1) Effective for utility bills issued through September 30, 2010:

$ 1.62 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.89 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :

$ 2.78 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.01 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 2.89 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.13 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 3.01 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.26 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 3.13 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.39 per thousand gallons.

(c) Sanitary sewer volume charges – Outside City, Incorporated, Retail Rate.

Service provided to a retail customer outside the City for which a fee in lieu of franchise is paid.

(1) Effective for utility bills issued through September 30, 2010:

$ 1.62 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.95 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :

$ 2.84 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.07 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 2.95 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.19 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 3.07 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.32 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 3.19 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.45 per thousand gallons.

(d) Sanitary sewer volume charges – Tinker Air Force Base Rate.

(1) Effective for utility bills issued through September 30, 2010:

$ 1.62 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 1.89 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :

$ 2.78 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 1.97 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 2.89 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.05 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 3.01 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.13 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 3.13 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.22 per thousand gallons.

(e) Sanitary sewer volume charges – Outside City, Wholesale Rate.

(1) Effective for utility bills issued through September 30, 2010:

$ 1.62 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.48 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :

$ 2.78 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.58 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 2.89 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.68 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 3.01 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.79 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 3.13 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.90 per thousand gallons.

Section 60-47-30. Additional surcharge for industrial users with assessable concentrations.

Users whose discharge quality or composition exceeds the standards set forth below shall pay an industrial surcharge in addition to the sanitary sewer volume charge and the sanitary sewer utility charge. The industrial surcharges are as follows:

(a) Milligrams per liter of BOD in excess of 250 milligrams per liter (250 mg/l).

Users whose discharge exceeds 250 milligrams of BOD per liter shall pay an industrial surcharge equal to the product of the BOD surcharge rate times the total volume of discharge

times the sum of the number of milligrams of BOD per liter minus 250 milligrams per liter. The BOD surcharge rates are as follows:

(1) Effective for utility bills issued through September 30, 2010:
$ 2.77 per million gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :
$ 2.88 per million gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:
$ 3.00 per million gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:
$ 3.12 per million gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:
$ 3.24 per million gallons.

(b) Milligrams per liter of suspended solids (TSS) in excess of 300 milligrams per liter (300 mg/l).

Users whose discharge exceeds 300 milligrams of TSS per liter shall pay an industrial surcharge equal to the product of the TSS surcharge rate times the total volume of discharge times the sum of the number of milligrams of TSS per liter minus 300 milligrams per liter. The TSS surcharge rates are as follows:

(1) Effective for utility bills issued through September 30, 2010:
$ 1.94 per million gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011 :
$ 2.02 per million gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 2.10 per million gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 2.18 per million gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 2.27 per million gallons.

* * *

TITLE 55. UTILITIES

ARTICLE II. CITY WATER SERVICE

* * *

Section 60-55-15. Housekeeping unit charges.

The monthly housekeeping charge shall be the number of housekeeping units served by the same meter times the housekeeping charge rate as follows:

(a) Effective for utility bills issued through September 30, 2010:

$1.26

(b) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$1.50

(c) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$1.56

(d) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$1.62

(e) Effective for utility bills issued from October 1, 2013 and thereafter:

$1.69

Section 60-55-16. Water user charges.

The water user charges shall be the monthly customer service charge (the monthly base rate times meter multiplier) plus the water usage charge (volume), as use is measured or estimated pursuant to this Code or contract, times the applicable water rate per thousand gallons for the user's customer class. The water user charges for each customer class are:

(a) **Water user charges – Inside City, Retail; and**

Inside City, Retail, Non Dedicated Private Fire Line Service.

(1) Effective for utility bills issued through September 30, 2010:

$ 7.37 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.26 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$ 9.75 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.35 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$10.14 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.45 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$10.55 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.55 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$10.97 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.65 per thousand gallons.

(b) **Water user charges - Outside City, Unincorporated, Retail; and**

Outside City, Unincorporated, Non-Dedicated Private Fire Line Service.

Service provided to a retail customer outside the City for which a fee in lieu of franchise is not paid.

(1) Effective for utility bills issued through September 30, 2010:

$ 9.07 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.96 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$12.00 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.08 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$12.48 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.20 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$12.98 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.33 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$13.50 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.46 per thousand gallons.

(c) **Water user charges – Outside City, Incorporated, Retail; and Outside City, Incorporated, Non-Dedicated Private Fire Line Service.**

Service provided to a retail customer outside the City for which a fee in lieu of franchise is paid.

(1) Effective for utility bills issued through September 30, 2010:

$ 9.24 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.05 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$12.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.17 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$12.71 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.30 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$13.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.43 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$13.75 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.57 per thousand gallons.

(d) **Water user charges – Tinker Air Force Base.**

(1) Effective for utility bills issued through September 30, 2010:

$ 8.65 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.10 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$11.44 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.22 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$11.90 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.35 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$12.38 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.49 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$12.88 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 3.63 per thousand gallons.

(e) **Water user charges - Outside City, Wholesale, Take-or-Pay.**

The subscribed monthly usage is the minimum monthly usage the customer has determined and agreed to be charged by contract; provided that to qualify for this rate the customer's take-or-pay minimum monthly gallons must be at least fifteen percent of the customer's maximum historic monthly usage.

(1) Effective for utility bills issued through September 30, 2010:

$ 9.24 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.01 per thousand gallons for subscribed monthly usage; plus

$ 2.01 per thousand gallons for usage between subscribed monthly usage and 2.5 times subscribed monthly usage; plus

$ 4.47 per thousand gallons for usage in excess of 2.5 times subscribed monthly usage.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$12.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.09 per thousand gallons for subscribed monthly usage; plus

$ 2.09 per thousand gallons for usage between subscribed monthly usage and 2.5 times subscribed monthly usage; plus

$ 4.65 per thousand gallons for usage in excess of 2.5 times subscribed monthly usage.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$12.71 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.17 per thousand gallons for subscribed monthly usage; plus

$ 2.17 per thousand gallons for usage between subscribed monthly usage and 2.5 times subscribed monthly usage; plus

$ 4.84 per thousand gallons for usage in excess of 2.5 times subscribed monthly usage.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$13.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.26 per thousand gallons for subscribed monthly usage; plus

$ 2.26 per thousand gallons for usage between subscribed monthly usage and 2.5 times subscribed monthly usage; plus

$ 5.03 per thousand gallons for usage in excess of 2.5 times subscribed monthly usage.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$13.75 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 2.35 per thousand gallons for subscribed monthly usage; plus

$ 2.35 per thousand gallons for usage between subscribed monthly usage and 2.5 times subscribed monthly usage; plus

$ 5.23 per thousand gallons for usage in excess of 2.5 times subscribed monthly usage.

(f) Water user service charges - Outside City, Wholesale, All Others, As Available. (Demand Supply, Demand-Sole Source and Annual Take-or-Pay).

There is no minimum monthly usage the customer has determined and agreed to be charged by contract.

(1) Effective for utility bills issued through September 30, 2010:

$ 9.24 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 4.47 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$12.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 4.65 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$12.71 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 4.84 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$13.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 5.03 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$13.75 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 5.23 per thousand gallons.

(g) **Water user charges - Outside City, Wholesale, Service Availability.**

The subscribed monthly capacity reservation is the minimum monthly reservation the customer has determined and agreed to be charged by contract; provided that to qualify for this rate the customer's monthly capacity reservation must be at least ninety percent of the customer's maximum historic monthly usage in gallons.

(1) Effective for utility bills issued through September 30, 2010:

$ 9.24 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ .84 per thousand gallons for monthly capacity reservation charge; plus

$ .29 per thousand gallons for usage up to the subscribed monthly capacity reservation gallons; plus

$ 4.47 per thousand gallons for usage in excess of subscribed monthly capacity reservation gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$12.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ .88 per thousand gallons for monthly capacity reservation charge; plus

$ .31 per thousand gallons for usage up to the subscribed monthly capacity reservation gallons; plus

$ 4.65 per thousand gallons for usage in excess of subscribed monthly capacity reservation gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$12.71 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ .92 per thousand gallons for monthly capacity reservation charge; plus

$ .33 per thousand gallons for usage up to the subscribed monthly capacity reservation gallons; plus

$ 4.84 per thousand gallons for usage in excess of subscribed monthly capacity reservation gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$13.22 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ .96 per thousand gallons for monthly capacity reservation charge; plus

$ .35 per thousand gallons for usage up to the subscribed monthly capacity reservation gallons; plus

$ 5.03 per thousand gallons for usage in excess of subscribed monthly capacity reservation gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$13.75 (monthly base rate) times meter multiplier (see § 60-55-17); plus

$ 1.00 per thousand gallons for monthly capacity reservation charge; plus

$ .36 per thousand gallons for usage up to the subscribed monthly capacity reservation gallons; plus

$ 5.23 per thousand gallons for usage in excess of subscribed monthly capacity reservation gallons.

(h) Water user service charges – Bulk, Usage through Flushmeters.

(1) Effective for utility bills issued through September 30, 2010:

$ 7.54 (monthly base rate) for each meter, plus

$ 4.47 per thousand gallons.

(2) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$ 9.98 (monthly base rate) for each meter, plus

$ 4.65 per thousand gallons.

(3) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$10.37 (monthly base rate) for each meter, plus

$ 4.84 per thousand gallons.

(4) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$10.79 (monthly base rate) for each meter, plus

$ 5.03 per thousand gallons.

(5) Effective for utility bills issued from October 1, 2013 and thereafter:

$11.22 (monthly base rate) for each meter, plus

$ 5.23 per thousand gallons.

(i) "Maximum historic monthly usage" as used in this section shall mean the maximum historic usage of Oklahoma City water in gallons for any month regardless the rate or customer class at the time of usage, less and except as re-calculated by the Utilities Director in accordance with subsection (j) below. The maximum historic monthly usage shall be calculated and/or re-calculated upon the date designated by contract for establishing or amending the take-or-pay minimum monthly gallons or the monthly capacity reservation gallons.

(j) In the event a wholesale customer receiving service under subsections (e) (Outside City, Wholesale, Take-or-Pay) or (h) (Outside City, Wholesale, Service Availability) losses an outside City wholesale or retail customer, the Utilities Director may, subsequent to the receipt and review of adequate appropriate supporting documentation, prospectively re-calculate and reduce the maximum historic monthly usage based upon the contribution of the outside City customer to the maximum historic monthly usage.

(k) The Utilities Director is authorized to negotiate written contracts and amendments for water service under each established customer class and rate schedule subject to approval of the final written contracts by the Trust and the City. The Utilities Director may also negotiate contracts and amendments that phase a customer into a service availability customer class or rate schedule subject to approval of the final written contracts by the Trust and the City; provided such phase-in period may not exceed three contract years.

* * *

Section 60-55-26. Dedicated private fire line service charges – Monthly.

(Fire line service size in inches)	Charges effective for utility bills issued to 9/30/10	Charges effective for utility bills issued 10/1/10 through 9/30/11	Charges effective for utility bills issued 10/1/11 through 9/30/12	Charges effective for utility bills issued 10/1/12 through 9/30/13	Charges effective for utility bills issued 10/1/13 and thereafter
2	$ 3.87	$ 4.50	$ 4.68	$ 4.87	$ 5.06
3	$ 5.81	$ 6.76	$ 7.03	$ 7.31	$ 7.60
4	$ 7.74	$ 9.01	$ 9.37	$ 9.74	$10.13
6	$10.33	$12.01	$12.49	$12.99	$13.51
8	$15.50	$18.02	$18.74	$19.49	$20.27
10	$25.83	$30.03	$31.24	$32.49	$33.79
12	$38.73	$45.03	$46.84	$48.71	$50.66

Fire service lines in excess of twelve inches shall be charged based upon a separate contract with the City.

* * *

Section 60-55-28. Additional City meter and private monthly meter charges.

The monthly meter charge for each additional City meter or private meter for establishing water usage or sanitary sewer discharge shall be paid by the customer and shall be equal to the following:

(1) Inside City customers:

(a) Effective for utility bills issued through September 30, 2010:

$ 3.17

(b) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$ 3.30

(c) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 3.43

(d) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 3.57

(e) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 3.71

ide City Customers:

(a) Effective for utility bills issued through September 30, 2010:

$ 4.10

(b) Effective for utility bills issued from October 1, 2010 through September 30, 2011:

$ 4.26

(c) Effective for utility bills issued from October 1, 2011 through September 30, 2012:

$ 4.43

(d) Effective for utility bills issued from October 1, 2012 through September 30, 2013:

$ 4.61

(e) Effective for utility bills issued from October 1, 2013 and thereafter:

$ 4.80

* * *

SECTION 3. **EMERGENCY.** Whereas, it being immediately necessary, for the preservation of the peace, health, safety and public good of the City of Oklahoma City and the inhabitants thereof, that the provisions of this ordinance be put into full force and effect, an emergency is hereby declared to exist, by reason whereof, this ordinance shall take effect, and be in full force, from and after its passage, as provided by law.

INTRODUCED and **CONSIDERED** in open meeting of the Council of the City of ma City this _____ day of _____, 2010.

ADOPTED by the Council of the City of Oklahoma City this _____ day of _____, 2010.

SIGNED by the Mayor of the City of Oklahoma City this _____ day of _____, 2010.

ATTEST: (seal)

City Clerk

MAYOR

REVIEWED for form and legality

Diane Lewis

Assistant Municipal Counselor

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u:\ordinances\chapter 60\water and sewer\cbk dc rate ordinance 2010 opt b draft 3 0 081610.doc

TETRA TECH

119 N. Robinson Ave., Ste. 700
Oklahoma City, OK 73102
Phone: 405.606.8600 Fax: 405.606.8601

MEMORANDUM

TO: File

FROM: Ryan Smith

COPY:

RE: Norman's Maximum Obtainable Water Flow Rate from the City of Oklahoma City Treated Water Connection

DATE: Wednesday, August 22, 2012

The purpose of this memo is to document a phone conversation with Bryan Hapke of the City of Norman Utilities Department regarding the maximum obtainable flow rate from the connection to the City of Oklahoma City (OKC) finished water line, located just north of the intersection of S Telephone Road (36th Avenue NW) and SW 34th Street in Moore, OK. The maximum obtainable flow rate from OKC is dependent upon a number of factors.

Relative Pressures

Water is supplied from OKC by a 24" water main and travels from the connection to approximately 3 miles south, where it joins another 24" main carrying well water from the wells on the east side of Norman. The relative pressures for both water mains impact the maximum obtainable flow rate from OKC. These relative pressures are dependent upon current OKC water demand, OKC reserves, and the City of Norman water production from their eastern wells.

Connection

The connection to the OKC transmission line also impacts the maximum obtainable flow rate. At the connection there is a 12" turbine meter on the 24" water main. Immediately downstream of the 12" meter, the line splits into a 12" and a 20" line that are then passed through a flow control vault. The 12" line has a 12" Singer anti-cavitation globe valve that is hydraulically diaphragm controlled by solenoid valves. The 20" line has a 20" flow control ball valve with an electric motor operator. The two lines then pass through butterfly valves before they tee back together into a 24" main and travel south to the junction with the City of Norman's 24" east well water main. Flow continues south in a 24" line to the Cascade water tower, an elevated 2 MG tower. Water tees in/out of the tower through a 12" line, and the flow in and out of the tower is controlled by a 12" altitude valve. Flow continues south of the Cascade water tower through a 16" water main.

Recorded Flow Rates

On December 10, 2007, the City of Norman experienced one their worst ice storms in their history. As a result the entire Norman water production system was without power and unable to produce any water. The City of Norman was forced to rely solely on their water connection to

the City of Oklahoma City for all of their water needs. At this time the City of Norman fully opened the 20" ball valve at the connection to the OKC main. A flow rate of 9.5 MGD was observed at this time. With this event occurring in December, water pressure on the Oklahoma City line is estimated to have been high, based on the assumption that the water demand on the OKC system was low and that OKC water reserves were high. Additionally, the backpressure from the 24" water main from the City of Norman's eastern well water production, that is normally restrictive on this main, was nonexistent at this time. 9.5 MGD is consistent with rough calculations of maximum flow rate assuming a friction-loss factor and pressure on the OKC main. Due to the limited water demand in December, it was unnecessary to keep the valve fully open for an entire day, and the recorded water purchase from OKC for that day was 4.9 MG. Due to the circumstances of this flow rate, 9.5 MGD is not considered to be achievable on a consistent basis, particularly during the summer months when the demand on the OKC system is higher and reserves are lower.

Historically, the City of Norman's maximum recorded water purchase from OKC in a single day occurred on August 15, 2007, in the amount of 7.35 MG. However, this flow rate is also somewhat of an anomaly, and is not considered to be achievable on a consistent basis, particularly during the summer months.

Conclusions

According to the City of Norman Water Treatment Supervisor, Bryan Hapke, the maximum flow rate he is able to achieve on a continual regular basis from the OKC treated water connection is 6.0 MGD. This flow rate is consistent with recorded values of daily water purchases from the City of Oklahoma City during summer months.

APPENDIX G – REFERENCE INFORMATION – LAKE THUNDERBIRD AUGMENTATION (IPR)

Appendix G – Lake Thunderbird Augmentation (IPR)

For the 2060 SWSP, it was assumed that the following treatment process modifications at Norman's existing Water Reclamation Facility would be necessary to address regulatory and non-regulatory constituents for discharge into Dave Blue Creek as tributary flow to Lake Thunderbird:

- Anaerobic Conversion – convert primary clarifiers to anaerobic zones
- Anoxic Basin – add new basin
- Recycle Piping – recycle pumps and piping for mixed liquor suspended solids (MLSS) between reactors
- Waste Activated Sludge (WAS) Pumping – additional WAS pumping
- WAS Thickening – additional thickening
- Ozone – new basin
- Biofilters – new basin
- Chemical feed systems for phosphorus removal and biofiltration
- Yard piping/appurtenances

APPENDIX H – REFERENCE INFORMATION – NON-POTABLE REUSE

Appendix H – Non-potable Reuse

This appendix contains detailed information that was used to support development of the conceptual Phase I non-potable reuse system. Water use data were provided by NUA and reviewed to determine which these customers/sites may be best suited for conversion to non-potable reuse service under a conceptual Phase I project. Actual customer sites and demands would likely vary from this list, dependent on a more detailed analysis and customer outreach as part of preliminary implementation activities.

Table H.1 Potential Customers for Phase I Non-potable Reuse Project

No.	Customer Name	Demand Type	Diurnal Pattern	Demand Estimation Method	Gross Area (ac)	Irrigation Area Adjustment Factor	Irrigation Area (ac)	Average Annual Demand (afy)	Peak Day Demand (mgd)	Peak Hour Demand (gpm)
1	The Trails Golf Club	Irrigation	8 hrs	Acreage x unit demand	169.2	0.90	152.3	216.3	2.7	5,714
2	Duck Pond	Irrigation	8 hrs	Acreage x unit demand	51.3	0.90	46.2	65.6	0.8	1,732
3	Madison School	Irrigation	8 hrs	Acreage x unit demand	13.2	0.60	7.9	11.2	0.1	297
4	Canadian Trails	Irrigation	8 hrs	Acreage x unit demand	1.5	0.90	1.4	1.9	0.0	51
5	New Reagan Elementary	Irrigation	8 hrs	Acreage x unit demand	12.0	0.60	7.2	10.2	0.1	270
6	Martin Marietta Asphalt Plant	Industrial	12 hrs	Given	NA	NA	NA	5.5	0.0	2
7	Cobblestone Golf Course	Irrigation	8 hrs	Acreage x unit demand	23.10	0.90	20.8	29.5	0.4	780
8	Links Golf Course	Irrigation	8 hrs	Acreage x unit demand	153.30	0.90	138.0	196.0	2.5	5,177
9	John H Saxon Park	Irrigation	8 hrs	Acreage x unit demand	131.36	0.40	52.5	74.6	0.9	1,972
10	University of OK Golf Course	Irrigation	8 hrs	Given	NA	NA	NA	112.3	0.3	625
11	WEDR Stinson Investors llc	Irrigation	8 hrs	Existing Potable Usage				6.2	0.1	164
12	Reaves Park	Irrigation	8 hrs	Existing Potable Usage				10.3	0.1	271
13	Astellas	Irrigation	8 hrs	Existing Potable Usage				2.9	0.0	76
14	The Cottages OF Norman	Irrigation	8 hrs	Existing Potable Usage				28.3	0.4	746
15	Hitachi	Irrigation	8 hrs	Existing Potable Usage				2.3	0.0	60
16	Crosspointe Church	Irrigation	8 hrs	Existing Potable Usage				8.4	0.1	222
17	US Postal Training Center (Irrigation)	Irrigation	8 hrs	Existing Potable Usage				24.5	0.3	648
18	US Postal Training Center (Cooling)	Cooling Tower	9 hrs (8 am - 5 pm)	Existing Potable Usage				14.0	0.0	55
19	USPS Marriott Hotel (Irrigation)	Irrigation	8 hrs	Existing Potable Usage				8.2	0.1	217
20	USPS Marriott Hotel (Cooling)	Cooling Tower	24 hrs	Existing Potable Usage				11.8	0.0	28
21	Chickasaw Nation Industries	Irrigation	8 hrs	Existing Potable Usage				9.7	0.1	257
22 (1)	Future Demands	Irrigation	8 hrs	Assumed				850.0	10.8	22,452

Notes:
1. Allowance for future expansion to meet demands outside the initial area served through the direct non-potable reuse project.

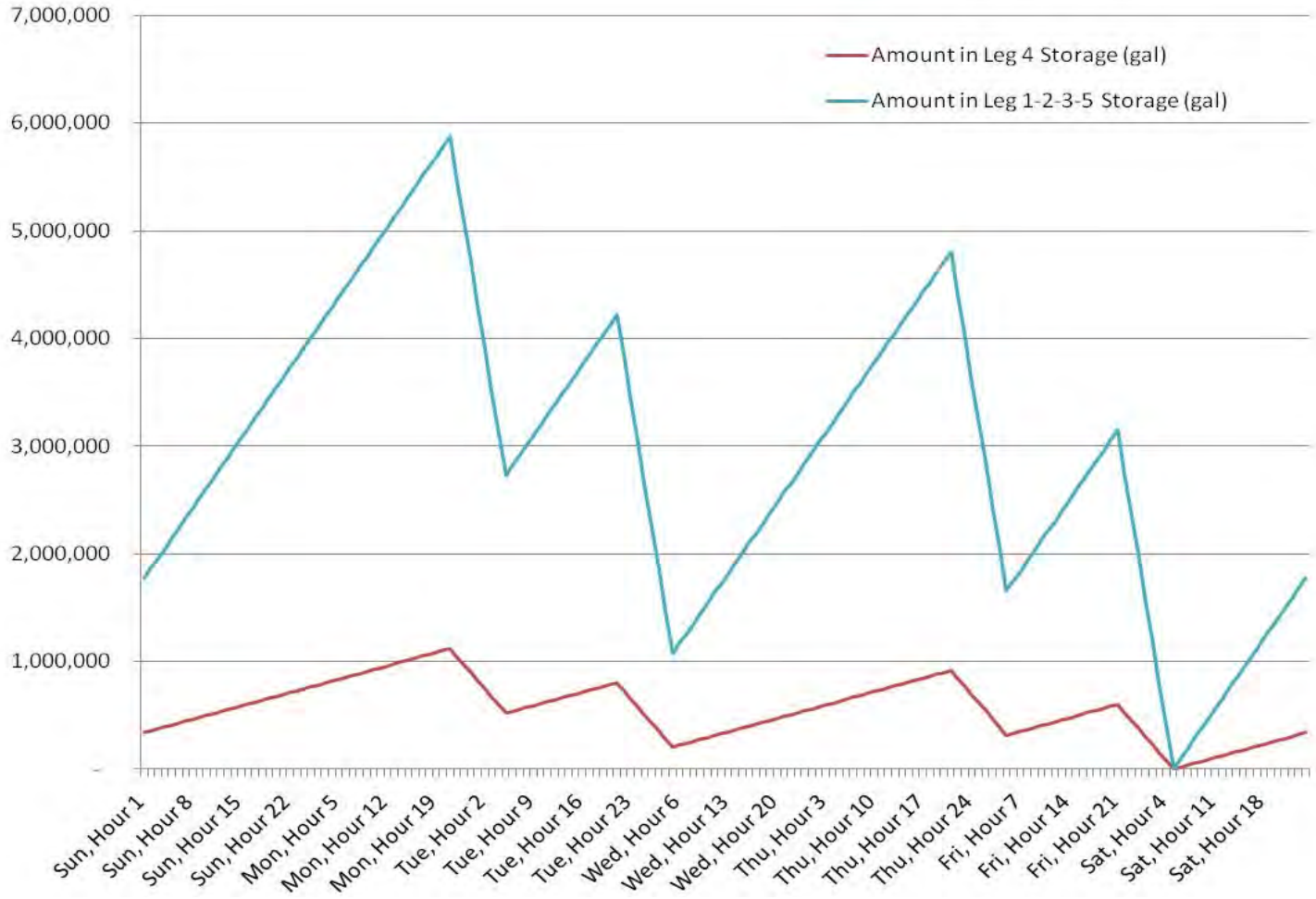
Table H.2 Phase I Non-potable Reuse – Pipeline Summary					
Pipe Segment	**From**	**To**	**Length (ft)**	**Size [1] (in)**	**Peak Hour Flow (gpm)**
Leg 1	Plant	E Cedar Ln & 24th Ave SE	10,700	24	8,050
Leg 2	E Cedar Ln & 24th Ave SE	24th Ave SE & E Imhoff Rd	5,300	20	5,000
Leg 3	24th Ave SE & E Imhoff Rd	E Imhoff Rd & Saxon Park	3,200	12	1,550
Leg 4	Plant	Duck Pond	16,400	18	4,350
Leg 5	Plant	Trails Golf Club pond	5,800	16	2,900

Notes:
1. Based on maximum velocity of 6 ft/s.

Table H.3 Phase I Non-potable Reuse – Pumping Summary

No.	Pump Type	Pipe Segments Served	Elevation Upstream [1] (ft msl)	Elevation Downstream (ft msl)	Headloss [2] (ft)	Required pressure (psi)	TDH (ft)	Design Flows [3] (gpm)	Pump Motor Input Power [4] (hp)
1	Variable Speed	Legs 1, 2, 3	1,093	1,175	95	50	290	5,250	600
2	Constant Speed	Leg 4	1,093	1,312 [4]	80	-	300	500	50
3	Variable Speed	Leg 5	1,093	1,090	30	50	140	2,900	150

Notes:
(1) Current normal water elevation at plant's effluent pump sump
(2) Assumes 5 ft of headloss for every 1,000 ft of pipe
(3) Excludes any future demand
(4) Existing water tank's overflow elevation
(5) This is maximum required power for variable speed pumps. Assumes overall efficiency of 65%. Excludes spare horsepower. Rounded to the nearest 25 hp.



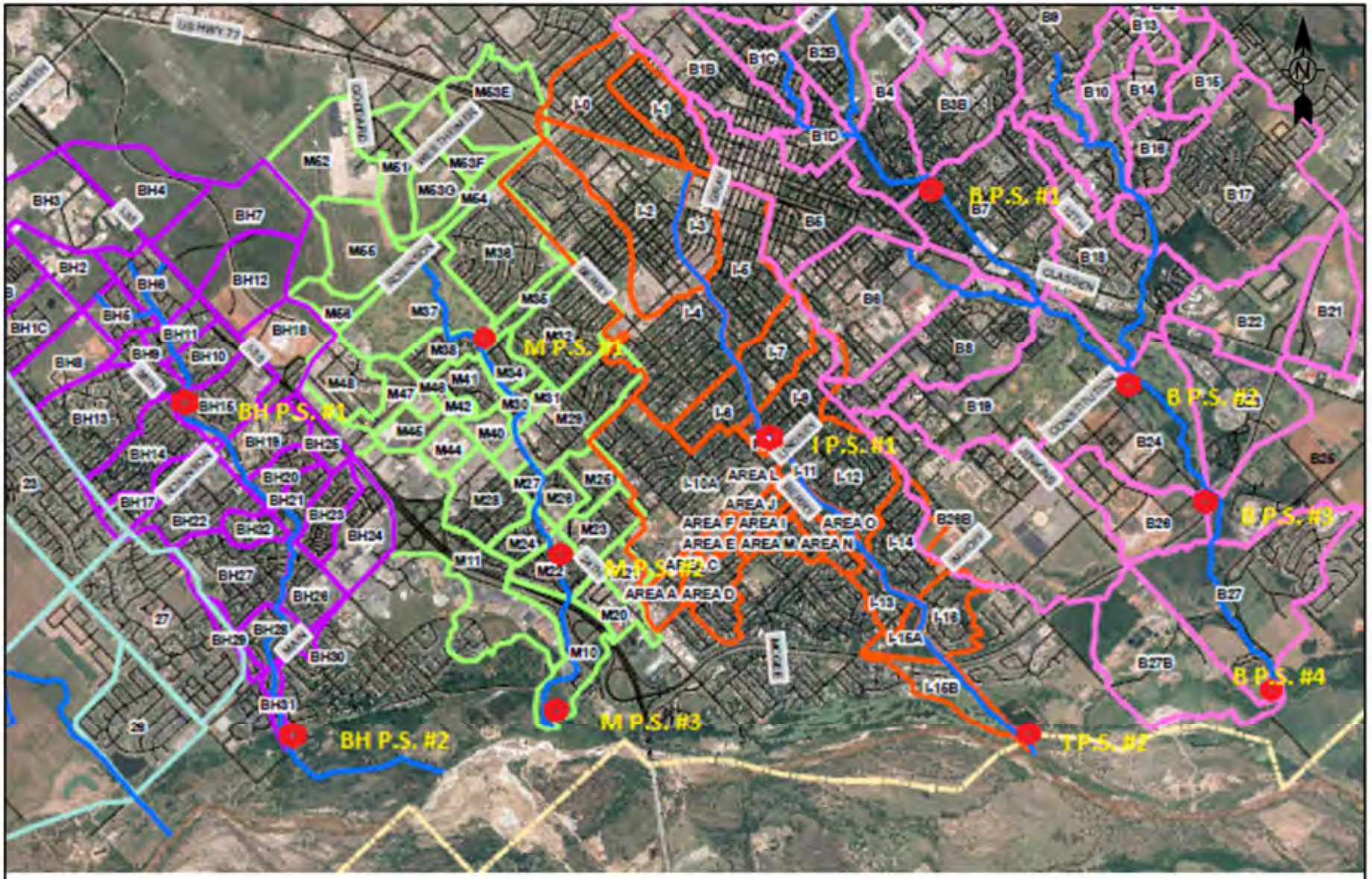
PHASE I NON-POTABLE REUSE – SYSTEM STORAGE

FIGURE H.1

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo TETRA TECH

APPENDIX I – REFERENCE INFORMATION – STORMWATER CAPTURE AND REUSE

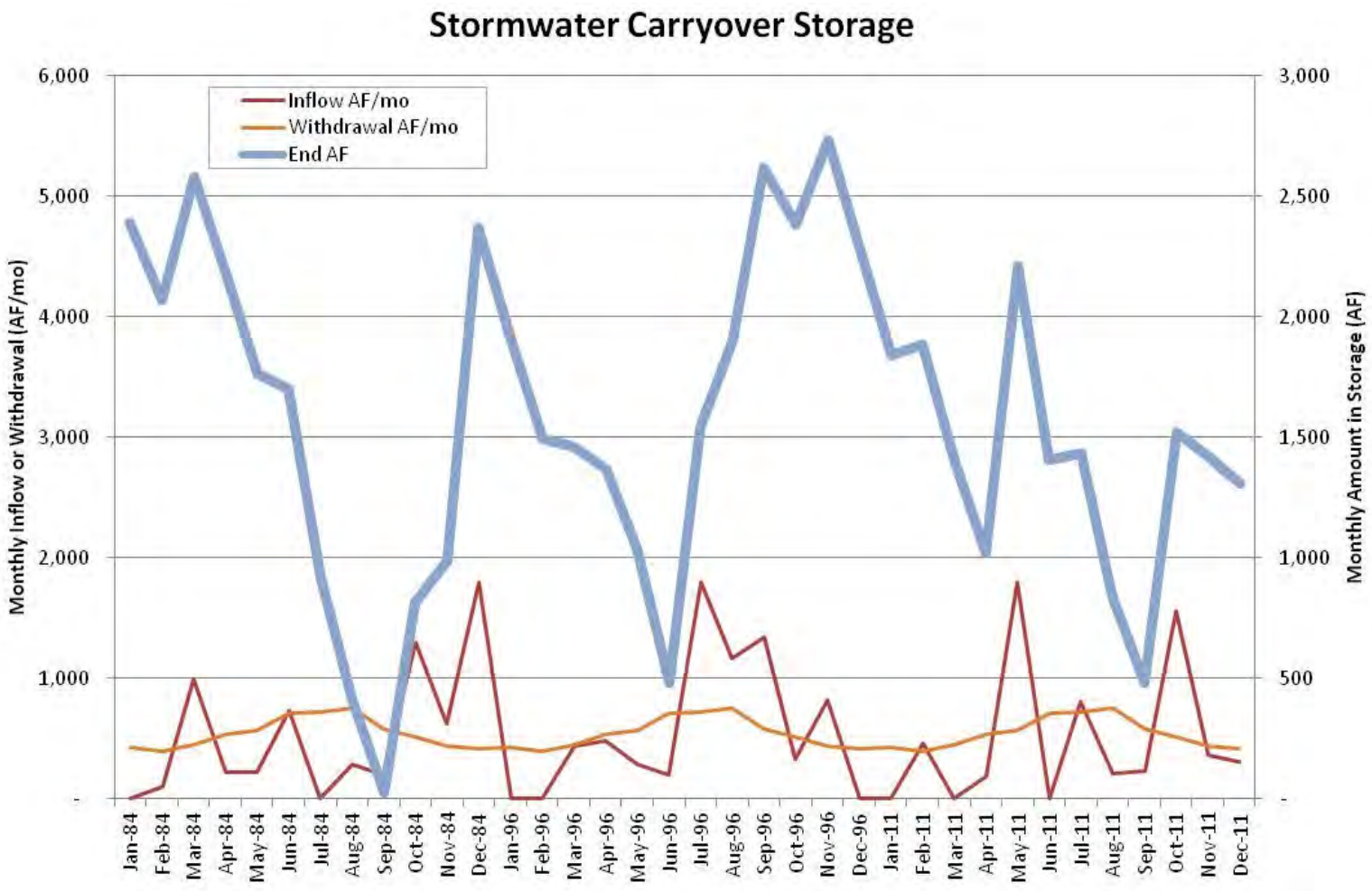


*FROM "*STORMWATER MASTERPLAN, NORMAN, OKLAHOMA*"
DATED FEBRUARY 2009, USED TO DEVELOP STORMWATER
CAPTURE AND REUSE SOURCE OPTION

Figure I.1 - Stormwater Capture Watersheds and Collection Locations
2060 Strategic Water Supply Plan
Norman, Oklahoma

TETRA TECH

carollo
Engineers...Working Wonders With Water™



GRAPHICAL REPRESENTATION OF MASS BALANCE CALCULATION

FIGURE I.2

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo TETRA TECH

APPENDIX J – REFERENCE INFORMATION – CANADIAN RIVER DIVERSION

Appendix J – Canadian River Diversion

This appendix provides more information on the three Canadian River diversion options as well as a preliminary evaluation of the feasibility of a new low head dam on the Canadian River.

ASSUMPTIONS FOR FUTURE USE

Identifying the amount of water that can be withdrawn from the Canadian River was the first step in analyzing this potential water supply source. The USGS has three gauges located along the Canadian River through central Oklahoma that record the flow rate of the river. The monthly means of these data are publicly available. One gauging station is located near Bridgeport (upstream of Norman) and was implemented in 1970. One is located near Norman and was implemented in 1996. The third gauging station is near Purcell (downstream of Norman) and was implemented in 1979. Because the Norman gauging station does not provide as much historical data as the Bridgeport station, the monthly mean flow rates from the Bridgeport gauging station were used for this analysis. Due to the relative proximity of this gauging station, and the fact that it is upstream of Norman without any significant water users in between, it was assumed that the mean monthly flow rates will be similar between these two gauging stations.

TERMINAL STORAGE NEEDS

Using the monthly mean flow rates from the Bridgeport station, it was possible to determine the amount of water that would be available for withdrawal on a firm yield basis. The first assumption was that water diversions would only be permitted by the OWRB when the river flow rate exceeds 100 cubic feet per second (CFS, or 155 mgd). Additionally, diversions were also capped in order to minimize the required size of the intake structure, conveyance pipeline diameter, and terminal storage volume. The actual cap amount was determined later by optimizing the unit costs for this supply without allowing the firm yield to drop below 20% of Norman's projected 2060 water demand (5.8 mgd annual average).

Using these assumptions, a mass balance calculation was performed, which accounted for losses due to seepage and evaporation. The optimized firm yield of the Canadian River was determined to be 6.0 MGD, and this was attainable with 38,000 AF of terminal storage. This solution capped diversions from the Canadian River at 2,000 AF/month. Figure J.1 illustrates the mass balance calculation. Assuming an average depth of 20 feet and an operational depth of 16 feet, 38,000 AF of terminal storage would require an area of 2,375 acres within relatively close proximity to the Norman WTP.

INFRASTRUCTURE NEEDS

Once the firm yield and terminal storage volume were determined, three unique options were developed for utilizing the Canadian River as a supply source. The first two options were developed in the *2040 Strategic Water Supply Plan*, and were amended in this plan based on the revised firm yield calculation. The third developed option considered withdrawing from the Canadian River, south of the City of Norman as opposed to the previously proposed north intake locations.

Canadian River Diversion Option 1

The first option involves a diversion of the Canadian River on the northwest side of Norman. At the diversion, a low head intake system with a capacity of 6.0 mgd would be constructed. Located near this diversion, on the northwest side of Norman, would be a 38,000 AF terminal storage reservoir and a new, north water treatment plant. Conveyance from the intake system to the terminal storage reservoir is accomplished through a 36-inch diameter pipeline. This option has several advantages. First, the conveyance infrastructure needed for this option is very minimal with storage and treatment very near to the diversion. Secondly, producing treated water on the northwest side of Norman aides the distribution system tremendously in alleviating potential bottlenecks, as the majority of treated water is currently fed into the distribution system on the east side of Norman. It is important to note that exact locations or coverage areas for the intake structure, terminal storage reservoir, and water treatment plant have not been identified or studied in this report. Locations are only approximate.

Canadian River Diversion Option 2

The second option was also initially developed in the *2040 Strategic Water Supply Plan* for Norman, and it also involves a diversion of the Canadian River on the northwest side of Norman. At the diversion, a low head intake system with a capacity of 6.0 mgd would be constructed. Water would then be conveyed a short distance through a 36 inch pipeline to a 34,800 AF intermediate storage reservoir. From there, water would be transferred to a 3,200 AF terminal storage reservoir on the east side of Norman through a 24-inch diameter pipeline before being treated at the existing Norman WTP. The purpose of the intermediate storage reservoir is to minimize the size of pipe that is used to convey water from the west side of Norman to the east. Due to the revised firm yield potential of this source, and the subsequently revised intake structure requirements, using an intermediate storage reservoir does not provide as much savings in this study as it did when this option was first developed in the *2040 Strategic Water Supply Plan*. Lastly, the Norman WTP would require an expansion that would include advanced treatment facilities to treat the brackish Canadian River water. Similar to Option 1, exact locations and coverage areas for the intake structure, intermediate storage reservoir and terminal storage reservoir have not been identified or studied in this report.

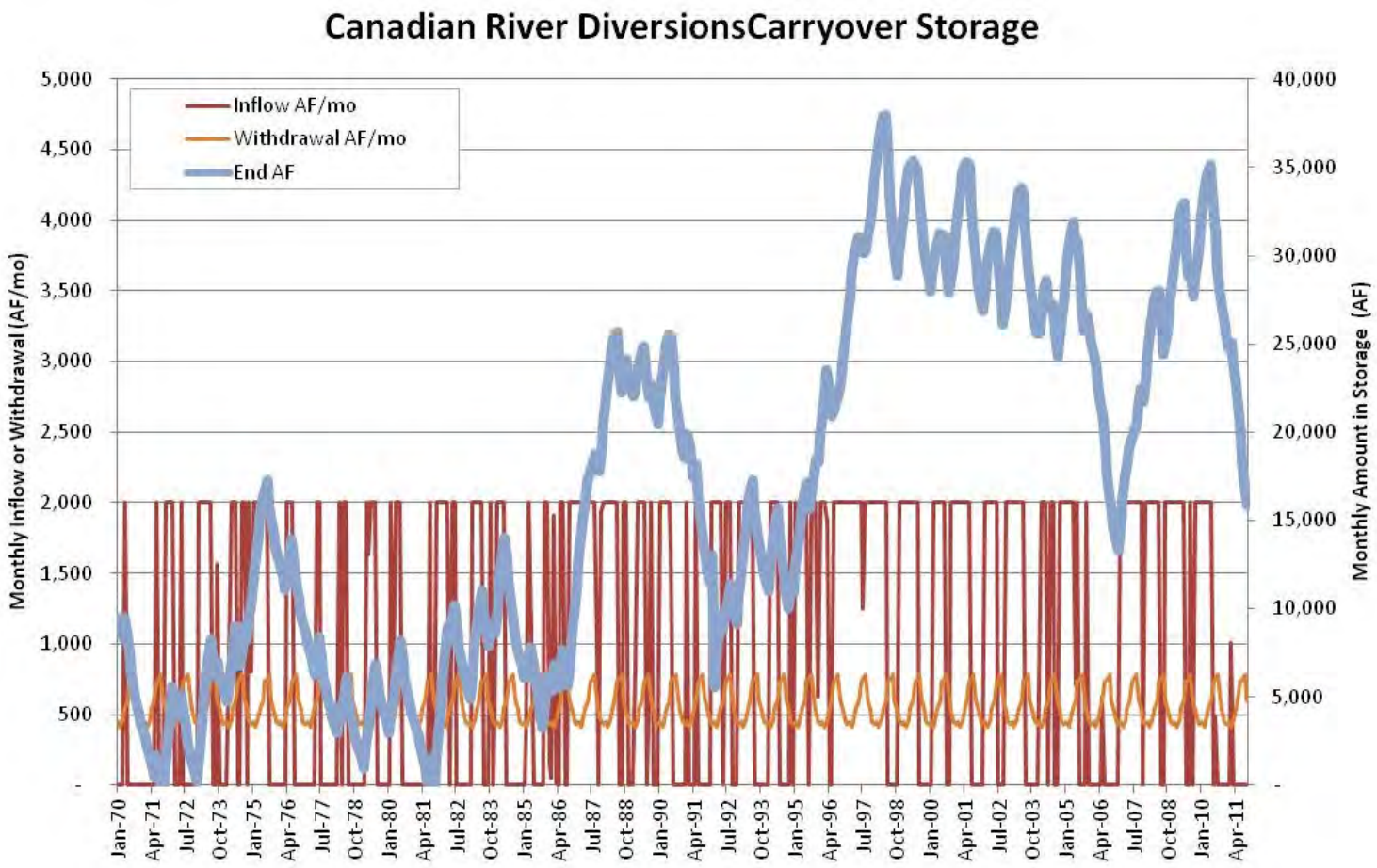
Canadian River Diversion Option 3

The final option involves a diversion of the Canadian River on the southeast side of Norman. An intake structure, conveyance infrastructure, and a terminal storage reservoir would be required for this option. The terminal storage reservoir would be located on the east side of Norman, near the existing water treatment plant. The Norman WTP would require an expansion that would include advanced treatment facilities to treat the brackish Canadian River water.

With this option, the intake structure would be located downstream of the Norman WRF discharge, increasing reliable yields from the diversion. The Canadian River flow rates would be aided by a fairly continuous supply of treated effluent. Rerunning the mass balance calculation from before allows the same 6.0 mgd firm yield to be achieved by capping diversions at 1,830 AF/month or 19.9 MGD with a terminal storage reservoir volume of 35,700 AF, as illustrated in Figure J.2.

Maintaining the same firm yield would be possible with slightly less infrastructure requirements due to the more consistent flow rate downstream of the Norman WRF. For

this option, the intake and conveyance system could be reduced to a 32-inch diameter pipeline, and the terminal storage reservoir could be reduced in size to 35,700 AF. Similar to Options 1 and 2, exact locations and coverage areas for the intake structure, intermediate storage reservoir and terminal storage reservoir have not been identified or studied in this report.

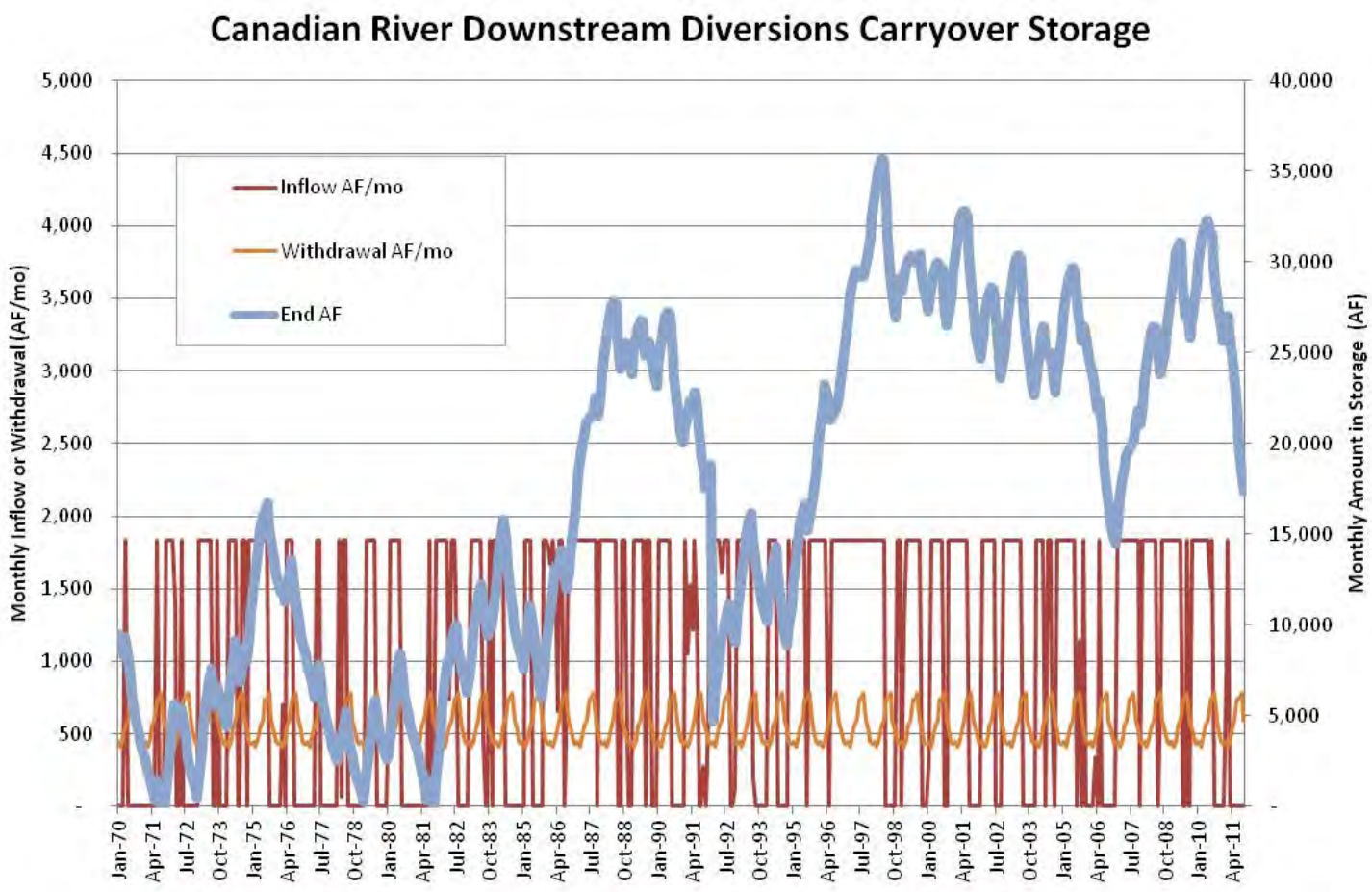


GRAPHICAL REPRESENTATION OF MASS BALANCE CALCULATION FOR CANADIAN RIVER DIVERSION OPTIONS 1 AND 2

FIGURE J.1

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo TETRA TECH



GRAPHICAL REPRESENTATION OF MASS BALANCE CALCULATION FOR CANADIAN RIVER DIVERSION OPTION 3

FIGURE J.2

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo TETRA TECH

TETRA TECH

119 N. Robinson Ave., Ste. 700
Oklahoma City, OK 73102
Phone: 405.606.8600 Fax: 405.606.8601

MEMORANDUM

TO: File

FROM: Ryan Smith

COPY:

RE: The Feasibility of a Series of Low-Head Dams on the Canadian River through Norman for Water Supply

DATE: Wednesday, October 3, 2012

The purpose of this memo is to evaluate the feasibility of developing a water supply for the City of Norman through the construction of low-head dams on the Canadian River through the city limits of Norman.

This feasibility analysis is predicated upon a number of assumptions regarding the design and construction of this proposed water supply option. These assumptions are listed below.

- The average depth of the detained river will be 3 feet.
- The average width of the detained river will be 250 feet.
- The usable length of the Canadian River is limited to a 7.5 mile stretch adjacent to the City of Norman.
- The beginning water surface elevation is 1115 feet.
- The ending water surface elevation is 1080 feet.
- This option can only serve as a water source when upstream flows exceed 100 CFS.
- All necessary permits and authorizations can be obtained from the respective organizations.
- From a firm yield analysis of the Canadian River, a terminal storage reservoir size of 35,700 AF is required in order to achieve a firm yield of 6,721 AFY (6.0 MGD).

Calculations

Total Volume = (3 ft.) * (250 ft.) * (7.5 mi.) * (5280 ft. / 1 mi.) * (1 acre / 43560 ft.^{2}) = **682 AF**

Assuming a linear relationship between terminal storage size and firm yield, which is optimistically inaccurate (in favor of this option), the firm yield would be:

Firm Yield = (682 AF) * (6,721 AFY) / (35,700 AF) = **129 AFY (0.12 MGD)**

APPENDIX K – REFERENCE INFORMATION – CAPTURE LAKE THUNDERBIRD SPILLAGE

Appendix K – Capture Lake Thunderbird Spillage

This appendix provides more information on using spilled water from Lake Thunderbird as a water supply source.

ASSUMPTIONS FOR FUTURE USE

Two options were analyzed for capturing spillage from Lake Thunderbird. The first option is to divert water from the lake itself within its flood pool storage. However, the primary purpose of the flood pool is for flood control and the United States Army Corps of Engineers (USACE) has the jurisdiction on the control and release of flood pool. Historically, OWRB has not issued permits from the flood pools before. Permitting of the flood pool is a complex and uncertain endeavor that requires approval from several different agencies. An informal inquiry through OWRB was conducted to determine the feasibility of acquiring a permit for water rights for the flood pool of Lake Thunderbird (see attached Technical Memorandum). The OWRB did not have any objections, and felt optimistic about the possibility of obtaining the necessary approvals from the BOR and USACE. However, the OWRB indicated that the USACE may not make any modifications to its policies for when releases are made, and therefore, the withdrawal would likely be at the discretion of the USACE to meet flood control obligations first. Thus, any withdrawals from the Lake Thunderbird flood pool would need to be made at the same rate that the USACE would typically release water.

The second option analyzed is to divert water downstream of the lake after it released from the lake or spilled over the spillway. This would require a new water right permit from the OWRB similar to a new stream water permit, except that OWRB may need to perform a stream flow study to establish the potential downstream yield and mitigating factors. This option would require substantial infrastructure to capture peak spill rates, such as intake structures, pump stations and conveyance pipes. Since the intake rate would be the same whether the water is diverted from the flood pool or downstream of the dam, it is more advantageous to withdraw the water from the flood pool as this would save approximately 8 miles of conveyance infrastructure.

TERMINAL STORAGE NEEDS

Monthly flood control release data from COMCD were analyzed relative to an annual average daily withdrawal rate in order to determine the required terminal storage requirements. Because only monthly data were available, it was assumed that on average the monthly releases occurred during only 50% of the days in the month. In order to minimize the required terminal storage volume, a firm yield of 5.8 mgd, equal to 20% of Norman's projected 2060 water demand, was used as the annual average daily withdrawal rate from terminal storage. Incorporating evaporation and seepage rates along with dead pool and flood pool storage, the total storage volume required to achieve a firm yield of 5.8 mgd was determined to be 75,000 AF. This is a very large volume, nearly 75% of the size of Lake Thunderbird. This large volume is required primarily due to the infrequent nature of releases from Lake Thunderbird. Additionally, when releases are made, they occur in large quantities over a short period of time.

Assuming an average depth of 20 feet and an operational depth of 16 feet, this would require an area of 4,688 acres within relatively close proximity to the Norman WTP.

INFRASTRUCTURE NEEDS

Because water is released over short periods of time in large quantities, it was assumed that withdrawals from the flood pool would need to be made in the same fashion; in large quantities over short periods of time. Calculations were performed to determine the required withdrawal and conveyance infrastructure that would be required to transfer water from the Lake Thunderbird flood pool to the a new terminal storage reservoir. Assuming a maximum flow rate of 6 ft./sec. through a pipeline, it was determined that a 7-mile long, 72 inch diameter pipeline would be required. An intake system with a capacity of 107 mgd would need to be constructed from Lake Thunderbird at the flood pool elevation of the lake, and a 7,000 HP pump station would also be required.

TETRA TECH

119 N. Robinson Ave., Ste. 700
Oklahoma City, OK 73102
Phone: 405.606.8600 Fax: 405.606.8601

MEMORANDUM

TO: File

FROM: Ryan Smith

COPY:

RE: Permitting the Spillage from Lake Thunderbird

DATE: Thursday, September 13, 2012

The purpose of this memo is to document a phone conversation with Rick Wicker of the Oklahoma Water Resources Board (OWRB) regarding Lake Thunderbird Spillage and the possibility of permitting this water for use by the City of Norman.

- After internal discussions at OWRB, Rick is optimistic that OWRB would have no objections to permitting the water from Lake Thunderbird that is released from the Norman Dam.
    - Rick verified that there were no significant permits downstream of the Norman Dam that would limit the amount of water OWRB could permit.
- Rick is also optimistic that water could be withdrawn from Lake Thunderbird before it is released from the Norman Dam. In other words, the water would not have to be captured downstream of the dam, but could instead be captured from the Lake Thunderbird Flood Control Storage Pool (elevation 1039'-1049') and the Surcharge Pool (elevation 1049'-1068').
    - COE would likely not modify their designed releases from Lake Thunderbird to accommodate a permit of this nature, in which water is being withdrawn from the Flood Control Storage Pool or the Surcharge Pool.

APPENDIX L – REFERENCE INFORMATION – GROUNDWATER RECHARGE (IPR)

Appendix L – Groundwater Recharge (IPR)

Groundwater recharge with treated effluent from the Norman WRF presents a variety of unknowns and implementation challenges. These include uncertainty as to whether and to what degree injecting highly treated water into the aquifer and the subsequent withdrawal could affect and remobilize naturally present constituents like arsenic. In some areas of the country, recharged water has been recovered with higher concentrations of metals than either the injected water or native groundwater.

ARSENIC MOBILITY IN THE GARBER-WELLINGTON AQUIFER

From available literature sources, it appears that mobility of metals such as arsenic, selenium, uranium, and chromium is possible in portions of the aquifer that have not been exposed to oxygenated groundwater. Studies indicate that arsenic may be present in readily mobilized sites or in less readily mobilized sites within the matrix of the aquifer. The USGS examined distribution of arsenic in comparison to soil horizons, bulk characteristics of the aquifer matrix (lithologies), and in specific sites in cores of the aquifer formations (mineralogies). Four primary relationships between arsenic concentration in solid phases and concentration are significant: the B horizon of soils, clay-rich lithologies and iron oxide containing lithologies of outcrop samples, and iron oxide rich intervals of cores. The USGS also investigated arsenic mobilization using sequential dissolution with increasingly aggressive solvents. Again, arsenic was readily available from surface staining and less available from minerals. In effect, the sequential dissolution studies are meant to mimic digenetic alteration of aquifer rocks, and would be a reasonable facsimile of the long-term effects of either natural or artificial recharge. The difference being more pronounced, at first, where artificial recharge was introduced into otherwise anoxic intervals of the aquifer. Geochemical reaction studies were conducted, but it isn't clear that the results are directly applicable because they are based on equilibrium reactions, which may not provide much information on the groundwater arsenic concentration increases resulting from introduction of recharge water. That is, the predicted rate of desorption or dissolution may not be well constrained in comparison to the rate of recharge. That problem is compounded by uncertainty in the duration of storage or recharge groundwater, and by the variations and uncertainty over the distance between recharge areas and withdrawal areas.

Some of the unresolved issues related to arsenic mobility include:

- The geologic media on which, and in which, arsenic resides is not uniformly distributed throughout the Garber-Wellington Aquifer.
- The spatial variation and variability is only known through comparatively few sample locations.
- The scale and location of possible recharge activities may be small in comparison to the holes in the data.

The other issue is the lack, at this time, of geo-referenced sample results. That notwithstanding, it is apparent that this issue has been considered by the State and the USGS for many years.

Garber-Wellington Aquifer arsenic concentrations and mobility were studied by the USGS in the 1980s and 1990s. The results are reported in a series of USGS publications. The most comprehensive compilation of those results were published in 1998 as Water Supply Papers, WSP2357-A, -B, and –C.

A tabulation of water quality results by sample are not available, and the reports mostly base their analyses with respect to the then existing MCL for arsenic, 50 µg/L. Reported analyses for shallow wells report extremely low concentrations of dissolved arsenic, whereas intermediate wells are reported to have as high as 9 µg/l of dissolved arsenic and deep wells as high as 110 µg/L. That suggests that exposure to oxygenated recharge water has removed readily available arsenic from the shallowest intervals at the location of the tested wells. Arsenic mobilized from those shallow sites is likely to have found new residence elsewhere within the Garber-Wellington Aquifer, and research indicates that the mobilized arsenic will be more readily re-mobilized.

APPENDIX M – REFERENCE INFORMATION – CO-OWNER WITH OKLAHOMA CITY FOR TREATED WATER

Appendix M – Co-owner with Oklahoma City for Treated Water

TERMINAL STORAGE NEEDS

For this option, terminal storage would be at Oklahoma City's existing Lake Stanley Draper, which is considered adequate for this option. No expansion or improvement costs are anticipated for this scenario.

INFRASTRUCTURE NEEDS

If the City of Norman chooses to collaborate with the City of Oklahoma City, it would pay a portion of the total costs in proportion to its usage of Oklahoma City's infrastructure. For this analysis, water supply needs were estimated at 29.1 mgd in 2060 (100 percent of Norman's 2060 demand) and 2012 dollars. Consistent with the 2009 Central Oklahoma Regional Water Supply Study, the capital cost figures in the SWSP were based on the construction of a new 90-inch diameter pipeline with the required pump stations, and the construction of a new regional treatment plant.

NOTES ON FUTURE OF SUPPLY SOURCE

Oklahoma City is currently proceeding with plans to expand the Atoka Pipeline by adding a parallel pipeline. Since the *2009 Regional Raw Water Supply Study* was completed, the City of Oklahoma City has determined that it will be financially easier to implement a water conveyance system that can be constructed in phases. Thus, the City is now considering construction of two smaller-diameter parallel pipelines as opposed to the single 90-inch pipeline proposed in the 2009 study. The exact size of the first new pipeline will be determined in the future. When better data are available, this option, if selected, should be updated to reflect revised project plans.

APPENDIX N – REFERENCE INFORMATION – CO-OWNER WITH OKLAHOMA CITY FOR RAW WATER

Appendix N – Co-owner with Oklahoma City for Raw Water

TERMINAL STORAGE NEEDS

Because this water would be piped directly to the Norman instead of to Lake Stanley Draper, terminal storage would be required near the Norman WTP in order to meet the increased peak summer water demands. It was assumed that terminal storage capacity would not always be available in Lake Thunderbird when needed (e.g., when the lake is spilling), thus eliminating that option for terminal storage. Terminal storage requirements are relatively small, however, with only 6,100 AF of storage required. An exact location for this terminal storage reservoir has not been determined in this study but is assumed to be near the water treatment plant. Assuming an average depth of 20 feet and an operational depth of 16 feet, this would require an area of 381 acres.

NOTES ON FUTURE OF SUPPLY SOURCE

Oklahoma City is currently proceeding with plans to expand the Atoka Pipeline by adding a parallel pipeline. Since the *2009 Regional Raw Water Supply Study* was completed, the City of Oklahoma City has determined that it will be financially easier to implement a water conveyance system that can be constructed in phases. Thus, the City is now considering construction of two smaller-diameter parallel pipelines as opposed to the single 90-inch pipeline proposed in the 2009 study. The exact size of the first new pipeline will be determined in the future. When better data are available, this option, if selected, should be updated to reflect revised project plans.

APPENDIX O – REFERENCE INFORMATION – SCISSORTAIL RESERVOIR

Appendix O – Scissortail Reservoir

ASSUMPTIONS FOR FUTURE USE

Scissortail Reservoir was most recently evaluated by in a feasibility study completed in August 2009. The feasibility study was created for the City of Ada, but was also presented to the City of Norman because Ada is interested in partnering with other communities to develop the reservoir.

The 2009 study considered three different demand scenarios for the City of Ada: a conservative demand of 6.7 mgd annual average, a moderate demand of 8.7 mgd annual average, and an aggressive demand of 11.9 mgd annual average. For the 2060 SWSP, Ada's demand was assumed to be the moderate demand scenario of 8.7 mgd on average. This leaves 22,272 AFY or 19.87 mgd available for Norman's use, representing 68% of Norman's projected 2060 water demand. This supply source was evaluated based on this assumed allotment of water for Norman.

In order for costs to be consistent and comparable amongst all source options, the unit costs from the OCWUT Regional Water Supply Study were used as the standard for all water supply options. Costs from the Scissortail Reservoir feasibility study were modified to match unit costs derived from the OCWUT study.

TERMINAL STORAGE NEEDS

In order to buffer peak summer demands and reduce pipeline size, terminal storage would be required for this water supply option. 4,200 AF of storage would be required to meet this summer time. Assuming an average depth of 20 feet and an operational depth of 16 feet, this would require an area of 263 acres within relatively close proximity to the Norman WTP.

INFRASTRUCTURE NEEDS

A pipeline from Scissortail Reservoir to Norman would be required along with either the construction of a new WTP or an expansion to the existing Norman WTP. The pipeline is sized for the average daily demand, which for this study is the entire reservoir yield, 19.87 mgd. The estimated pipeline size is 36-inch diameter, with a length of approximately 60 miles. Pipeline easement acquisition would also be required and is included in the pipeline costs.

APPENDIX P – REFERENCE INFORMATION – PARKER RESERVOIR

Appendix P – Parker Reservoir

ASSUMPTIONS FOR FUTURE USE

For the SWSP, analysis of Parker Reservoir was based on this water supply source meeting 100% of Norman's projected 2060 water demand of 32,551 AFY or 29.1 mgd on average.

Costs were developed and published for Parker Reservoir in the Oklahoma Comprehensive Water Plan from 1980. These costs represent land acquisition and reservoir construction costs only, and unfortunately, these costs are not reflective of present day costs.

In order for costs to be consistent and comparable amongst all source options, the unit costs from the OCWUT Regional Water Supply Study were used as the standard for all water supply options. However, unit costs for reservoir construction were not a part of the OCWUT study, and thus the unit costs from the Scissortail Reservoir feasibility study were used to estimate updated costs for Parker Reservoir. This provides a reasonable comparison because of the proximity and relative similarity of Parker Reservoir and Scissortail Reservoir, but costs will vary depending on construction methods and site-specific conditions and topography.

TERMINAL STORAGE NEEDS

In order to buffer peak summer demands and reduce pipeline size, terminal storage would be required for this water supply option. 5,900 AF of storage would be required to meet peak demand.

Assuming an average depth of 20 feet and an operational depth of 16 feet, this would require an area of 369 acres within relatively close proximity to the Norman WTP.

INFRASTRUCTURE NEEDS

A pipeline from Parker Reservoir to Norman would be required along with either the construction of a new WTP or an expansion to the existing Norman WTP. The pipeline was sized for the average daily demand of 29.1 mgd. The estimated pipeline size is 42 inches in diameter, with a length of approximately 75 miles. Pipeline easement acquisition would be required from Parker Reservoir, through Ada, up to Norman.

NOTES ON FUTURE OF SUPPLY SOURCE

COMCD has expressed an interest in developing Parker Reservoir. If this supply source is selected, there may be an opportunity to collaborate with COMCD and its regional partners.

APPENDIX Q – REFERENCE INFORMATION – KAW LAKE

Appendix Q – Kaw Lake

DESCRIPTION OF SUPPLY SOURCE

Kaw Lake has a total surface area of 17,040 acres and total storage volume of 428,600 AF. The firm yield of the lake is 187,040 AFY or 167 mgd on average. Of this total firm yield, 45,637 AFY or 41 mgd on average remains unpermitted. There are three pending water supply permits for Kaw Lake that total 64,050 AFY.

Although 75% of the lake's firm yield is allocated and another 35% of the lake's firm yield is under pending permit applications, less than 15% of the firm yield was actually used in 2010. Discussions with OWRB indicate that certain permits are no longer relevant for various reasons (see attached Technical Memorandum). Based on discussions with OWRB, it is anticipated that Kaw Lake would likely have sufficient available permit capacity to meet Norman's entire projected 2060 water demand. Norman would need to apply to OWRB for allocation of available water rights.

ASSUMPTIONS FOR FUTURE USE

For the 2060 SWSP, it was assumed that Kaw Lake could provide 32,551 AFY or 29.1 mgd annual average, Norman's entire projected 2060 demand. Currently, the City of Stillwater is moving forward with plans to increase its supply capacity from Kaw Lake. In the past, the City of Edmond has shown interest in potentially collaborating with Stillwater and Norman to transport water from Kaw Lake. However, at this time it appears that Edmond has chosen to pursue other water source alternatives and is no longer interested in participating. This study assumes that costs for the pipeline from Kaw Lake to Stillwater would be shared by Norman and Stillwater, and that the costs for the pipeline south of Stillwater would be Norman's sole responsibility.

TERMINAL STORAGE NEEDS

In order to buffer peak summer demands and reduce pipeline size, terminal storage would be required for this water supply option. 6,100 AF of storage would be required to meet peak demand. Assuming an average depth of 20 feet and an operational depth of 16 feet, this would require an area of 381 acres within relatively close proximity to the Norman WTP.

INFRASTRUCTURE NEEDS

Currently, Stillwater receives water from Kaw Lake through a 39-mile long, 36-inch diameter steel pipe that transports water to the Stillwater WTP. The pipeline continues an additional 7 miles to the Oklahoma State University WTP. This pipeline supplies approximately 7 mgd to Stillwater and OSU water customers.

This water supply option considers the construction of pipeline from Kaw Lake to Stillwater that would be shared by Stillwater and Norman. From Kaw Lake to Stillwater, the pipeline is estimated to be a 46-mile long, 54-inch diameter line (assuming a maximum design velocity of 5.5 feet per second). The costs for this line would be shared between Stillwater and Norman proportionally to their respective anticipated demands. For this study, Stillwater's demand is assumed to be 27 mgd.

From Stillwater to Norman, an 83-mile long, 36-inch diameter pipeline would convey 29.1 mgd with a maximum design velocity of 6.4 feet per second. The City of Norman would assume 100% of the costs of this second pipeline segment.

The pipeline would end at a new terminal storage reservoir in Norman. Water would then be piped to either an expanded Norman WTP or a new WTP. The treatment plant expansion or new treatment plant is sized for the peak daily demand. The maximum day to annual average peaking factor used in SWSP planning is 1.9, and this corresponds to a treatment plant capacity of 55.2 mgd for this water supply option.

Existing water users at Kaw Lake have paid $185 per AF on average to cover the reservoir development costs. As a percentage of firm yield, it was assumed that Norman would be required to pay for 17.4% of the reservoir development costs for Kaw Lake. This equates to 74,576 AF of storage or approximately $13.8 million. This estimate was used as Norman's required capital expenditure for utilizing the water from Kaw Lake.

Amber Wooten

From: Jordan, Aimee SWT [Aimee.Jordan@SWT03.usace.army.mil]
Sent: Tuesday, October 09, 2012 9:28 AM
To: Smith, Ryan
Subject: RE: info on Kaw (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Ryan, the cost per acre foot of water supply storage at Kaw Lake is approximately $185.00. Any of the additional information that you've inquired about would need to be requested through a FOIA request as it is customer information. Should you wish to pursue that, let me know and I'll walk you through the process.

Thanks,
Aimee

-----Original Message-----
From: Smith, Ryan [mailto:Ryan.Smith@tetratech.com]
Sent: Tuesday, October 09, 2012 9:18 AM
To: Jordan, Aimee SWT
Subject: RE: info on Kaw (UNCLASSIFIED)

Thank you so much Aimee. This is perfect timing.

Is there any supporting documentation you can send me? If not, I think this email will suffice for our documentation purposes.

Also, do you have any information on how much existing users are paying per Acre-Foot of water right? Or maybe what date the debt is planned to be paid off?

Thank you for your help. I really appreciate it.

Ryan C. Smith, P.E. | Project Manager
Direct: 405.416.2030 | Main: 405.606.8600 | Fax: 405.606.8601 ryan.smith@tetratech.com

Tetra Tech | Engineering Consulting Services
119 N. Robinson Ave., Suite 700 | Oklahoma City, OK 73102
7645 E. 63rd St., Suite 301 | Tulsa, OK 74133 www.tetratech.com

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-----Original Message-----
From: Jordan, Aimee SWT [mailto:Aimee.Jordan@SWT03.usace.army.mil]
Sent: Tuesday, October 09, 2012 9:03 AM
To: Smith, Ryan
Subject: info on Kaw (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Ryan, by my estimation, there is approximately $26,231,189 remaining costs at Kaw Lake.

I apologize for the delay, and please let me know if you need any additional info.

Thanks,

Aimee Jordan
USACE, Tulsa District
Planning-Water Supply Storage
918-669-7181-office
918-361-2953-cell
Fax 918-669-7546

Classification: UNCLASSIFIED
Caveats: NONE

Classification: UNCLASSIFIED
Caveats: NONE

TETRA TECH

119 N. Robinson Ave., Ste. 700
Oklahoma City, OK 73102
Phone: 405.606.8600 Fax: 405.606.8601

MEMORANDUM

TO: File

FROM: Ryan Smith

COPY:

RE: Water Availability at Kaw Lake

DATE: Thursday, September 20, 2012

The purpose of this memo is to document a phone conversation with Rick Wicker of the Oklahoma Water Resources Board (OWRB) regarding existing permits and permit applications with the OWRB at Kaw Lake.

- Rick stated that the Kaw Reservoir Authority had disbanded, thus nullifying their existing permit of 14,159 AF and their existing permit application for 35,600 AF.
    - This would leave 59,796 AF unpermitted and 31,346 AF unapplied for.

11/03/2011

Oklahoma Water Resources Board
Reservoir Summary Sheet

			Storage	Yield
Reservoir Name	33 - Kaw Lake			
Complete	Yes	Hydro Power		
Completion Year	1976	Irrigation		
Construction Agency	COE	Low Flow Regulation		
Purpose	WS,FC,WQ,R,FW	Migitigation of Fish Loss		
Dam Location	30 26N 04EI	Navigation		
		Water Quality	31,800.0	43,680.0
		Water Supply	171,200.0	187,040.0

Source Pool - Water Suppy

Record Type - Permit

Permit Num.	Permit Holder	Stream System	Primary Purpose	Total Authorized Acre Feet	2010 Water Use
19690327	Newkirk, City of	2120	Public Water Supply	1,124.0	
19700168	Conoco Inc	2120	Industrial	12,000.0	
19720491	Stillwater, City of	2120	Public Water Supply	56,210.0	7,488.3
19730235	Oklahoma Gas & Electric Company	2120	Power	40,000.0	17,872.9
19810180	Kaw Reservoir Authority	2120	Public Water Supply	14,159.0	
19870031	Tonkawa, City of	2120	Public Water Supply	2,800.0	
19910018	Otoe-Missouria Tribe	2120	Public Water Supply	200.0	
19930034	Ponca City, City of	2120	Public Water Supply	14,031.0	
20030001	Perkins PWA	2120	Public Water Supply	879.0	
				141,403.00	**25,361.2**
			Amount left for Allocation	45,637.0	

Record Type - Applications

Permit Num.	Permit Holder	Stream System	Primary Purpose	Total Authorized Acre Feet
20000033	Kaw Reservoir Authority		Public Water Supply	35,600.0
20040034	Osage County RWD #21		Public Water Supply	450.0
20050007	Bartlesville, City of		Public Water Supply	28,000.0
				64,050.00

Source Pool - River

Record Type - Permit

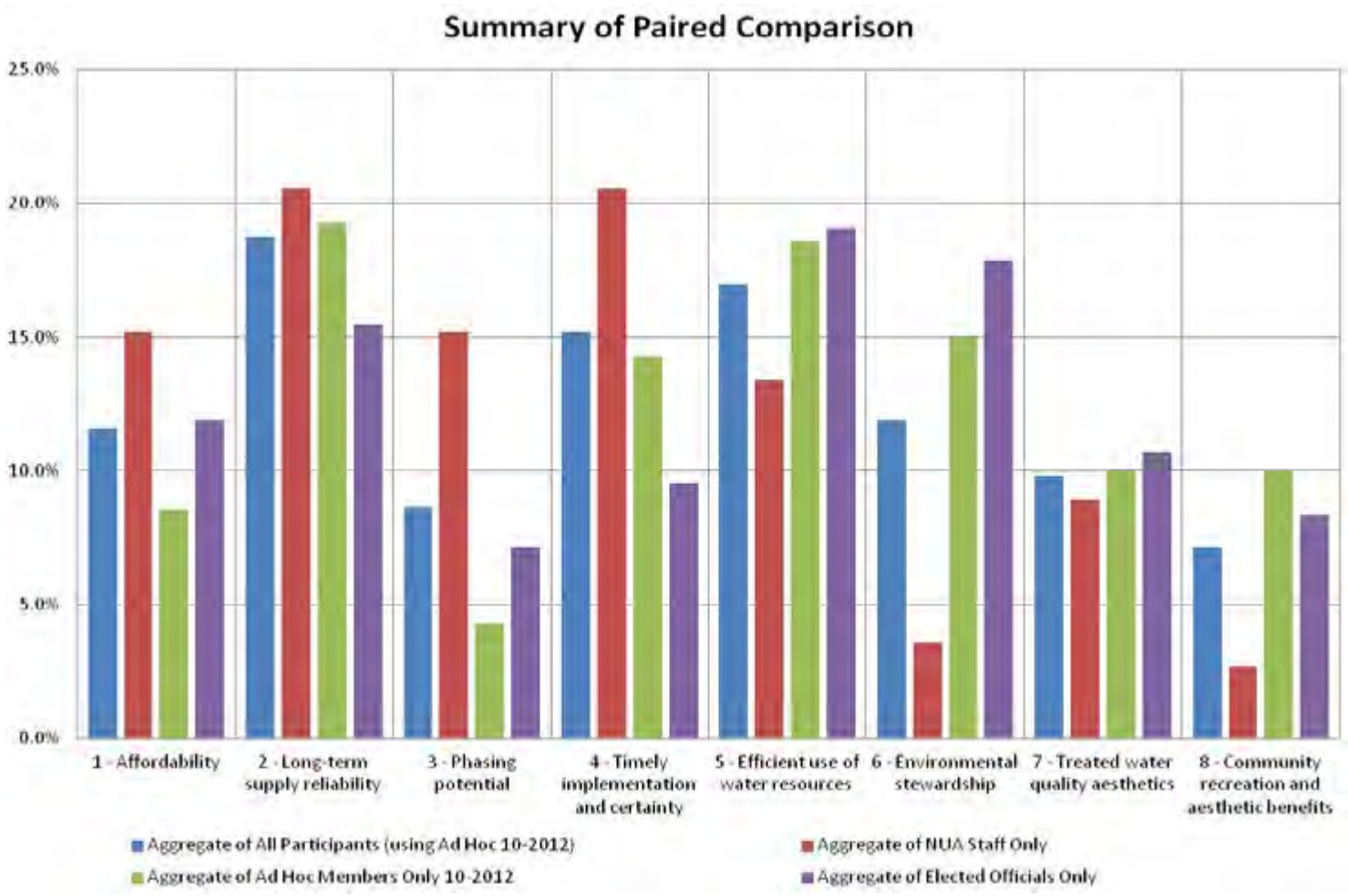
Permit Num.	Permit Holder	Stream System	Primary Purpose	Total Authorized Acre Feet	2010 Water Use
19730235	Oklahoma Gas & Electric Company	2120	Power	33,000.0	17,872.9
				33,000.00	**17,872.9**
			Amount left for Allocation	0.0	

APPENDIX R – PAIRED COMPARISON

Appendix R – Paired Comparison

Members of the SWSP Ad Hoc Committee, City Council members, the Mayor, and City staff were asked to complete the paired comparison worksheet. The final version of the paired comparison was distributed to participants is included in this appendix.

Figure R.1 illustrates the results of the weighting exercise. The aggregate score from all participants (blue bar in Figure R.1) was used for evaluating the water supply portfolios.



PAIRED COMPARISON RESULTS

FIGURE R.1

NORMAN UTILITIES AUTHORITY
2060 STRATEGIC WATER SUPPLY PLAN

carollo TETRA TECH

PROJECT MEMORANDUM

Project Name:	2060 Strategic Water Supply Plan (SWSP)	**Date:**	REVISED August 15, 2012
Client:	Norman Utilities Authority (NUA)	**Project Number:**	8956A.00
Prepared By:	John Rehring		
Subject:	Revised List of Evaluation Criteria and Proposed Performance Measures		
Distribution:	NUA, SWSP Ad-Hoc Committee, Carollo, Tetra Tech Project Staff		

Updated Project Memorandum 8/15/12: Per City Council direction on 8/14/12, the "Community Recreation and Aesthetic Benefits" objective and its subobjectives have been revised to include protection of property rights. No changes have been made to the other objectives. The members of the Ad Hoc Committee are being asked to complete the revised Paired Comparison exercise; previous results will be discarded.

This project memorandum is intended to provide the Strategic Water Supply Plan (SWSP) Ad Hoc Committee information on the alternatives evaluation process. The objectives, sub-objectives, and performance measures represent the list of factors that will be used to compare the supply portfolios in Phase 2 of the SWSP development.

Evaluation criteria sometimes referred to as "objectives" will be used as the basis for evaluation and comparing different water supply options and portfolios. The evaluation process is described briefly below.

- Objectives development: objectives, sub-objectives and performance measures are defined to provide a common basis for evaluation and comparison of supply portfolios.
- Project screening: Supply projects are initially screened to eliminate projects with major constraints. This will be performed in the Phase 1 of the SWSP.
- Portfolio development: Projects passing the initial screening are then used to develop the alternative portfolios. This will be performed in the Phase 2 of the SWSP.
- Objectives weighting: Major objectives are comparatively weighted using 'paired comparison' methodology.
- Portfolio ranking: Alternatives are first scored separately for each objective and then ranked using the individual objectives' weights developed in the preceding step.

The objectives, sub-objectives, and performance measures, shown in Table 1, represent the list of factors that will be used to compare the supply portfolios. The major evaluation criteria or "objectives" for water supply were revised based on discussion at the SWSP Kickoff Workshop on April 6, 2012 and finalized following the June 25, 2012 public meeting. These objectives generally are consistent with the criteria used in the City's previous 2040 Strategic Water Supply Plan and with the types of criteria used in other municipal water supply plans in Oklahoma and surrounding states.

Table 1 FINAL Portfolio Evaluation Criteria
2060 Strategic Water Supply Plan
Norman Water Utilities Authority

Objective	Sub-objective	Performance Measure
Affordability *"What will it cost to reliably provide treated water?"*	✓ Minimize capital cost	✓ Unit capital cost including diversion, transmission, and treatment ($/AFY of firm yield using 2012 non-escalated dollars)
	✓ Minimize life-cycle cost	✓ Unit life-cycle cost (present value of capital cost plus 20-year O&M cost, $/AFY)
Long-Term Supply Reliability *"Will we be able to reliably meet our demand?"*	✓ Reduce drought vulnerability	✓ Ratio of supply portfolio's firm yield to median yield
	✓ Minimize supply shortages	✓ Weighted average of 2060 shortages (magnitude & frequency) in basins of origin (per 2012 OCWP Watershed Planning Regional Reports, or other acceptable measure)
		✓ Supply diversity in terms of number of sources and types of sources (qualitative score)
		✓ Percent of supply portfolio coming from Garber-Wellington aquifer
	✓ Infrastructure reliability	✓ Raw water transmission distance (mi)
		✓ Transmission complexity, considering length of pipeline and number/complexity of pumping operations (qualitative score)
		✓ Treatment complexity (qualitative score)
		✓ Degree of redundancy, e.g., parallel pipelines (qualitative score)
Phasing Potential *"Can we defer capital and increase the supply over time?"*	✓ Defer capital costs	✓ Ability to phase implementation and construction (qualitative score)
	✓ Provide for future needs	✓ Ability to access additional supplies beyond projected 2060 demands (qualitative score)
Timely Implementation and Certainty *"Are we certain we can bring the supply online by the time it is needed?"*	✓ Reduce institutional complexity and increase local control	✓ Number of agency/utility partners (facility owners and/or project co-participants)
		✓ Percent of supply sourced in Norman
		✓ Public/political acceptability (qualitative score)
		✓ Vulnerability to potential future changes in water rights allocations and water quality standards (qualitative score)
	✓ Timely implementation	✓ Project development status in 2012 for new supplies in portfolio (qualitative score)
		✓ Amount and ease of environmental permitting, water rights acquisition, and land acquisition (qualitative score)

Efficient Use of Water Resources *"Are we making the best use of the available resources?"*	✓ Maximize water use efficiency	✓ Percent of total demand met by direct non-potable reuse in 2060
		✓ Percent of total demand met by indirect reuse (supply augmentation) in 2060
	✓ Increase conservation	✓ Percent reduction from baseline demand due to additional conservation measures and programs
Environmental Stewardship *"Are we preserving our environmental resources?"*	✓ Minimize energy consumption	✓ Pumping head per unit supply (ft/AFY)
	✓ Minimize temporary construction impacts and environmental mitigation needs	✓ Amount of land disturbed during construction (ac)
	✓ Minimize permanent ecosystem impacts	✓ Environmental impacts (qualitative score)
	✓ Increase use of renewable resources	✓ Renewable supply score for portfolio (qualitative score)
Treated Water Quality Aesthetics *"Will our customers be satisfied with the quality of the water we deliver?"*	✓ Achieve secondary MCLs	✓ Blended average TDS concentration (mg/L)
	✓ Minimize taste and odor potential	✓ Percent of supply originating from surface water sources
Community Values (Recreation, Aesthetics, and Property Rights) *"Will our community gain value from this alternative, while protecting property rights?"*	✓ Impact on non-water supply benefits	✓ Perceived impacts to recreation and aesthetics (qualitative score)
		✓ Enhanced quality of life (qualitative score)
	✓ Protection of property rights	✓ Potential impact to property rights (qualitative score)

In nearly all decision-making processes, the objectives are not all equally important. Some objectives may be more relevant for the stakeholder than others. As an example, for a given individual, environmental stewardship may be more important than timely implementation. Moreover, these relative weightings vary from person to person, reflecting each individual's values. Thus, weighting objectives is necessary to reflect better the range of values and preferences present in the decision-making process.

The relative weights of various objectives are determined through a process known as 'paired comparison'. This method is based on the fact that when presented with a series of objectives, a decision as to the relative importance of those objectives against each other is made more simply when the objectives are compared separately in pairs. The results of the comparison of each pair of objectives are later aggregated to determine the overall importance of every objective.

All members of NUA staff and SWSP Ad Hoc Committee will be asked to complete the paired comparison exercise (form attached). This exercise and the portfolio evaluation process is intended to show the range of values present in the community and to seek out two or more portfolios that robustly meet the range of values expressed by community members.

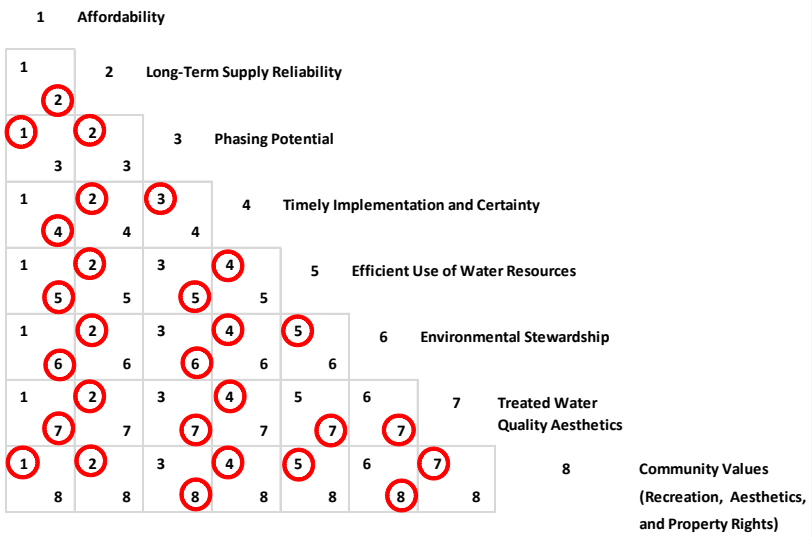
In the paired comparison exercise, each possible pair of primary objectives is paired. Each participant chooses which objective is more important. The results are summed to get a relative percentage weight of importance for each objective. Higher percent weightings indicate a higher importance placed by a given participant on a given objective. Figure 1 illustrates a example of a paired comparison exercise.

Norman Utilities Authority
2060 Strategic Water Supply Plan
Water Supply Objectives Weighting
Paired Comparison Worksheet

Name: *Sample Participant*

Date Completed: *0/00/00*

Use the grid below to compare objectives one to another. For each box, ask the question "Which of these two objectives is most important to me?" Circle the most important of the two.
When completed, there should be one circle in each one of the squares.



Optional: If you would like to know the results of your exercise, total the number of times each objective is circled and divide by 28 to get an approximate weighting for that objective (expressed as a percent).

Objective ID	1	2	3	4	5	6	7	8	Total
Number of Times Circled [A]	2	7	1	5	4	2	5	2	28
Percentage of All Matches [B]	7%	25%	4%	18%	14%	7%	18%	7%	100%

A. Number of circles should total 28
B. To calculate, divide number of circles by 28 and multiply by 100. Total should equal 100%.

Figure 1: Paired Comparison Example

Norman Utilities Authority
2060 Strategic Water Supply Plan
Water Supply Objectives Weighting
Paired Comparison Worksheet

Name: _____

Date Completed: _____

Use the grid below to compare objectives one to another. For each box, ask the question "Which of these two objectives is most important to me?" Circle the most important of the two.
When completed, there should be one circle in each one of the squares.

1	**Affordability**							
1 **2**		**2**	**Long-Term Supply Reliability**					
1 **3**	**2** **3**		**3**	**Phasing Potential**				
1 **4**	**2** **4**	**3** **4**		**4**	**Timely Implementation and Certainty**			
1 **5**	**2** **5**	**3** **5**	**4** **5**		**5**	**Efficient Use of Water Resources**		
1 **6**	**2** **6**	**3** **6**	**4** **6**	**5** **6**		**6**	**Environmental Stewardship**	
1 **7**	**2** **7**	**3** **7**	**4** **7**	**5** **7**	**6** **7**		**7**	**Treated Water Quality Aesthetics**
1 **8**	**2** **8**	**3** **8**	**4** **8**	**5** **8**	**6** **8**	**7** **8**		**8** **Community Values (Recreation, Aesthetics, and Property Rights)**

Optional: If you would like to know the results of your exercise, total the number of times each objective is circled and divide by 28 to get an approximate weighting for that objective (expressed as a percent).

Objective ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Number of Times Circled [A]									
Percentage of All Matches [B]									

A. Number of circles should total 28
B. To calculate, divide number of circles by 28 and multiply by 100. Total should equal 100%.

APPENDIX S – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #1

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting
12 noon, May 30, 2012
Multipurpose room, City Hall

- **Introductions**
  - Norman Utilities Authority staff
  - Consulting engineers; Carollo Engineers and Tetra Tech
  - Ad hoc committee members
- **Review of planning goals and process**
  - Overview of what a Strategic Water Supply Plan is
  - Municipal purpose of a Strategic Water Supply Plan
  - What we expect a Strategic Water Supply Plan to cover
  - Drivers for periodic updates to the Strategic Water Supply Plan
  - Overview of SWSP Phase 1 and Phase 2 goals and end points
  - Expected time line
- **Ad hoc committee responsibilities**
- **SWSP Public meetings: content and timing**

Norman 2060 Strategic Water Plan

Ad Hoc Committee Meeting

May 30, 2012 – 12:00 pm
Multipurpose Room, City Hall

Discussion Overview

- Introductions
- Review of planning goals and process
- Ad Hoc Committee responsibilities
- SWSP Public meetings: content and timing

Discussion Overview

- Introductions
- Review of planning goals and process
- Ad Hoc Committee responsibilities
- SWSP Public meetings: content and timing

Discussion Overview

- Introductions
- Review of planning goals and process
- Ad Hoc Committee responsibilities
- SWSP Public meetings: content and timing

Norman 2060 Strategic Water Supply Plan

The goal of the Plan is to strengthen our knowledge of short and long-term water supply source(s) and begin implementation of a robust, economical water supply solution acceptable to the citizens of Norman.

The NUA is currently unable to supply sufficient potable water to meet peak demands and is concerned about losing our groundwater resource due to a probable reduction of the maximum contaminant level (MCL) for chromium, arsenic, or other contaminants.

Norman 2060 Strategic Water Supply Plan

- **Norman Current Water Supply**
  - Surface Water – 70%
  - Garber Wellington – 27%
  - OKC – 3%
- **Issues Facing Norman's Water Supply Future**
  - Current yield of Lake Thunderbird may be reduced
  - Quality of Lake Thunderbird is uncertain
  - Garber-Wellington aquifer yield may be reduced by half or more
  - Total Norman 2060 population will be about 200,000; service area population could approach that level
  - Based on expected demand, there may be a shortfall of over 20 mgd in 2060

Background: Previous Studies

- Norman 2020 Land Use and Transportation Plan, prepared by The Burnham Group in 1997
- Norman 2025 Land Use and Transportation Plan, as amended
- 2040 Strategic Water Supply Plan, prepared by CDM/CH2M Hill in 2001
- Arsenic Study, prepared by CH2M HILL in 2002
- Water Treatment Plant Expansion Evaluation, prepared by Carollo Engineers in 2007

Other Sources of Information to be Leveraged

- 2012 Oklahoma Comprehensive Water Plan (OCWP) by Oklahoma Water Resources Board (OWRB)
- Regional Raw Water Supply Study for Central Oklahoma, prepared by CDM in 2009
- Proposed Scissortail Reservoir Feasibility Study, prepared by CH Guernsey & Company in 2009
- Possible affects of the pending Garber Wellington Water Management Study
- Pending EPA Toxicological Review of Hexavalent Chromium
- Water Reuse Regulations promulgated by the Oklahoma Dept. of Environmental Quality (ODEQ)
- Ongoing Central Oklahoma Master Conservancy District (COMCD) Lake Thunderbird Reuse Study

Previous Water Supply Planning

- 1992 Master Water Plan
- 2001 Strategic Water Supply Plan
  - Baseline development
  - Existing system assessment
  - Alternatives evaluation
  - Plan development
- 2001 Recommended Plan
  - Expand Garber Wellington Wellfield
  - Partner for SE Oklahoma Water Sources

Previous Water Supply Planning

- 2008 Regional Raw Water Supply Infrastructure Study
  - Gather information from each participating City (11 Cities in Central Oklahoma)
  - Review quantity and quality from various SE Oklahoma sources (Kiamichi River, Lake Sardis, Lake Hugo)
  - Distribution of raw or treated water to member Cities

Changes Since Norman's 2001 Water Supply Plan

- Arsenic Rule
- Chromium VI
- Additional Ground Water Rules
- Aquifer Yield
- Lake Thunderbird Safe Yield
- Reuse Regulations
- Conservation
- Technological Improvements

Water Supply Planning Best Practices

- Periodic water plan updates address rapidly-evolving water issues
  - Water quality and reuse regulations
  - Changes in existing sources
  - Reuse and conservation opportunities
  - Diversion and treatment technologies
  - Supply options and partnering opportunities
- State and local planning in Oklahoma & the west
  - 2012 Oklahoma Comprehensive Water Plan
  - 2009 Central Oklahoma Study
  - Many metro communities are updating their supply plans (Edmond, Shawnee, Chickasha…)

Sources to be Evaluated (Proposed)

- Existing sources under new regulations & yield
  - Local Garber-Wellington groundwater wells
  - Lake Thunderbird & WTP
  - OKC treated water interconnect
- Leverage Outside Water Sources
  - Bulk purchase from OKC
  - Bulk raw water from SE Oklahoma
  - Scissortail Reservoir
  - Kaw Reservoir
  - Other new sources

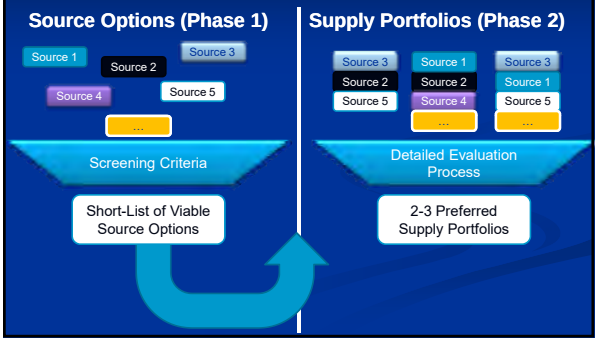
Sources to be Evaluated (Proposed)

- Maximize and enhance local supplies
  - Lake Thunderbird spillage
  - Lake Thunderbird augmentation
  - Groundwater recharge
  - New Eastside or Westside Reservoir
  - New Diversions from the Canadian River
  - Treated Effluent Reuse
  - Stormwater Capture and Reuse

Other Tasks included in Scope

- Agency coordination
- Updated demand projections
- Estimates of potential reuse demand
- Public meetings (up to 4)
- City Council presentations (2)
- Final portfolio revisions or final ranking

Water Supply Planning Terminology & Process



Scope of Work for 2060 Strategic Water Supply Plan

- Phase 1: Characterization and Screening of Individual Supply Options
- Phase 2: Development and Optimization of Supply Portfolios

- Proposed Scope of Work:
  Phase 1 + Phase 2 = $385,947
- Proposed Time of Completion
  Phase 1 = 5 months; Phase 2 = approx. 4 months

Discussion Overview

- Introductions
- Review of planning goals and process
- **Ad Hoc Committee responsibilities**
- SWSP Public meetings: content and timing

Ad Hoc Committee Roles

- Ensure open and two-way dialogue between the project and the community
- Make sure the project continues on track and on schedule
- Ensure the options and suggestions of the public for potential water supplies are addressed
- Assist in evaluating non-monetary criteria for potential water supply sources
- Understand and be able to communicate the objectives and conclusions of the Strategic Water Supply Plan to the public

Discussion Overview

- Introductions
- Review of planning goals and process
- Ad Hoc Committee responsibilities
- **SWSP Public meetings: content and timing**

Public Meetings

- Public meeting 1 – June 2012
  - SWSP background and goals
  - Input on list of supply sources
  - Input on relative importance of evaluation criteria for supply portfolios
- Public meeting 2:
  Results of screening of options
- Public meeting 3:
  Supply portfolios to be evaluated
- Public meeting 4:
  Results of portfolio screening

Discussion Overview

- Introductions
- Review of planning goals and process
- Ad Hoc Committee responsibilities
- SWSP Public meetings: content and timing
- **DISCUSSION / Q&A**

SWSP Ad-Hoc Kick Off Meeting Minutes

May 30, 2012
12:00 Noon
In Multi-purpose Room

In attendance:
John Rehring and Tom Crowley of Carollo
Joe Painter of TetraTech
Ken Komiske, Mark Daniels, Gay Webb, Charlie Thomas, and Chris Mattingly, Utilities
Mayor Rosenthal
Councilmember Gallagher
Former Councilmember Bob Thompson
1. Former Councilmember Al Atkins
2. Judith Wilkins, Oklahoma Conservation Commission Water Quality
3. Amanda Nairn, Stay at Home Mom, Heads ECAB
4. Dave Sabatini, OU professor and Director of Water Technologies for Emerging Regions
5. Lynne Miller, Retired School Board Administrator, Library Board
6. Sandy Bahan, Norman Public Schools Retired Teacher
7. Steven Tyler Holman, Ran for Council Ward 7
8. Matthew Leal, Ran for Council Ward 2
9. Jim Gasaway, Retired OU Fund Raising Dept, Planning Commission
10. Mike Pullin, Banker at First Fidelity Bank
11. Samantha Kahoe, Recent OU graduate, Researched Water Quality, OK Young Leaders, Serves on Chamber Board

Not in Attendance: Curtis McCarty, Joe Love, Roger Frech, Andy Sherrer, Chris Lohne

- Self-Introduction of everyone in room
- Ken Komiske discussed slides regarding history and background of water supply in Norman and present water use.
- John Rehring discussed slides what, why, and where we are going for a Strategic Water Supply Plan. Discussed the reason for Cities to have water plans, what they may contain, the options for water supplies and how the Ad Hoc committee will help in this process.
- John provided hand-outs to everyone as a homework assignment to become familiar of how the group will be asked to prioritize the various portfolios.
- Q&A's:
    - Mayor – Please better explain extent of re-use we can expect to see. Komiske explained the differences of gray water and water reuse and the options and availability for both resources.
    - Holman – Can we store more water off-peak? Rehring talked about the pros and cons and the ability to be able to 'store' water.

- Gasaway – Will we phase to cover intermediate needs? Komiske and Rehring discussed the options and possibilities of phasing new water supply options.
- Sabatini – Looking at the 2 to 1 peaks, could we offer rebates for customers to drill irrigation wells, tiered rates for increase use? Komiske discussed the pros and cons of individual drilled wells and left open the options of incentives for conservation.
- Nairn – We will need to make effort in Public Education. All agreed public education is necessary to any water plan. Part of the Ad Hoc committee responsibility is to make sure we continue a two way communication with customers and capture feed back and buy in.
- Lunch meetings are good with everyone except Judith Wilkins.
- When is next meeting? The next meeting will be determined based on the work being completed with the water plan. The next piece will be for the Ad Hoc committee to help in prioritizing the wants, needs, availability, costs and other impacts of the different water supply options.

- Adjourned at 1:15 PM

APPENDIX T – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #2

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #2
12 noon, August 6, 2012
Multi-Purpose Room, City Hall
201 W. Gray

- Introduction and Goals for Ad Hoc Committee Meeting
- Project Progress Update
- Alternative Portfolios Evaluation
  - Evaluation Process Overview
  - Evaluation Criteria Overview
- Objectives Weighting
  - Paired Comparison Methodology and Instructions
  - Paired Comparison Exercise
- Action Items and Next Steps

Norman Utilities Authority
2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting
August 6, 2012

Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Alternative Portfolios Evaluation
- Objective Weighting
- Action Items and Next Steps

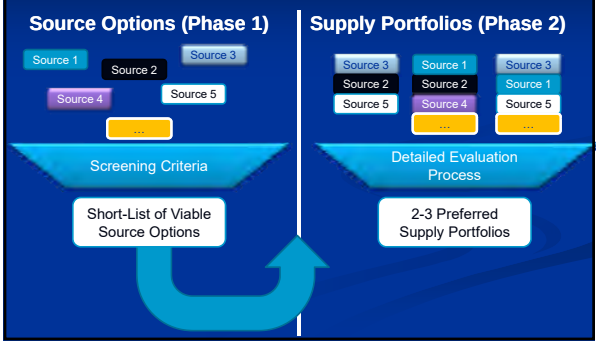
Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Alternative Portfolios Evaluation
  - Evaluation Process Overview
  - Evaluation Criteria Overview
- Objective Weighting
- Action Items and Next Steps

Evaluation Process Overview

- Objective Development
  - Drafted and revised based on SWSP Kickoff Workshop and Public Meeting
- Project Screening
- Portfolio Development
- Objectives Weighting
  - Will be completed today
- Portfolio Ranking

Water Supply Planning Terminology & Process



Evaluation Criteria Overview

Objective	Sub-objective	Performance Measure
Affordability *"What will it cost to reliably provide treated water?"*	✓Minimize capital cost	✓Unit capital cost including diversion, transmission, and treatment
	✓ Minimize life-cycle cost	✓Unit life-cycle cost

Evaluation Criteria Overview (cont.)

Objective	Sub-objective	Performance Measure
Long-Term Supply Reliability *"Will we be able to reliably meet our demand?"*	✓Reduce drought vulnerability	✓Ratio of supply portfolio's firm yield to median yield
	✓Minimize Supply shortages	✓Weighted average of 2060 shortages in basins of origin
		✓Supply diversity in terms of number of sources and types of sources
		✓Percent of supply portfolio from Garber-Wellington aquifer
	✓Infrastructure reliability	✓Raw water transmission distance (mi)
		✓Transmission complexity
		✓Treatment complexity

Evaluation Criteria Overview (cont.)

Objective	Sub-objective	Performance Measure
Phasing Potential *"Can we defer capital and increase the supply over time?"*	✓Defer capital costs	✓Ability to phase implementation and construction
	✓Provide for future needs	✓Ability to access additional supplies beyond projected 2060 demands

Evaluation Criteria Overview (cont.)

Objective	Sub-objective	Performance Measure
Timely Implementation and Certainty *"Are we certain we can bring the supply online by the time it is needed?"*	✓Reduce institutional complexity and increase local control	✓Number of agency/utility partners
		✓Percent of supply sourced in Norman
		✓Public/political acceptability
		✓Vulnerability to potential future changes in water rights allocations and water quality standards
	✓Timely implementation	✓Project development status in 2012 for new supplies in portfolio
		✓Amount and ease of environmental permitting, water rights acquisition, and land acquisition

Evaluation Criteria Overview (cont.)

Objective	Sub-objective	Performance Measure
Efficient Use of Water Resources *"Are we making the best use of the available resources?"*	✓Maximize water use efficiency	✓Percent of total demand met by direct non-potable reuse in 2060
		✓Percent of total demand met by indirect reuse (supply augmentation) in 2060
	✓Increase conservation	✓Percent reduction from baseline demand due to additional conservation measures and programs

Evaluation Criteria Overview (cont.)

Objective	Sub-objective	Performance Measure
Environmental Stewardship *"Are we preserving our environmental resources?"*	✓Minimize energy consumption	✓Pumping head per unit supply
	✓Minimize temporary construction impacts and environmental mitigation needs	✓Amount of land disturbed during construction
	✓Minimize permanent ecosystem impacts	✓Environmental impacts (qualitative score)
	✓Increase use of renewable resources	✓Renewable supply score for portfolio (qualitative score)

Evaluation Criteria Overview (cont.)

Objective	Sub-objective	Performance Measure
Treated Water Quality Aesthetics *"Will our customers be satisfied with the quality of the water we deliver?"*	✓Achieve secondary MCLs	✓Percent of supply originating from surface water sources
	✓Minimize taste and odor potential	✓Percent of supply originating from surface water sources
Community Recreation and Aesthetic Benefits *"Will our customers gain non-water supply value from this alternative?"*	✓Impact on non-water supply benefits	✓Perceived impacts to recreation and aesthetics (qualitative score)
		✓Enhanced quality of life (qualitative score)

Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Alternative Portfolios Evaluation
- Objective Weighting
  - Paired Comparison Methodology and Instructions
  - Paired Comparison Execution
- Action Items and Next Steps

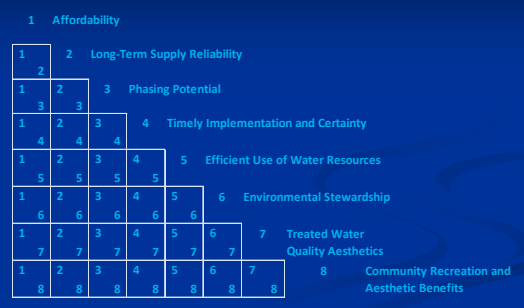
About the Objectives Weighting Process…

- It is:
  - A way of measuring the community's relative priorities as we compare Norman's future supply portfolios
  - An opportunity to find supply solutions that robustly meet a wide range of the most important criteria, using sensitivity analyses
- It is NOT:
  - A "voting" exercise – we are seeking consensus
  - A numeric "machine" that will trap us into accepting results we don't agree with – common sense and facilitated dialogue still govern our decisions

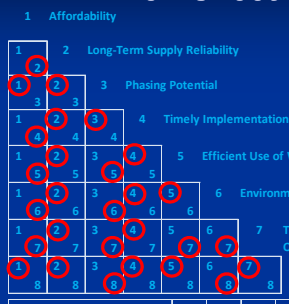
Paired Comparison Methodology and Instructions

- Used to determine values and preferences of a wide range of community interests
- Participants are asked to compare one objective against each other objective, one by one
- Comparison of objectives are made in pairs
- Results are aggregated to determine the overall importance of each objective

Paired Comparison Worksheet



Paired Comparison Worksheet Example



Objective ID	1	2	3	4	5	6	7	8	Total
Number of Times Circled	2	7	1	5	4	2	5	2	28
Percentage of All Matches	7%	25%	4%	18%	14%	7%	18%	7%	100%

Paired Comparison Exercise

1. Affordability – *What will it cost to reliably provide treated water?*
2. Long-Term Supply Reliability – *Will we be able to reliably meet our demand?*
3. Phasing Potential – *Can we defer capital and increase the supply over time?*
4. Timely Implementation and Certainty – *Are we certain we can bring the supply online by the time it is needed?*
5. Efficient Use of Water Resources – *Are we making the best use of the available resources?*
6. Environmental Stewardship – *Are we preserving our environmental resources?*
7. Treated Water Quality Aesthetics – *Will our customers be satisfied with the quality of water we deliver?*
8. Community Recreation and Aesthetic Benefits – *Will our customers gain non-water supply value from this alternative?*

Action Items and Next Step

- Next Ad Hoc Committee Meeting

Public Meetings

- Public meeting 1 – June 2012
  - SWSP background and goals
  - Input on list of supply sources
  - Input on relative importance of evaluation criteria for supply portfolios
- Public meeting 2:
  Results of screening of options
- Public meeting 3:
  Supply portfolios to be evaluated
- Public meeting 4:
  Results of portfolio screening

Norman Utilities Authority

2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting

August 6, 2012

Strategic Water Supply Plan Ad Hoc Committee Meeting #2
Minutes
August 6, 2012
Multi-Purpose Room
12:00 P.M.

Attendance

- Presenters: John Rehring and Amber Wooten, Carollo and Ken Komiske, City of Norman
- Councilmember: Roger Gallagher
- Staff: Mark Daniels, Chris Mattingly, Charlie Thomas, Gay Webb
- Ad Hoc Committee Members: Andy Sherrer, Curtis McCarty, Judith Wilkins, Lynne Miller, Mike Pullin, Roger Frech, Stephen Tyler Holman
- Public: Jacy Crosbie, Joy Hampton, Howard Haines

Presentation

Mr. Komiske thanked everyone for attending the meeting and asked John Rehring with Carollo to begin the presentation. Mr. Rehring introduced Ms. Amber Wooten, Carollo Project Engineer. Attendees introduced themselves and explained their role on the project.

Mr. Rehring explained the goal for the meeting today is to collect committee member priorities for the objectives of the Strategic Water Supply Plan (using the paired comparison worksheet) and give attendees an opportunity to ask questions related to the project. The project team is continuing to evaluate individual supply options. The next step will be to screen the individual supply options and present findings to the Ad Hoc Committee.

Prior to the meeting, information on the objectives was distributed to committee members. Mr. Rehring explained the evaluation process and each of the following objectives:

Affordability
Long-Term Supply Reliability
Phasing Potential
Timely Implementation and Certainty
Efficient Use of Water Resources
Environmental Stewardship
Treated Water Quality Aesthetics
Community Recreation and Aesthetic Benefits

Questions Asked

- What is the role of the Ad Hoc Committee? Mr. Rehring explained it is to understand and support the recommendations that come from the Strategic Water Supply Plan (SWSP) project. Information gathered from the paired comparison worksheet completed by each committee member will be aggregated to determine which objectives are most important to the Ad Hoc Committee. This will enable us to meet our SWSP project goal of finding a water supply portfolio that meets a range of interest and needs. It is a consensus based process, not a voting process.

- Will tribal issues be considered in this process? Mr. Rehring provided an example of how tribal issues for southeast Oklahoma water might affect scoring for the timely implementation and certainty objective.

- What percentage of our water supply comes from Lake Thunderbird and water wells and what is the cost? Mr. Komiske explained we get about 2/3 of our water supply from Lake Thunderbird and about 1/3 from water wells. Currently well water is about half the price of lake water, but this can change as new regulations are established.

- Can heavy metals such as chromium be removed from the water supply? Mr. Komiske replied yes, but it is costly.

- How is this process going to intersect with the Oklahoma Comprehensive Water Plan? Mr. Rehring explained the SWSP project uses pertinent data from the 2012 Oklahoma Comprehensive Water Plan (OCWP). The SWSP is focused on more local planning (that was beyond the scope of the OCWP).

- How does our unaccounted for (non-revenue) water loss amount compare to other cities. Mr. Komiske indicated an average water loss of about 10% and explained losses come from not only leaks in the system but other sources such as inaccurate meters and water line and fire hydrant flushing. Mr. Rehring stated The American Water Works Association established 10% water loss as the standard for communities to aim for. Ten percent is a reasonable number.

- A concern was raised that control of water hardness was more important than control of taste and odor issues. Mr. Rehring noted that all of the proposed projects will meet mandated drinking water requirements. The treated water quality aesthetics objective will evaluate projects that treat water to a quality beyond current regulations (for example, taste and odor and hardness). He noted that more emphasis can be placed on sub-objectives.

- How do private wells in the east affect the water supply. Mr. Komiske explained municipal water wells are drilled and completed deeper than most residential water wells. Water bearing zones for municipal wells are typically screened from approximately 350 to 650 feet below ground while private wells typically are 100 to 200 feet in depth so they are generally in different aquifers.

- How is any water resource not renewable? Mr. Rehring discussed the Garber Wellington aquifer recharge rates as an example. The recharge rate is about 6 to 12 inches per year while the temporary state permit allows withdrawal at 24 inches per year; this would be "mining the aquifer" and if continued would not be renewable over the long term. Recharge rates vary depending on location.

- Is dredging the lake a possibility? Staff noted it is typically less expensive to acquire more property and construct a new lake than to dredge a large reservoir. Dredging small ponds or navigable waterways is more cost effective. Mr. Frech noted Central Oklahoma Master Conservancy District looked at dredging Lake Thunderbird and found that it was not economical.

Alternative Portfolios Evaluation

Members were asked to complete the paired comparison worksheet. This exercise requires each participant to compare each objective to another and choose which objective is more important to them.

Action Items and Next Steps

Mr. Rehring stated the next Ad Hoc Committee meeting is anticipated in mid to late September. Results of the paired comparison worksheets will be presented and utilized on the individual source screening. The next public meeting will be held in late September to present the individual source screening results. Subsequent public meetings will be held to present water supply portfolio development and portfolio evaluations.

Committee members not present at today's meeting will be asked to complete and submit the paired comparison worksheet.

The meeting adjourned at 1:20 P.M.

Items submitted for the record:

1. PowerPoint presentation entitled, Norman Utilities Authority 2060 Strategic Water Plan Ad Hoc Committee Meeting, August 6, 2012
2. Carollo Project Memorandum dated July 27, 2012 Revised List of Evaluation Criteria and Proposed Performance Measures

APPENDIX U – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #3

Revised

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #3
12 noon, October 9, 2012
Multi-Purpose Room, City Hall
201 W. Gray

- Introduction and Goals for Ad Hoc Committee Meeting
- Project Progress Update
- Water Supply Option Screening
  - Description of Supply Options
  - Relative Comparison of Supply Options
  - Supply Option Screening: Which options are most viable for further analysis.
- Objectives Weighting
  - Paired Comparison Exercise with Revised Criteria
- Action Items and Next Steps
  - Council Study Session tonight, October 9, 2012 at 5:30 p.m.
  - Public Meeting, October 17, 2012 at 7:00 p.m.

Norman Utilities Authority
2060 Strategic Water Supply Plan

Ad Hoc Committee & City Council Study Session
October 9, 2012

Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Water Supply Option Screening
- Objective Weighting
- Next Steps

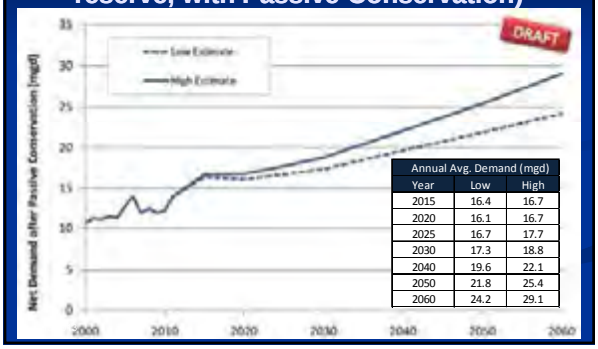
Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Water Supply Option Screening
- Objective Weighting
- Next Steps

Agenda

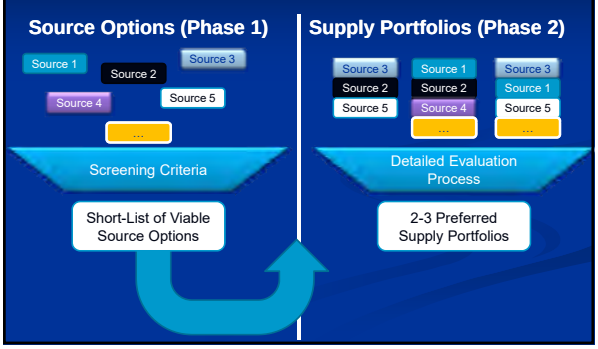
- Introductions and Goals for Workshop
- Project Progress Update
- Alternative Portfolios Evaluation
- Objective Weighting
- Next Steps

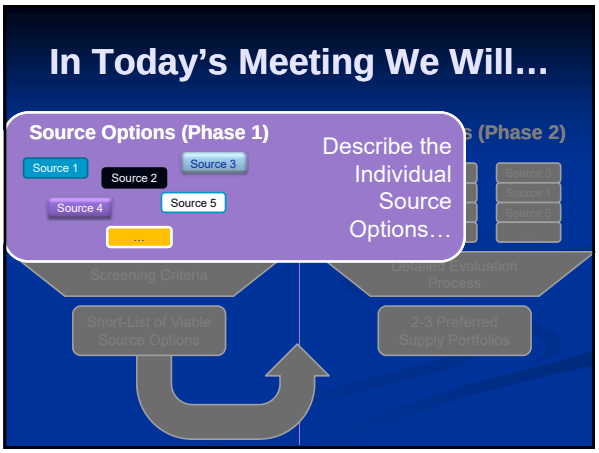
Baseline Demand Projections
(Annual average produced water, including reserve, with Passive Conservation)

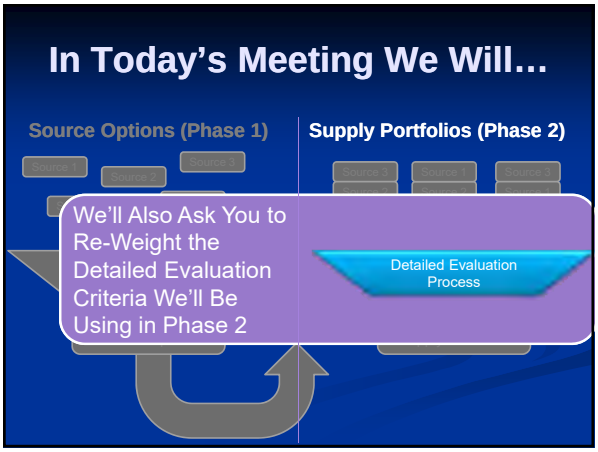


Annual Avg. Demand (mgd)		
Year	Low	High
2015	16.4	16.7
2020	16.1	16.7
2025	16.7	17.7
2030	17.3	18.8
2040	19.6	22.1
2050	21.8	25.4
2060	24.2	29.1

Water Supply Planning Terminology & Process







Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Water Supply Option Screening
  - Description of Supply Options
  - Relative Comparison of Supply Options
  - Supply Options Screening: Which options are most viable for further analysis?
- Objective Weighting
- Next Steps

Existing Supplies

- All existing sources will be considered in Phase II (with modifications for regs)
  - Lake Thunderbird
  - Garber-Wellington Aquifer Wells
  - Purchase water from Oklahoma City
- Water Conservation
  - Implement specific measures from 2011 Conservation Plan and Statewide Plan

New Local Supplies

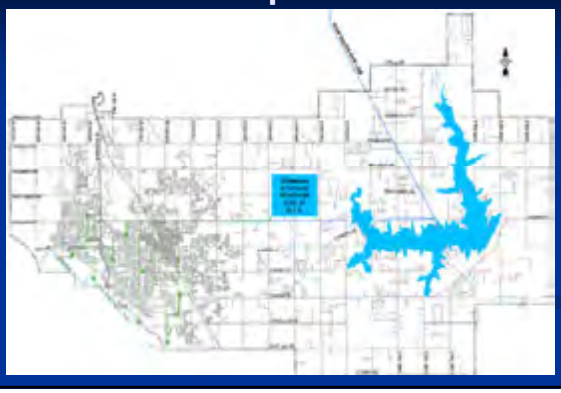
- Direct Non-potable Reuse
  - Wastewater effluent treated to be suitable for irrigation purposes, per ODEQ regulations
  - Expand upon existing use at OU Golf Course
  - Initial project demand = 0.8 mgd annual avg.
  - Initial project demand = 4.6 mgd peak day
  - Significant future northern expansion possible
- Lake Thunderbird Augmentation
  - Evaluation will be completed following publication of COMCD study

Non-potable Reuse (Phase 1)

New Local Supplies (cont.)

- Stormwater Capture and Reuse - Firm yield 5.8+ mgd
  - Capture and storage of stormwater from South Canadian drainage basin
  - Terminal reservoir and new treatment plant
  - Possible use of Lake Thunderbird instead
- Canadian River Diversion – Firm yield 6+ mgd
  - Option 1 – With new west side reservoir
  - Option 2 – With new west side reservoir and new east side reservoir
  - Option 3 – With new east side reservoir

Stormwater Capture and Reuse



Canadian River Diversion Option 1

Canadian River Diversion Option 2

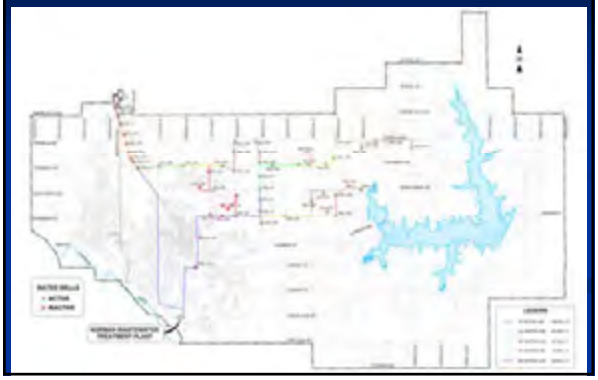
Canadian River Diversion Option 3

New Local Supplies (cont.)

- Lake Thunderbird Spillage
  - Captures intermittently-available spilled water from downstream of dam
  - Uses terminal storage reservoir
  - Firm yield available to Norman 5.8+ mgd
- Groundwater Recharge
  - Highly treated wastewater effluent suitable for recharge into Garber-Wellington aquifer
  - Firm yield available to Norman 10.2 mgd

Lake Thunderbird Spillage

Groundwater Recharge



Regional Supply Options

- Purchase bulk treated water from OKC
  - Based on regional treatment (OKC Draper WTP) of southeast Oklahoma water
  - Firm yield available to Norman >29.1 mgd
- Purchase bulk raw water from OKC
  - Based on local treatment (in Norman) of southeast Oklahoma water
  - Uses terminal reservoir
  - Firm yield available to Norman >29.1 mgd

Regional Supply Options (cont.)

- Scissortail Reservoir
  - New reservoir 3 miles west of Ada
  - Uses terminal reservoir
  - Firm yield available to Norman 19.9 mgd
    - Assumes 28.6 mgd firm yield of reservoir, of which 8.7 mgd is allocated to Ada
- Parker Reservoir
  - New reservoir 15 miles east of Ada
  - Uses terminal reservoir
  - Firm yield available to Norman 29.1+ mgd
    - Assumes no allocation to others, 41 mgd firm yield of reservoir

Scissortail Reservoir

Parker Reservoir

Regional Supply Options (cont.)

- Kaw Lake
  - Convey water from Kaw Lake (shared infrastructure with Stillwater)
  - Uses terminal reservoir
  - Firm yield available to Norman potentially >29.1 mgd*
    - Firm yield of reservoir is 166.9 mgd
    - 126.2 mgd allocated to others (existing permits)
    - * 57.1 mgd pending permits to others
    - * Not all pending permits expected to go through

Kaw Lake

Relative Comparison of Supply Sources

SUPPLY AVAILABILITY

RELIABILITY

CERTAINTY & TIMELINESS

COST-EFFECTIVENESS

- Quantitative (supply avail. & cost)
- Qualitative (reliability & certainty)
  - Scored from 1 (worst) to 5 (best)

Relative Comparison of Supply Sources (cont.)

Source Name	Meet 20% of demand?	Long-term reliability?	Implementation status and issues?	Capital Cost ($/AFY)
Canadian River Diversion Option 1	21%	1	2	$34,000
Canadian River Diversion Option 2	21%	1	2	$44,000
Canadian River Diversion Option 3	21%	1	2	$41,000

Relative Comparison of Supply Sources (cont.)

Source Name	Meet 20% of demand?	Long-term reliability?	Implement-ation status and issues?	Capital Cost ($/AFY of firm yield)
Lake Thunderbird Spillage	20%	2	1	$86,000
Groundwater Recharge	35%	4	1	$34,000
Canadian River Diversion Option 1	21%	1	2	$39,000
Direct Non-potable Reuse	5% (+ peak)	4	5	$22,000
Stormwater Capture and Reuse	20%	2	2	$188,000
Bulk Treated Water from OKC	100%	5	4	$12,000
Bulk Raw Water from OKC	100%	5	4	$14,000
Scissortail Reservoir	68%	3	3	$18,000
Parker Reservoir	100%	4	3	$19,000
Kaw Lake	100%	5	4	$18,000

Relative Comparison of Supply Sources (cont.)

Source Name	Meet 20% of demand?	Long-term reliability?	Implement-ation status and issues?	Capital Cost ($/AFY of firm yield)
Groundwater Recharge	35%	4	1	$34,000
Canadian River Diversion Option 1	21%	1	2	$39,000
Direct Non-potable Reuse	5%	4	5	$22,000
Bulk Treated Water from OKC	100%	5	4	$12,000
Bulk Raw Water from OKC	100%	5	4	$14,000
Scissortail Reservoir	68%	3	3	$18,000
Parker Reservoir	100%	4	3	$19,000
Kaw Lake	100%	5	4	$18,000

Relative Comparison of Supply Sources (cont.)

Source Name	Meet 20% of demand?	Long-term reliability?	Implement-ation status and issues?	Capital Cost ($/AFY of firm yield)
Direct Non-potable Reuse	5%	4	5	$22,000
Bulk Treated Water from OKC	100%	5	4	$12,000
Bulk Raw Water from OKC	100%	5	4	$14,000
New Out of Basin Reservoir	100%	4	3	$19,000
Kaw Lake	100%	5	4	$18,000

Supply Sources Recommended for Portfolio Development

- Existing:
  - Lake Thunderbird
  - Garber-Wellington Aquifer Wells
  - Conservation
- New Local:
  - Direct non-potable reuse
  - Lake Thunderbird Augmentation (pending results of COMCD study)
- Regional:
  - Bulk treated water from OKC
  - Bulk raw water from OKC
  - New out of basin reservoir
  - Kaw Lake

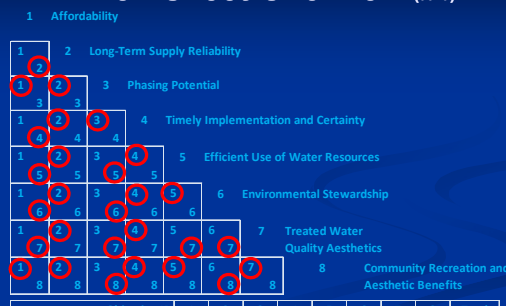
Agenda

- Introductions and Goals for Workshop
- Project Progress Update
- Water Supply Option Screening
- Objective Weighting
  - Complete Paired Comparison with revised criteria
- Next Steps

Paired Comparison Worksheet Overview

	1	2	3	4	5	6	7	8
1 Affordability								
2 Long-Term Supply Reliability	1 2							
3 Phasing Potential	1 3	2 3						
4 Timely Implementation and Certainty	1 4	2 4	3 4					
5 Efficient Use of Water Resources	1 5	2 5	3 5	4 5				
6 Environmental Stewardship	1 6	2 6	3 6	4 6	5 6			
7 Treated Water Quality Aesthetics	1 7	2 7	3 7	4 7	5 7	6 7		
8 Community Recreation and Aesthetic Benefits	1 8	2 8	3 8	4 8	5 8	6 8	7 8	

Paired Comparison Worksheet Overview (cont.)



Objective ID	1	2	3	4	5	6	7	8	Total
Number of Times Circled	2	7	1	5	4	2	5	2	28
Percentage of All Matches	7%	25%	4%	18%	14%	7%	18%	7%	100%

Paired Comparison Exercise

1. Affordability – *What will it cost to reliably provide treated water?*
2. Long-Term Supply Reliability – *Will we be able to reliably meet our demand?*
3. Phasing Potential – *Can we defer capital and increase the supply over time?*
4. Timely Implementation and Certainty – *Are we certain we can bring the supply online by the time it is needed?*
5. Efficient Use of Water Resources – *Are we making the best use of the available resources?*
6. Environmental Stewardship – *Are we preserving our environmental resources?*
7. Treated Water Quality Aesthetics – *Will our customers be satisfied with the quality of water we deliver?*
8. Community Values (Recreation, Aesthetics, and Property Rights) – *Will our community gain value from this alternative, while protecting property rights?*

Next Steps

- Ad Hoc Committee Meeting – today
- Council Study Session – today
- Public Meeting 2 – October 17, 2012 at 7:00 pm
  - Present results of water supply option screening
- Complete screening of individual options
- Develop supply portfolios
- Public meeting 3
  - Supply portfolios to be evaluated
- Public meeting 4
  - Results of portfolio screening

Norman Utilities Authority

2060 Strategic Water Supply Plan

Ad Hoc Committee & City Council Study Session

October 9, 2012

Strategic Water Supply Plan Ad Hoc Committee Meeting #3
Minutes
October 9, 2012
Multi-Purpose Room
12:00 P.M.

Attendance

Ad Hoc Committee Members: Amanda Nairn, Andy Sherrer, Jim Gasaway, Judith Wilkins, Matthew Leal, Roger Frech, Samantha Kahoe, Stephen Tyler Holman
Councilmembers: Mayor Rosenthal, Roger Gallagher
Public: Kate Anders, Jay Cervie, Harold Heiple,
Carollo Project Team: John Rehring, Amber Wooten, Srini Sundaramoorthy, Ryan Smith
Staff: Ken Komiske, Mark Daniels, Chris Mattingly, Charlie Thomas, John McIntosh, Gay Webb

Introductions and Goal

Mr. John Rehring introduced the Carollo Project team. Mr. Rehring is the Project Manager for Carollo, Amber Wooten is the Carollo Project Engineer, Srini Sundaramoorthy is the Tetra Tech Project Manager and Ryan Smith is the Tetra Tech Project Engineer. He explained the goal for the workshop today is to obtain feedback on how the individual supply sources were screened.

Project Update

Mr. Rehring reviewed water demand projections and the water supply terminology and process.

- A question was asked about peak day versus annual average. Mr. Rehring replied peak day is approximately 1.9 times the annual average day demand.

- A question was asked about population used for demand estimation. Mr. Rehring stated the study assumes 1500 people added per year.

Water Supply Option Screening

Mr. Rehring provided information regarding existing water sources and new local and regional sources. The purpose of the preliminary screening is to determine which individual water supply options are most viable (relative to each other) and use those in developing portfolios. All are likely technically possibly but some are clearly more viable for Norman than others based on their relative costs and other basic characteristics.

The new local supply and regional supply sources were compared using supply availability, reliability, certainty and timeliness and cost effectiveness as the evaluation criteria to identify the most viable individual supply options for further analysis.

The Canadian River Diversions were removed from further study due to high cost and concern with long-term reliability. Lake Thunderbird Spillage and Stormwater Capture were removed from further study due to high costs because of intermittent nature of these supplies and the cost of storage infrastructure. (Note that the groundwater recharge alternative was initially ruled out, but after further discussion at the October 9th evening City Council Conference meeting, it was decided to carry this source forward into the portfolio development phase for comparison to the pending results of the Lake Thunderbird augmentation study.)

Based on the results of the preliminary screening, the following sources are recommended for use in the development of water supply portfolios to be evaluated in Phase II of the Strategic Water Supply Plan.

Existing Supplies
- Lake Thunderbird
- Garber-Wellington aquifer wells
- Water conservation

New Local Supplies
- Direct non-potable reuse
- Groundwater recharge (retained for further study by City Council)
- Lake Thunderbird augmentation (pending results of Central Oklahoma Master Conservancy District study)

Regional Supplies
- Purchase bulk treated water from Oklahoma City
- Purchase bulk raw water from Oklahoma City
- New out of basin reservoir
- Kaw Lake

<u>Questions Asked</u>

- Question was asked where a dam would be located on the Canadian River. Mr. Rehring explained the dam could be located on-channel however, this study has evaluated a stream diversion to an off channel reservoir. Cursory evaluation shows that a low head dam would have insufficient storage.

- Question about whether any of the sites are more cost effective from property ownership/private property issues/politically effective perspective? Mr. Rehring responded for screening, this study looked at relative infrastructure needs between supply sources. No siting analyses were conducted considering property issues for an off channel reservoir, nor has an on-channel dam been ruled out.

- Question asked about how many acres would be impacted if Lake Thunderbird dam was raised to height necessary to get storage needed. Mr. Rehring answered, the acreage impacted is not known, however the footprint would be significantly larger, primarily along Little River and Blue River upper tributaries to the lake.

- Question about the quantity of wastewater treatment plant effluent flow compared to projected water demands. Mr. Rehring answered the wastewater treatment plant effluent flow used in this study represents the projected build-out of the existing plant, 17 mgd, with an assumed physical and permitted recovery rate of 60 percent.

- Are any states using groundwater recharge? Mr. Rehring replied yes. California and Arizona and several other States have groundwater recharge projects. It can technically be done, but permitting precedence is not in Oklahoma.

- How are costs extrapolated to each water meter? Mr. Rehring responded that the Strategic Water Plan scope does not include estimating rate changes or tap fee changes. They are looking at the most cost effective supplies relative to other supply sources. To look at cost per meters, you need to complete a financial rate analysis.

- Is there an unlimited supply of water from Oklahoma City through 2060? Mr. Rehring answered in terms of planning and permitting, it is much further along than other sources. Everything that Oklahoma City has indicated confirms that they can meet the full 2060 demand of Norman.

- Is this why raw and treated water from Oklahoma City received a 5 for reliability? Mr. Rehring answered, Yes.

- Is there enough geographic separation between new out of basin and Southeast Oklahoma source to get "multi-source benefit"? Mr. Rehring's response was maybe. You would receive some benefit if you used the same pipeline to bring water to Norman.

- Will our options include taping into the raw water line that goes to Oklahoma City? Mr. Rehring replied yes.

- How are costs calculated? Mr. Rehring explained the costs are all in today's dollars. As we go forward, the ability to implement the long-term water supply portfolio in phases will be considered favorably.

- How long before out of basin reservoirs would be built. Mr. Rehring responded that it may be a long time due to challenges with permitting a new reservoir.

Ms. Wilkins distributed an article from the USA Today on cost of water trends nationally.

Paired Comparison

Mr. Rehring explained number eight on the paired comparison worksheet, which the members were asked to rank at the August 6th Ad-Hoc meeting, has been revised to include property rights. Members were asked to complete the revised worksheet at the end of the meeting or send the completed form to city staff.

Action Items and Next Steps

Mr. Rehring stated a Council Study Session will be held tonight at 5:30 p.m. to present this information to City Council. The next public meeting will be held Wednesday, October 17 at 7:00 p.m. in the Council Chambers. Public Meeting #3 will explain how we packaged portfolios and Public Meeting #4 will show ranking of portfolios.

The meeting adjourned at 1:05 P.M.

Items submitted for the record:

1. PowerPoint presentation entitled, 2060 Strategic Water Supply Plan Ad Hoc Committee & City Council Study Session, October 9, 2012
2. Carollo Project Memorandum dated October 5, 2012, Preliminary Screening of Supply Sources
3. Carollo Project Revised Memorandum dated August 15, 2012, Revised List of Evaluation Criteria and Proposed Performance Measures

APPENDIX V – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #4

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #4
12 noon, January 10, 2013
Multi-Purpose Room, City Hall
201 W. Gray

- Introduction and Goals for Ad Hoc Committee Meeting

- Selection of Ad Hoc Committee Chair

- Update on Water Supply Options
  - COMCD report on augmenting Lake Thunderbird
  - Analysis of existing water supplies under anticipated regulations
  - Reuse Options: Direct non-potable reuse, Groundwater recharge, Lake Thunderbird augmentation

- Review Initial List of Water Supply Portfolios

- Upcoming Public Meetings
  - Public Meeting #3: Propose moving to after evaluation of initial water supply portfolios is completed
  - Public Meeting #4: After evaluation of revised water supply portfolios

- Action Items and Next Steps

Norman Utilities Authority
2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting
January 10, 2013

Agenda

- Introduction and Goals for Meeting
- Selection of Ad Hoc Committee Chair
- Update on Water Supply Options
  - COMCD report on augmenting Lake Thunderbird
  - Reuse options
  - Existing water supplies – anticipated regulations
- Review Initial List of Water Supply Portfolios
- Upcoming Public Meetings
- Action Items and Next Steps

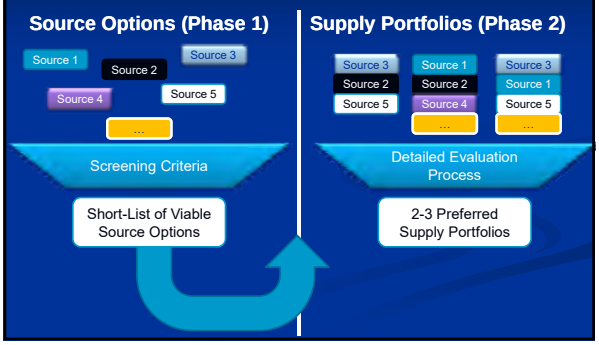
Agenda

- Introduction and Goals for Meeting
- Selection of Ad Hoc Committee Chair
- Update on Water Supply Options
  - COMCD report on augmenting Lake Thunderbird
  - Reuse options
  - Existing water supplies – anticipated regulations
- Review Initial List of Water Supply Portfolios
- Upcoming Public Meetings
- Action Items and Next Steps

Agenda

- Introduction and Goals for Meeting
- Selection of Ad Hoc Committee Chair
- Update on Water Supply Options
  - COMCD report on augmenting Lake Thunderbird
  - Reuse options
  - Existing water supplies – anticipated regulations
- Review Initial List of Water Supply Portfolios
- Upcoming Public Meetings
- Action Items and Next Steps

Water Supply Planning Terminology & Process



COMCD Study on Lake Thunderbird Augmentation

- Considered treated wastewater reuse and traditional water supply alternatives for augmenting Lake Thunderbird water supply
- End point = additional raw water supplies (usually in Lake Thunderbird) → Costs are not comparable to SWSP
- Sought 15 mgd of supply in each case

Takeaways from COMCD Study

- Study conclusion: Augmentation with treated effluent is best option
- 15 mgd phased in over time
  - 5 mgd Moore + 10 mgd Norman effluent
  - 15 mgd Norman effluent
  - Requires WWTP upgrades, pipeline, pump stn.
- DEQ indirect potable reuse regs mid-2013
- Significant permitting uncertainties and challenges with Sensitive Water Supply

Indirect Potable Reuse Options

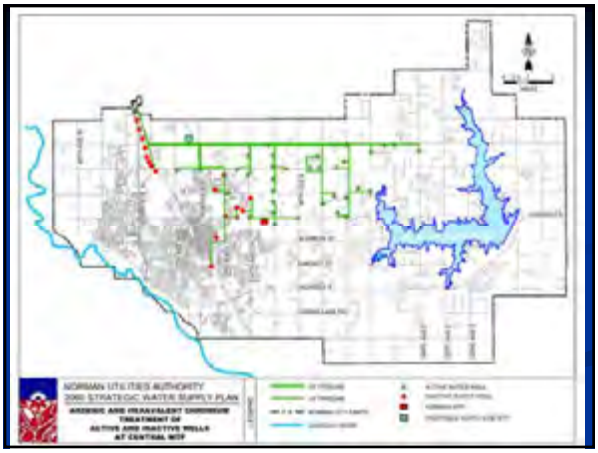
Groundwater Recharge	Lake TB Augmentation
Needs groundwater modeling and feasibility study for quantity and quality	COMCD study completed
Concerns re: mobilize arsenic, chromium-6, other parameters?	Water quality implications understood & treatable
No Oklahoma precedent or regulatory framework	Already occurs in many Oklahoma watersheds (unplanned)
Anticipate extremely stringent treatment, water quality, reliability issues if/when approved	DEQ regulations underway – due July 2013
Estimated unit capital cost: $33,600/AFY	Estimated unit capital cost: $8,300/AFY

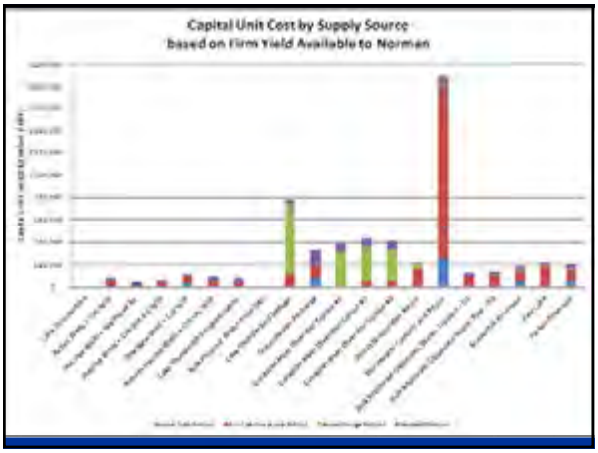
Existing Supply Sources

- Lake Thunderbird
  - 6.1 mgd firm yield available to Norman (43.8% of Thunderbird's firm yield)
- Garber-Wellington Aquifer Options
  - Existing active wells – 6.0 mgd average, 7.5 mgd peak
  - Existing inactive wells – 2.1 mgd average, 2.9 mgd peak
  - New wells – assumed 0.17 mgd average, 0.25 mgd peak per new well

Garber-Wellington Treatment Options

- Centralized treatment for arsenic and chromium-6
  - Chromium-6 regs still uncertain
  - California likely implementing next year
  - Federal rule possible by ~2016, comply ~2020?
- Wellhead treatment for arsenic
  - Wellhead arsenic first, then centralized Cr6 later?
  - Wellhead higher unit cost but targeted treatment to flow that needs arsenic removal
  - Can all wells blended reliably meet arsenic with no treatment under all operating scenarios?





Relative Comparison of Individual Source Options

- SUPPLY AVAILABILITY
- RELIABILITY
- CERTAINTY & TIMELINESS
- COST-EFFECTIVENESS

- Quantitative (supply avail. & cost)
- Qualitative (reliability & certainty)
  - Scored from 1 (worst) to 5 (best)

Supply Sources Recommended for Portfolio Development

- Existing:
  - Lake Thunderbird
  - Garber-Wellington Aquifer Wells
  - Conservation
- New Local:
  - Direct non-potable reuse
  - Lake Thunderbird augmentation
- Regional:
  - Bulk treated water from OKC
  - Bulk raw water from OKC
  - New out of basin reservoir
  - Kaw Lake

Agenda

- Introduction and Goals for Meeting
- Selection of Ad Hoc Committee Chair
- Update on Water Supply Options
  - COMCD report on augmenting Lake Thunderbird
  - Reuse options
  - Existing water supplies – anticipated regulations
- Review Initial List of Water Supply Portfolios
- Upcoming Public Meetings
- Action Items and Next Steps

Criteria for Detailed Evaluations

- Affordability
- Long-Term Supply Reliability Phasing Potential
- Timely Implementation and Certainty
- Efficient Use of Water Resources
- Environmental Stewardship
- Treated Water Quality Aesthetics
- Community Values (Recreation, Aesthetics, and Property Rights)

Initial Portfolios

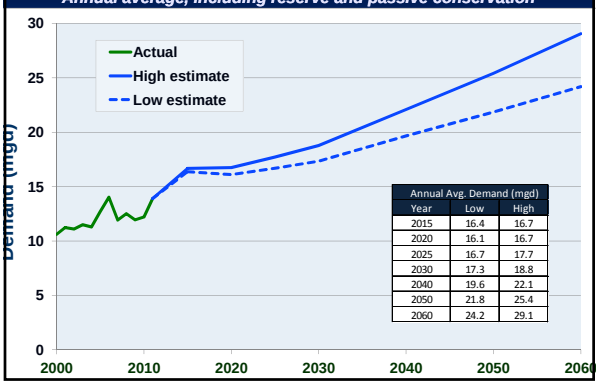
- Portfolio 1: Maximize Local Source Use
  - Lake Thunderbird at baseline yield
  - Existing wells treated for chromium-6 & arsenic
  - Additional conservation + direct non-pot reuse
  - New GW wells to meet remaining deficit through ~2020 (max # wells = twice current)
  - Thunderbird augmentation for deficit post-2020
- Portfolio 2: Low Capital Cost
  - Same as above but no new wells, no Thunderbird augmentation, and fill deficit with OKC Treated ($/kgal)

Initial Portfolios

- Compare "bookend portfolios" for New Regional options
  - Portfolio 3: 100% from OKC Treated
  - Portfolio 4: 100% from OKC Raw
  - Portfolio 5: 100% from New Out of Basin Resv.
  - Portfolio 6: 100% from Kaw Reservoir
- Hybrid Portfolios – TBD
  - Likely a combination of strongest Regional project and strongest Local sources
  - Sensitivity on peaking with infrequent OKC use

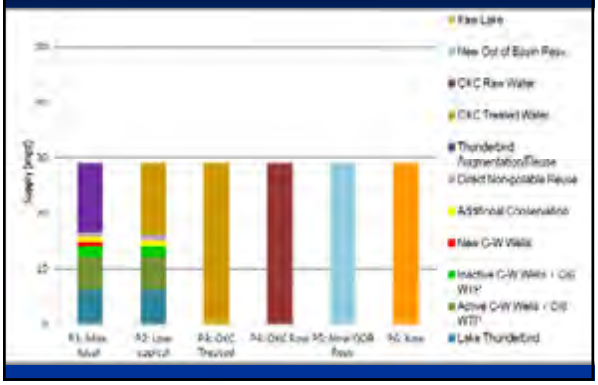
Baseline Demand Projections

Annual average, including reserve and passive conservation

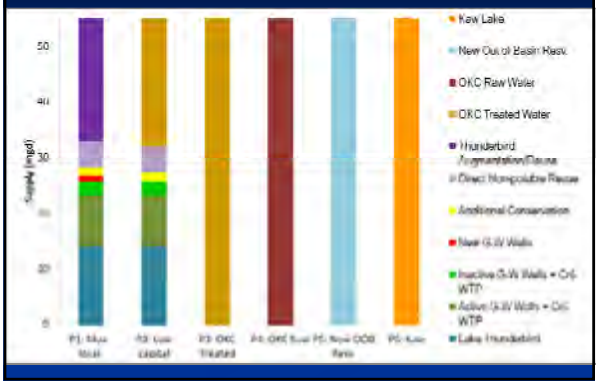


Annual Avg. Demand (mgd)		
Year	Low	High
2015	16.4	16.7
2020	16.1	16.7
2025	16.7	17.7
2030	17.3	18.8
2040	19.6	22.1
2050	21.8	25.4
2060	24.2	29.1

2060 Average Supply



2060 Peak Day Supply



Next Steps for Portfolios and Public Meetings

- Public Meeting 3
- Evaluate 6 preliminary portfolios against all the weighted criteria
- Assess results, develop hybrid portfolios
- Evaluate hybrid portfolios against all the weighted criteria
- Public Meeting 4

Agenda

- Introduction and Goals for Meeting
- Selection of Ad Hoc Committee Chair
- Update on Water Supply Options
  - COMCD report on augmenting Lake Thunderbird
  - Reuse options
  - Existing water supplies – anticipated regulations
- Review Initial List of Water Supply Portfolios
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Norman Utilities Authority

2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting

January 10, 2013

Strategic Water Supply Plan Ad Hoc Committee Meeting #4
Minutes
January 10, 2013
Multi-Purpose Room
12:00 Noon

Attendance:

Ad Hoc Committee Members: Amanda Nairn, Curtis McCarty, David Sabatini, Jim Gasaway, Judith Wilkins, Matthew Leal, Mike Pullin, Roger Frech, Sandy Bahan, Stephen Tyler Holman

Councilmembers: Mayor Rosenthal, Roger Gallagher

Public: Joy Hampton, Jay Cervi, Richard McKown

Staff: John Rehring, Amber Wooten, Ken Komiske, Mark Daniels, Chris Mattingly, Charlie Thomas, Gay Webb

Introduction and Goals for Ad Hoc Committee Meeting

Mr. Komiske welcomed committee members to the meeting. He announced that Central Oklahoma Master Conservancy District (COMCD) has imposed a 10% reduction in the amount of water that Norman can get from Lake Thunderbird. A proclamation declaring Phase 2 Mandatory Water Conservation effective January 14, 2013 will be published in the Transcript on Sunday.

A comment was made that Phase 3 Water Conservation allows hand watering anytime but should be restricted to cooler time of day. Mr. Komiske stated staff will be reviewing the current Water Conservation Plan with Council; any changes to the plan will require Council approval.

The goal of the meeting today is to provide an update on water supply options, discuss the list of initial supply portfolios, and get Committee members' feedback on when to schedule the next public meeting to best get meaningful input.

Selection of Ad Hoc Committee Chair

Mr. Komiske asked if the Committee would like to elect a Chairperson to serve as a spokesperson for the group; the Committee concluded that no Chair is needed.

Update On Water Supply Options

Mr. Komiske introduced John Rehring, Carollo Project Manager and Amber Wooten, Carollo Project Engineer. Mr. Rehring reviewed the water supply planning process and

updated the Committee on the recently completed Central Oklahoma Master Conservancy District (COMCD) Study on Lake Thunderbird Augmentation. COMCD found that augmenting Lake Thunderbird with treated wastewater effluent is the best option. For the Strategic Water Supply Plan (SWSP) options, the COMCD study option for 15 million gallons day (mgd) augmentation from Norman's wastewater treatment plant was selected as the basis of analysis, since it is more directly in Norman's control (vs. augmenting the lake with effluent from Moore and Norman), and since Moore's participation is uncertain. There are significant permitting uncertainties and challenges with this sensitive water supply.

Mr. Rehring discussed indirect potable reuse options, which include groundwater recharge and Lake Thunderbird Augmentation with augmentation appearing to be the better option, as it is less costly (in terms of unit capital costs) and more likely to be implemented in the time needed. Direct potable reuse (landscape irrigation and commercial/industrial uses) will also be considered in the portfolios. Ms. Wooten explained cost estimate calculations.

Review Initial List of Water Supply Portfolios

Mr. Rehring described existing water supply sources and the Garber-Wellington treatment options for chromium 6 and arsenic. The six "bookend" portfolios to be evaluated based on the weighted criteria ranked by members include:

- Portfolio 1: Maximize Local Source Use
- Portfolio 2: Low Capital Cost
- Portfolio 3: 100% from Oklahoma City Treated
- Portfolio 4: 100% from Oklahoma City Raw
- Portfolio 5: 100% from New Out of Basin Reservoir
- Portfolio 6: 100% from Kaw Reservoir

After the detailed evaluations are complete, four hybrid portfolios will be created. They will likely be a combination of strongest regional and local sources. From the four hybrid portfolios, approximately two portfolios with the best water supply options will be chosen to carry forward in the process.

Questions Asked

- What is the major groundwater recharge cost? Mr. Rehring responded treatment and infrastructure costs to reach augmentation point.

- What about public perception of Lake Thunderbird augmentation? Public acceptance would need to be addressed with either Lake Thunderbird indirect public reuse or groundwater recharge.

- Roger Frech noted the COMCD is very concerned with maintaining water quality. Water put into the lake must not degrade existing lake's water quality.

- Question asked about what costs were included in the reuse options estimated unit capital costs. Ms. Wooten explained they include both piping and treatment that would occur on the wastewater effluent and on water treatment before distribution. Operating and life cycle costs will be considered during portfolio analyses.

- Request that potential for arsenic remobilization in groundwater recharge and recovery operations be explained further. Mr. Rehring explained in other places where they have implemented groundwater recharge and recovery, due to differences in water chemistry between aquifer water and the water being recharged, there have been some elevated levels of arsenic in the water when withdrawn due to remobilization of arsenic in the aquifer. We do not know enough now to say whether this would be an issue in the Garber Wellington aquifer.

- How many existing wells, inactive wells and what are we allowed to take out of Lake Thunderbird? Staff responded we have 36 operational wells (9 mgd), 12 inactive wells and an allocation of 8.3 mgd (average) from Lake Thunderbird.

- Don't we anticipate fewer options to drill more wells when they are back up for renewal? Mr. Rehring stated preliminary results from Oklahoma Water Resources Board (OWRB) indicate equal proportionate shares cutback by 1.5 AFY/AC to 0.5 AFY/AC but reduced permit rate should not be limiting factor on new wells, given the amount of land Norman could dedicate to well permits.

- When does contract renew to take out of Lake Thunderbird? Contract does not renew; allocations are set permanently unless COMCD votes to change allocation percentages.

- Comment made that Cleveland County Rural Water District is planning to drill 2 or 3 wells – would this impact Norman's well supply (or aquifer levels)? Mr. Rehring responded it depends on proximity, but likely their wells would not impact Norman.

- Do we have funds budgeted to drill new wells? Staff responded that there is no funding for new wells in the budget. The last rate increase had funding for new wells and the City has completed those. New future wells likely would require rate increase.

- Overall holding capacity of the lake has decreased by how much due to sedimentation? Mr. Rehring responded the Lake Thunderbird firm yield has

allocated storage capacity to account for 100 years of silt accumulation. Current allocation does not need to be decreased to account for sedimentation.

- Mr. Mattingly noted that staff worries if we just continue to drill more wells, these funds may be wasted if the regulations change requiring treatment of all groundwater.

- Will Operation and Maintenance costs be evaluated in the final portfolio review? Mr. Rehring replied yes.

- Question asked for more information on additional conservation. Mr. Rehring responded for the SWSP, we are building on what is in Norman's current conservation plan including public education, reducing non-revenue water, conservation rates, etc.

Action Items and Next Steps

Mr. Rehring asked when the Committee thought would be the best time to hold Public Meeting #3: now and then evaluate the six preliminary portfolios and develop hybrid portfolios or go ahead and evaluate the six preliminary portfolios and develop hybrid portfolios and provide that information at Public Meeting #3. The Committee agreed to have the evaluation information available at Public Meeting #3. It will take approximately a month to evaluate the portfolios and then Public Meeting #3 will be scheduled.

Mr. Rehring and Mr. Komiske thanked the committee members for attending. The meeting adjourned at 1:10 p.m.

Items submitted for the record:

1. PowerPoint presentation entitled, Norman Utilities Authority 2060 Strategic Water Supply Plan Ad Hoc Committee Meeting, January 10, 2013.

APPENDIX W – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #5

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #5
12 noon, March 4, 2013
Multi-Purpose Room, City Hall
201 W. Gray

- Introduction and Goals for Ad Hoc Committee Meeting
- Project Update: Status and activities since January 10 Ad Hoc meeting
- Quick Review of Supply Options and Evaluation Criteria
  - Shortlisted supply options used in development of supply portfolios
  - Criteria used to evaluate portfolios, and their relative importance ("weight")
  - How the criteria are applied to evaluate and compare portfolios
- Portfolio Evaluations
  - Initial portfolios:
    What supply options do they include, and how did they perform?
  - "Hybrid" portfolios:
    What supply options do they include, and how did they perform?
  - Ad Hoc Committee feedback on portfolios evaluated to date
  - Ad Hoc Committee suggestions on other portfolios we should evaluate
- Upcoming Public Meetings
  - Public Meeting #3: Portfolio evaluation – What/how should we present?
  - Public Meeting #4: After evaluation of revised water supply portfolios
- Action Items and Next Steps

Norman Utilities Authority
2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #5
March 4, 2013

Agenda

- Introduction and Goals for Meeting
- Project Update: Status and activities since January 10 Ad Hoc meeting
- Quick Review of Supply Options & Criteria
- Portfolio Evaluations
- Upcoming Public Meetings
- Action Items and Next Steps

Agenda

- Introduction and Goals for Meeting
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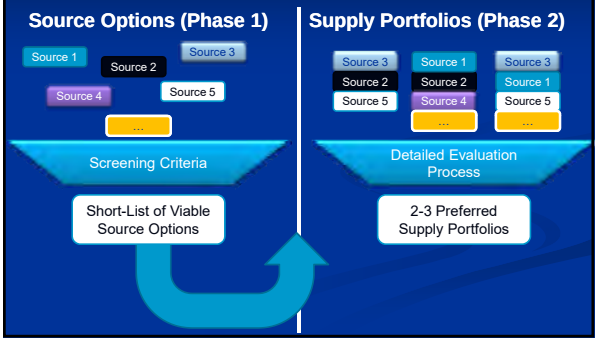
Water Supply Planning Terminology & Process



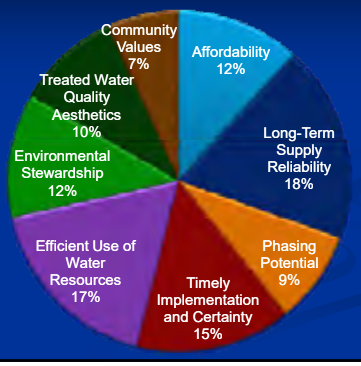
Agenda

- Introduction and Goals for Meeting
- Project Update: Status and activities since January 10 Ad Hoc meeting
- Quick Review of Supply Options & Criteria
- Portfolio Evaluations
- Upcoming Public Meetings
- Action Items and Next Steps

Supply Sources Used for Portfolio Development

- Existing:
  - Lake Thunderbird
  - Garber-Wellington Aquifer Wells
  - Conservation
  - OKC (wholesale)
- New Local:
  - Direct non-potable reuse
  - Additional conservation
  - Lake Thunderbird augmentation (indirect potable reuse)
- Regional:
  - Bulk treated water from OKC (owner)
  - Bulk raw water from OKC (owner)
  - New out of basin reservoir (Parker or Scissortail)
  - Kaw Lake

Criteria and Their Relative Importance or "Weight" in Comparing Portfolios

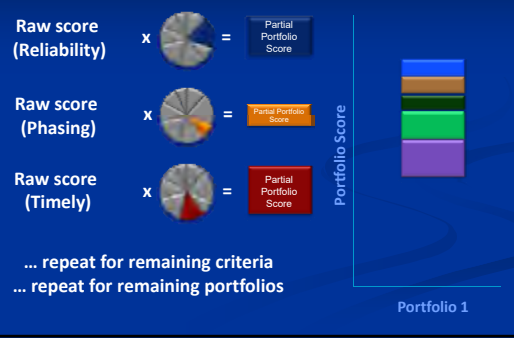


Portfolio Scoring Process

1. Portfolio is scored against first Objective ("Raw Score" without weighting):
   Can be in $, acre-feet, 1-5 score…
2. Raw Score x Objective Weighting = Partial Portfolio Score
3. Process repeated for remaining Objectives to get Total Portfolio Score

Steps 1-3 repeated for remaining Portfolios

Portfolio Scoring Process



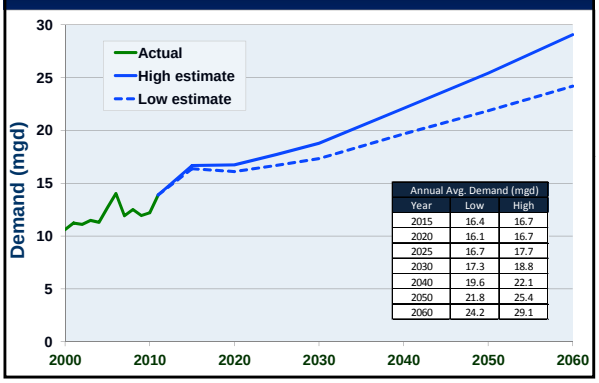
… repeat for remaining criteria
… repeat for remaining portfolios

Agenda

- Introduction and Goals for Meeting
- Project Update: Status and activities since January 10 Ad Hoc meeting
- Quick Review of Supply Options & Criteria
- Portfolio Evaluations
- Upcoming Public Meetings
- Action Items and Next Steps

Service Area Demand Projections

Annual average, including reserve and passive conservation savings



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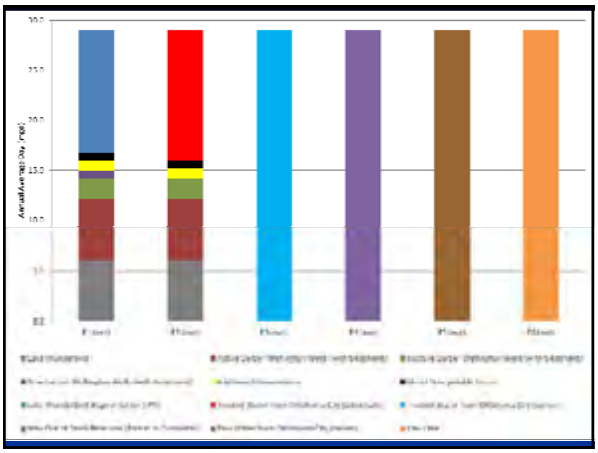
Initial Portfolios

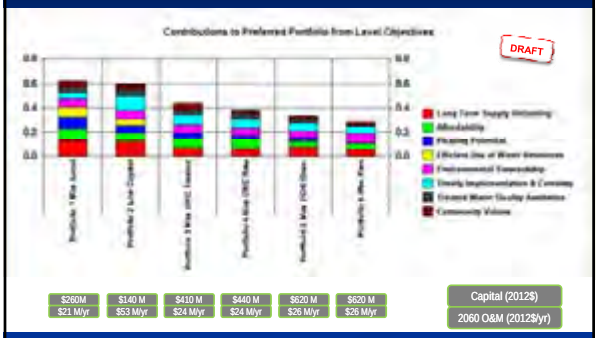
- Portfolio 1: Maximize Local Source Use
  - Lake Thunderbird at baseline yield
  - Existing wells treated for chromium-6 & arsenic
  - Additional conservation + non-potable reuse
  - New GW wells to meet remaining deficit through ~2020 (max # wells = twice current)
  - Thunderbird augmentation for deficit post-2020
- Portfolio 2: Low Capital Cost
  - Same as above but no new wells, no Lake TB augmentation, fill gap with OKC Treated ($/kgal)

Additional Portfolios

- Compare "bookend portfolios" for New Regional options
  - Portfolio 3: 100% from OKC Treated
  - Portfolio 4: 100% from OKC Raw
  - Portfolio 5: 100% from New Out of Basin Resv.
  - Portfolio 6: 100% from Kaw Reservoir
- Review Results → Create Hybrid Portfolios
  - Combination of strongest Regional sources and strongest Local sources



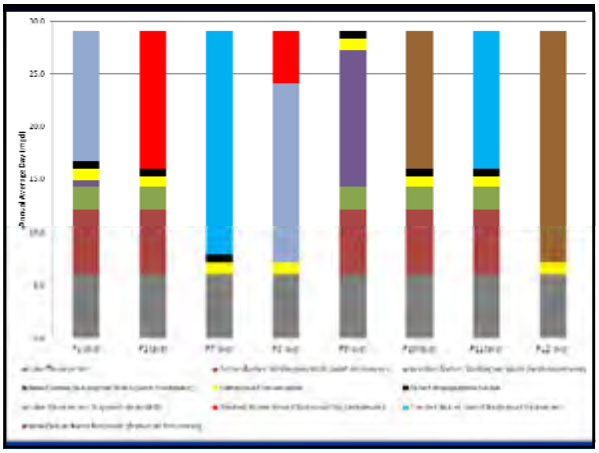
Initial Portfolios: Weighted Scoring



Hybrid Portfolios

(All have Lake TB baseline & Additional Conservation)

- **Portfolio 7**: Non-potable direct reuse, OKC (owner) – no groundwater use
- **Portfolio 8**: Indirect potable reuse (Lake Thunderbird augmentation), OKC (wholesale) – no groundwater use
- **Portfolio 9**: Maximize groundwater use, Non-potable direct reuse
- **Portfolio 10**: Existing groundwater use (plus treatment), Non-potable direct reuse, New out-of-basin reservoir (Parker)
- **Portfolio 11**: Existing groundwater use, Non-potable direct reuse, OKC (owner) – similar to P2 but OKC (owner) instead of OKC (wholesale)
- **Portfolio 12**: New out-of-basin reservoir (Scissortail)



Hybrid Portfolios: Weighted Scoring

Hybrid Portfolios:

Feedback?

Different portfolios we should evaluate?

Agenda

- Introduction and Goals for Meeting
- Project Update: Status and activities since January 10 Ad Hoc meeting
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  - Public Meeting #3: Portfolio evaluation – What/how should we present?
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Norman Utilities Authority

2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #5

March 4, 2013

Norman 2060 Strategic Water Supply Plan

Supplemental Materials for
Ad Hoc Committee Meeting
March 4, 2013

- Detailed Evaluation Criteria
- Matrix of Supply Options Comprising Each Portfolio
  (Average and Peak Supply in 2060 for Bookend Portfolios 1-6; Hybrid Portfolios 7-12)
- Chart of Supply Options Comprising Each Portfolio
  (Average Supply in 2060 for Bookend Portfolios 1-6)
- Chart of Supply Options Comprising Each Portfolio
  (Average Supply in 2060 for Bookend Portfolios 1-2 and Hybrid Portfolios 7-12)

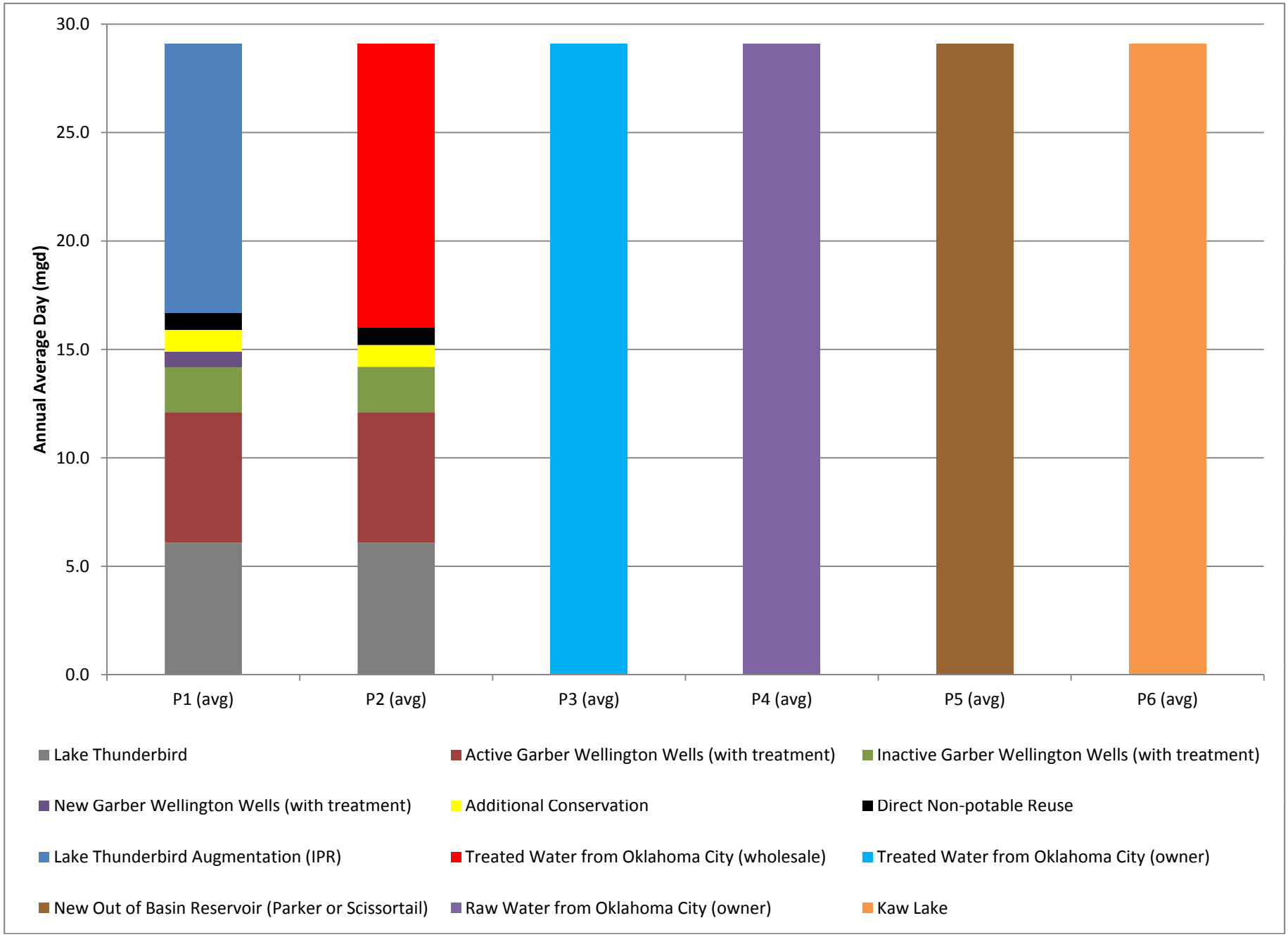
Objectives Weighting			
Objective	**Objective Description**	**Sub-objective**	**Performance Measures**
Affordability	What will it cost to reliably provide treated water?	Minimize capital cost	Unit capital cost including diversion, transmission, and treatment ($/AFY of firm yield using 2012 non-escalated dollars)
		Minimize life-cycle cost	2060 O&M cost (meeting total demand, $M/yr in 2012 dollars)
Long-Term Supply Reliability	Will we be able to reliably meet our demand?	Minimize supply shortages	Weighted average of 2060 shortages (frequency in basins of origin)
			Supply diversity in terms of number of sources and types of sources (qualitative)
			Percent of supply portfolio coming from Garber-Wellington aquifer
		Infrastructure reliability	Raw water transmission distance (mi)
			Transmission complexity, considering length of pipeline and number/complexity of pumping operations (qualitative)
			Treatment complexity (qualitative)
			Degree of redundancy (qualitative)
Phasing Potential	Can we defer capital and increase the supply over time?	Defer capital cost	Ability to phase implementation and construction (qualitative)
		Provide for future needs	Ability to access additional supplies beyond projected 2060 demands (qualitative)
Timely Implementation and Certainty	Are we certain we can bring the supply online by the time it is needed?	Reduce institutional complexity and increase local control	Number of agency/utility partners (facility owners and/or project co-participants)
			Percent of supply sourced in Norman
			Public/political acceptability (qualitative)
			Vulnerability to potential future changes in water rights allocations and water quality standards (qualitative)
		Timely implementation	Project development status in 2012 for new supplies in portfolio (qualitative)
			Amount and ease of environmental permitting, water rights acquisition, and land acquisition (qualitative)
Efficient Use of Water Resources	Are we making the best use of the available resources?	Maximize water use efficiency	Percent of total demand met by new direct non-potable reuse in 2060
			Percent of total demand met by indirect reuse (supply augmentation) in 2060
			Percent reduction from baseline demand due to additional conservation measures and programs
Environmental Stewardship	Are we preserving our environmental resources?	Minimize energy consumption	Pumping head per unit supply (ft/1000 AFY)
		Minimize temporary construction impacts	Amount of land disturbed during construction (ac)
		Minimize permanent ecosystem impacts	Environmental impacts (qualitative)
		Increase use of renewable resources	Renewable supply score for portfolio (qualitative)
Treated Water Quality Aesthetics	Will our customers be satisfied with the quality of the water we deliver?	Achieve secondary MCLs	Blended average conductivity (uS/cm)
		Minimize taste and odor potential	Percent of supply originating from surface water sources
Community Values (recreation, aesthetics, and property rights)	Will our community gain value from this alternative, while protecting property rights?	Impact on non-water supply benefits	Perceived impacts to recreation and aesthetics (qualitative)
		Protection of property rights	Potential impact to property rights (qualitative)

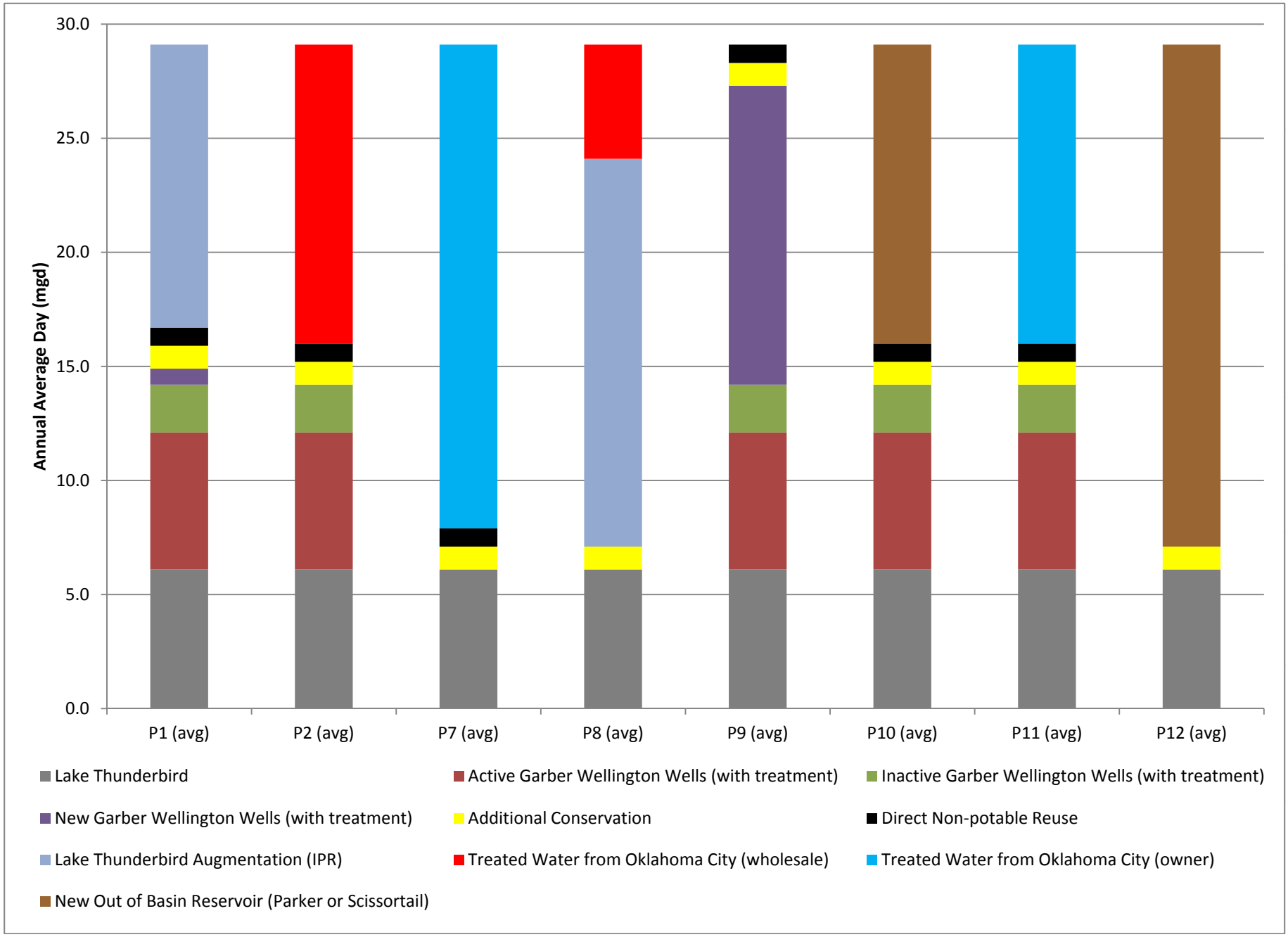
Norman 2060 Strategic Water Supply Plan

DRAFT 2/25/13 - Supply Options Comprising Each Portfolio

Description (Flows in mgd)	Portfolio ID	Lake Thunderbird	Active Garber Wellington Wells (with treatment)	Inactive Garber Wellington Wells (with treatment)	New Garber Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (owner)	Raw Water from Oklahoma City (owner)	New Out of Basin Reservoir (Parker or Scissortail)	Kaw Lake	Total
Maximize local sources with add'l cons/full reuse	P1 (avg)	6.1	6.0	2.1	0.7	1.0	0.8	12.4	-	-	-	-	-	29.1
	P1 (peak)	14.0	9.0	2.7	1.0	1.5	4.6	22.5	-	-	-	-	-	55.3
Low capital cost (OKC wholesale)	P2 (avg)	6.1	6.0	2.1	-	1.0	0.8	-	13.1	-	-	-	-	29.1
	P2 (peak)	14.0	9.0	2.7	-	1.5	4.6	-	23.5	-	-	-	-	55.3
Maximize outside sources - OKC Treated (owner)	P3 (avg)	-	-	-	-	-	-	-	-	29.1	-	-	-	29.1
	P3 (peak)	-	-	-	-	-	-	-	-	55.3	-	-	-	55.3
Maximize outside sources - OKC Raw (owner)	P4 (avg)	-	-	-	-	-	-	-	-	-	29.1	-	-	29.1
	P4 (peak)	-	-	-	-	-	-	-	-	-	55.3	-	-	55.3
Maximize outside sources - New OOB Reservoir	P5 (avg)	-	-	-	-	-	-	-	-	-	-	29.1	-	29.1
	P5 (peak)	-	-	-	-	-	-	-	-	-	-	55.3	-	55.3
Maximize outside sources - Kaw	P6 (avg)	-	-	-	-	-	-	-	-	-	-	-	29.1	29.1
	P6 (peak)	-	-	-	-	-	-	-	-	-	-	-	55.3	55.3
No GW or TB Aug; OKC Treated (as owner)	P7 (avg)	6.1	-	-	-	1.0	0.8	-	-	21.2	-	-	-	29.1
	P7 (peak)	14.0	-	-	-	1.5	4.6	-	-	35.2	-	-	-	55.3
P7 plus Max. TB Aug, less OKC (wholesale)	P8 (avg)	6.1	-	-	-	1.0	-	17.0	5.0	-	-	-	-	29.1
	P8 (peak)	14.0	-	-	-	1.5	-	32.3	7.5	-	-	-	-	55.3

Description (Flows in mgd)	Portfolio ID	Lake Thunderbird	Active Garber Wellington Wells (with treatment)	Inactive Garber Wellington Wells (with treatment)	New Garber Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (owner)	Raw Water from Oklahoma City (owner)	New Out of Basin Reservoir (Parker or Scissortail)	Kaw Lake	Total
Max GW use	P9 (avg)	6.1	6.0	2.1	13.1	1.0	0.8	-	-	-	-	-	-	29.1
	P9 (peak)	14.0	9.0	2.7	23.5	1.5	4.6	-	-	-	-	-	-	55.3
Lake Thunderbird and New Out-of-basin Reservoir (Parker)	P10 (avg)	6.1	6.0	2.1	-	1.0	0.8	-	-	-	-	13.1	-	29.1
	P10 (peak)	14.0	9.0	2.7	-	1.5	4.6	-	-	-	-	23.5	-	55.3
P2 but OKC (owner) instead of OKC (wholesale)	P11 (avg)	6.1	6.0	2.1	-	1.0	0.8	-	-	13.1	-	-	-	29.1
	P11 (peak)	14.0	9.0	2.7	-	1.5	4.6	-	-	23.5	-	-	-	55.3
Lake Thunderbird and New Out-of-basin Reservoir (Scissortail)	P12 (avg)	6.1	-	-	-	1.0	-	-	-	-	-	22.0	-	29.1
	P12 (peak)	14.0	-	-	-	1.5	-	-	-	-	-	39.8	-	55.3


30.0
25.0
20.0
15.0
10.0
5.0
0.0
Annual Average Day (mgd)
P1 (avg)
P2 (avg)
P3 (avg)
P4 (avg)
P5 (avg)
P6 (avg)
Lake Thunderbird
Active Garber Wellington Wells (with treatment)
Inactive Garber Wellington Wells (with treatment)
New Garber Wellington Wells (with treatment)
Additional Conservation
Direct Non-potable Reuse
Lake Thunderbird Augmentation (IPR)
Treated Water from Oklahoma City (wholesale)
Treated Water from Oklahoma City (owner)
New Out of Basin Reservoir (Parker or Scissortail)
Raw Water from Oklahoma City (owner)
Kaw Lake


30.0
25.0
20.0
15.0
10.0
5.0
0.0
Annual Average Day (mgd)
P1 (avg)
P2 (avg)
P7 (avg)
P8 (avg)
P9 (avg)
P10 (avg)
P11 (avg)
P12 (avg)
Lake Thunderbird
Active Garber Wellington Wells (with treatment)
Inactive Garber Wellington Wells (with treatment)
New Garber Wellington Wells (with treatment)
Additional Conservation
Direct Non-potable Reuse
Lake Thunderbird Augmentation (IPR)
Treated Water from Oklahoma City (wholesale)
Treated Water from Oklahoma City (owner)
New Out of Basin Reservoir (Parker or Scissortail)

Strategic Water Supply Plan Ad Hoc Committee Meeting #5
Minutes
March 4, 2013
Multi-Purpose Room
12:00 Noon

Ad Hoc Committee Members: Amanda Nairn, Andy Sherrer, David Sabatini, Jim Gasaway, Judith Wilkins, Lynne Miller, Matthew Leal, Mike Pullin, Roger Frech, Sandy Bahan, Stephen Tyler Holman

Councilmembers: Mayor Rosenthal, Linda Lockett, Robert Castleberry, Roger Gallagher

Public: Jacy Crosbie, Howard Haines

Consultants: John Rehring, Amber Wooten

Staff: Ken Komiske, Mark Daniels, Charlie Thomas, Debbie Smith, Steve Lewis, Gay Webb

Introduction and Goals for Ad Hoc Committee Meeting

Mr. Komiske welcomed committee members to the 5th Ad Hoc Committee Meeting. He announced the next Strategic Water Supply Plan Public Meeting #3 will be held Wednesday, March 13th at 6:30 p.m. in the Council Chambers. He introduced John Rehring, Carollo Project Manager and Amber Wooten, Carollo Project Engineer.

Project Update: Status and activities since January 10 Ad Hoc meeting

Mr. Rehring informed the Committee they have evaluated the six preliminary portfolios and have developed six hybrid portfolios since the January 10th Ad Hoc meeting. The goal is to have two or three preferred supply options.

Review of Supply Options and Evaluation Criteria

Mr. Rehring described the existing, new local and regional supply sources used for the portfolio development and the criteria used to evaluate the portfolios. He also explained the three-step portfolio scoring process and reviewed the service area demand projections.

Portfolio Evaluations

Ms. Wooten explained the six initial portfolios and the six hybrid portfolios developed:

Initial Portfolios

- Portfolio 1: Maximize Local Source Use - Lake Thunderbird, Additional Conservation, Non-Potable Reuse, Existing Wells (with treatment), New

Groundwater Wells to meet deficit through approximately 2020, Lake Thunderbird Augmentation for deficit post 2020

- Portfolio 2: Low Capital Cost – Lake Thunderbird, Additional Conservation, Non-Potable Reuse, Existing Wells (with treatment), Oklahoma City Treated Water (wholesale)
- Portfolio 3: 100% from Oklahoma City Treated Water (co-owner)
- Portfolio 4: 100% from Oklahoma City Raw Water (co-owner)
- Portfolio 5: 100% from New Out of Basin Reservoir
- Portfolio 6: 100% from Kaw Reservoir

Hybrid Portfolios

- Portfolio 7: Lake Thunderbird, Additional Conservation, Non-Potable Reuse, Oklahoma City Treated Water (co-owner)
- Portfolio 8: Lake Thunderbird, Additional Conservation, Lake Thunderbird Augmentation, Oklahoma City (wholesale)
- Portfolio 9: Lake Thunderbird, Additional Conservation, Maximize Groundwater Use, Non-Potable Reuse
- Portfolio 10: Lake Thunderbird, Additional Conservation, Existing Groundwater Use (with treatment), Non-Potable Reuse, New Out of Basin Reservoir (Parker)
- Portfolio 11: Lake Thunderbird, Additional Conservation, Existing Groundwater Use (with treatment), Non-Potable Reuse, Oklahoma City Treated Water (co-owner)
- Portfolio 12: Lake Thunderbird, Additional Conservation, New Out-of-Basin Reservoir (Scissortail)

Mr. Rehring described the weighted scoring of the initial portfolios and hybrid portfolios and noted the estimated total cost of each portfolio in present day dollars. Diversity in the portfolio will help the reliability of the portfolio.

Upcoming Public Meetings

This same information will be presented at the Public Meeting #3 which will be held Wednesday, March 13th at 6:30 p.m. in the Council Chambers.

Questions asked:

- What is the distinction between Oklahoma City as owner versus wholesale?
  Mr. Rehring explained right now, Norman buys water from Oklahoma City to meet peak demands on a wholesale basis (cost per 1000 gallons). Oklahoma City has several rates based on how much water would be used. Wholesale rates are controlled by Oklahoma City (as Oklahoma City costs go up, Norman's costs would go up). Oklahoma City as co-owner means that Norman would be a co-owner in infrastructure (responsible for own financing of capital). As owner, shared operations of pump stations and, if treated, there must be some agreement on future treatment processes and costs. Oklahoma City sources (as co-owner)

are referring to a parallel pipeline to bring water from southeast Oklahoma. Norman can access as much water as needed, subject to the infrastructure portion purchased and water rights.

- Would the price be controlled by Oklahoma City? Mr. Rehring replied if you are a wholesale customer you would pay the cost established by Oklahoma City but if you are a co-owner of the supply system you would pay some portion of debt service for a portion of the assets and a lesser amount for water usage.

- Clarification of the parallel pipeline requested. Mr. Rehring answered that Oklahoma City needs additional water and is planning to build a pipeline parallel to their current line. Norman could choose to join this project and become a co-owner of the pipeline.

- As a co-owner, could we withdraw water whenever needed? Mr. Rehring replied it depends on how much we contribute to the project.

- Recommendation made to state "co-owner" rather than "owner" on regional supply source slide.

- What is the estimated population in 2060? Mr. Rehring replied about 200,000.

- According to the demand projections for 2060, the average water demand could be 29 million gallons per day (mgd) and the peak demand could be 55 mgd? Mr. Rehring replied yes.

- Does the service area demand projections factor in the entire eastern boundary of Norman? Mr. Rehring explained all portfolios were designed to meet full build out of the 2025 Land Use and Transportation Plan.

- Do we have a time limit waiting for Department of Environmental (DEQ) augmentation approval? Mr. Rehring and Mr. Komiske responded. We must prove we won't degrade the water quality. Reuse is new to Oklahoma so parameters have not been established. Staff will be meeting next week with the Oklahoma Water Resources Board (OWRB) and DEQ to discuss this matter.

- How can DEQ hold up the augmentation approval? Mr. Komiske answered that DEQ controls permitted discharges.

- If we augment Lake Thunderbird, how much can we get? Mr. Komiske responded this is an issue the City will have to resolve with the OWRB and DEQ and Central Oklahoma Master Conservancy District (COMCD).

- How many water customers do we have? Mr. Komiske replied approximately 32,000 bills are sent monthly. Some apartments have one meter while others have individual meters.

- There seems to be a disconnect between using Oklahoma City water and what we are reading in the paper (that Oklahoma City does not have water). Mr. Rehring responded the Oklahoma City sources under consideration for this project include paralleling the Atoka pipeline to bring Southeast Oklahoma water to the area. Oklahoma City is moving forward with this plan. Oklahoma City has been asking metro area communities how much water they need. There is a lot of permitting, financing, etc. that still needs to happen.

- How many wells would be drilled under Portfolio 9 option? Ms. Wooten responded 80 to 90 wells, depending on yield.

- Isn't there some uncertainty with how much water the OWRB will allow us to remove? Mr. Rehring responded that OWRB is currently studying this issue and will announce a new limit in the future. We do expect a reduction from 2 acre feet per year to possibly 1 to 1.5 acre feet per year.

- Concern expressed about drilling more wells.

- Reference made to United States Geological Survey (USGS) report of possibility of lessening the amount of arsenic from rock formations within the well. Mr. Komiske responded that USGS did a study of our wells to see if different zones or depths have higher arsenic. They found it difficult to isolate because of the makeup of the aquifer.

- What was the result of the USGS study of pumping arsenic wells into Little River in hopes of reducing arsenic? Mr. Komiske responded the City is starting follow-up project on this aspect with the USGS. Arsenic has to go somewhere (sediment). City has another meeting with Oklahoma Water Resources Board/Department of Environmental Quality in two weeks on well discharge to Little River to determine if this is a possible pilot project.

- Will arsenic put in water help control algae on Lake Thunderbird? It is unlikely.

Action Items and Next Steps

Mr. Rehring asked for feedback from members regarding the portfolios and asked if they have suggestions of other portfolio combinations that should be evaluated. Members may call, email or provide feedback at the next public meeting. He thanked members for attending the meeting. The meeting adjourned at 1:10 p.m.

Items submitted for the record:

1. PowerPoint presentation entitled, Norman Utilities Authority 2060 Strategic Water Supply Plan Ad Hoc Committee Meeting #5, March 4, 2013

APPENDIX X – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #6

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #6
12 noon, May 23, 2013
Multi-Purpose Room, City Hall
201 W. Gray

- Introduction and Goals for Ad Hoc Committee Meeting

- Status and Progress Update
    - Recap of Last Ad Hoc & Public Meeting
    - 5 water supply portfolios that best meet our criteria and needs
    - Feedback received on those 5 portfolios

- Recommended Portfolios
    - Dialogue with Oklahoma City
    - Screening the top 5 portfolios
    - New Portfolio 13
    - Recommended portfolios
        - Portfolio 1: Diverse Portfolio that Maximizes Use of Local Supplies, including Lake Thunderbird Augmentation
        - Portfolio 2: Diverse Portfolio that Minimizes Capital Cost including Wholesale Purchases from Oklahoma City
        - , Portfolio 13: Diverse Portfolio with Co-Ownership in SE Oklahoma Raw Water System

- Implementation Planning for Recommended Portfolios
    - Basis for implementation timing, phasing, and capital financing
    - Comparison of long-term capital financing and annual costs for the recommended portfolios

- Upcoming Public Meeting 4: Recommended Portfolios

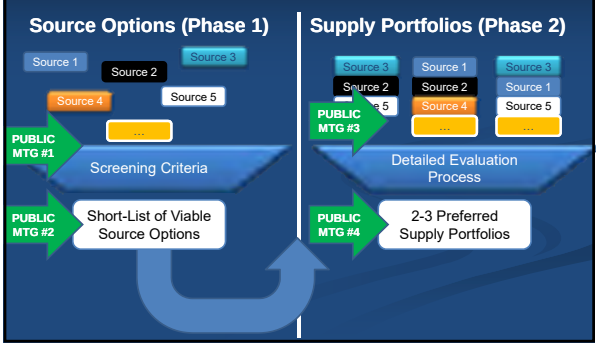
- Action Items and Next Steps

Norman Utilities Authority
2060 Strategic Water Supply Plan

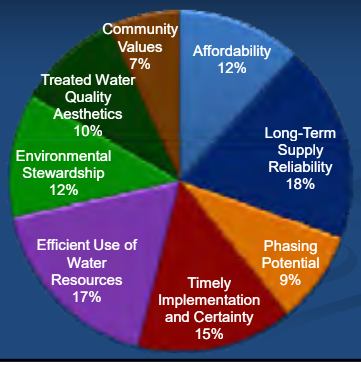
Ad Hoc Committee Meeting
May 23, 2013

AGENDA
Status and Progress Update
Recommended Portfolios
Implementation Planning for Recommended Portfolios
Upcoming Public Meeting 4: Recommended Portfolios
Action Items and Next Steps

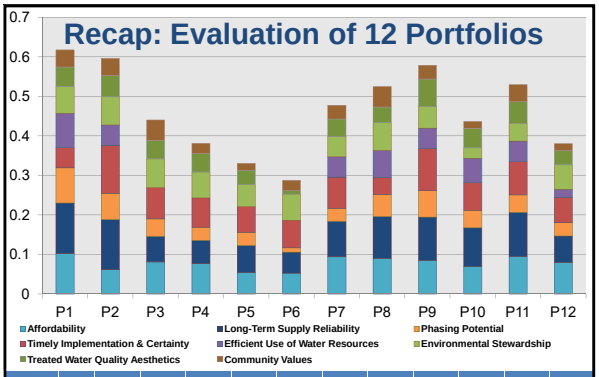
SWSP Planning Process



Criteria and Their Relative Importance or "Weight" in Comparing Portfolios

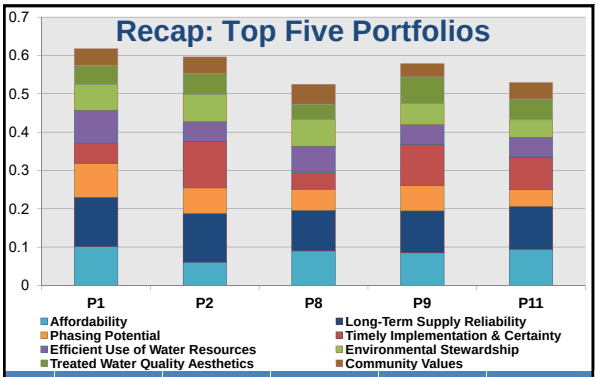


Recap: Evaluation of 12 Portfolios



2012$	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Capital	$260M	$140M	$410M	$440M	$620M	$620M	$320M	$180M	$360M	$490M	$300M	$440M
O&M per year	$21M	$53M	$24M	$24M	$26M	$26M	$22M	$34M	$26M	$25M	$22M	$22M

Recap: Top Five Portfolios



2012$	P1	P2	P8	P9	P11
Capital	$260M	$140M	$180M	$360M	$300M
O&M per year	$21M	$53M	$34M	$26M	$22M

AGENDA

- Status and Progress Update
- **Recommended Portfolios**
- Implementation Planning for Recommended Portfolios
- Upcoming Public Meeting 4: Recommended Portfolios
- Action Items and Next Steps

Annual Average Day Source Use in 2060 (mgd)

Portfolio ID	Lake Thunderbird	Active Garber-Wellington Wells (with treatment)	Inactive Garber-Wellington Wells (with treatment)	New Garber-Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (co-owner)	Raw Water from Oklahoma City (co-owner)
P1	6.1	6.0	2.1	0	1.0	0.8	13.1			
P2	6.1	6.0	2.1		1.0	0.8		13.1		
P8	6.1				1.0		17.0	5.0		
P9	6.1	6.0	2.1	13.1	1.0	0.8				
P11	6.1	6.0	2.1		1.0	0.8			13.1	

Annual Average Day Source Use in 2060 (mgd)

Portfolio ID	Lake Thunderbird	Active Garber-Wellington Wells (with treatment)	Inactive Garber-Wellington Wells (with treatment)	New Garber-Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (co-owner)	Raw Water from Oklahoma City (co-owner)
P1	6.1	6.0	2.1	0	1.0	0.8	13.1			
P2	6.1	6.0	2.1		1.0	0.8		13.1		
P8	P8 Eliminated: Lowest Weighted Score among the Top 5									
P9	P9 Eliminated: Concerns with Heavy Reliance on Groundwater									
P11	P11 Modified to form New P13 (Raw Water from SE Oklahoma)									
NEW P13	6.1	6.0	2.1		1.0	0.8				13.1

Recommended Portfolios

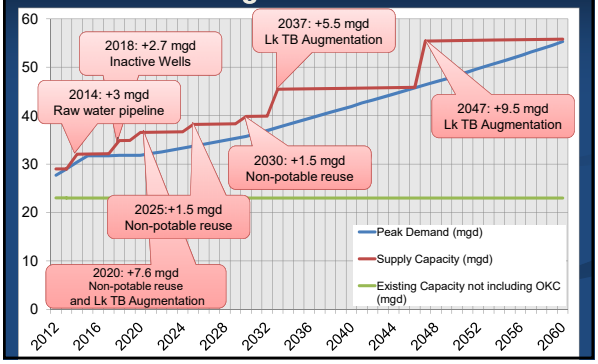
- All three have diverse supplies including:
  - Lake Thunderbird at reduced (firm) lake yield
  - Active & inactive existing wells with treatment
  - Additional conservation
  - Additional non-potable water reuse
- Meeting future growth in demand varies
  - P1: Lake Thunderbird Augmentation (indirect potable reuse)
  - P2: OKC Treated Water (wholesale customer)
  - P13: Raw Water from SE Okla. (co-owner)

AGENDA

- Status and Progress Update
- Recommended Portfolios
- **Implementation Planning for Recommended Portfolios**
- Upcoming Public Meeting 4: Recommended Portfolios
- Action Items and Next Steps

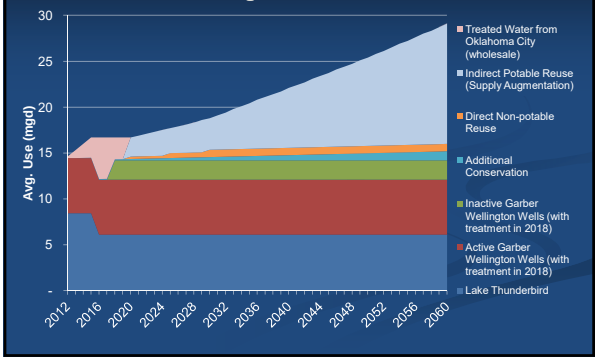
Phased Capacity Increases to Meet Growing Demand: Portfolio 1

PROVISIONAL VALUES SUBJECT TO CHANGE



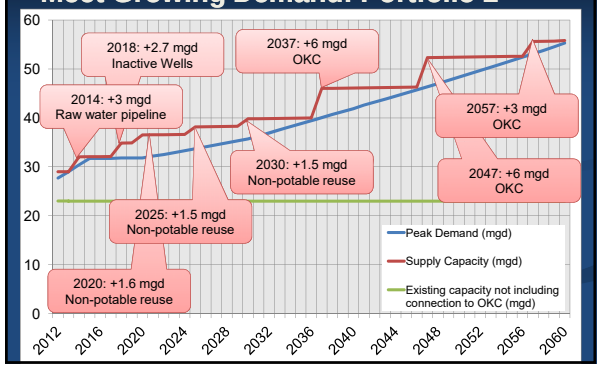
Phased Capacity Increases to Meet Growing Demand: Portfolio 1

PROVISIONAL VALUES SUBJECT TO CHANGE



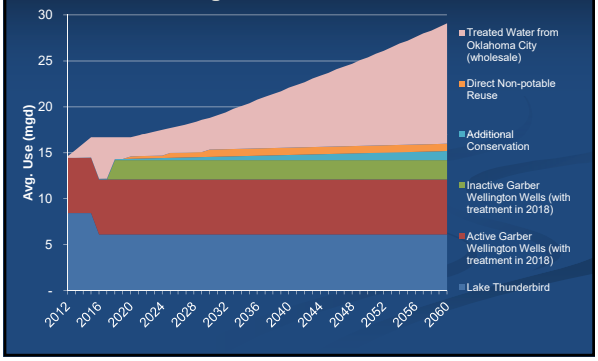
Phased Capacity Increases to Meet Growing Demand: Portfolio 2

PROVISIONAL VALUES SUBJECT TO CHANGE



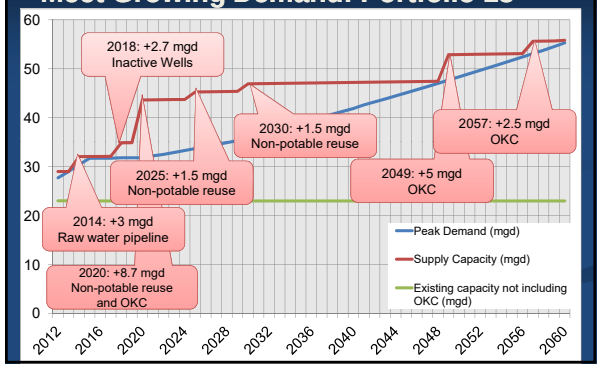
Phased Capacity Increases to Meet Growing Demand: Portfolio 2

PROVISIONAL VALUES SUBJECT TO CHANGE



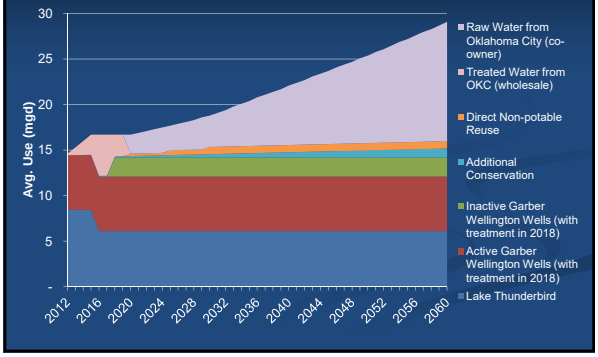
Phased Capacity Increases to Meet Growing Demand: Portfolio 13

PROVISIONAL VALUES SUBJECT TO CHANGE



Phased Capacity Increases to Meet Growing Demand: Portfolio 13

PROVISIONAL VALUES SUBJECT TO CHANGE

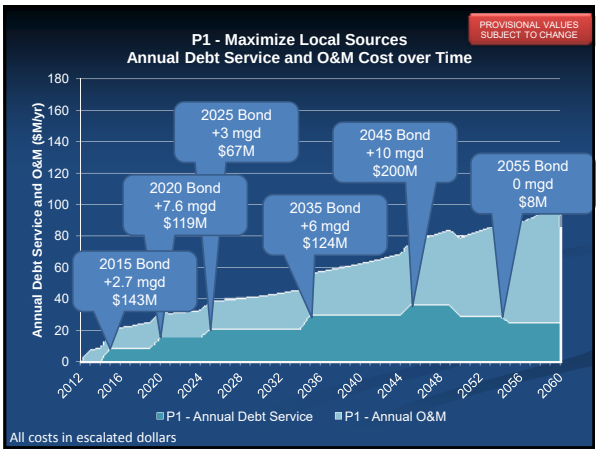


Comparison of Capital Costs

PROVISIONAL VALUES SUBJECT TO CHANGE

	P1: Lake Thunderbird Augmentation (IPR)	P2: OKC Treated Water (wholesale customer)	P13: Raw water from SE Oklahoma (co-owner)
Rehabilitation/Replacement of Existing Infrastructure (2012 $M) [1]	72.0	82.6	72.0
New Infrastructure Required for Capacity Increases (2012 $M)	176.0	81.1	273.9
New Infrastructure Improvements Required by Regulatory Changes (2012 $M) [2]	69.8	69.8	69.8
Rehabilitation/Replacement of New Infrastructure (2012 $M)	74.3	49.5	57.1
Total (2012 $M)	392.1	283.0	472.8
Total (escalated $M)	661.3	492.8	759.7

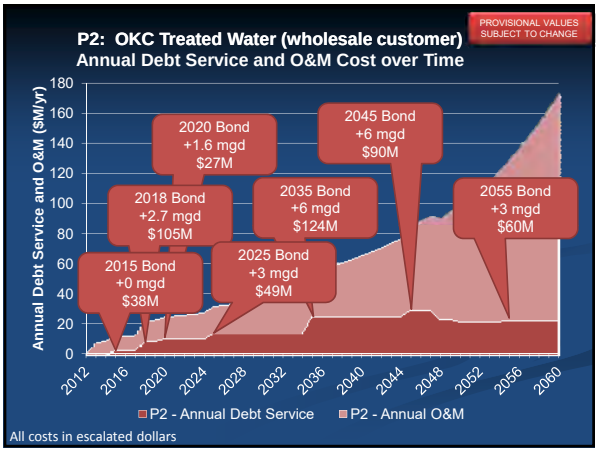
Notes:
1. Existing infrastructure includes Vernon Campbell WTP , raw water piping, and treated water connection to OKC.
2. Infrastructure required because of anticipated regulatory changes includes treatment for active Garber-Wellington Aquifer wells.



Bond Issuance – Portfolio 1

PROVISIONAL VALUES SUBJECT TO CHANGE

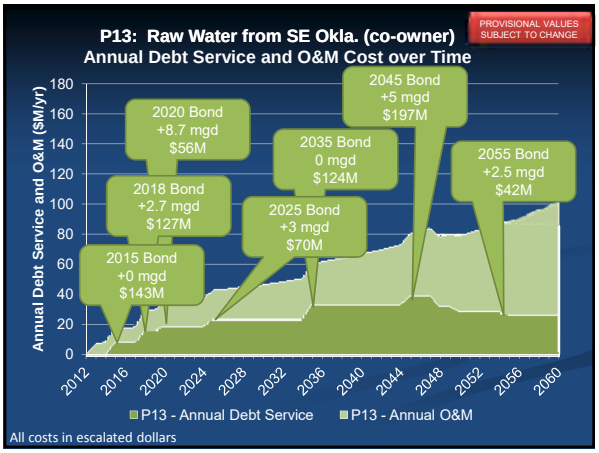
Bond Issue Year	Amount ($M escalated)	Capital Projects
2015	143	Lake Thunderbird - Existing WTP disinfection and clarifier rehab Garber-Wellington Wells – Treatment (active and inactive wells) OKC Wholesale – 2nd connection
2020	119	Lk TB Augmentation – intake rehab Non-potable Reuse – Treatment and 1/3 transmission network Lk TB Augmentation – 4 mgd WRF and 6 mgd WTP and transmission system
2025	67	Non-potable Reuse – Remainder of transmission network, storage tank rehab Lk TB Augmentation – Treatment expansion to 8.5 mgd WRF and 18 mgd WTP
2035	124	Lake Thunderbird – Existing WTP rehab Non-potable Reuse – Storage tank rehab Garber-Wellington Wells – Treatment rehab
2045	200	Non-potable Reuse – Treatment rehab Lk TB Augmentation - Treatment expansion and rehab to 13.5 mgd WRF and 25 mgd WTP Non-potable Reuse – Storage tank rehab
2055	8	Non-potable Reuse – Storage tank rehab



Bond Issuance – Portfolio 2

PROVISIONAL VALUES SUBJECT TO CHANGE

Bond Issue Year	Amount ($M escalated)	Capital Projects
2015	38	Lake Thunderbird - Existing WTP disinfection OKC Wholesale – 2nd connection
2018	105	Lake Thunderbird - Existing WTP clarifier rehab Garber-Wellington Wells – Treatment (active and inactive wells)
2020	27	Lake Thunderbird – intake rehab Non-potable Reuse – Treatment and 1/3 transmission network
2025	49	Non-potable Reuse – Remainder of transmission network, storage tank rehab OKC Wholesale – Rehab connection
2035	124	Lake Thunderbird – Existing WTP rehab Garber-Wellington Wells – Treatment rehab Non-potable Reuse – Storage tank rehab
2045	90	Non-potable Reuse – Treatment rehab OKC Wholesale – 3rd connection
2055	60	Non-potable Reuse – Storage tank rehab OKC Wholesale – 4th connection



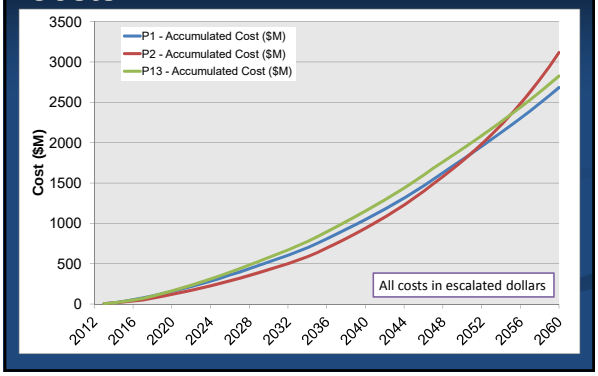
Bond Issuance – Portfolio 13

PROVISIONAL VALUES SUBJECT TO CHANGE

Bond Issue Year	Amount ($M escalated)	Capital Projects
2015	143	Lake Thunderbird - Existing WTP disinfection improvements OKC Wholesale – 2nd connection OKC Co-owner – Debt for Atoka transmission system
2018	127	Lake Thunderbird - Existing WTP clarifier rehab Garber-Wellington Wells – Treatment (active and inactive wells) OKC Co-owner – Connection from Atoka pipe to Norman
2020	56	Lake Thunderbird – intake rehab Non-potable Reuse – Treatment and 1/3 transmission network OKC Co-owner – Treatment (13.1 mgd)
2025	70	Non-potable Reuse – Remainder of transmission network, storage tank rehab OKC Co-owner – Debt for Moyers to Atoka transmission system
2035	124	Lake Thunderbird – Existing WTP rehab Garber-Wellington Wells – Treatment rehab Non-potable Reuse – Storage tank rehab
2045	197	Non-potable Reuse – Treatment rehab OKC Co-owner – Terminal storage reservoir, Treatment rehab and expansion to 18.5 mgd
2055	42	Non-potable Reuse – Storage tank rehab OKC Co-owner – Treatment expansion to 23.5 mgd

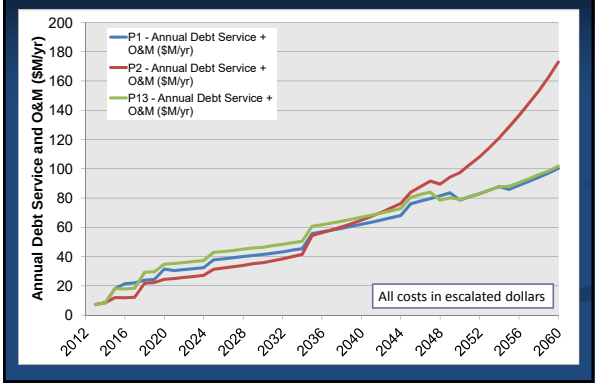
Comparison of Cumulative Costs

PROVISIONAL VALUES SUBJECT TO CHANGE



Comparison of Annual Costs

PROVISIONAL VALUES SUBJECT TO CHANGE



Key Supply Timing Assumptions

- 2014: First full year of operation for expanded (to 17 mgd) raw water supply capacity to existing WTP
- 2016: Norman's allocation of Lake Thunderbird yield will be reduced to 6.1 mgd
- 2018: Cr6 regulations become effective, requiring GW treatment
- By 2020: Lake Thunderbird Augmentation with effluent can be permitted and constructed
- Existing inactive wells (arsenic) will be brought back online and treated in same year that Cr6 regulations become effective
- Additional conservation measures/ programs will be increasingly implemented by Norman and adopted by public at a steady rate
- Additional direct non-potable reuse implemented in 3 equal phases (2020, 2025, 2030), serving only south Norman nonpotable sites
- Lake Thunderbird Augmentation (P1) and OKC supplies (P2/P13) expanded over time as needed to meet increased peak demand

Key Phasing and Costing Assumptions

- Costs developed in 2012 dollars and escalated at 3%/year (except OKC wholesale rates escalated at 6%)
- Capital Projects
  - New projects come online just before capacity is needed
  - Treatment, intake, and pumping infrastructure rehabilitated every 25 years
  - Storage tanks rehabilitated every 10 years
- Operation & Maintenance and Annual Costs
  - One well per year is rehabilitated/replaced
  - 1.3% of pipeline is rehabilitated each year (75 year life)
  - Treatment O&M includes both fixed costs and costs that vary based on amount of water treated
- O&M and Annual Costs (cont.)
  - P1 uses Demand Service rates for OKC wholesale
  - P2 uses Demand Service rates through 2015, then switches to Take or Pay rates for OKC wholesale
  - P13 uses Demand Service rates through 2015, then switches to Take or Pay rates until 2019
- Debt Service on Capital
  - Bonds issued for 100% of capital and can cover multiple projects
  - Bond interest rate of 4% (present to 2024) or 6% (from 2025 on)
  - 30-year term
  - 1% cost of issuance

Key Attributes of Recommended Portfolios

P1: Thunderbird Augmentation

- Discharge permitting uncertainties
- Efficient use of water resources
- Greater phasing potential than P2 or P13

P2: OKC Treated Wholesale

- Low capital
- Low near-term costs
- Fewer capital projects and simpler operations for Norman
- High long-term costs
- Contingent on OKC projects

P13: SE Okla. Raw Water

- Local control over treatment
- Higher near-term costs than P2 but lower long-term costs
- Contingent on OKC projects

AGENDA
Status and Progress Update
Recommended Portfolios
Implementation Planning for Recommended Portfolios
Upcoming Public Meeting 4: Recommended Portfolios
Action Items and Next Steps

Strategic Water Supply Plan Ad Hoc Committee Meeting #6
Minutes
May 23, 2013
Multi-Purpose Room

Attendance

Ad Hoc Committee Members: Amanda Nairn, Andy Sherrer, Curtis McCarty, Jim Gasaway, Judith Wilkins, Lynne Miller, Mike Pullin, Roger Frech, Sandy Bahan, Stephen Tyler Holman

Councilmembers: Mayor Rosenthal, Robert Castleberry, Roger Gallagher

Public: Greg Heiple

Consultants: John Rehring and Amber Wooten with Carollo Engineers

Staff: Ken Komiske, Mark Daniels, Chris Mattingly, Charlie Thomas, Debbie Smith, Anthony Francisco, Gay Webb

Presentation

Mr. Komiske thanked Committee members for their input in the Strategic Water Supply Plan process to date and announced the fourth public meeting will be scheduled for some time in June.

Mr. Rehring, Carollo Engineers, recapped the twelve portfolios evaluated and described the top five. After further evaluation, Portfolio 8 was eliminated due to lowest weighted score among the top 5; Portfolio 9 was eliminated due to concerns with heavy reliance on groundwater and Portfolio 11 was modified to form a new Portfolio 13 to utilize raw water from Southeast Oklahoma with treatment at Norman facilities. The top three portfolios include:

- Portfolio 1 (P1) – a diverse portfolio that maximized local sources
  - Lake Thunderbird firm yield (6.1 mgd)
  - Existing wells treated (8.1 mgd)
  - Additional conservation (1 mgd)
  - Direct non-potable reuse (0.8 mgd)
  - Lake Thunderbird augmentation (13.1 mgd)

- Portfolio 2 (P2) - minimizes capital cost
  - Lake Thunderbird firm yield (6.1 mgd)
  - Existing wells treated (8.1 mgd)
  - Additional conservation (1 mgd)
  - Direct non-potable reuse (0.8 mgd)
  - Treated water from Oklahoma City (wholesale) (13.1 mgd)

- Portfolio 13 (P13) - a diverse portfolio with co-ownership in southeast Oklahoma Raw Water System
  - Lake Thunderbird firm yield (6.1 mgd)
  - Existing wells treated (8.1 mgd)
  - Additional conservation (1 mgd)
  - Direct non-potable reuse (.8 mgd)
  - Raw water from Oklahoma City (co-owner) (13.1 mgd)

Portfolio 1 has been modified slightly to eliminate new groundwater wells with an increase in supply from Lake Thunderbird augmentation (i.e., indirect potable reuse, IPR). Previously, new wells had been used to "bridge the gap" in supply until IPR could be brought online. However, continued use of Oklahoma City water in the interim can serve that purpose.

Portfolios 2 and 13 both look at long-term supply from Oklahoma City. In Portfolio 2, Oklahoma City finances capital investment and Norman is their wholesale customer. In Portfolio 13, Norman is a co-owner with Oklahoma City for capital infrastructure. Norman would finance their portion of the capital costs. Oklahoma City staff has indicated a strong preference for Norman being a co-owner in infrastructure.

All three recommended portfolios include: Lake Thunderbird at reduced firm lake yield, active and inactive existing wells with treatment, additional conservation, and additional non-potable water reuse. Each portfolio has strengths and weaknesses. Mr. Rehring discussed implementation timing, phasing and capital financing of the portfolios.

Questions

Mr. Rehring and Mr. Komiske responded to the following questions.

- Where would raw water be stored? Mr. Rehring responded it would be sent to Lake Stanley Draper and we would draw it to the new treatment plant.

- Can we treat water at a lower rate? Mr. Komiske replied we produce water cheaper than Oklahoma City does right now.

- Do you have a preferred method of financing any of the three portfolios? Mr. Francisco replied that would be a policy decision.

- How confident are you about the 6.1 mgd yield? Mr. Rehring stated the firm yield calculated by the Bureau of Reclamation assumes 100 years of siltation. The end of this period will occur in the mid-2060's. At that point, some rehabilitation costs can be expected. However, with what we know now, Norman's portion of the lake's firm yield is not expected to decrease within the current planning period.

- Have you looked at financing options? Mr. Rehring replied we have now grouped them into bond packages in 10 year increments.

- Reuse is a great option; do we have a timeline for political approval? Mr. Komiske responded we looked at initiating it in 2020. When we have regulatory clarity it could push certain things back. Mr. Rehring responded we think 2018 is a reasonable estimate for state regulations.

- Will we get a larger allotment if we augment Lake Thunderbird? Mr. Rehring replied yes, but we will have to work through the process.

- What about future siltation reducing water in 2060? Mr. Rehring answered yield calculations include 100 years of siltation already built into life of lake. Something will need to be done in 2060 or when it does reach its design life. At that point tough decisions will need to be made, possibly remove material or add to dam height.

- Can we guarantee water from Oklahoma City or will it only be given, if available. Mr. Rehring answered it would need to be written into agreement. Under the current contract between Norman and Oklahoma City, water is used "as needed" on an emergency basis – basically, treated water from Oklahoma City is used to meet a portion of Norman's demands on the highest peak summer demand days. Under P2 and in the near term for P1 and P13, it is recommended that Norman switch to a different rate structure for wholesale water purchase. This results in a lower unit cost but requires a more constant water use pattern. (Norman would have to switch from using Oklahoma City water only when needed to meet Norman's peak day demands to using Oklahoma City water regularly to meet a portion of Norman's base water demand. Peak day demands would be met using local sources along with water from Oklahoma City.)

- When will 10% water reduction be lifted by Central Oklahoma Master Conservancy District (COMCD)? It is unknown when this reduction will be removed; however, COMCD is expected to discuss this at their next meeting at the end of May.

- Can we share treatment plant with Moore? This could be future consideration, but at this point, Moore purchases its water from Oklahoma City, therefore Moore has little interest in funding and building a new water treatment plant. However, this is a question to be discussed with Moore, should the interest arise.

- Can we be a customer of Oklahoma City and have other customers ourselves? The current SWSP does not include Norman supplying any wholesale customers, such as other cities or communities.

Comment made that issuing multiple bonds rather than one big bond seems to be the best financial approach to addressing the water needs through 2060.

Members recommended highlighting that the City of Norman cannot meet even its current water demands using only local sources, even in a normal year (i.e., one without Lake Thunderbird supply cut-backs). Norman is not just buying Oklahoma City water because of the current drought. Norman loses money on water purchased from Oklahoma City (because Norman's rates are less than what is paid for Oklahoma City water).

Members suggested including additional groundwater in the interim to meet short-term water demands.

Members recommended defining portfolios at the beginning and end of the public meeting presentation.

Mr. Komiske thanked the Committee members for giving of their time and effort in this important planning process. Questions and comments from the meeting today will be incorporated into the upcoming public meeting.

The meeting adjourned at 1:25 p.m.

APPENDIX Y – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #7

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #7
12 noon, July 16, 2013
Study Session Room, City Hall
201 W. Gray

- Introduction and Goals for Ad Hoc Committee Meeting #7

- Status and Progress Update
  - Recap of Last Ad Hoc
  - Feedback received on top three portfolios: New Portfolio 14

- Recommended Portfolios
  - Portfolio 1: Diverse portfolio that maximizes use of local supplies, including Lake Thunderbird augmentation
  - Portfolio 13: Diverse portfolio including regional raw water as co-owner with Oklahoma City
  - Portfolio 14: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation and new groundwater wells

- Implementation Planning for Recommended Portfolios
  - Basis for implementation timing, phasing, and capital financing
  - Comparison of long-term capital financing and annual costs for the recommended portfolios

- Path Forward for 2060 SWSP
  - Public Meeting 4 at 6:30 pm this evening: Recommended Portfolios
  - Future SWSP and Ad Hoc Committee Activities

Norman Utilities Authority
2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting
July 16, 2013

AGENDA

- **Status and Progress Update**
- Recommended Portfolios
- Implementation Planning for Recommended Portfolios
- Path Forward

Project Overview and Update on Progress

Public Meeting 1 (June 2012)	Basis of Planning - Demand, supply options, and evaluation criteria
Public Meeting 2 (October 2012)	Phase 1 – Individual Water Supply Options
Public Meeting 3 (March 2013)	Phase 2 (part A) – Future Water Supply Portfolios - Evaluation of initial supply portfolios
Public Meeting 4 (Tonight)	Phase 2 (part B) – Future Water Supply Portfolios - Evaluation of revised portfolios

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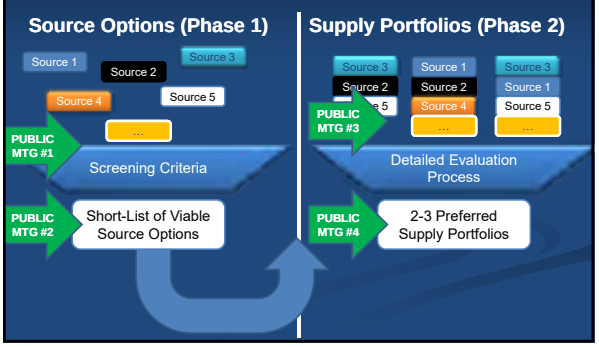
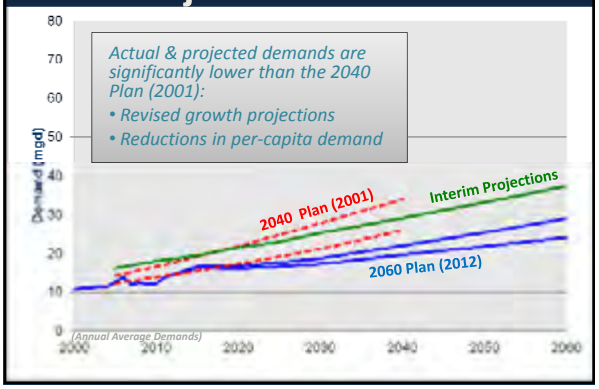
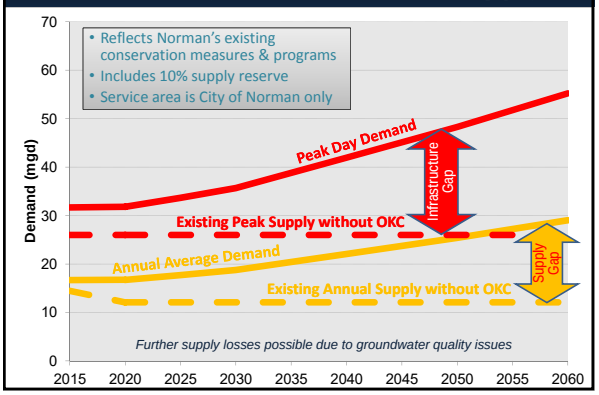
SWSP Planning Process



Projected Water Use



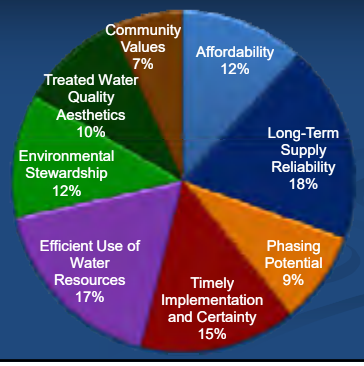
Use Already Exceeds Local Supply



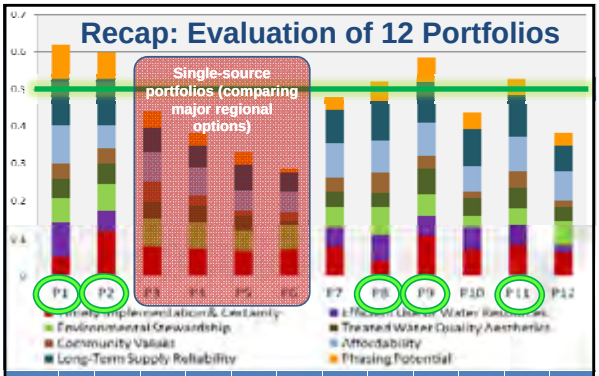
Portfolio ID	Lake Thunderbird	Active Garber Wellington Wells (with treatment)	Inactive Garber Wellington Wells (with treatment)	New Garber Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (co-owner)	Raw Water from Oklahoma City (co-owner)	New Out of Basin Reservoir (Parker or Scissortail)	Kaw Lake
P1	6.1	6.0	2.1	0.7	1.0	0.8	12.4					
P2	6.1	6.0	2.1		1.0	0.8		13.1				
P3									29.1			
P4										29.1		
P5											29.1	
P6												29.1
P7	6.1				1.0	0.8			21.2			
P8	6.1				1.0		17.0	5.0				
P9	6.1	6.0	2.1	13.1	1.0	0.8						
P10	6.1	6.0	2.1		1.0	0.8					13.1	
P11	6.1	6.0	2.1		1.0	0.8			13.1			
P12	6.1				1.0						22.0	

2060 Annual Average Daily Supply (mgd)

Criteria and Their Relative Importance or "Weight" in Comparing Portfolios



Recap: Evaluation of 12 Portfolios



2012$	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Capital	$250M	$140M	$410M	$440M	$620M	$620M	$320M	$180M	$330M	$490M	$300M	$430M
O&M per year	$21M	$53M	$24M	$24M	$26M	$26M	$22M	$34M	$24M	$25M	$22M	$22M

Top 5 Portfolios for Meeting our Objectives

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City
P1 Max Local	6	8		2	13	
P2 Low Capital	6	8		2		13 W T
Ma[illegible]						W T
P9 Max Groundwater	6	8	13	2		
P11 Regional OKC	6	8		2		13 O T

P8 Eliminated: Impractical to Completely Eliminate Groundwater

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

Portfolios that use significant regional supplies

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City
[illegible]						W T
[illegible]						O T
NEW P13 Regional OKC	6	8		2		13 O R

P2 Eliminated: High annual costs, lacks benefits of co-ownership

P11 Modified to form New P13 (Regional Raw Water, co-owner w/OKC)

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

Portfolios that focus on use of local sources

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City
P1 Max Local	6	8		2	13	
Ma[illegible]						
NEW P14 Wells + TBird Aug.	6	8	2	2	11	

P9 Eliminated: Concerns with Excess Reliance on Groundwater

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

AGENDA

- Status and Progress Update
- **Recommended Portfolios**
- Implementation Planning for Recommended Portfolios
- Path Forward

Recommended Portfolios that Best Meet our Objectives

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City	Capital and O&M Costs (2012$)
P1 Max Local	6	8		2	13		$250M $21M/yr
P13 Regional OKC	6	8		2		13 O R	$340M $23M/yr
P14 Wells + TBird Aug.	6	8	2	2	11		$270M $22M/yr

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

Recommended Portfolios

- All three have diverse supplies including:
  - Lake Thunderbird at reduced (firm) lake yield
  - Active & inactive existing wells with treatment
  - Additional conservation
  - Additional non-potable water reuse
- Meeting future growth in demand varies
  - P1: Lake Thunderbird Augmentation
  - P13: Regional Raw Water (co-owner with OKC)
  - P14: New Wells & Lake Thunderbird Augment'n

Key Attributes of Recommended Portfolios

P1: Thunderbird Augmentation

- Discharge permitting uncertainties
- Efficient use of water resources
- Greater phasing potential than P13

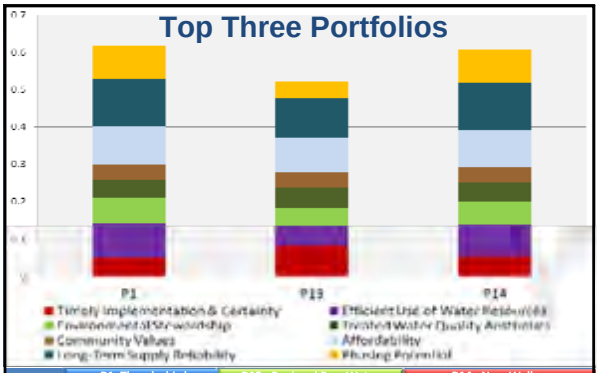
P13: Regional Raw Water (co-owner with OKC)

- Local control over treatment
- Contingent on OKC projects

P14: New Wells and Thunderbird Augmentation

- Local control over sources
- Discharge permitting uncertainties
- Efficient use of water resources
- Greater phasing potential than P1

Top Three Portfolios

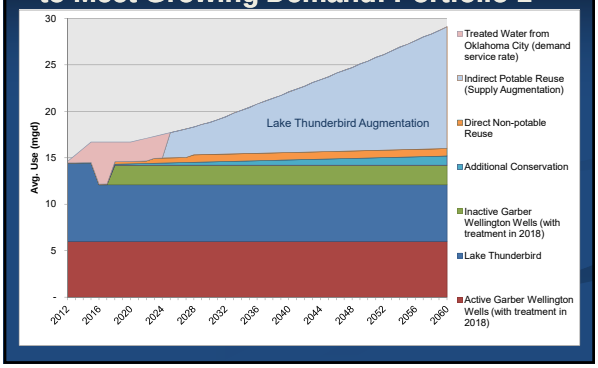


2012$	P1: Thunderbird Augmentation	P13: Regional Raw Water (co-owner with OKC)	P14: New Wells + Thunderbird Augmentation
Capital	$250M	$340M	$270M
O&M	$21M/yr	$23M/yr	$22M/yr

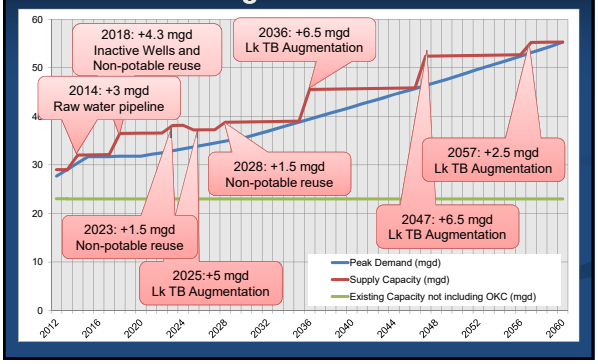
AGENDA

- Status and Progress Update
- Recommended Portfolios
- **Implementation Planning for Recommended Portfolios**
- Path Forward

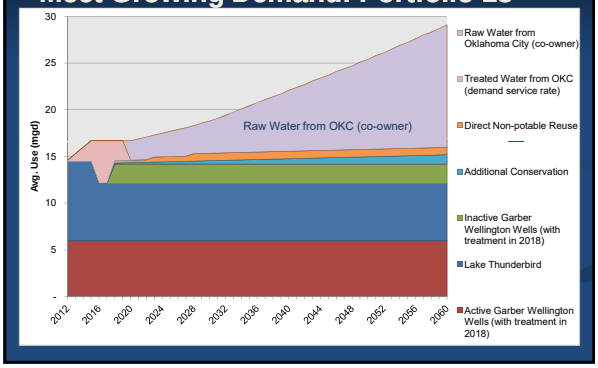
Phased Capacity Increases to Meet Growing Demand: Portfolio 1



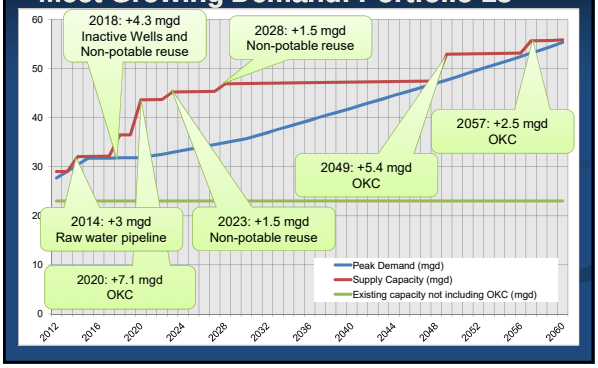
Phased Capacity Increases to Meet Growing Demand: Portfolio 1



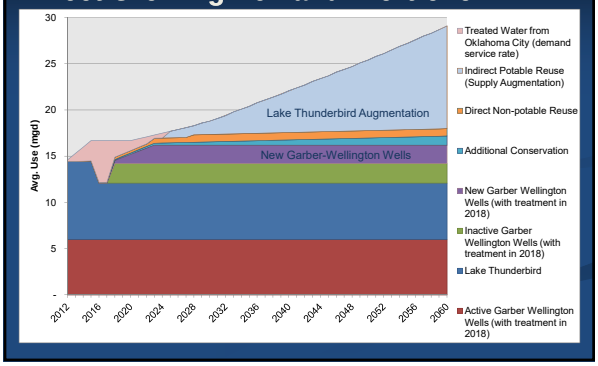
Phased Capacity Increases to Meet Growing Demand: Portfolio 13



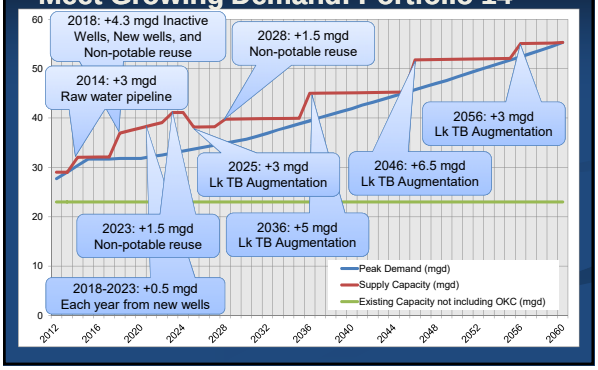
Phased Capacity Increases to Meet Growing Demand: Portfolio 13



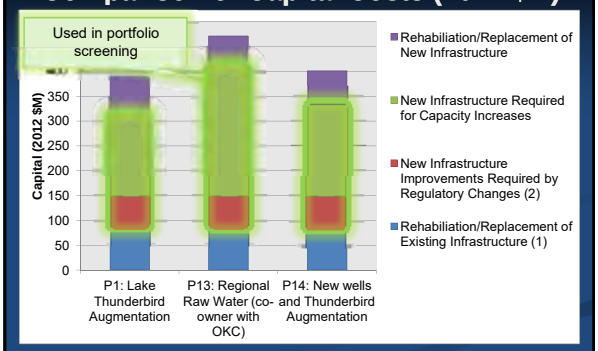
Phased Capacity Increases to Meet Growing Demand: Portfolio 14



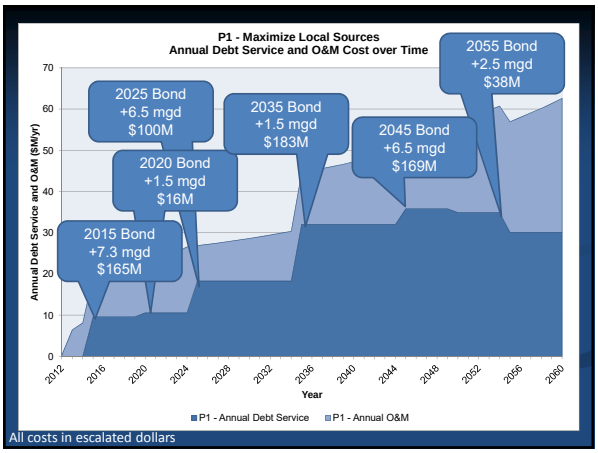
Phased Capacity Increases to Meet Growing Demand: Portfolio 14



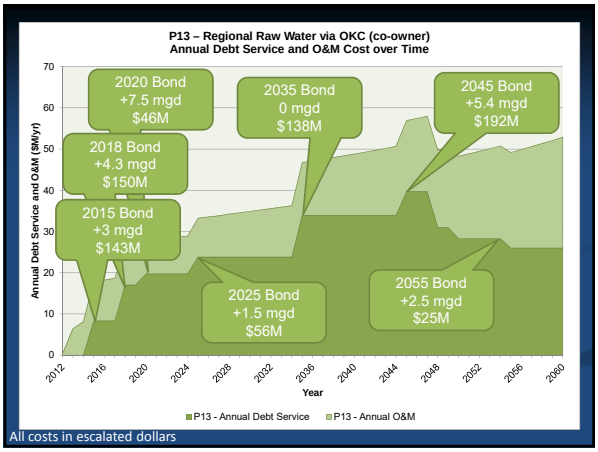
Comparison of Capital Costs (2012 $M)



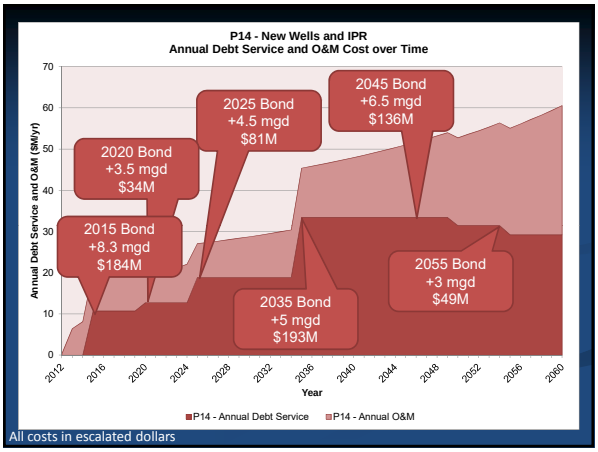
Notes:
1. Existing infrastructure includes Vernon Campbell WTP, raw water piping, and treated water connection to OKC.
2. Infrastructure required because of anticipated regulatory changes includes treatment for active Garber-Wellington Aquifer wells.



All costs in escalated dollars

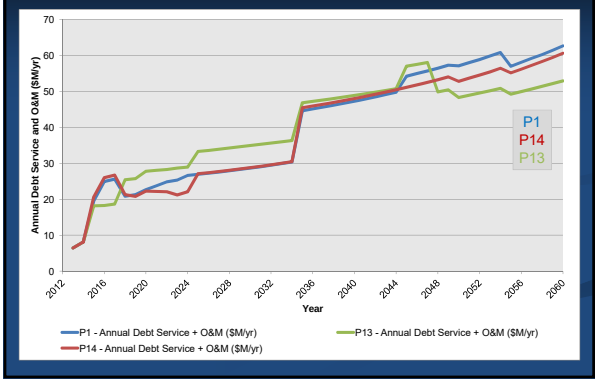


All costs in escalated dollars



All costs in escalated dollars

Comparison of Annual Costs



Key Attributes of Recommended Portfolios

P1: Thunderbird Augmentation	P13: Regional Raw Water (co-owner with OKC)	P14: New Wells and Thunderbird Augmentation
▪ Discharge permitting uncertainties ▪ Efficient use of water resources ▪ Greater phasing potential than P13	▪ Local control over treatment ▪ Contingent on OKC projects	▪ Local control over sources ▪ Discharge permitting uncertainties ▪ Efficient use of water resources ▪ Greater phasing potential than P1

AGENDA
Status and Progress Update
Recommended Portfolios
Implementation Planning for Recommended Portfolios
Path Forward

Norman Utilities Authority

2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting
July 16, 2013

Strategic Water Supply Plan Ad Hoc Committee Meeting #7
Minutes
July 16, 2013
Study Session Room

Attendees

- Presenters: John Rehring and Amber Wooten, Carollo
- Councilmembers: Mayor Rosenthal, Castleberry, Miller
- Ad Hoc Committee Members: Amanda Nairn, Andy Sherrer, Jim Gasaway, Judith Wilkins, Lynne Miller, Matthew Leal, Mike Pullin, Roger Frech, Sandy Bahan
- Public: Jacy Crosbie, Steve Ellis, Roger Gallagher, Howard Haines, Fred Pope, Cindy Rogers,
- Staff: Ken Komiske, Mark Daniels, Terry Floyd, Bryan Hapke, Chris Mattingly, Debbie Smith, Charlie Thomas, Gay Webb

Mr. Komiske welcomed the Ad Hoc Committee members and thanked them for attending. He announced tonight's public meeting will cover the same information but provide some additional details.

Status and Project Update

Mr. Rehring thanked members for attending and explained the presentation today will provide a progress update, recommended portfolios, implementation planning for recommended portfolios and the path forward. Mr. Rehring discussed Phase 1 and 2 of the planning process and noted changes made since the last Ad Hoc meeting. Some of the changes are cosmetic (example, how we presented components of portfolios now uses varying size circles). Portfolio 14 was created based on feedback received from City leaders. Graphical representation was added showing that Norman does not currently meet its annual or peak demands without using Oklahoma City water (wholesale), based on feedback received from staff and the Ad Hoc Committee.

Recommended Portfolios

After ranking the initial twelve portfolios against weighted criteria, the top five included:

P1- Maximize Local Sources
P2 - Low Capital
P8 - Maximize Lake Thunderbird Supplies
P9 - Maximize groundwater
P11 - Regional Oklahoma City of Norman

P2 was eliminated due to high annual costs and lacks benefits of co-ownership
P8 was eliminated because it was impractical to completely eliminate groundwater
P9 was eliminated due to concern with excess reliance on groundwater

P11 was modified to form P13 (Regional Raw Water via co-owner with Oklahoma City)
P14 was created to drill new wells and utilize augmentation

The recommended portfolios include, P1, P13 and P14. All three have portfolio supplies include:

- Lake Thunderbird at reduced (firm) lake yield
- Active and inactive existing wells with treatment
- Additional conservation
- Additional non-potable water reuse

The difference in the portfolios is reflected in how to meet future growth demands. Portfolio 1 utilizes Lake Thunderbird augmentation, Portfolio 13 uses Regional Raw Water (co-owner with Oklahoma City) and Portfolio 14 utilizes new wells and Lake Thunderbird augmentation.

Mr. Rehring explained how each of the portfolios could be phased in to meet growth demand and compared capital cost using 2012 dollars. All three portfolios have commonalities but tough decisions will need to be made when deciding which option to choose.

<u>Questions and Comments</u>

- Request made to mention at public meeting tonight that current expansion planned for the Water Reclamation Facility includes processes that will help facilitate treating water for future reuse. Mr. Rehring noted we have added some additional treatment in SWSP planning documents and costs (beyond what is anticipated to be required by regulations that will address Endocrine Disrupting Compounds) for all Lake Thunderbird augmentation projects. This represents a higher level of wastewater treatment than Central Oklahoma Master Conservancy District (COMCD) evaluated in its 2012 study of lake augmentation options.

- Comment made that the COMCD Board would prefer that Norman not remove Parker Reservoir from further consideration. The Board liked the yield of 41 mgd from Parker; it would provide a buffer for meeting possible participants' needs beyond 2060. With low levels in Lake Thunderbird, COMCD realizes needs for short, mid and long-term solutions. Parker is not a short term solution. The COMCD Board is tasked with serving member cities; between now and 2060, that means the Board is tasked with Norman's growing demands. It is also noted that Parker Reservoir costs may be lower than estimated in SWSP analyses. Mr. Rehring responded that we looked at a number of different sources – all of which could help us meet our long-term needs. There are no technical red flags to any of the source options or portfolios. It is about making decisions on how best to meet needs. The portfolios that included out-of-basin reservoirs (Scissortail and Parker) did not score as well. It does not mean these reservoirs could not work, but they did not score as well as others based on what we have decided was most

important. For example, Portfolio 10 (which contains use of Parker Reservoir at 13.1 mgd) did not do as well on phasing, costing, and not as well as others on environmental stewardship. The decision to screen P10 from further consideration was not simply based on costs. Moreover, Parker Reservoir could be part of a longer-term plan for Norman and could be reconsidered in future SWSP updates.

- Midwest City and Del City have raised concerns about pharmaceuticals being discharged into Lake Thunderbird as part of the Lake Thunderbird augmentation project. Glad we have addressed those concerns.

- For the Lake Thunderbird augmentation projects, do they assume the build out of the Wastewater Master Plan or are there different costs if there are multiple Water Reclamation Facilities in service? Mr. Rehring answered right now, it is similar to what was shown in COMCD (treatment improvements at existing WRF and pumping up and over ridge to then flow by gravity into Lake Thunderbird). If a North WRF were built, costs for portfolios that include Lake Thunderbird augmentation could potentially be reduced somewhat, as flow could be transported by gravity (no pumping).

- If this is the last Ad Hoc Committee meeting, how do we move forward? What if the public votes down future bond issuances? Mr. Rehring answered from a technical point of view, all of these portfolios require significant capital, and a significant portion of the costs is associated with rehabilitation and replacement of existing infrastructure to maintain current capacity. Practically, if the community does not approve spending capital dollars, the fall back supply is for Norman to continue to buy water from Oklahoma City as a wholesale customer. Mr. Komiske stated this project's purpose was to evaluate supply portfolios and recommend two or three of the portfolios. Now City staff will meet with City leaders and citizens and make decisions about how we, as a community, want to meet our long-term water demands. The City could hire someone to drill down into the three recommended portfolios but ultimately the City Council must select one portfolio. We have to keep moving forward as we are already unable to consistently meet our demands with local supplies. Mayor Rosenthal said next step is to generate discussion within the community and make a decision about where the community wants to go: partnership, do our own thing, etc. We need to be prepared to have a bond issue by 2015 (regardless of portfolio selected). If the City selects Portfolio 13 (co-owner with Oklahoma City), then participation in another large water supply project (like Parker) may be off the table. However, if Portfolios 1 or 14 are selected, then we may still choose to participate in a large, longer-term water supply project.

- How do we build in enough flexibility for future changes? We need to be able to back out if we need to. Many people are nervous about being in partnership with Oklahoma City. If we go into partnership with Oklahoma City, we will build

another pipeline, right? Mr. Komiske responded yes, Oklahoma City is currently using about 90% of the capacity in the existing Atoka pipeline. Oklahoma City would be happy to talk to us about how the partnership would work. They have a trust, and we would buy into that trust. We would not buy a specific pump or a specific section of pipe; we would buy into whole project (using capital dollars). Norman would own capacity in pipeline (which can be sold or traded in future). Norman may have specific ownership of water rights.

- How far out are we from having reuse regulations? P1 and P14 rely on indirect potable reuse (IPR), which is not currently legal in Oklahoma. Mr. Komiske responded we think realistically we can do indirect potable reuse within five years. We are working with Oklahoma Department of Environmental Quality (ODEQ) to develop a flow chart for regulatory development/administration. Right now the hard part is that ODEQ has not established a clear path forward. The flow chart is being developed, with ODEQ input, to provide that path.

- Right now, it is not legal to have an out-of-basin discharge into Lake Thunderbird. Does this have to change too? Federal legislation was approved last year to allow non-native water to be brought into Lake Thunderbird. In addition, COMCD would have to approve such use of the lake. City staff reported that the Bureau of Reclamation supports reuse (we are currently withdrawing water from Lake Thunderbird and discharging to the Canadian River, a reuse project will withdraw water from Lake Thunderbird and return the reuse water to Lake Thunderbird) and have given us their verbal support.

- Did we talk about contract to buy Del City's unused allocation from Lake Thunderbird? Mayor Rosenthal responded yes, we have a contract now, however this supply is not guaranteed. Del City can say no.

- COMCD requested a 10% reduction in water allocation from Lake Thunderbird. Did our water allocation go back up to the approved amount since the Lake is full? Mr. Komiske answered yes.

- If we augment the Lake, will our allocation increase? Mayor Rosenthal responded that will have to be negotiated.

- The Corps of Engineers recently allowed the Lake Thunderbird water elevation to be slightly above conservation pool. Can we continue to use more storage in the lake? Mr. Rehring replied reallocation of storage on a permanent basis is a lengthy federal permitting process with no guarantee of approval.

- Can you mention tonight at the public meeting why a second reservoir in Norman is not an option? Mr. Rehring responded to get a significant amount of water you need a site that has its own drainage basin. There are several sites around the state that have been studied (Parker and Scissortail are the closest). Nearby sites

with significant yield are just not there – sites that are viable were identified in the 2012 Update to the Oklahoma Comprehensive Water Plan.

- What is DEQs definition of reclaimed water? Mr. Komiske answered Category 5 requires the least amount of treatment and is most limited on its use. Category 2 allows reclaimed water to be used on playgrounds, ball fields, etc. Category 2 is the highest reuse allowed in the state currently. Category 1 is reserved for future regulation of indirect potable reuse (e.g., IPR, reclaimed water being placed into a reservoir).

- Do we have to get member city's permissions for using Lake Thunderbird to store reclaimed water? Yes. There is some advantage of blending the different water qualities and using Lake Thunderbird as an environmental buffer, although you could do this in a new terminal facility or in the raw water pipe leading to the water treatment plant.

- Comment made that a new terminal storage facility for supply augmentation with treated effluent would get us out of negotiations with Del City and Midwest City, but we would still have to negotiate with ODEQ. A new terminal facility would remove concerns about Lake Thunderbird being a sensitive water supply source.

The meeting adjourned at 1:20 p.m.

Items submitted for the record:

1. PowerPoint presentation entitled, 2060 Strategic Water Supply Plan Ad Hoc Committee Meeting July 16, 2013

APPENDIX Z – PUBLIC PARTICIPATION – PUBLIC MEETING #1

Press Release: June 21, 2012

2060 Strategic Water Supply Plan

Public meeting to be held Monday June 25, 2012 from 7:00 pm to 9:00 pm at City Council Chambers, 201 W. Gray, Norman, Oklahoma

On June 25 at 7:00 pm, the City of Norman will be hosting the first in a series of public meetings to provide the public with information about the making of its 2060 Strategic Water Supply Plan (SWSP) and gather public input regarding key aspects of the plan.

The City of Norman is updating its plans for supplying long term water solutions to its customers. The SWSP builds on previous planning efforts discussing water demands, supply options, and infrastructure as well as significant new developments in water supply regulations, new technology and availability of water. Regulatory changes on drinking water quality affecting our local groundwater supplies, new limits on the amount of groundwater and Lake Thunderbird water Norman will be allowed to use, and evolving opportunities to increase water conservation and reuse in the community will also be discussed.

The City is evaluating a wide range of potential water supply sources and identifying those that will best meet the community's short and long-term needs. The long-term water supply "portfolio" for Norman will likely include a combination of existing sources and new sources. Sources that pass the initial screening criteria will be combined into portfolios for further evaluation in the second phase of the project.

Public input is being sought through meetings that will be held at key milestones throughout the development of the SWSP. An Ad Hoc committee has been appointed by City Council to help guide this planning process and enhance feedback and communications. The June 25 public meeting will include a presentation on the goals and drivers for water supply planning in Norman, a description of the local and regional supply sources under consideration, and a review of the criteria that will be used to evaluate and compare supply options. Meeting participants will have an opportunity to suggest additional supply options for potential consideration, and to provide feedback on the evaluation criteria and the relative importance of planning drivers. That input will be considered as the SWSP planning team moves forward with the screening evaluation. Preliminary results of the screening evaluation will be discussed at the second SWSP public meeting, tentatively scheduled for late summer 2012.

Norman Utilities Authority
2060 Strategic Water Supply Plan

Public Meeting #1
June 25, 2012

AGENDA
Water supply planning overview
Norman's existing water system
What water supply options are being considered?
How will we evaluate and compare the options?
What will we discuss at upcoming public meetings?
Feedback on supply options and evaluation criteria

Norman 2060 Strategic Water Supply Plan

The goal of the Plan is to strengthen our knowledge of short and long-term water supply source(s) and begin implementation of a robust, economical water supply solution acceptable to the citizens of Norman.

The NUA is currently unable to supply sufficient potable water to meet peak demands and is concerned about the effects of regulations and other drivers on our existing sources of supply.

Issues Facing Norman's Water Supply Future

- Current yield of Lake Thunderbird may be reduced
- Quality of Lake Thunderbird water
- Cost of supplemental water from OKC
- Permitted withdrawals from Garber-Wellington aquifer may be reduced by half or more
- Norman's population is increasing
- Based on expected demand, there may be a shortfall of over 20 mgd in 2060

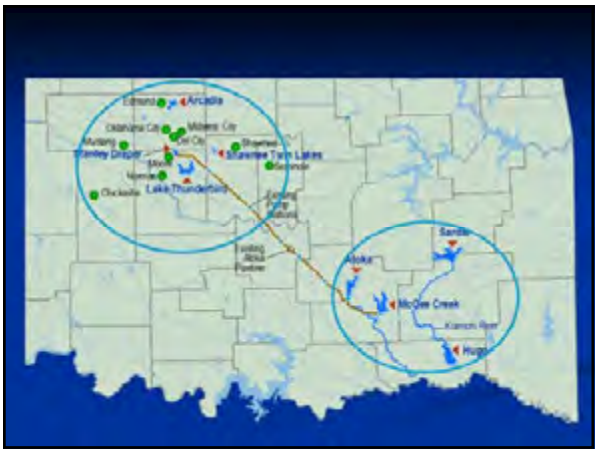
Previous Planning Provides a Solid Foundation & Key Data

- 1992 Master Water Plan
- 2001 NUA Strategic Water Supply Plan
- 2009 Regional Raw Water Supply Study for Central Oklahoma
- 2011 Norman Water Conservation Plan
- 2012 Oklahoma Comprehensive Water Plan
- Studies of Individual Water Supply Projects

- 2001 Recommended Plan
  - Expand Garber-Wellington Wellfield
  - Partner for SE Oklahoma Water Sources

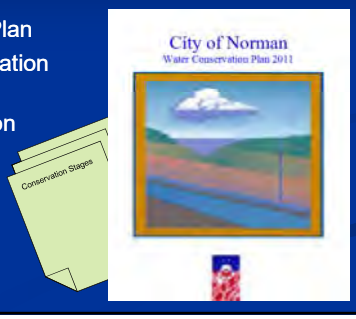
2009 Regional Raw Water Supply Study for Central Oklahoma

- 11 Cities in Central Oklahoma
- Quantity & quality from various SE Oklahoma sources
- Alternate diversion points & project costs
- Distribution of raw or treated water to cities



Water Conservation

- Updated Water Conservation Plan
- ECAB Conservation Research
- Public Education



Water Conservation: Existing Plan

- Metering Program 2000
- Plumbing fixtures 1997
- Leak Repair
- Education – newspaper, schools, etc.
- Reuse for golf course
- Water rates
  - inverted block 1999 rate
  - rate increase 2006

Water Conservation: Recent Additions

- Irrigation ordinances
- Odd/Even watering days
- Meter Replacement Program
- Water Reuse at the WWTP
- Griffin Park lake
- Westwood Golf Course
- Updates to City Ordinances
- Web sites and links

The Water Cycle

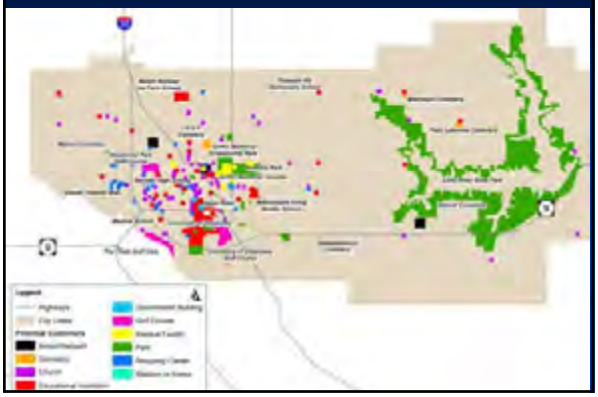
Continuous movement of water from ocean to air and land then back to the ocean, is as old as the earth itself.

The basic underlying principle is simple: *all water is recycled*.

There is no new water.

11+ MGD discharged to the Canadian River

Potential New Reuse Sites



Changes Since Norman's 2001 Water Supply Plan

- Arsenic Rule
- Chromium VI
- Additional Ground Water Rules
- Aquifer Yield
- Lake Thunderbird Safe Yield
- Reuse Regulations
- Conservation Successes
- Technological Improvements
- Partnering Opportunities / Regional Projects

Water Planners Speak a Different Language…

- Water Use Types
  - Municipal & Industrial (Public Water Supply)
  - Potable vs. Non-potable
  - Service area vs. domestic wells

All the water uses connected to the municipal system – Residential, Commercial, Industrial, Irrigation, Firefighting…

- Measurement
  - acre-foot
  - acre-feet per year (AFY)
  - million gallons per day (mgd)
  - gallons per capita per day (gpcd)

1 acre-foot = 325,851 gallons

2011 Norman use:
- 15,400 AFY
- 13.9 mgd on average
- 23.9 mgd peak day (Aug. 5, 2011)

Per-capita use includes residential AND industrial AND commercial

SWSP Ad Hoc Committee

- Ensure open and two-way dialogue between the project and the community
- Make sure the project continues on track and on schedule
- Ensure the options and suggestions of the public for potential water supplies are addressed
- Assist in evaluating non-monetary criteria for potential water supply sources
- Understand and be able to communicate the objectives and conclusions of the Strategic Water Supply Plan to the public

AGENDA
Water supply planning overview
Norman's existing water system
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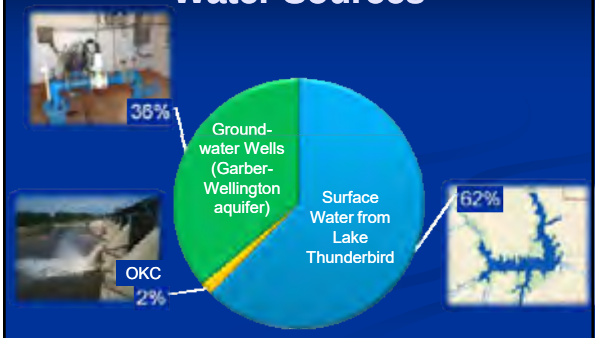
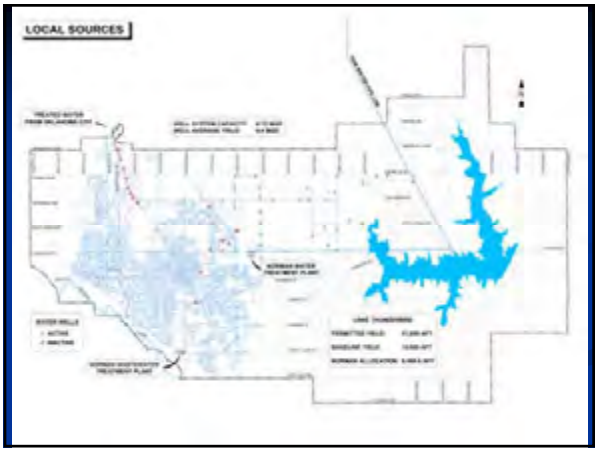
Water Enterprise Fund

- Over 5 billion gallons produced each year
- 24/7 365 days a year

- Over 550 miles of pipelines
- 170,000 water quality tests per year

Norman's Existing Water Sources



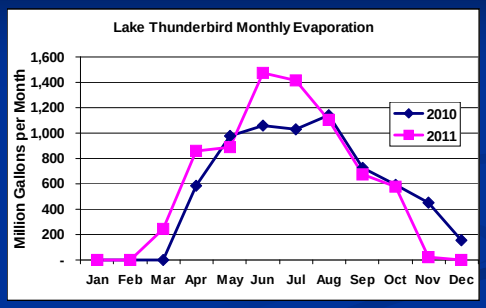


No Single Supply is "Perfect"

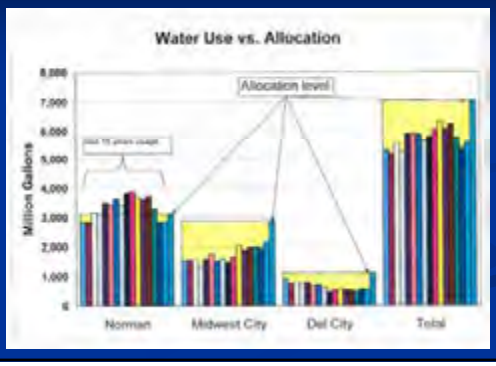
Surface Water: Renewable but may not be fully reliable in extended drought

Groundwater: Reliable but may not be sustainable if over-utilized; local water quality issues

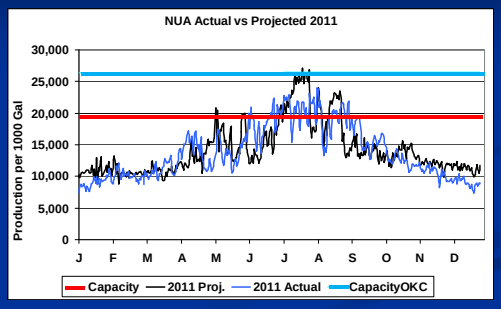
Lake Thunderbird Evaporation



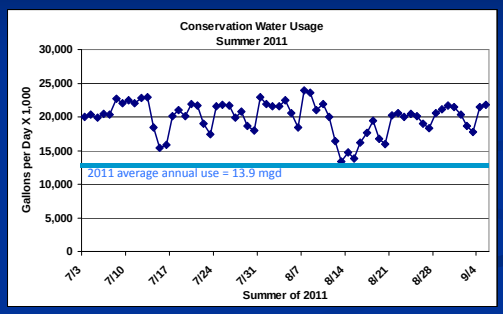
Lake Thunderbird Water Use



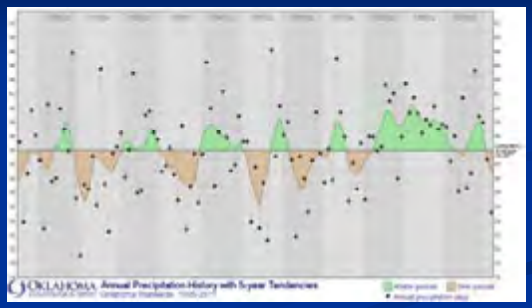
2011 Water Usage



Water Conservation Summer 2011

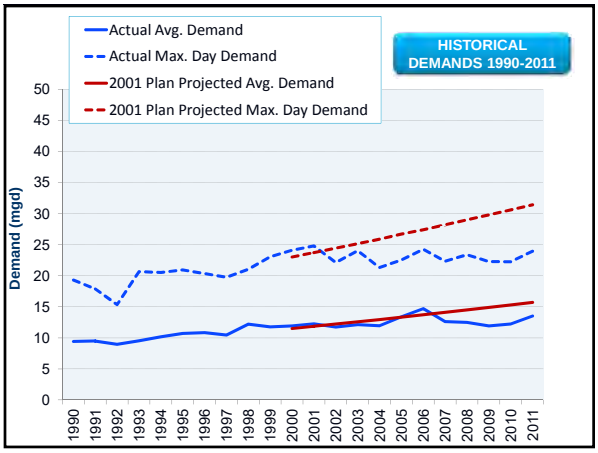


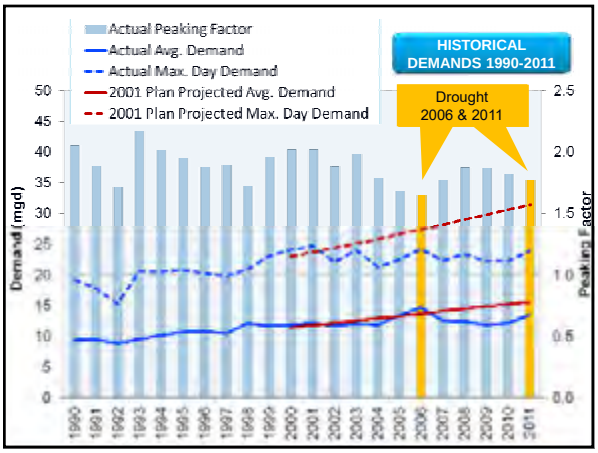
Oklahoma Precipitation



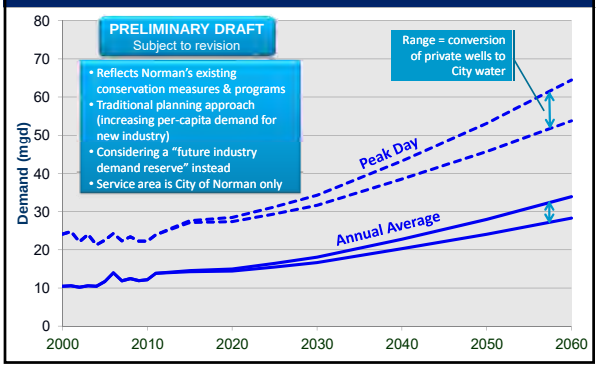
NORMAN 2025

Strategic Water Supply Plan meets demands based on City of Norman adopted land use plans





Projected Water Use



AGENDA

- Water supply planning overview
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Source Options to be Evaluated

- Three general types of sources
  1. Existing sources under new regulations and yield
  2. Maximize and enhance local supplies
  3. Leverage outside water sources

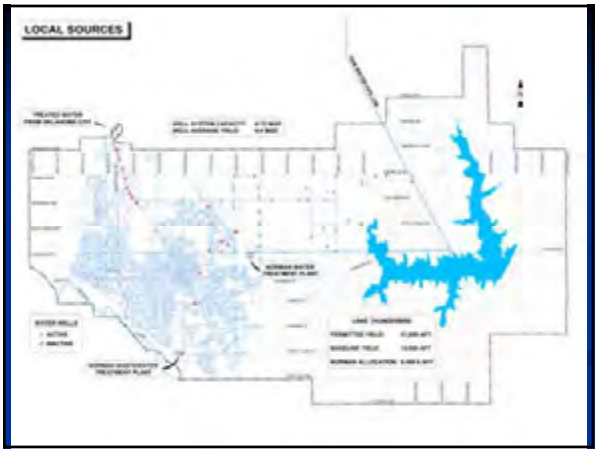
Not evaluating these sources or eliminating any right now – that's the next step

Sources to be Evaluated

- Existing sources under new regulations & yield
  - Local Garber-Wellington groundwater wells
  - Lake Thunderbird & WTP
  - OKC treated water interconnect

Source Options to be Evaluated

- Maximize and enhance local supplies
  - Lake Thunderbird spillage
  - Lake Thunderbird augmentation
  - Groundwater recharge
  - New Eastside or Westside Reservoir
  - New Diversions from the Canadian River
  - Treated Effluent Reuse (direct non-potable vs. indirect potable)
  - Additional Conservation Measures
  - Stormwater Capture and Reuse



Source Options to be Evaluated

- Leverage Outside Water Sources
  - Bulk purchase from OKC
  - Bulk raw water from SE Oklahoma
  - Scissortail Reservoir
  - Parker Reservoir
  - Kaw Reservoir

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Water Supply Planning Terminology & Process

EVALUATION CRITERIA

Objective	Questions We'll Answer
Affordability	*"What will it cost to reliably provide treated water?"*
Long-Term Supply Reliability	*"Will we be able to reliably meet our demand?"*
Phasing Potential	*"Can we defer capital and increase the supply over time?"*
Timely Implementation and Certainty	*"Are we certain we can bring the supply online by the time it is needed?"*
Efficient Use of Water Resources	*"Are we making the best use of the available resources?"*
Environmental Stewardship	*"Are we preserving our environmental resources?"*
Treated Water Quality Aesthetics	*"Will our customers be satisfied with the quality of the water we deliver?"*

Objective	Sub-objectives & measures
Affordability	• Minimize capital cost • Minimize life-cycle cost
Long-Term Supply Reliability	• Reduce drought vulnerability • Minimize supply shortages • Infrastructure reliability
Phasing Potential	• Defer capital costs • Provide for future needs
Timely Implementation and Certainty	• Reduce institutional complexity and increase local control • Timely implementation
Efficient Use of Water Resources	• Maximize water use efficiency • Increase conservation
Environmental Stewardship	• Minimize energy consumption • Minimize temporary construction impacts and environmental mitigation needs • Minimize permanent ecosystem impacts • Increase use of renewable resources
Treated Water Quality Aesthetics	• Achieve secondary MCLs • Minimize taste and odor potential

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SWSP Public Input

- Ad Hoc Committee Meetings
- Public meeting 1 – June 2012
  - SWSP background and goals
  - Input on list of supply sources
  - Input on relative importance of evaluation criteria for supply portfolios
- Public meeting 2:
  Results of screening of options
- Public meeting 3:
  Supply portfolios to be evaluated
- Public meeting 4:
  Results of portfolio screening

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Norman Utilities Authority

2060 Strategic Water Supply Plan

Public Meeting #1

June 25, 2012

Strategic Water Supply Plan Public Meeting #1
Minutes

June 25, 2012
7:00-9:00 PM
Council Chambers

Attendance:

- Presenters: John Rehring of Carollo and Ken Komiske of City of Norman
- Council Members: Mayor Rosenthal, Gallagher, Griffith, and Lockett.
- Staff: Scott Aynes, Mark Daniels, Bryan Hapke, Chris Mattingly, Debbie Smith, Charlie Thomas, Kathryn Walker, Gay Webb and Geri Wellborn,
- Ad-Hoc Committee Members: Al Atkins, Steven Tyler Holman, Matthew Leal, Amanda Nairn, Mike Pullin, Bob Thompson and Judith Wilkins

Presentation:

Mayor Rosenthal welcomed everyone to the first of four public meetings for the 2060 Strategic Water Supply Plan. She said there is nothing more important to the future of our community than water. The public meetings will be an opportunity for the citizens to provide guidance and input on the choices we will make in the future. Consultants along with a citizens advisory committee will help determine what water supplies we will draw upon, what options are available, what they will cost and help determine how we can make good decisions about our water future. The Mayor thanked the Strategic Water Supply Plan (SWSP) Ad-Hoc Committee Members for their help and read their names:

- Al Atkins/Bob Thompson
- Sandy Bahan
- Roger Frech
- Jim Gasaway
- Stephen Tyler Holman
- Samantha Kahoe
- Matthew Leal
- Joe Love
- Curtis McCarty
- Lynne Miller
- Amanda Nairn
- Mike Pullin
- David Sabatini
- Andy Sherrer
- Judith Wilkins

Mr. Komiske presented slides providing background information about Norman's surface and ground water supply system, water supply issues facing Norman, water conservation practices implemented, the potential for non-potable reuse, and briefly discussed the findings of the previous SWSP adopted by Council in 2001 and how it has been implemented to date.

Mr. Rehring presented slides on the goals of the SWSP, why a water supplier needs a SWSP, and future steps to be taken as the process moves forward to completion. He discussed historical and projected water demands, water supply sources to be evaluated, how the sources will be evaluated based on both economic and non-economic criteria, and emphasized the need for public input throughout the process of selecting a portfolio of water supply options that best serve the needs of Norman.

The presentation concluded after about an hour. A copy of presentation is attached.

Public Discussion and Input:

After the presentations, members of the audience provided input regarding water supply options and asked questions of the presenters/staff. The following is a synopsis of questions or comments with the response provided by the consultant or staff:

- It was asked if Congressman Cole's bill allowing water to be imported from Lake Atoka in SE Oklahoma into Lake Thunderbird would help. Mr. Komiske answered it would help if passed. The Central Oklahoma Master Conservancy District (COMCD) has examined the potential impacts (water quality and quantity, environmental, etc.) that might result if out of basin water were imported into Lake Thunderbird. This bill, supported by the COMCD study, is approved by the House of Representatives (and is awaiting Senate approval) and will provide opportunity for future importation of out of basin water into Lake Thunderbird.
- It was asked if the COMCD is seeking permission for discharge of highly treated effluent from Norman and Moore into Lake Thunderbird? Mr. Komiske answered yes, but there are many hurdles to be cleared before treated effluent reuse can be implemented.
- Regarding usage of the Garber Wellington aquifer (GW) and private wells during a drought situation, have we communicated with the University of Oklahoma (OU) and that OU and Norman will both need to reduce usage? Mr. Hapke commented that the GW is much larger than OU/Norman and extends from Guthrie to Noble. Mr. Komiske commented that all cities are allowed to utilize ground water according to their permit; OU uses its non-potable water wells for landscape irrigation. Norman cannot require their neighbors to restrict water usage. John Harrington of the Association of Central Oklahoma Governments (ACOG) answered similarly; he indicated that taking water from the aquifer is a property right that can't be mandated by Norman but you can ask for voluntary reductions in usage. The question was then asked more specifically: Has Norman talked to OU about restricting usage of their wells? Mr. Komiske answered "No". Additional discussion regarding the GW study continued and that it appears temporary permits of 2 acre-feet per year (AF/YR) will likely be reduced to 1.5 or 1 AF/YR. Recharge is actually only 2 to 4 inches per year but Oklahoma law allows the aquifer to be mined, i.e. the withdrawal rate is more than the recharge rate.
- It was asked how Norman's ground water supply would be affected if the permitted amount was reduced to 1.5 or 1 AF/YR. Mr. Komiske indicated that Norman is allowed to permit all platted lands within the city limits and that the existing permitted area would allow all existing wells to continue pumping as they do currently even if the allowable rate was reduced to 1 AF/YR rate.
- It was asked how long would the 2 AF/YR rate continue once they determine the new limit on usage of the GW? Mr. Harrington answered he guessed it would be 2 to 3 years.
- Mr. Harrington was asked to explain difference between permitted rate of aquifer use and recharge rate for an aquifer. Mr. Harrington mentioned that, temporary permitted use is 2 AF/YR but he expected a new rate of 1 AF/YR. This assumes mining the GW over a defined period of time. Mr. Harrington indicated that aquifer recharge from rain events has been studied and recharge is believed to be 2 to 4 inches per year in the GW.
- A citizen suggested that we should restrict yard application of fertilizers and pesticides to protect Lake Thunderbird from further degradation before we continue with the development in the north side of Norman, i.e. the Little River drainage basin. Canada has already passed such legislation.
- A citizen commented that since we already discharge effluent to the Canadian River which flows to Lake Eufaula, why shouldn't we discharge to Lake Thunderbird? Does a

larger distance between the discharge and the lake itself make it ok? Mr. Komiske indicated that the Oklahoma Department of Environmental Quality (DEQ) realizes "unintentional" indirect potable reuse is ongoing but has not yet come to terms with "intentional" indirect potable reuse. Mr. Komiske indicated that the distance does make a difference in the natural ability of a stream to improve the water quality.

- It was asked if storm water runoff could be used to re-charge an aquifer and if we can collect and reuse instead of allowing to drain back into the lake. Mr. Harrington and Mr. Komiske both answered yes. There has been a recent shift in public policy from quickly releasing storm water from development to rivers and streams, to capturing and storing or treating storm water flows prior to release at a much slower rate. Storage promotes infiltration into the underlying soils and ground water recharge.
- It was asked if raising the Lake Thunderbird dam was a way to capture more runoff and increase supply. Mr. Komiske answered that would increase storage capacity but not the dependable yield of the lake. If the dam were to be raised, costs for land acquisition would be very high because of the shallow nature of Lake Thunderbird.
- Mayor Rosenthal commented that our proposed evaluation criteria should also include a "public value" for public uses, such as recreational opportunities and aesthetics, for reservoirs rather than just the value as a water supply. Public use could be viewed positively or negatively.
- A concern was noted regarding the rate of growth anticipated, that all growth was not good, and if the SWSP would move to regulate the pace of growth. Mr. Rehring and Mr. Komiske indicated that the SWSP would attempt to match the full build-out water demand as defined in the Norman 2025 Land Use Plan. The Land Use Plan drives the SWSP; the SWSP does not drive the Land Use Plan. The SWSP would define improvements needed to meet certain demands and that actual water demands will trigger the timing of future improvements. Both the SWSP and the Land Use Plan are dynamic in nature and will need to be updated every 10 years or so to assess changing conditions and assure the plans are consistent with community desires.
- It was asked if we would consider ground water recharge into the brackish saltwater aquifer found below the GW similar to Florida where they created a usable aquifer where seawater intrusion had been occurring. Mr. Harrington indicated that he was not aware of this technology being implemented in aquifers such as the GW. He indicated that seawater is 10,000 parts per million (ppm) salt and that ground water beneath the fresh water in Oklahoma ranges from 100,000-200,000 ppm making this technology unusable now. Mr. Rehring indicated this technology would be examined for use during the initial screening process.
- A citizen asked how the final recommendations of the SWSP would be implemented. It was also asked what would happen if we don't follow our recommended plan like when the riparian restrictions suggested in the Storm Water Master Plan were not implemented last year? Mr. Komiske indicated that Council would hopefully adopt the recommended solution from the SWSP but that the voters will ultimately need to approve any water rate increase associated with implementation of the SWSP.
- A citizen asked about levels of mercury in the SE Oklahoma lakes where it is reported that fish are not allowed to be consumed. It was also asked why Norman would want to import water containing pharmaceuticals and personal care products (PPCP's). Mr. Rehring indicated all water quality issues would be addressed by the recommended treatment technology and would be considered in the ranking process. He also indicated that PPCP's are currently unregulated and are typically detected in reuse water in minuscule amounts.

- It was suggested that the OWRB indicated Norman had unlimited ground water supply in the GW through 2060 and there was no need to import other water. Mr. Harrington indicated that no such study exists and the use of the GW needs to be reduced.
- A citizen asked about staff being critical about the recent Oklahoma Comprehensive Water Plan (OCWP). Mr. Komiske indicated the OCWP implied there was plenty of water within the larger basin where Norman is situated. This statement was based on several factors including a lower water supply need, continuation of temporary ground water permits at 2 ACFT/YR, and use of the Canadian River as a water supply. Staff disagreed with OWRB's position because it did not account for higher projected demands, a future reduction in the rate of withdrawal from the GW aquifer, future regulation of metals in the GW, or for the lower water quality within region and the increased cost to treat local waters.
- Mr. Kyle Arthur, formerly with the OWRB and in charge of preparing the OCWP, commented that the OCWP was prepared as an overview of each basin and was not intended as a substitute for individual plans such the SWSP. He is glad the SWSP will further evaluate local sources such as the Canadian River and GW. He suggested Norman might consider obtaining rights to the GW outside the city limits of Norman.
- It was asked why staff was considering Kaw Reservoir as a viable option when staff previously said it was too salty? Mr. Rehring and Mr. Komiske indicated that the there are pros and cons to all water supply sources and each will be evaluated and ranked during the SWSP process.
- It was asked how tribal water rights and State water rights would be evaluated in our water supply selection process. Mr. Rehring indicated availability and certainty of water rights is a factor and will be evaluated and weighted based on its timeliness and viability.
- Adjourned at 9:00 PM

APPENDIX AA – PUBLIC PARTICIPATION – PUBLIC MEETING #2

Press Release: October 12, 2012

2060 Strategic Water Supply Plan

A public meeting will be held Wednesday, October 17, 2012 from 7:00 pm to 9:00 pm at City Council Chambers, 201 W. Gray, Norman, Oklahoma. This meeting will be the second in a series of public meetings to provide the public with information about the making of its 2060 Strategic Water Supply Plan (SWSP) and gather public input regarding key aspects of the plan.

The City of Norman is updating its plans for supplying long term water solutions to its customers. The SWSP builds on previous planning efforts discussing water demands, supply options, and infrastructure as well as significant new developments in water supply regulations, new technology and availability of water. Regulatory changes on drinking water quality affecting our local groundwater supplies, new limits on the amount of groundwater and Lake Thunderbird water Norman will be allowed to use, and evolving opportunities to increase water conservation and reuse in the community will also be discussed.

The City is evaluating a wide range of potential water supply sources and identifying those that will best meet the community's short and long-term needs. The long-term water supply "portfolio" for Norman will likely include a combination of existing sources and new sources. Sources that pass the initial screening criteria will be combined into portfolios for further evaluation in the second phase of the project.

Public input is being sought through meetings that will be held at key milestones throughout the development of the SWSP. An Ad Hoc committee has been appointed by City Council to help guide this planning process and enhance feedback and communications. The October 17th public meeting will include a presentation on the goals and drivers for water supply planning in Norman, a description of the local and regional supply sources under consideration, a relative comparison of the supply options and a supply option screening to reduce the number of options to those most viable for further analysis. Meeting participants will have an opportunity to review supply options, and to provide feedback on the evaluation criteria and the relative importance of planning drivers. The third public meeting will review the supply option portfolios and set the screening process for the portfolios.

Norman's 2060 Strategic Water Supply Plan

Public Meeting
7 PM to 9 PM, October 17, 2012
City Council Chambers, City Hall
201 W. Gray

- Introduction and Goals for Public Meeting
- Project Progress Update
- Water Supply Option Screening
    - Description of Supply Options
    - Relative Comparison of Supply Options
    - Supply Option Screening: Which options are most viable for further analysis.

Norman Utilities Authority
2060 Strategic Water Supply Plan

Public Meeting #2
October 17, 2012

AGENDA
Project overview and update on progress
What water supply options were considered?
Supply option screening
Feedback and discussion on supply option screening

Project Overview and Update on Progress

Public Meeting 1 (June 2012)
- Basis of Planning
  - Develop demand projections
  - Document water conservation & reuse opportunities
  - Identify supply options
  - Develop criteria for decision-making

Public Meeting 2 (tonight)
- Phase 1 – Individual Water Supply Options

Public Meetings 3 and 4
- Phase 2 – Future Water Supply Portfolios

Water Planners Speak a Different Language…

- Water Use Types
  - Municipal & Industrial (Public Water Supply)
  - Potable vs. Non-potable
  - City water service vs. domestic wells

All the water uses connected to the municipal system – Residential, Commercial, Industrial, Irrigation, Firefighting…

- Measurement
  - acre-foot
  - acre-feet per year (AFY)
  - million gallons per day (mgd)
  - gallons per capita per day (gpcd)

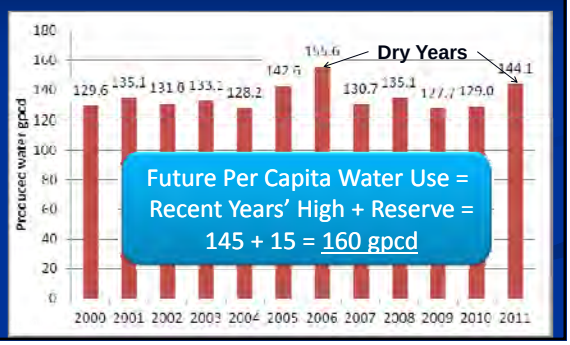
1 acre-foot = 325,851 gallons

2011 Norman use:
- 15,400 AFY
- 13.9 mgd on average
- 23.9 mgd peak day (Aug. 5, 2011)

Per-capita use includes residential AND industrial AND commercial

Strategic Water Supply Plan meets demands based on City of Norman adopted land use plans

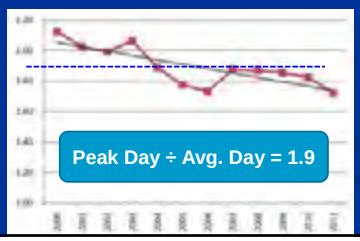
Historical Per-Capita Water Use in Norman



Future Per Capita Water Use = Recent Years' High + Reserve = 145 + 15 = 160 gpcd

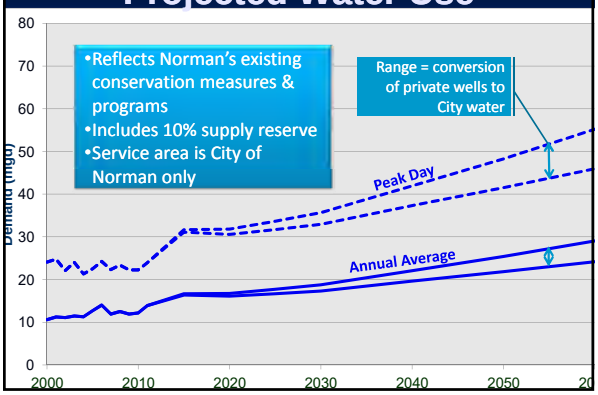
Historical Daily Peaking Factors

- Decreasing trend due to:
  - Reuse & non-potable conversion projects
  - Conservation measures

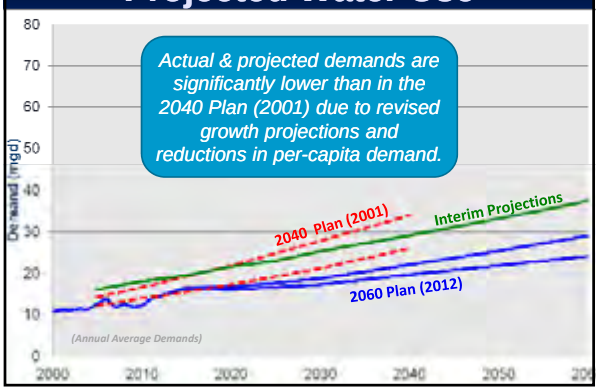


9/3/2013

Projected Water Use



Projected Water Use



Conservation Savings for Norman (Post 2010)

	Scenario I (mgd)*	Scenario II (mgd) *
2020	0.70	1.6
2030	0.74	1.9
2040	0.77	2.3
2050	0.79	2.5
2060	0.81	2.6

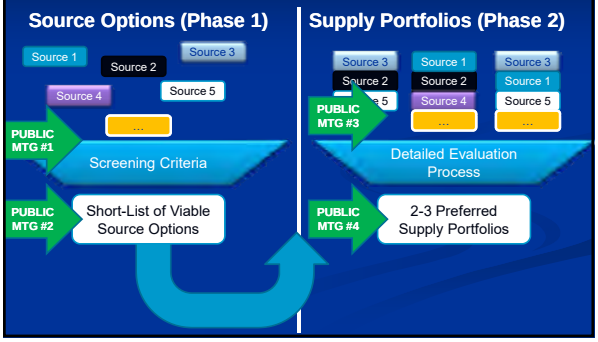
* 60% of OCWP estimates for Cleveland County

9/3/2013

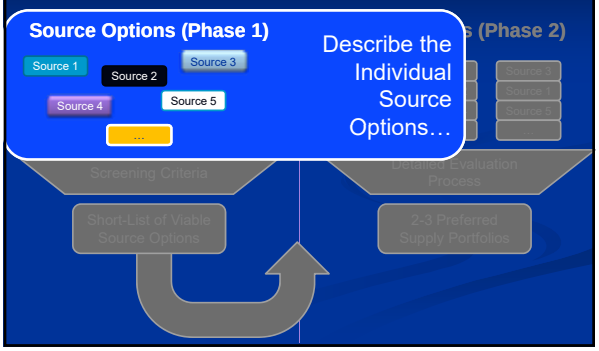
AGENDA

- Project overview and update on progress
- What water supply options were considered?
- Supply option screening
- Feedback and discussion on supply option screening

Water Supply Planning Terminology & Process



In Tonight's Meeting We Will…



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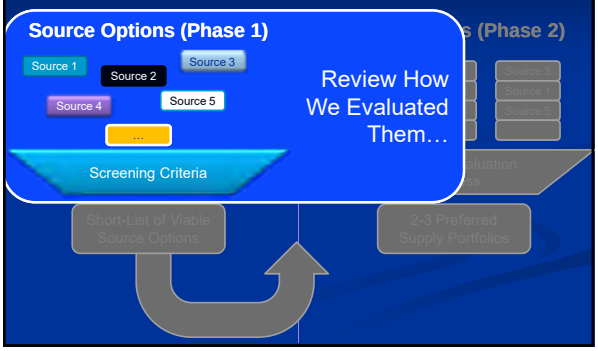
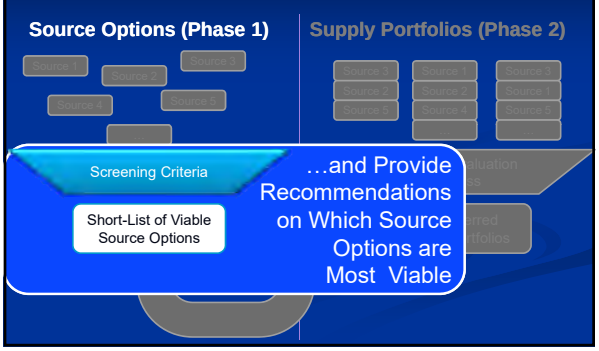


In Tonight's Meeting We Will…



Water Supply Options

- Three general types of sources
  1. Existing supplies (under new regulations and yield)
  2. New local supplies
  3. Regional supplies

The most viable and cost-effective supply options will be the "building blocks" for water supply portfolios

Existing Supplies

- All existing sources will be considered in Phase II (with modifications for regs)
  - Lake Thunderbird
  - Garber-Wellington Aquifer Wells
  - Intermittent purchase of OKC treated water
- Water Conservation
  - Significant measures already in place
  - Implement specific measures from 2011 Conservation Plan and OCWP (State Plan)

New Local Supplies

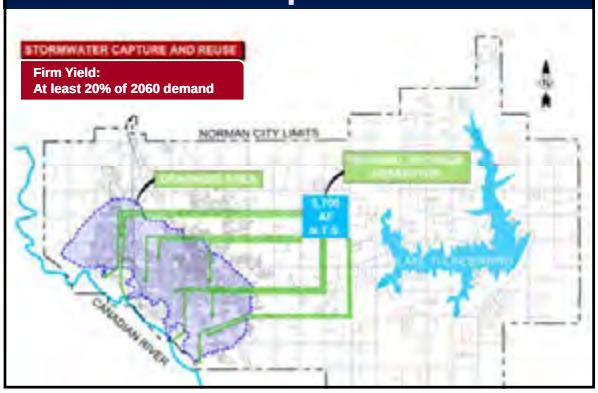
- Direct Non-potable Reuse
  - Irrigation and industrial uses of treated wastewater effluent
  - Water quality per ODEQ regulations
  - Expand upon existing use at OU Golf Course
  - Significant future northern expansion possible

Non-potable Reuse (Phase 1)

New Local Supplies (cont.)

- Lake Thunderbird Augmentation
  - Evaluation will be completed following publication of COMCD study
- Stormwater Capture and Reuse
  - Capture and storage of stormwater from South Canadian drainage basin
  - Terminal reservoir and new treatment plant
    - Possible use of Lake Thunderbird instead of separate reservoir

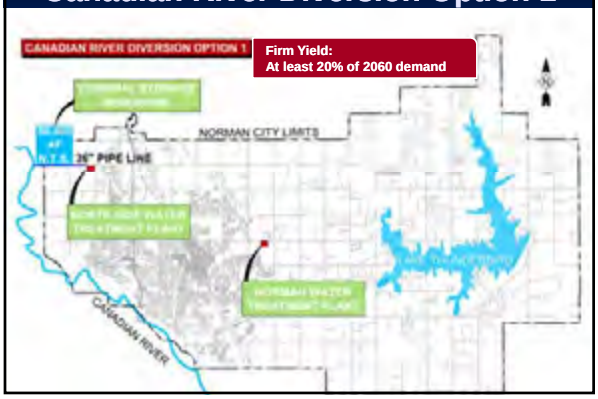
Stormwater Capture and Reuse



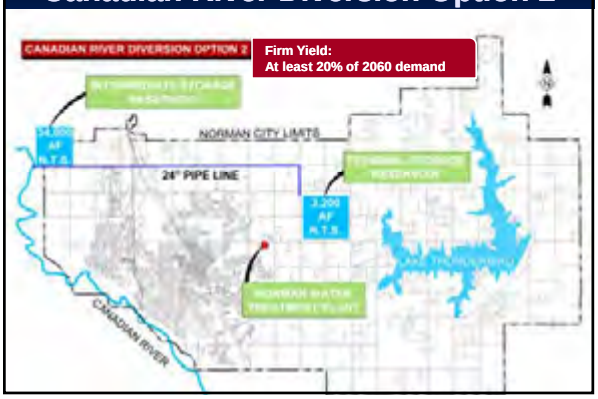
New Local Supplies (cont.)

- Canadian River Diversion
  - Option 1 – With new west side reservoir
  - Option 2 – With new west side reservoir and new east side reservoir
  - Option 3 – With new east side reservoir

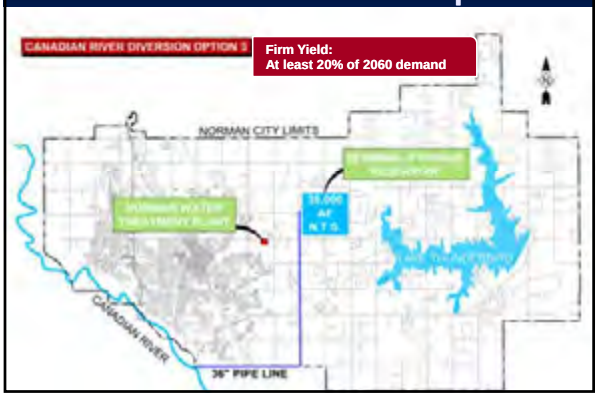
Canadian River Diversion Option 1



Canadian River Diversion Option 2



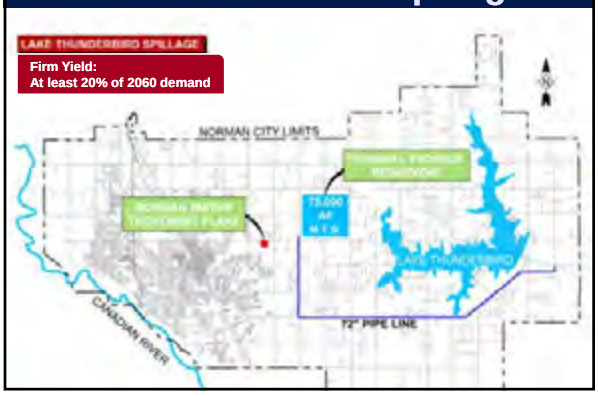
Canadian River Diversion Option 3



New Local Supplies (cont.)

- Lake Thunderbird Spillage
  - Capture intermittently-available spilled water from downstream of dam
  - Uses terminal storage reservoir

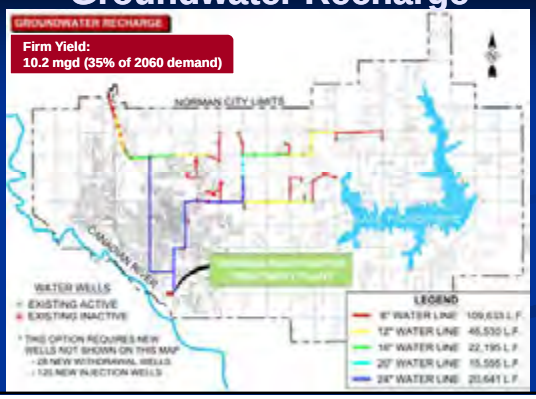
Lake Thunderbird Spillage



New Local Supplies (cont.)

- Groundwater Recharge
  - Highly treated wastewater effluent suitable for recharge into Garber-Wellington aquifer
  - Firm yield available to Norman 10.2 mgd

Groundwater Recharge



Regional Supply Options

- Purchase bulk treated water from OKC
  - Regional treatment (OKC Draper WTP) of southeast Oklahoma water
- Purchase bulk raw water from OKC
  - Local treatment (in Norman) of southeast Oklahoma water
  - Uses terminal reservoir

Bulk Treated Water or Raw Water from OKC

Regional Supply Options (cont.)

- Scissortail Reservoir
  - New reservoir 3 miles west of Ada
  - Uses terminal reservoir
  - Firm yield available to Norman 19.9 mgd
    - Assumes 28.6 mgd firm yield of reservoir, of which 8.7 mgd is allocated to Ada
- Parker Reservoir
  - New reservoir 15 miles east of Ada
  - Uses terminal reservoir
  - Firm yield available to Norman 29.1+ mgd
    - Assumes no allocation to others, 41 mgd firm yield of reservoir

Scissortail Reservoir

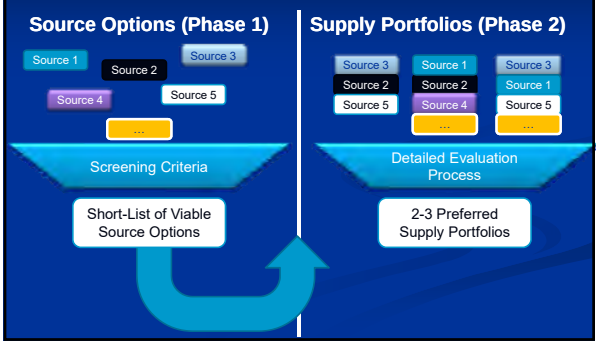
Parker Reservoir

Regional Supply Options (cont.)

- Kaw Lake
  - Convey water from Kaw Lake (shared infrastructure with Stillwater)
  - Uses terminal reservoir
  - Firm yield available to Norman potentially >29.1 mgd*
    - Firm yield of reservoir is 166.9 mgd
    - 126.2 mgd allocated to others (existing permits)
    - * 57.1 mgd pending permits to others
    - * Not all pending permits expected to go through

Kaw Lake

Water Supply Planning Terminology & Process



Criteria for Detailed Evaluations

- Affordability
- Long-Term Supply Reliability Phasing Potential
- Timely Implementation and Certainty
- Efficient Use of Water Resources
- Environmental Stewardship
- Treated Water Quality Aesthetics
- Community Values (Recreation, Aesthetics, and Property Rights)

Relative Comparison of Individual Source Options

SUPPLY AVAILABILITY

RELIABILITY

CERTAINTY & TIMELINESS

COST-EFFECTIVENESS

- Quantitative (supply avail. & cost)
- Qualitative (reliability & certainty)
  - Scored from 1 (worst) to 5 (best)

Relative Comparison of Supply Sources (cont.)

Source Name	Percent of 2060 demand	Long-term reliability	Implement-ation status and issues	Capital cost ($/AFY of firm yield)
Lake Thunderbird Spillage	20% +	2	1	$86,000
Groundwater Recharge	35%	4	1	$34,000
Canadian River Diversion Option 1	20% +	1	2	$39,000
Direct Non-potable Reuse	5% (+ peak)	4	5	$22,000
Stormwater Capture and Reuse	20% +	2	2	$188,000
Bulk Treated Water from OKC	100%	5	4	$12,000
Bulk Raw Water from OKC	100%	5	4	$14,000
Scissortail Reservoir	68%	3	3	$18,000
Parker Reservoir	100%	4	3	$19,000
Kaw Lake	100%	5	4	$18,000

Relative Comparison of Supply Sources (cont.)

Source Name	Percent of 2060 demand	Long-term reliability	Implement-ation status and issues	Capital cost ($/AFY of firm yield)
Groundwater Recharge	35%	4	1	$34,000
Canadian River Diversion Option 1	20% +	1	2	$39,000
Direct Non-potable Reuse	5% (+ peak)	4	5	$22,000
Bulk Treated Water from OKC	100%	5	4	$12,000
Bulk Raw Water from OKC	100%	5	4	$14,000
Scissortail Reservoir	68%	3	3	$18,000
Parker Reservoir	100%	4	3	$19,000
Kaw Lake	100%	5	4	$18,000

Relative Comparison of Supply Sources (cont.)

Source Name	Percent of 2060 demand	Long-term reliability	Implemen-tation status and issues	Annual firm yield	Capital cost (2012 $M)	Capital cost ($/AFY of firm yield)
Groundwater Recharge	35%	4	1	10.2 mgd (11,500 AFY)	$384	$34,000
Direct Non-potable Reuse	5% (+ peak)	4	5	0.8 mgd (850 AFY)	$37	$22,000
Bulk Treated Water from OKC	100%	5	4	29.1 mgd (32,700 AFY)	$407	$12,000
Bulk Raw Water from OKC	100%	5	4	29.1 mgd (32,700 AFY)	$441	$14,000
New Out of Basin Reservoir	100%	4	3	19.9+ mgd (22,300+ AFY)	$630*	$19,000*
Kaw Lake	100%	5	4	29.1 mgd (32,700 AFY)	$588	$18,000

* Some cost savings may be possible if Norman partners with others to develop supply source

Supply Sources Recommended for Portfolio Development

- Existing:
  - Lake Thunderbird
  - Garber-Wellington Aquifer Wells
  - Conservation
- New Local:
  - Groundwater recharge
  - Direct non-potable reuse
  - Lake Thunderbird augmentation (pending results of COMCD study)
- Regional:
  - Bulk treated water from OKC
  - Bulk raw water from OKC
  - New out of basin reservoir
  - Kaw Lake

AGENDA

- Project overview and update on progress
- What water supply options were considered?
- Supply option screening
- Feedback and discussion on supply option screening

Norman Utilities Authority

2060 Strategic Water Supply Plan

Public Meeting #2

October 17, 2012

Strategic Water Supply Plan Public Meeting #2
Minutes
October 17, 2012
City Council Chambers, City Hall
7:00 P.M.

Attendance

Strategic Water Supply Plan Project Team: John Rehring, Amber Wooten, Srini Sundaramoorthy and Ryan Smith
Councilmembers: Mayor Rosenthal, Castleberry, Gallagher, Griffith, Kovach, Lockett
Staff: Ken Komiske, Chris Mattingly, Charlie Thomas, Gay Webb

Introductions

Mayor Rosenthal welcomed everyone to the second public Strategic Water Supply Plan meeting and acknowledged Councilmembers in attendance. She stated this is an opportunity to gather input from the community on this project.

Mr. Komiske acknowledged Ad-Hoc Committee members in attendance and introduced the Strategic Water Supply Plan project team consisting of Ryan Smith and Srini Sundaramoorthy of Tetra Tech and John Rehring and Amber Wooten of Carollo Engineers.

Presentation

Mr. Rehring thanked Council and the Ad-Hoc committee for guidance in this process. He gave an overview of where we are at in the water supply planning process. The focus of the meeting tonight will be to describe the individual supply options, review how we evaluated them and provide recommendations on which ones we think are most viable and get your feedback on that. Any could technically work, but some are more viable than others.

Mr. Rehring discussed water terminology, per-capita water use, daily peaking factors, projected water use, Phase 1 and 2 of the planning process and described the individual supply options and the screening process. There are three general types of water sources (1) existing supplies (2) new local supplies and (3) regional supplies. The most viable and cost effective supply options will be the building blocks for the water supply portfolios.

Mr. Rehring explained the criteria used for detailed evaluations, using a subset of these, to screen new local and regional water supply options (relative comparison). Based on the results of the preliminary screening, the following sources are recommended for use in the development of water supply portfolios to be evaluated in Phase II of the Strategic Water Supply Plan:

Existing:
- Lake Thunderbird
- Garber-Wellington Aquifer Wells
- Conservation
- Oklahoma City water during peak demands

New Local:
- Groundwater recharge
- Direct non-potable reuse
- Lake Thunderbird augmentation (pending results of Central Oklahoma Master Conservancy District study)

Regional
- Bulk treated water from Oklahoma City
- Bulk raw water from Oklahoma City
- New out of basin reservoir (Scissortail or Parker)
- Kaw Lake

Public Discussion and Input

Mr. Rehring asked for feedback on the information presented. The following is a synopsis of questions or comments with the response provided by the consultant or staff:

- Why does raw water from southeast Oklahoma cost more than treated water from Oklahoma City? Mr. Rehring explained when Oklahoma City brings water in from southeast Oklahoma, they use Lake Stanley Draper as their terminal reservoir. If we brought water into Norman, we would need our own terminal storage reservoir. Potentially, we might be able to use Lake Thunderbird. We are waiting for results of the Central Oklahoma Master Conservancy District augmentation study.

- Where would we store water if brought in from other source options? Mr. Rehring answered there are two options. Potentially in Lake Thunderbird, pending the findings of the ongoing Central Oklahoma Master Conservancy District Lake Thunderbird augmentation study, or we would need to build a terminal storage reservoir. Typically, sizing transmission infrastructure to convey peak demands is less cost-effective than using local storage. Alternatively, transmission infrastructure (pipelines and pump stations) could be sized to meet peak diversions and demands.

- How do issues with Indian Tribes surrounding the southeast Oklahoma water impact these source options? Mr. Rehring responded the tribes in southeast Oklahoma have asserted claims to water rights but no determination has been made yet. This is reflected in our study through the implementation rating for each source. This source has been significantly studied and is currently in

detailed planning. From a permitting perspective, there are some unknowns that must be considered.

- What is the status of Oklahoma City southeast Oklahoma project? Mr. Rehring replied the initial planning has started, building on the 2009 Central Oklahoma study, but no design or construction has begun.

- What is the current status of Scissortail and Parker reservoirs? Mr. Rehring responded it takes a considerable amount of time to permit and develop a new reservoir. This is why source planning is being done now for 2060. It could take 10 – 20 years to complete a new reservoir.

- Why did groundwater recharge option receive a score of 1 for implementation? Mr. Rehring explained while technology is available for groundwater recharge, it is unproven in Oklahoma. Additionally, permitting procedures are not in place to allow this in Oklahoma, leading to significant uncertainties about the treatment requirements, operational requirements, permitting requirements and costs for this option.

- Why is Lake Thunderbird allowance anticipated to be cut back? Mr. Rehring said it is anticipated that permitted withdrawals will be recalculated based on the firm yield of Thunderbird. The original permits were based on firm yield of Thunderbird plus conjunctive use of some groundwater wells. Existing permits exceed the firm yield of Thunderbird.

- Can we get a bigger allocation of Lake Thunderbird by securing Del City and Midwest City's excess unused allocation? Mr. Komiske answered we are discussing leasing water rights from Del City and Midwest City. It would take federal legislation to reallocate supplies between the cities, and the other cities would not likely support such a move.

- What is the expected life of Lake Thunderbird? Mr. Rehring stated typically, reservoir firm yield includes a 100-year allowance for sedimentation.

- When you are talking about potential water supply sources from southeast Oklahoma, are you just talking about Sardis or are you talking abut multiple basins? Mr. Rehring said the project would build on the existing system that is already there, essentially paralleling the pipeline from McGee Creek and the Atoka Reservoir. Oklahoma City has applied for additional water rights in the Kiamichi River basin of which Sardis is a tributary to that river basin. The withdrawal point has not been determined yet.

- Is the sustainability being considered at the source location? Mr. Rehring replied for this study, we are basing reliability on the availability of permits in the source basin, as defined in the 2012 Update to the Oklahoma Comprehensive Water Plan.

- A gentleman commented that in his opinion the state Comprehensive Water Supply Plan is flawed because the supply they say is needed does not take into account the tourism aspect that takes place on many of the lakes in the area. He suggested maybe we should take a better look at the Comprehensive Water Plan. Mr. Rehring responded that community values scores for each portfolio could consider source basin issues, beyond compliance with the requirements of Oklahoma water law.

- Why not think of conservation as a source? Mr. Rehring stated we do. You can think of conservation or reuse as either reduces your potable demand or adds to your supply, it is the same equation. Absolutely, additional conservation is one of the existing supplies and expanding conservation moderately or significantly is a supply option that will be put in a portfolio.

- What if Texas beats us to southeast Oklahoma water supplies? Mr. Rehring responded that is still in Federal litigation and appeals at this time. However, to date, the courts have sided in Oklahoma's favor.

- What conservation measures are being considered? Mr. Rehring replied we are evaluating two levels of conservation. Scenario 1 includes leak detection and educational programs. Scenario 2 includes expanded leak detection and educational programs plus more aggressive conservation water rate structure and implementation of high efficiency plumbing standards that go beyond national standards. Conservation measures build on the 2011 plan adopted by Norman.

- Do we have total cost for the various options? Mr. Rehring explained they are working on costs as they move forward into the portfolios. We will put together estimates using guidelines but they will be based on assumptions of level of participation.

- Was the extension of the groundwater well field considered? Mr. Rehring said yes. It will be carried forward into Phase II of the portfolio development/evaluation.

Mr. Komiske thanked everyone for attending and said the presentation will be available on the website. There will be one or two more public meetings in the future, as the plan evaluations move forward. He reminded everyone to please sign the attendance list, if they had not already done so.

The meeting adjourned at 8:30 p.m.

Item submitted for the record:
PowerPoint presentation entitled, 2060 Strategic Water Supply Plan Public Meeting #2, October 17, 2012

APPENDIX AB – PUBLIC PARTICIPATION – PUBLIC MEETING #3

Press Release

2060 Strategic Water Supply Plan Public Meeting #3

A public meeting will be held Wednesday, March 13, 2013 from 6:30 p.m. to 8:30 p.m. at City Council Chambers, 201 W. Gray, Norman, Oklahoma. This meeting will be the third in a series of public meetings to provide the public with information about the making of its 2060 Strategic Water Supply Plan (SWSP) and gather public input regarding key aspects of the plan.

The City of Norman is updating its plans for supplying long term water solutions to its customers. The SWSP builds on previous planning efforts discussing water demands, supply options, and infrastructure as well as significant new developments in water supply regulations, new technology and availability of water.

The City is evaluating a wide range of potential water supply sources and identifying those that will best meet the community's short and long-term needs. The long-term water supply "portfolio" for Norman will likely include a combination of existing sources and new sources. Sources that passed the initial screening criteria have been combined into portfolios for evaluation in the second phase of the project.

Public input is being sought through meetings that will be held at key milestones throughout the development of the SWSP. An Ad Hoc committee has been appointed by City Council to help guide this planning process and enhance feedback and communications. The March 13 public meeting presentation will include a project update, review of supply options and evaluation criteria, and portfolio evaluations. Meeting participants will have an opportunity to review supply options and provide feedback on the portfolios to be evaluated. This meeting will also be televised on the local government Channel 20.

Norman's 2060 Strategic Water Supply Plan

Public Meeting
6:30 PM to 8:30 PM, March 13, 2013
City Council Chambers, City Hall
201 W. Gray

- Introduction and Goals for Public Meeting

- Project Update

- Review of Supply Options and Evaluation Criteria
    - Shortlisted supply options used in development of supply portfolios
    - Criteria used to evaluate portfolios, and their relative importance ("weight")
    - How the criteria are applied to evaluate and compare portfolios

- Portfolio Evaluations
    - Initial portfolios:
      What supply options do they include, and how did they perform?
    - "Hybrid" portfolios:
      What supply options do they include, and how did they perform?

- Questions and input

Norman Utilities Authority
2060 Strategic Water Supply Plan

Public Meeting #3
March 13, 2013

AGENDA

- Project overview and update on progress
- Quick review of supply options and evaluation criteria
- Portfolio evaluations
- Feedback and discussion on supply portfolios

Project Overview and Update on Progress

Public Meeting 1 (June 2012)	■ Basis of Planning ▪ Demand, supply options, and evaluation criteria
Public Meeting 2 (October 2012)	■ Phase 1 – Individual Water Supply Options
Public Meeting 3 (Tonight)	■ Phase 2 (part A) – Future Water Supply Portfolios ▪ Evaluation of initial supply portfolios
Public Meeting 4	■ Phase 2 (part B) – Future Water Supply Portfolios ▪ Evaluation of revised portfolios

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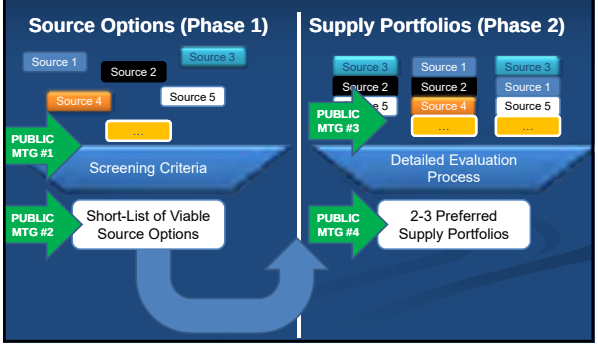
Water Supply Planning Terminology & Process



AGENDA

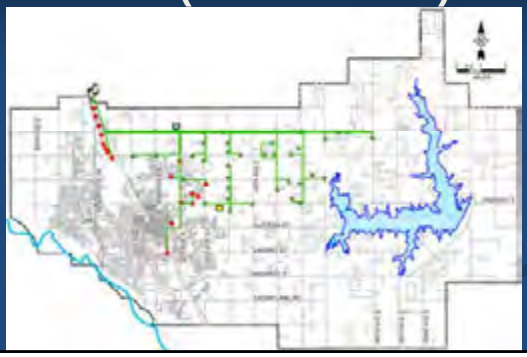
- ~~Project overview and update on progress~~
- Quick review of supply options and evaluation criteria
- ~~Portfolio evaluations~~
- ~~Feedback and discussion on supply portfolios~~

Review of Supply Sources and Evaluation Criteria

Water Supply Options

Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
Garber Wellington Aquifer Wells (with treatment)	Direct non-potable reuse (purple pipe)	Co-owner with OKC for SE Oklahoma raw water
Intermittent purchase of treated water from OKC (wholesale)	Indirect potable reuse (Lake Thunderbird augmentation)	Scissortail Reservoir
Conservation and reuse	Indirect potable reuse (groundwater recharge)	Parker Reservoir
	Stormwater capture and reuse	Kaw Lake
	Canadian River Diversion	
	Capture Lake Thunderbird spillage	
	Dredging Lake Thunderbird	

Garber Wellington Aquifer Wells (with treatment)

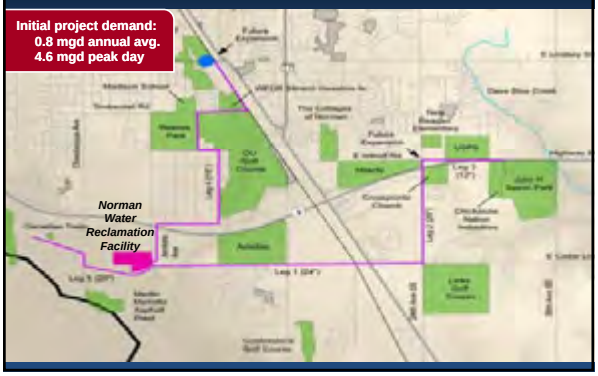


Potential Additional Conservation Savings for Norman (Post 2010)

	Scenario I (mgd)*	Scenario II (mgd) *
2020	0.70	1.6
2030	0.74	1.9
2040	0.77	2.3
2050	0.79	2.5
2060	0.81	2.6

* 60% of OCWP estimates for Cleveland County

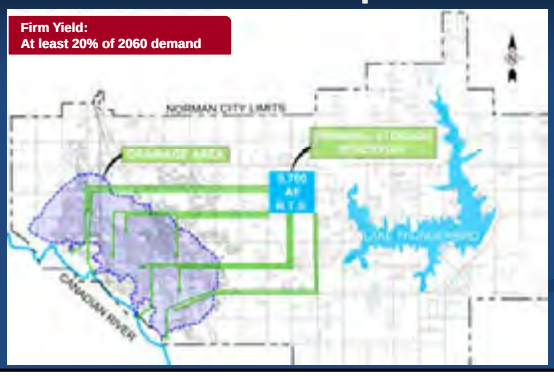
Direct Non-Potable Reuse



Lake Thunderbird Augmentation

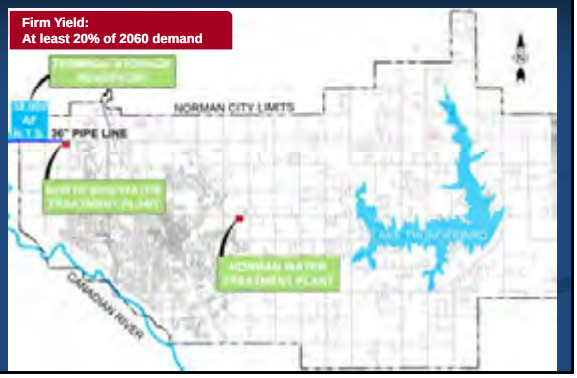
From COMCD 2012 Lake Thunderbird Water Reuse Feasibility Study

Stormwater Capture



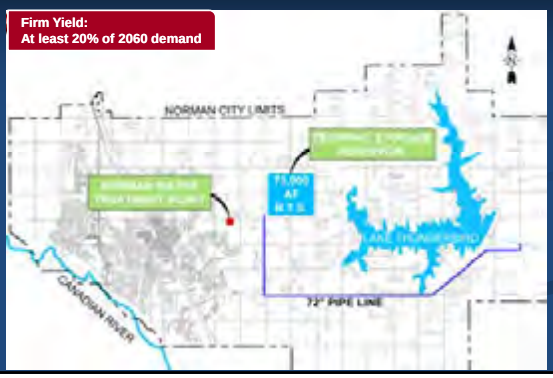
Canadian River Diversion

Firm Yield:
At least 20% of 2060 demand



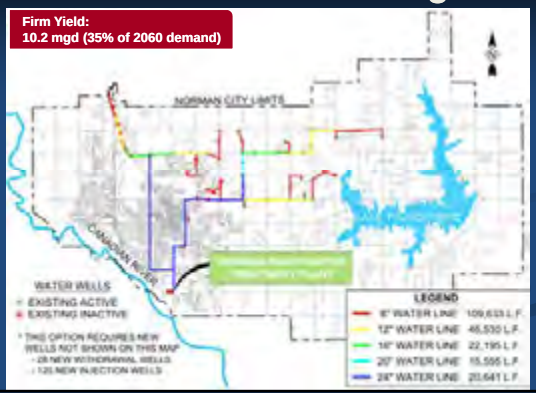
Capture Lake Thunderbird Spillage

Firm Yield:
At least 20% of 2060 demand

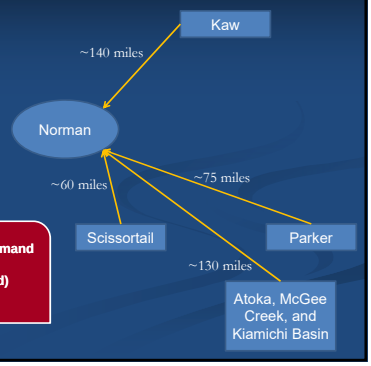


Groundwater Recharge

Firm Yield:
10.2 mgd (35% of 2060 demand)



New Regional Sources



Firm Yield:
Co-owner with OKC – full 2060 demand
Scissortail – firm yield of 20 mgd (68% of 2060 demand)
Parker – full 2060 demand
Kaw – full 2060 demand

Review of Supply Sources and Evaluation Criteria (continued)

Relative Comparison of Individual Source Options

- **SUPPLY AVAILABILITY**
- **RELIABILITY**
- **CERTAINTY & TIMELINESS**
- **COST-EFFECTIVENESS**

- Quantitative (supply avail. & cost)
- Qualitative (reliability & certainty)
  - Scored from 1 (worst) to 5 (best)

Review of Supply Sources and Evaluation Criteria (continued)

Source Options (Phase 1) | **Supply Portfolios (Phase 2)**

Source 1 Source 2 Source 3 Source 4 Source 5

Source 3 Source 2 Source 5 | Source 1 Source 2 Source 4 | Source 3 Source 1 Source 5 …

Screening Criteria

Short-List of Viable Source Options

…Which Source Options are Most Viable?

Water Supply Options Selected for Portfolio Development

Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
Garber Wellington Aquifer Wells (with treatment)	Direct non-potable reuse (purple pipe)	Co-owner with OKC for SE Oklahoma raw water
Intermittent purchase of treated water from OKC (wholesale)	Indirect potable reuse (Lake Thunderbird augmentation)	New out of basin reservoir (either Scissortail or Parker)
Conservation and reuse	~~Indirect potable reuse (groundwater recharge)~~	Kaw Lake
	~~Dredging Lake Thunderbird~~	

The most viable and cost-effective supply options became the "building blocks" for water supply portfolios

AGENDA

- Project overview and update on progress
- Quick review of supply options
- Portfolio evaluations
- Feedback and discussion on supply portfolios

In Tonight's Meeting We Will…

Source Options (Phase 1) | **Supply Portfolios (Phase 2)**

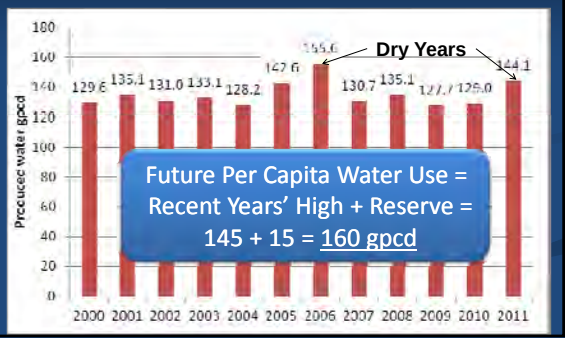
Describe portfolios and present preliminary results of portfolio evaluations

Source 3 Source 2 Source 5 | Source 1 Source 2 Source 4 … | Source 3 Source 1 Source 5 …

Detailed Evaluation Process

2-3 Preferred Supply Portfolios

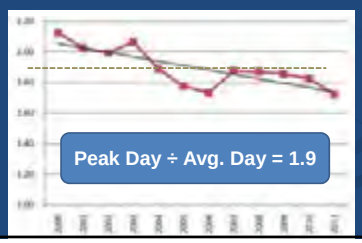
Historical Per-Capita Water Use in Norman



Future Per Capita Water Use = Recent Years' High + Reserve = 145 + 15 = 160 gpcd

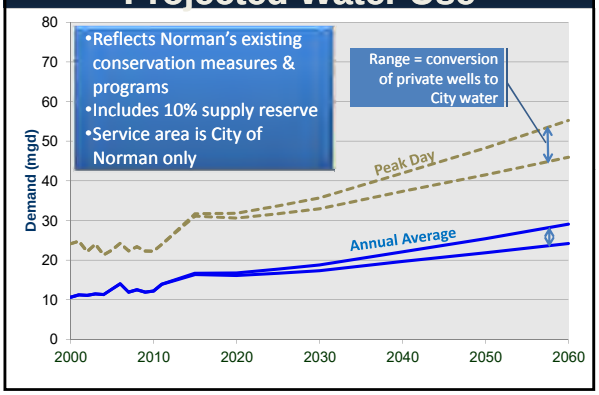
Historical Daily Peaking Factors

- Decreasing trend due to:
  - Reuse & non-potable conversion projects
  - Conservation measures

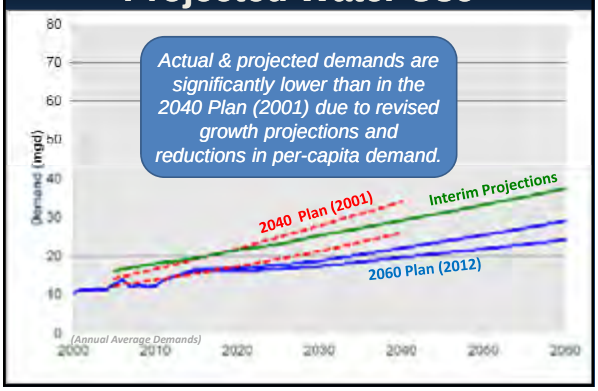


Peak Day ÷ Avg. Day = 1.9

Projected Water Use



Projected Water Use



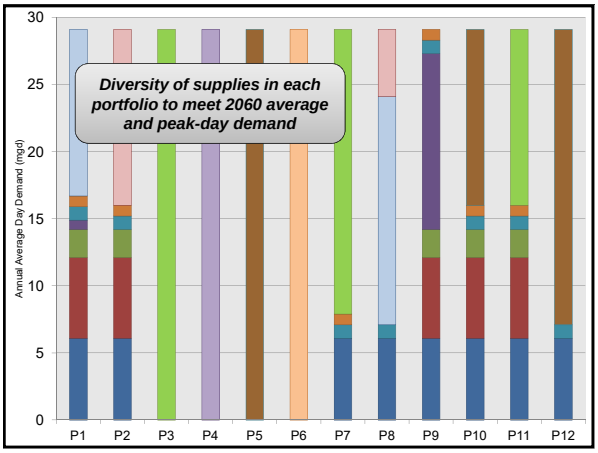
Portfolio	Supply Sources
P1 – Maximize local sources	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1 mgd + 0.8 mgd) ▪ New GW wells to meet deficit through ~2020 (0.7 mgd) ▪ IPR – Thunderbird augmentation post-2020 (12.4 mgd)
P2 – Minimize capital cost	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Purchase treated water from OKC (wholesale) (13.1 mgd)
P3 – Regional option with OKC treated water	▪ Co-owner with OKC for treated water (29.1 mgd)
P4 – Regional option with OKC treated water	▪ Co-owner with OKC for raw water (29.1 mgd)
P5 – Regional option with new reservoir	▪ New out of basin reservoir (29.1 mgd)
P6 – Regional option with Kaw	▪ Kaw Lake (29.1 mgd)

Portfolio	Supply Sources
P7 – Hybrid portfolio with OKC treated water	▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Co-owner with OKC for treated water (21.2 mgd)
P8 – Hybrid portfolio with IPR	▪ Additional conservation (1 mgd) ▪ IPR – Thunderbird augmentation (17 mgd) ▪ Purchase treated water from OKC (wholesale) (5 mgd)
P9 – Hybrid portfolio max. groundwater	▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ New GW wells (with treatment) to meet 2060 deficit (~~13.~~1 mgd)
P10 – Hybrid portfolio with Parker	▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Parker Reservoir to meet 2060 deficit (13.1 mgd)
P11 – Hybrid portfolio with OKC treated water	▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Co-owner with OKC for treated water (13.1 mgd)
P12 – Hybrid portfolio with Scissortail	▪ Additional conservation (1 mgd) ▪ Scissortail Reservoir to meet 2060 deficit (22 mgd)

Lake Thunderbird at firm yield (6.1 mgd)

Portfolio ID	Lake Thunderbird	Active Garber Wellington Wells (with treatment)	Inactive Garber Wellington Wells (with treatment)	New Garber Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (co-owner)	Raw Water from Oklahoma City (co-owner)	New Out of Basin Reservoir (Parker or Scissortail)	Kaw Lake
P1	6.1	6.0	2.1	0.7	1.0	0.8	12.4					
P2	6.1	6.0	2.1		1.0	0.8		13.1				
P3									29.1			
P4										29.1		
P5											29.1	
P6												29.1
P7	6.1				1.0	0.8			21.2			
P8	6.1				1.0		17.0	5.0				
P9	6.1	6.0	2.1	13.1	1.0	0.8						
P10	6.1	6.0	2.1		1.0	0.8					13.1	
P11	6.1	6.0	2.1		1.0	0.8			13.1			
P12	6.1				1.0						22.0	

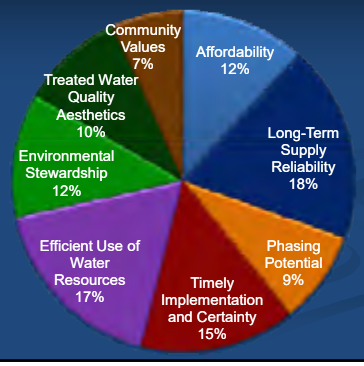
Annual Average Day Demand (mgd)



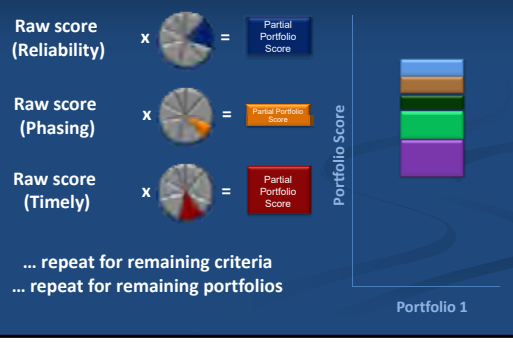
Criteria for Detailed Evaluations

- Affordability
- Long-Term Supply Reliability
- Phasing Potential
- Timely Implementation and Certainty
- Efficient Use of Water Resources
- Environmental Stewardship
- Treated Water Quality Aesthetics
- Community Values (Recreation, Aesthetics, and Property Rights)

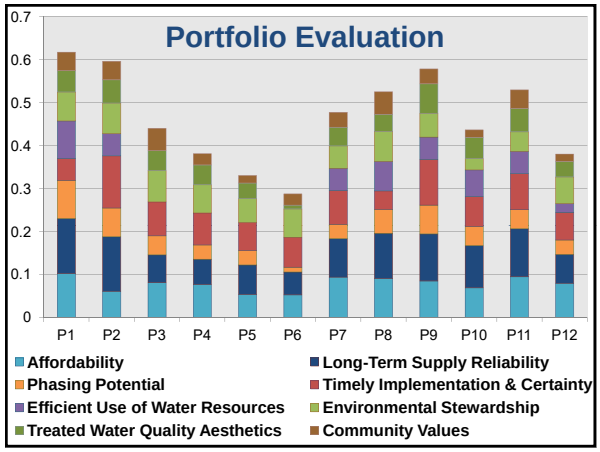
Criteria and Their Relative Importance or "Weight" in Comparing Portfolios

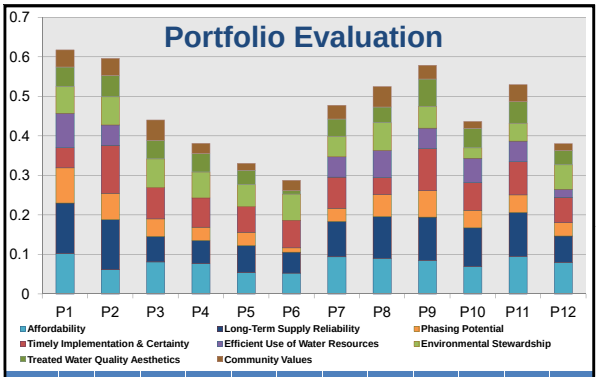


Portfolio Scoring Process

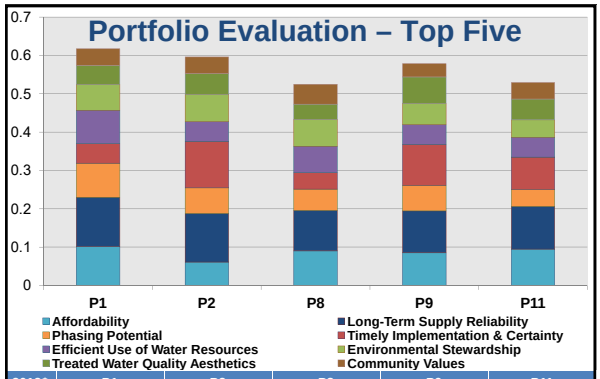


... repeat for remaining criteria
... repeat for remaining portfolios





2012$	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Capital	$260M	$140M	$410M	$440M	$620M	$620M	$320M	$180M	$360M	$490M	$300M	$440M
O&M per year	$21M	$53M	$24M	$24M	$26M	$26M	$22M	$34M	$26M	$25M	$22M	$22M



2012$	P1	P2	P8	P9	P11
Capital	$260M	$140M	$180M	$360M	$300M
O&M per year	$21M	$53M	$34M	$26M	$22M

Portfolio Evaluation – Top Five

Portfolio	Supply Sources	Costs (2012$)
P1 – Maximize local sources	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1 mgd + 0.8 mgd) ▪ New GW wells to meet deficit through ~2020 (0.7 mgd) ▪ IPR – Thunderbird augmentation post-2020 (12.4 mgd)	Capital $260M O&M $21M/yr
P2 – Minimize capital cost	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Purchase treated water from OKC (wholesale) (13.1 mgd)	Capital $140M O&M $53M/yr
P8 – Hybrid portfolio with IPR	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Additional conservation (1 mgd) ▪ IPR – Thunderbird augmentation (17 mgd) ▪ Purchase treated water from OKC (wholesale) (5 mgd)	Capital $180M O&M $34M/yr
P9 – Hybrid portfolio max. groundwater	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ New GW wells (with treatment) to meet 2060 deficit (13.1 mgd)	Capital $360M O&M $26M/yr
P11 – Hybrid portfolio with OKC treated water	▪ Lake Thunderbird at firm yield (6.1 mgd) ▪ Existing wells treated for chromium-6 & arsenic (8.1 mgd) ▪ Additional conservation + non-potable reuse (1.8 mgd) ▪ Co-owner with OKC for treated water (13.1 mgd)	Capital $300M O&M $22M/yr

AGENDA

- Project overview and update on progress
- Quick review of supply options and evaluation criteria
- Portfolio evaluations
- Feedback and discussion on supply portfolios

Water Supply Portfolios

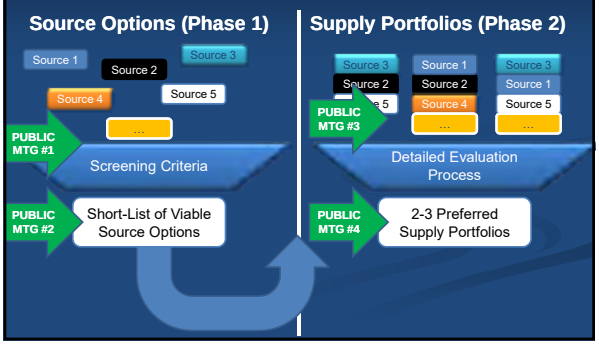
Feedback?

Different portfolios we should evaluate?

Portfolio Feedback

- **P1 – Maximize local sources**
- **P2 – Minimize capital cost**
- P3 – Regional option with OKC treated water
- P4 – Regional option with OKC raw water
- P5 – Regional option with new out of basin reservoir
- P6 – Regional option with Kaw
- P7 – Hybrid portfolio with OKC treated water
- **P8 – Hybrid portfolio with IPR (Thunderbird augmentation)**
- **P9 – Hybrid portfolio maximizing groundwater**
- P10 – Hybrid portfolio with Parker
- **P11 – Hybrid portfolio with OKC treated water**
- P12 – Hybrid portfolio with Scissortail

Activity from Now to Public Meeting #4



Norman Utilities Authority

2060 Strategic Water Supply Plan

Public Meeting #3
March 13, 2013

Strategic Water Supply Plan Public Meeting #3
Minutes
March 13, 2013
6:30 p.m.

Attendance:

- Strategic Water Supply Plan Project Team: John Rehring and Amber Wooten
- Councilmembers: Mayor Rosenthal, Castleberry, Gallagher, Lockett
- Staff: Ken Komiske, Mark Daniels, Chris Mattingly, Charlie Thomas, Gay Webb

Mr. Komiske welcomed the public and Ad Hoc Committee members to the third public meeting of the Strategic Water Supply Plan (SWSP). This process is to help plan for our long term water needs through 2060.

Mr. Komiske introduced John Rehring and Amber Wooten with Carollo Engineers.

Project Overview and update on progress

Mr. Rehring gave a project overview. He explained the two phases of the planning process; the first phase focuses on supply options, individual sources that alone, may or may not be able to meet our long term water needs. The second phase of the process focuses on portfolios, different packages of water supplies that together, could meet our 2060 water demands. The first SWSP public meeting included the basis of planning, water demand projections, supply options and evaluation criteria. The second public meeting reviewed individual water supply options and screening. The meeting tonight will focus on different supply portfolios to meet long term water needs through 2060. The fourth public meeting will focus on results of revised portfolios and where we go from here. Ultimately, we will end with two or three preferred supply portfolios.

Review of supply options and evaluation criteria

Ms. Wooten reviewed the existing, new local and new regional supply sources. The supply sources were categorized and compared using supply availability, reliability, certainty and timeliness, and cost-effectiveness to determine which supply options ones were most viable to Norman.

Portfolio evaluations

Mr. Rehring explained the per-capita water usage calculation of 160 gallons per capita per day (gpcd) with a peaking factor of 1.9 and a peak day demand of 55 million gallons a day (mgd) projected in 2060 to be used in the planning process.

Mr. Rehring described the 12 portfolios that have been evaluated. All portfolios meet the 29.1 mgd annual average day demand and 55 mgd peak day demand in 2060. The annual costs are in present day dollars.

Portfolio 1 – Maximize local sources
- Lake Thunderbird firm yield (6.1 mgd)
- Existing wells treated for chromium 6 and arsenic (8.1 mgd)
- Additional conservation + non-potable reuse (1 mgd + 0.8 mgd)
- New Garber Wellington wells to meet deficit through approximately 2020 (0.7 mgd)
- IPR – Thunderbird augmentation post 2020 (12.4 mgd)
  - *Capital Cost - $260 Million*
  - *Operations & Maintenance Cost - $21 Million*

Portfolio 2 – Minimize capital cost
- Lake Thunderbird firm yield (6.1 mgd)
- Existing wells treated for chromium 6 and arsenic (8.1 mgd)
- Additional conservation + non-potable reuse (1.8 mgd)
- Purchase treated water from Oklahoma City (wholesale) (13.1 mgd)
  - *Capital Cost - $ 140 Million*
  - *Operations & Maintenance Cost – $53 Million*

Portfolio 3 – Regional option with Oklahoma City treated water
- Co-owner with Oklahoma City for treated water (29.1 mgd)
  - *Capital Cost – $410 Million*
  - *Operations & Maintenance Cost – $24 Million*

Portfolio 4 – Regional option with Oklahoma City treated water
- Co-owner with Oklahoma City for raw water (29.1 mgd)
  - *Capital Cost - $440 Million*
  - *Operations & Maintenance Cost - $24 Million*

Portfolio 5 – Regional option with new reservoir
- New out of basin reservoir (29.1 mgd)
  - *Capital Cost - $620 Million*
  - *Operations & Maintenance Cost – $26 Million*

Portfolio 6 – Regional option with Kaw
- Kaw Lake (29.1 mgd)
  - *Capital Cost - $620 Million*
  - *Operations & Maintenance Cost - $26 Million*

Portfolio 7 – Hybrid portfolio with Oklahoma City treated water
- Lake Thunderbird firm yield (6.1 mgd)
- Additional conservation + non-potable reuse (1.8 mgd)
- Co-owner with Oklahoma City for treated water (21.2 mgd)
  - *Capital Cost - $320 Million*
  - *Operations & Maintenance Cost - $22 Million*

Portfolio 8 – Hybrid portfolio with Indirect Potable Reuse
- Lake Thunderbird firm yield (6.1 mgd)
- Additional conservation (1 mgd)
- Indirect Potable Reuse – Lake Thunderbird augmentation (17 mgd)
- Purchase treated water from Oklahoma City (wholesale) (5 mgd)
  - *Capital Cost – $180 Million*
  - *Operations & Maintenance - $34 Million*

Portfolio 9 – Hybrid portfolio maximum groundwater
- Lake Thunderbird firm yield (6.1 mgd)
- Additional conservation + non-potable reuse (1.8 mgd)
- Existing wells treated for chromium 6 and arsenic (8.1 mgd)
- New Garber Wellington wells (with treatment) to meet 2060 deficit (13.1 mgd)
  - *Capital Cost - $360 Million*
  - *Operations & Maintenance - $26 Million*

Portfolio 10 – Hybrid portfolio with Parker Reservoir
- Lake Thunderbird firm yield (6.1 mgd)
- Existing wells treated for chromium 6 and arsenic (8.1 mgd)
- Additional conservation + non-potable reuse (1.8 mgd)
- Parker Reservoir to meet 2060 deficit (13.1 mgd)
  - *Capital Cost - $490 Million*
  - *Operations & Maintenance - $25 Million*

Portfolio 11 – Hybrid portfolio with Oklahoma City treated water
- Lake Thunderbird firm yield (6.1 mgd)
- Existing wells treated for chromium 6 and arsenic (8.1 mgd)
- Additional conservation + non-potable reuse (1.8 mgd)
- Co-owner with Oklahoma City for treated water (13.1 mgd)
  - *Capital Cost - $300 Million*
  - *Operations & Maintenance - $22 Million*

Portfolio 12 – Hybrid portfolio with Scissortail Reservoir
- Lake Thunderbird firm yield (6.1 mgd)
- Additional conservation (1 mgd)
- Scissortail Reservoir to meet 2060 deficit (22 mgd)
  - *Capital Cost - $440 Million*
  - *Operations & Maintenance - $22 Million*

Mr. Rehring described the criteria used in the detailed evaluations and the scoring process. The criteria included:
- Affordability
- Long-Term Supply Reliability Phasing Potential
- Timely Implementation and Certainty
- Phasing Potential
- Efficient Use of Water Resources

Environmental Stewardship
Treated Water Quality Aesthetics
Community Values (Recreation, Aesthetics, and Property Rights)

After evaluating all twelve portfolios, the five portfolios that scored the best include:

Portfolio 1 – Maximize local sources
Portfolio 2 – Minimize capital costs
Portfolio 8 – Hybrid portfolio with Indirect Potable Reuse
Portfolio 9 – Hybrid portfolio maximizing groundwater
Portfolio 11 – Hybrid portfolio with Oklahoma City treated water

Mr. Rehring explained once we obtain feedback tonight and identify other potential portfolios or different emphasis for those supplies, we will go back and, if necessary, identify new portfolios and go through the same analysis process and bring them back to public meeting number four where we will have what appears to be best two or three supply portfolios to build on.

Feedback and discussion on supply portfolios

Mr. Rehring answered the following questions:

- What is the basis for population projections and subsequent demand projections? The population projections were taken from the Norman 2025 Plan extrapolated out to 2060. We looked at historical percent growth per year, which varies quite a bit, and number of people per year, which is more consistent. Projected growth (people per year) from 2020 – 2025 was used to extrapolate population projections from 2025 – 2060. The population projections combined with the percent of Norman's population served by city water and the gallons per capita per day were used to estimate 2060 water demands.

- What is the difference between the Oklahoma Comprehensive Water Plan (OCWP) Scenario I and Scenario II conservation levels? First, note that these estimated savings are in addition to conservation measures that Norman is already doing. Scenario I includes additional public education, further reductions in non-revenue water, and stronger conservation pricing (as more water is used, the cost per 1000 gallons of water increases). Generally Scenario I measures build on what Norman is already doing. Scenario II conservation measures are more aggressive and could affect lifestyles, including measures such as turf grass buy-back programs that may not be fully embraced or adopted by the community.

- How do you quantify items like reliability? We evaluated reliability in a number of ways. One was using information from the OCWP about projected water shortages in the raw water supply source basin. We also looked at reliability in terms of the diversity of supply sources in the portfolio. Additionally, we looked at the

infrastructure that brings the raw water to Norman. Collectively, these tell us a lot about the reliability of a portfolio to meet Norman's long-term water needs.

- Did you evaluate the actual availability of water from Oklahoma City if we were to become a larger wholesale customer or a co-owner in the project? This was not explicitly evaluated: however, in 2009 Oklahoma City along with others looked at the availability and cost of bringing water from Southeast Oklahoma. This 2009 study showed that there is available raw water. There is still some uncertainty about which communities might participate in the project.

- What about the tribal claims on Southeast Oklahoma raw water? There are ongoing mediation efforts surrounding Southeast Oklahoma water. This project does assume that eventually Oklahoma City's project will move forward, however, we have reflected the uncertainty associated with this supply in the portfolio scoring (for example, in timely implementation and certainty).

- Will you expand on the Lake Thunderbird augmentation option specifically with regard to water quality impacts? A concern with this supply option is that Oklahoma Department of Environmental Quality (ODEQ) has not established the details of water quality requirements for indirect potable reuse (Lake Thunderbird augmentation). Lake Thunderbird is designated as a sensitive water supply. There is general language that says that you cannot degrade water quality of a sensitive water supply with permitted discharges. Central Oklahoma Master Conservancy District (COMCD) evaluated the augmentation of Lake Thunderbird with additionally treated reclaimed water (wastewater treatment plan effluent) in its 2012 study.

- Was the uncertainty regarding ODEQ's actions factored into analysis? The uncertainty associated with this supply source is reflected in the timely implementation and certainty portfolio scoring.

- What was assumed regarding the amount of reclaimed water Norman puts into Lake Thunderbird that could be recovered by Norman? This study assumes that the amount of water delivered to Lake Thunderbird will be recovered by Norman, minus losses due to evaporation and seepage. This assumption is based on our understanding of Oklahoma water law and precedents set by other states. Intentional indirect potable reuse is untested in Oklahoma. Norman may be asked to pay for a larger portion of Lake Thunderbird's operation and maintenance costs if they will be a bigger user.

- This seems to like a big assumption. Norman would be taking its own reusable supplies and intentionally recharging Lake Thunderbird. That is significantly different from the original construction of the reservoir, where the three cities were allocated proportions of the yield from the reservoir from flows originating within the stream or watershed.

- Why can we not use reclaimed water directly for potable supply? Some would argue that the technology to employ direct potable reuse (where reclaimed water is treated

and then piped directly to the distribution system or to the water treatment plant) is available. However, it may not be the best option for Norman at this time. Storing water in a reservoir (like Lake Thunderbird) helps to buffer a relatively constant supply (reclaimed water) with a variable demand. Additionally, it provides dilution, some degree of natural attenuation, and an additional buffer between source and customer in case there is a water quality issue.

- Will we use more water consistently than we recover? Yes. During winter, we see 90% or more of water use coming back to the sanitary sewer, but that number is much lower in summer due to outdoor water use.

- You included both purchasing raw and treated water from Oklahoma City initially, however you seem to include purchasing Oklahoma City treated water more in portfolios. Why was this decision made? At this point, we do not have enough information to distinguish between which Oklahoma City water option is best for Norman. Prior to becoming co-owner with Oklahoma City in the Southeast Oklahoma project or becoming a larger wholesale customer to Oklahoma City, more discussions and analysis need to be completed.

- Of the top five portfolios, which one is most vulnerable to environmental changes, which is most vulnerable to political changes and which one is most vulnerable to economic changes? Assuming that environmental changes being discussed include both climate change and environmental disasters like hazardous spills, the portfolios that heavily depend on surface water are most vulnerable to climate change (although groundwater recharge can also be impacted). The Oklahoma Comprehensive Water Plan projections suggest that water supplies could be increased or reduced with climate change; there is significant uncertainty in those projections. Both surface water and groundwater supplies can be impacted by environmental accidents (e.g., via stormwater going into surface water). The portfolios that are least vulnerable to political changes are those that have supplies most within Norman's control, however you limit political vulnerability by having strong intergovernmental agreements on shared sources. Regarding economic vulnerability, capital cost is a function of the market (those with higher costs may be more susceptible to construction cost changes) while operation and maintenance costs are a function of the agreement (example wholesale customer to Oklahoma City). Additionally, high-energy requirements may increase economic vulnerability due to changes in energy costs.

- Comment made it would be helpful if costs presented could be translated into a cost per customer. With the final two or three portfolios, implementation plans will be developed. At this point, we will have a cost per year of water. There are many ways that water can be paid for.

- Has anyone talked to regulatory agencies about whether they will be writing rules that govern ownership of reclaimed water? This has not been done yet, however we know that COMCD is very interested in augmenting Lake Thunderbird immediately along

with Oklahoma City, so the concept of augmenting Lake Thunderbird will continue to be pushed.

- Has limiting population been considered as part of the long-range water supply planning process? No, we used the Norman 2025 plan. Updates to this plan would be the place to address land use planning and growth planning. Water supply planning would need to be updated pending land use plan updates.

- Have you looked at the possibility of building a new lake for Norman, how much would it cost and how big would the lake need to be? First, there are not good reservoir sites everywhere. As part of the OCWP, feasible reservoir sites with good yields were identified. The ones closest to Norman were Parker and Scissortail. Norman's potential costs for those are identified in the SWSP supply portfolios.

- What needs to be done by others to implement some of these supply sources? Mr. Komiske responded that City staff is meeting with legislators, Oklahoma Water Resources Board and Oklahoma Department of Environmental Quality to discuss reuse and use of arsenic wells. The City is interested in moving forward on these options with the safety of our citizens as a priority.

- Why is no one cleaning out Lake Thunderbird while it is low (trash removal) or dig it deeper? The firm yield of the lake assumes some amount of sedimentation allowance (meaning that having sediment fill in the lake to this level does not affect the available supply). As far as digging the lake deeper, it would be tremendously costly. It would not only have to be deeper but wider; which would have property implications so relative to other sources available, it does not look as viable compared to other options.

- Has Lake Thunderbird been dredged for sediment? No, not to my knowledge. However the accumulation of sediment for that reservoir is built into the calculations of the yield of the reservoir. It will eventually need to be dredged to maintain that yield, but the lake is only 50 years old so we have not reached that point yet where it is impacting the yield beyond what the calculations say that it can produce.

- Do you know how much it would cost to dredge Lake Thunderbird? Comment made that option of dredging Lake Thunderbird should be considered. Mr. Komiske responded we have not looked specifically at dredging Lake Thunderbird but we have relied on other engineering reports, such as a study in Texas, which indicated that in land rich areas, it is less expensive to build a new reservoir than it is to clean out or dredge an existing reservoir. Lake Thunderbird is 50 years old and lakes are usually built with a 100 year life so we have not reached the point of dredging. Additionally, you will need a considerable amount of land mass to dry the dredged material. It has been found to be cheaper to build a new reservoir.

- Would you have to find area for excavated materials from construction of a new lake too? When you are trying to locate a new reservoir, you would look for an area that

has natural topography that would provide adequate water storage volume (with new dam structure) that does not require significant excavating.

- Comment made advocating trash and debris removal should be done at times when Lake Thunderbird water level is down.

- What is the difference in capacity of Lake Thunderbird now versus when it was built? Surveys are taken from time to time to determine if the sedimentation in the Lake is occurring at the rate they expect it to and it is currently on track. The yield we are allowed to take has not changed.

- What will be the impact on the system if the drought continues? Mr. Komiske responded we are in our third year of the drought. Currently COMCD has instituted a mandatory 10 percent reduction in Lake Thunderbird use. We are following our conservation plan. Norman has implemented Stage 2 mandatory conservation (meaning odd/even watering, not watering on Wednesday and Thursday, reduced street sweeping, etc.). Should COMCD require further reductions, Norman would follow ordinances already in place and move to Stage 3 mandatory conservation, which would be one day a week watering.

- We have been talking about the long-term water supply plan. What is the short-term (next 1 – 5 years) water plan? Mr. Komiske answered based on the last rate increase, all new wells and changes that were approved have been implemented (finishing expansion of transmission pipeline from Lake Thunderbird to the Water Treatment Plant and the first phase of the expansion of the Water Treatment Plant. There is not additional money available for new water supplies. We have made an agreement with Del City to purchase their excess water from Lake Thunderbird. Additionally, we have an agreement to purchase water from Oklahoma City on an emergency basis and if the water is available.

Mr. Komiske thanked those in attendance and encouraged citizens to provide feedback on this very important issue. He asked Mayor Rosenthal to make the closing remarks. Mayor Rosenthal announced there will be one more SWSP public meeting and strongly encouraged citizens to provide feedback to staff or Council on the different supply options and portfolios being presented. The Mayor also announced the Environmental Control Advisory Board will be co-sponsoring a public education meeting to be held in the Council Chambers on April 1st at 6:30 p.m. on ways individuals can adapt to the short-term water challenges in terms of plantings and things you can do at home to reduce your water consumption. The Mayor thanked the Ad Hoc Committee members and those in attendance.

The meeting adjourned at 8:25 p.m.

Items submitted for the record:

1. PowerPoint presentation entitled, 2060 Strategic Water Supply Plan Public Meeting #3, March 13, 2013

APPENDIX AC – PUBLIC PARTICIPATION – PUBLIC MEETING #4

Press Release

2060 Strategic Water Supply Plan Public Meeting #4

A public meeting will be held Tuesday, July 16, 2013 from 6:30 p.m. to 8:30 p.m. at City Council Chambers, 201 W. Gray, Norman, Oklahoma. This meeting will be the fourth in a series of public meetings to provide the public with information about the making of its 2060 Strategic Water Supply Plan (SWSP) and gather public input regarding key aspects of the plan.

The City of Norman is updating its plans for supplying long term water solutions to its customers. The SWSP builds on previous planning efforts discussing water demands, supply options, and infrastructure as well as significant new developments in water supply regulations, new technology and availability of water.

The City is evaluating a wide range of potential water supply sources and identifying those that will best meet the community's short and long-term needs. The long-term water supply "portfolio" for Norman will likely include a combination of existing sources and new sources. Sources that passed the initial screening criteria have been combined into portfolios for evaluation in the final phase of the project.

Public input is being sought through meetings that have been held at key milestones throughout the development of the SWSP. An Ad Hoc committee has been appointed by City Council to help guide this planning process and enhance feedback and communications. The July 16 public meeting presentation will include a project update, review of supply options and evaluation criteria, and portfolio evaluations. Meeting participants will have an opportunity to review supply options and provide feedback on the portfolios to be evaluated. This meeting will also be televised on the local government Channel 20.

Norman's 2060 Strategic Water Supply Plan

Public Meeting #4
6:30 PM to 8:30 PM, July 16, 2013
City Council Chambers, City Hall
201 W. Gray

- Introduction and Goals for Public Meeting #4

- Status and Progress Update
  - Review of supply source options
  - Review of future water needs
  - Review of initial 12 supply portfolios and results of portfolio evaluations
  - New portfolios developed since Public Meeting #3

- Recommended Portfolios
  - Portfolio 1: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation
  - Portfolio 13: Diverse portfolio including regional raw water as co-owner with Oklahoma City
  - Portfolio 14: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation and new groundwater wells

- Implementation Planning for Recommended Portfolios
  - Basis for implementation timing, phasing, and capital financing
  - Comparison of long-term capital financing and annual costs for the recommended portfolios

- Discussion: Path Forward for 2060 SWSP

***

The City Council has been invited to attend this meeting. This is not an official meeting of the City Council. This notice is being posted to comply with the Open Meeting Act in the event a quorum of the City Council is present. No formal action of the City Council will take place.

Norman Utilities Authority
2060 Strategic Water Supply Plan

Public Meeting #4
July 16, 2013

AGENDA

- **Status and Progress Update**
- Recommended Portfolios
- Implementation Planning for Recommended Portfolios
- Path Forward

Project Overview and Update on Progress

Public Meeting 1 (June 2012)	▪ Basis of Planning ▪ Demand, supply options, and evaluation criteria
Public Meeting 2 (October 2012)	▪ Phase 1 – Individual Water Supply Options
Public Meeting 3 (March 2013)	▪ Phase 2 (part A) – Future Water Supply Portfolios ▪ Evaluation of initial supply portfolios
Public Meeting 4 (Tonight)	▪ Phase 2 (part B) – Future Water Supply Portfolios ▪ Evaluation of revised portfolios

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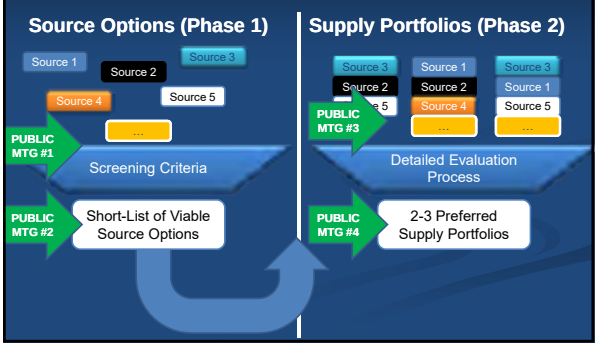
SWSP Planning Process

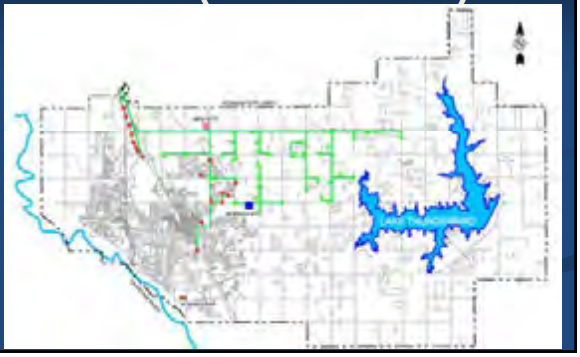


Review of Supply Sources and Evaluation Criteria

Water Supply Options

Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
Garber Wellington Aquifer Wells (with treatment)	Direct non-potable reuse (purple pipe)	Co-owner with OKC for SE Oklahoma raw water
Intermittent purchase of treated water from OKC (wholesale)	Lake Thunderbird Augmentation (indirect potable reuse)	Scissortail Reservoir
Conservation and reuse	Groundwater Recharge (indirect potable reuse)	Parker Reservoir
	Stormwater capture and reuse	Kaw Lake
	Canadian River Diversion	
	Capture Lake Thunderbird spillage	
	Dredging Lake Thunderbird	

Garber Wellington Aquifer Wells (with treatment)

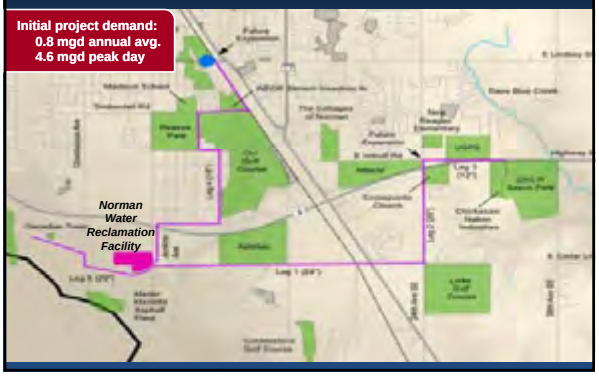


Potential Additional Conservation Savings for Norman (Post 2010)

	Scenario I (mgd)*	Scenario II (mgd) *
2020	0.70	1.6
2030	0.74	1.9
2040	0.77	2.3
2050	0.79	2.5
2060	0.81	2.6

* 60% of OCWP estimates for Cleveland County

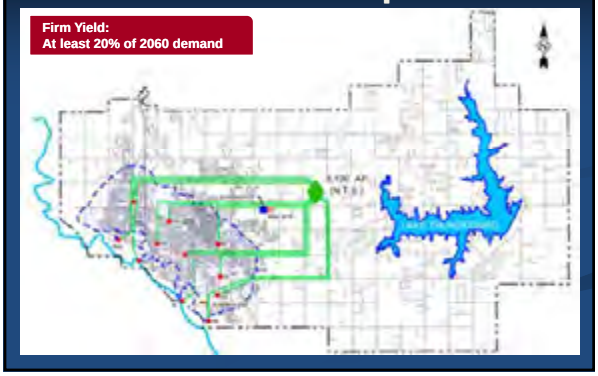
Direct Non-Potable Reuse



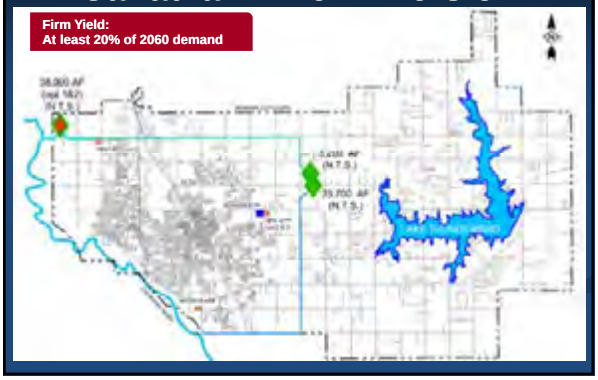
Lake Thunderbird Augmentation

From COMCD 2012 Lake Thunderbird Water Reuse Feasibility Study

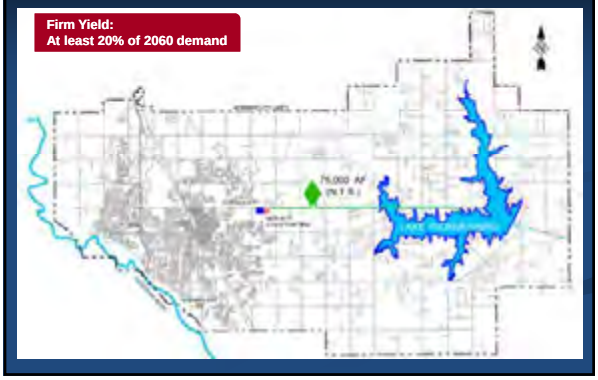
Stormwater Capture



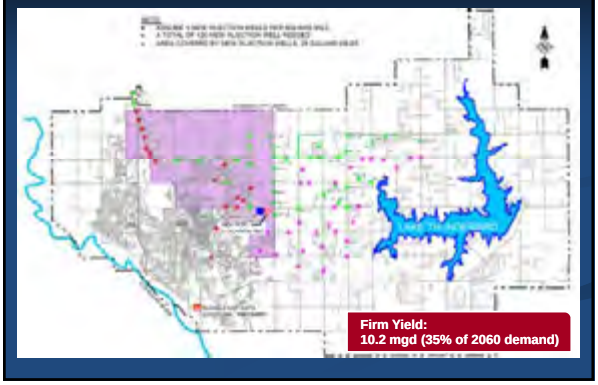
Canadian River Diversion



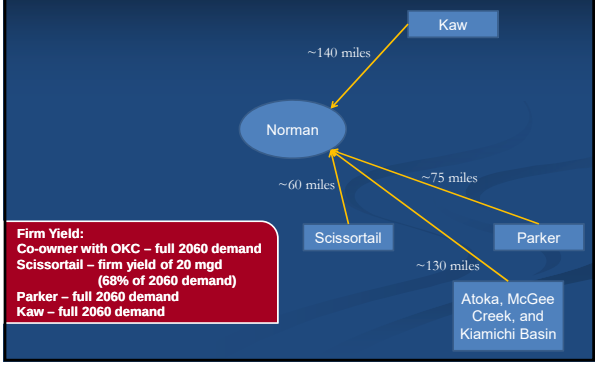
Capture Lake Thunderbird Spillage



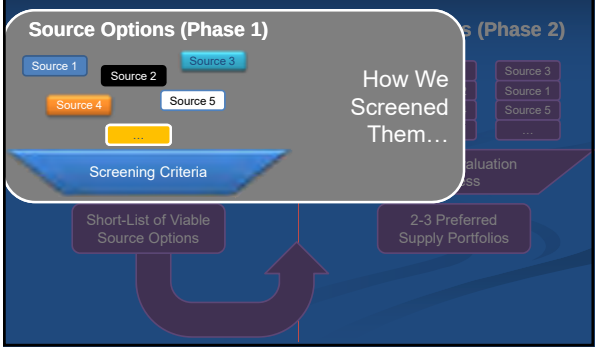
Groundwater Recharge



New Regional Sources



Review of Supply Sources and Evaluation Criteria (continued)

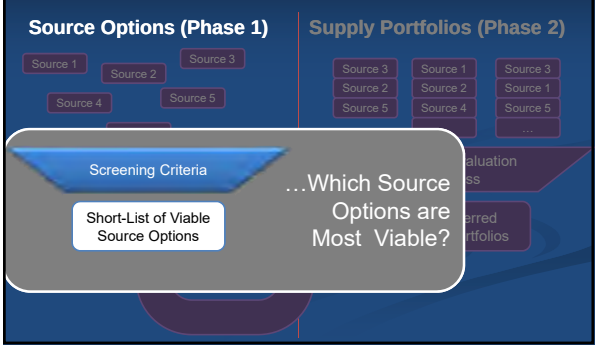


Relative Comparison of Individual Source Options

- SUPPLY AVAILABILITY
- RELIABILITY
- CERTAINTY & TIMELINESS
- COST-EFFECTIVENESS

- Quantitative (supply avail. & cost)
- Qualitative (reliability & certainty)
  - Scored from 1 (worst) to 5 (best)

Review of Supply Sources and Evaluation Criteria (continued)

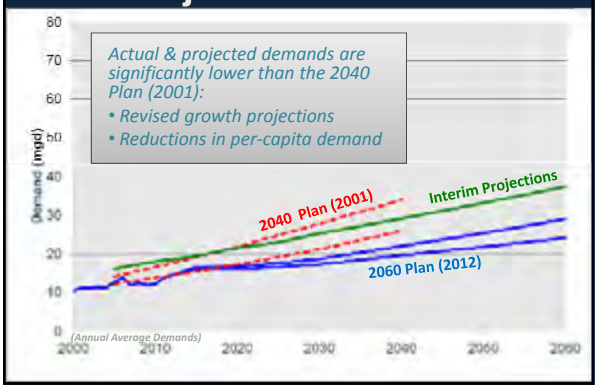


Water Supply Options Selected for Portfolio Development

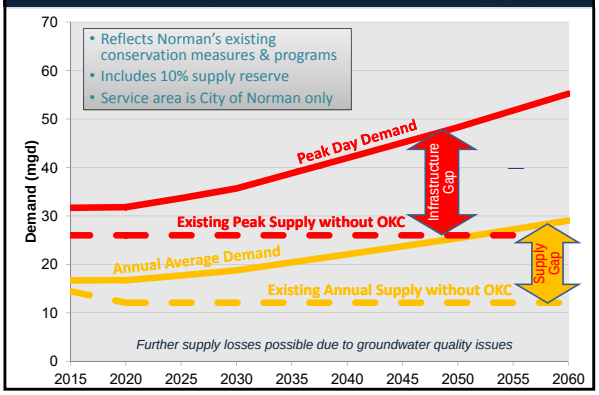
Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
Garber Wellington Aquifer Wells (with treatment)	Direct non-potable reuse (purple pipe)	Co-owner with OKC for SE Oklahoma raw water
Intermittent purchase of treated water from OKC (wholesale)	Lake Thunderbird Augmentation (indirect potable reuse)	New out of basin reservoir (either Scissortail or Parker)
Conservation and reuse	~~Groundwater Recharge (indirect potable reuse)~~	Kaw Lake
	~~Dredging Lake Thunderbird~~	

The most viable and cost-effective supply options became the "building blocks" for water supply portfolios

Projected Water Use



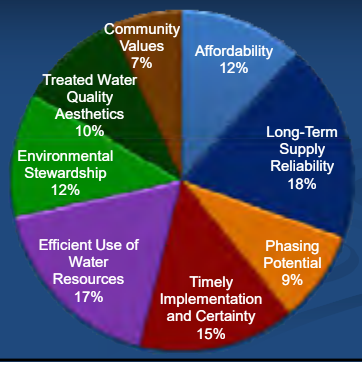
Use Already Exceeds Local Supply



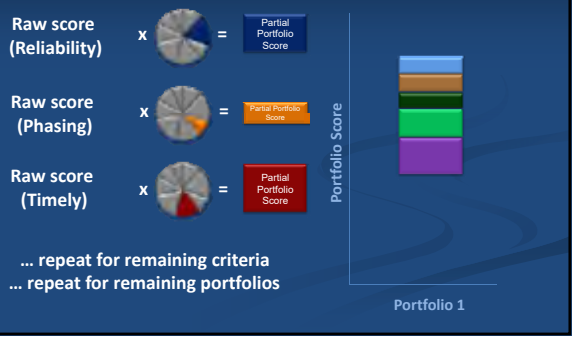
Portfolio ID	Lake Thunderbird	Active Garber Wellington Wells (with treatment)	Inactive Garber Wellington Wells (with treatment)	New Garber Wellington Wells (with treatment)	Additional Conservation	Direct Non-potable Reuse	Lake Thunderbird Augmentation (IPR)	Treated Water from Oklahoma City (wholesale)	Treated Water from Oklahoma City (co-owner)	Raw Water from Oklahoma City (co-owner)	New Out of Basin Reservoir (Parker or Scissortail)	Kaw Lake
P1	6.1	6.0	2.1		1.0	0.8	13.1					
P2	6.1	6.0	2.1		1.0	0.8		13.1				
P3									29.1			
P4										29.1		
P5											29.1	
P6												29.1
P7	6.1				1.0	0.8			21.2			
P8	6.1				1.0		17.0	5.0				
P9	6.1	6.0	2.1	13.1	1.0	0.8						
P10	6.1	6.0	2.1		1.0	0.8					13.1	
P11	6.1	6.0	2.1		1.0	0.8			13.1			
P12	6.1				1.0						22.0	

2060 Annual Average Daily Supply (mgd)

Criteria and Their Relative Importance or "Weight" in Comparing Portfolios

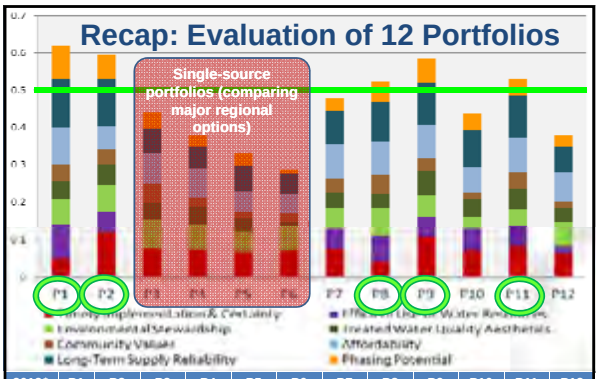


Portfolio Scoring Process



... repeat for remaining criteria
... repeat for remaining portfolios

Recap: Evaluation of 12 Portfolios



2012$	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Capital	$250M	$140M	$410M	$440M	$620M	$620M	$320M	$180M	$330M	$490M	$300M	$430M
O&M per year	$21M	$53M	$24M	$24M	$26M	$26M	$22M	$34M	$24M	$25M	$22M	$22M

Top 5 Portfolios for Meeting our Objectives

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City
P1 Max Local	6	8		2	13	
P2 Low Capital	6	8		2		13 W T
P8 Eliminated: Impractical to Completely Eliminate Groundwater						
P9 Max Groundwater	6	8	13	2		
P11 Regional OKC	6	8		2		13 O T

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

Portfolios that use significant regional supplies

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City
P2 Eliminated: High annual costs, lacks benefits of co-ownership						W T
P11 Modified to form New P13 (Regional Raw Water, co-owner w/OKC)						O T
NEW P13 Regional OKC	6	8		2		13 O R

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

Portfolios that focus on use of local sources

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City
P1 Max Local	6	8		2	13	
P9 Eliminated: Concerns with Excess Reliance on Groundwater						
NEW P14 Wells + TBird Aug.	6	8	2	2	11	

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

AGENDA

- Status and Progress Update
- **Recommended Portfolios**
- Implementation Planning for Recommended Portfolios
- Path Forward

Recommended Portfolios that Best Meet our Objectives

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City	Capital and O&M Costs (2012$)
P1 Max Local	6	8		2	13		$250M $21M/yr
P13 Regional OKC	6	8		2		13 O R	$340M $23M/yr
P14 Wells + TBird Aug.	6	8	2	2	11		$270M $22M/yr

Values are 2060 Annual Avg. Use (mgd) OKC Notes: W=Wholesale purchases, O=Owner; T=Treated, R=Raw

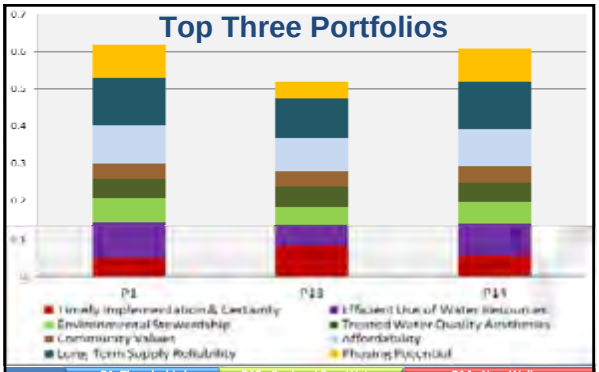
Recommended Portfolios

- All three have diverse supplies including:
  - Lake Thunderbird at reduced (firm) lake yield
  - Active & inactive existing wells with treatment
  - Additional conservation
  - Additional non-potable water reuse
- Meeting future growth in demand varies
  - P1: Lake Thunderbird Augmentation
  - P13: Regional Raw Water (co-owner with OKC)
  - P14: New Wells & Lake Thunderbird Augment'n

Key Attributes of Recommended Portfolios

P1: Thunderbird Augmentation	P13: Regional Raw Water (co-owner with OKC)	P14: New Wells and Thunderbird Augmentation
▪ Discharge permitting uncertainties ▪ Efficient use of water resources ▪ Greater phasing potential than P13	▪ Local control over treatment ▪ Contingent on OKC projects	▪ Local control over sources ▪ Discharge permitting uncertainties ▪ Efficient use of water resources ▪ Greater phasing potential than P1

Top Three Portfolios



2012$	P1: Thunderbird Augmentation	P13: Regional Raw Water (co-owner with OKC)	P14: New Wells + Thunderbird Augmentation
Capital	$250M	$340M	$270M
O&M	$21M/yr	$23M/yr	$22M/yr

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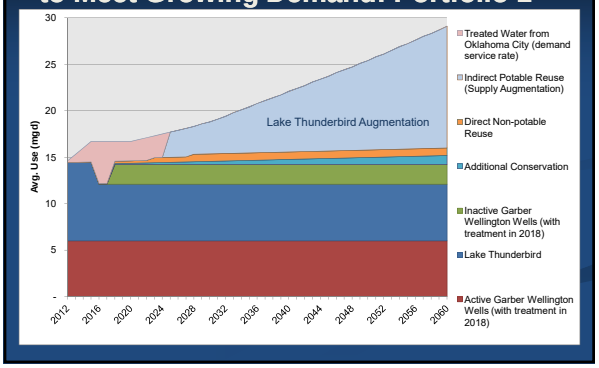
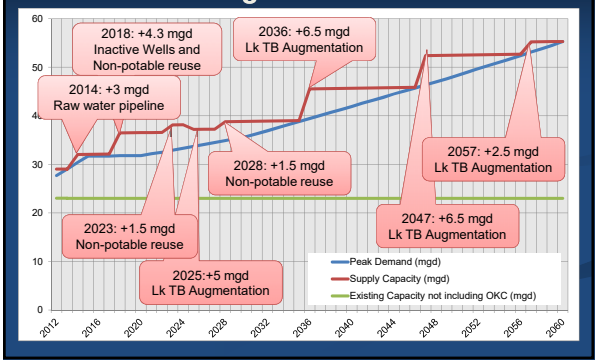
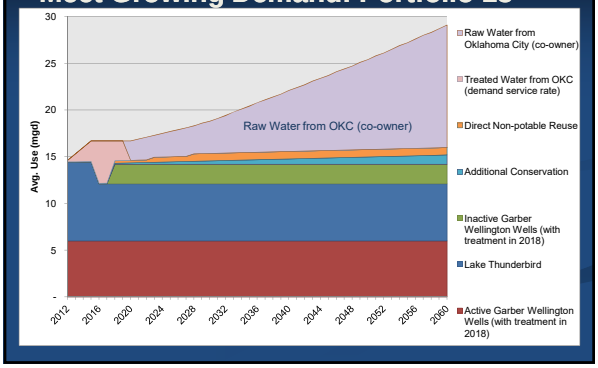
Phased Capacity Increases to Meet Growing Demand: Portfolio 1



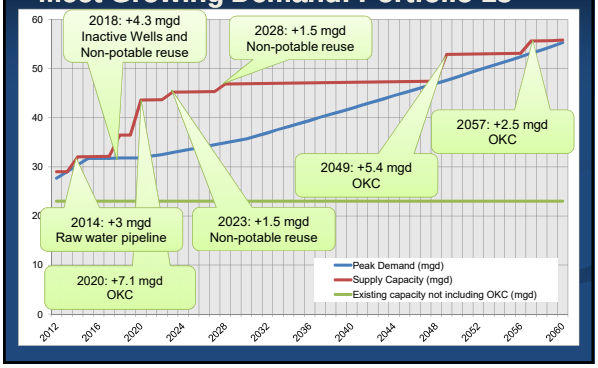
Phased Capacity Increases to Meet Growing Demand: Portfolio 1



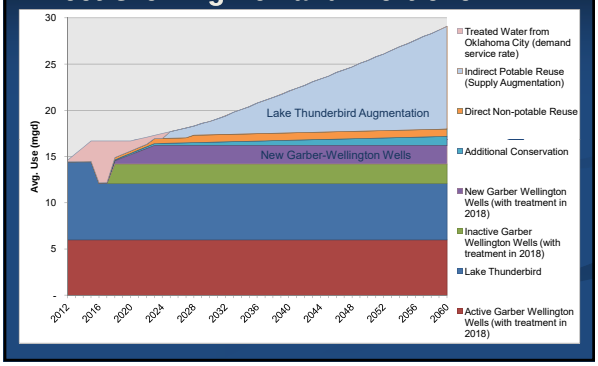
Phased Capacity Increases to Meet Growing Demand: Portfolio 13



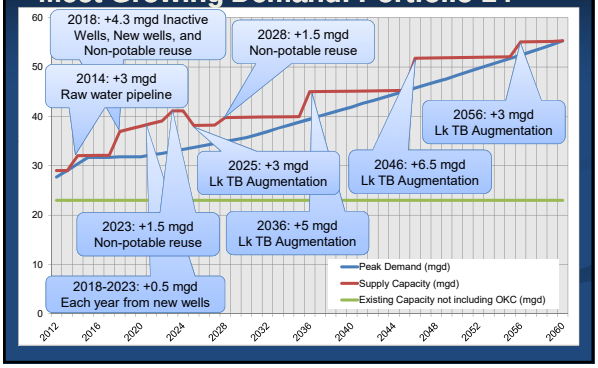
Phased Capacity Increases to Meet Growing Demand: Portfolio 13



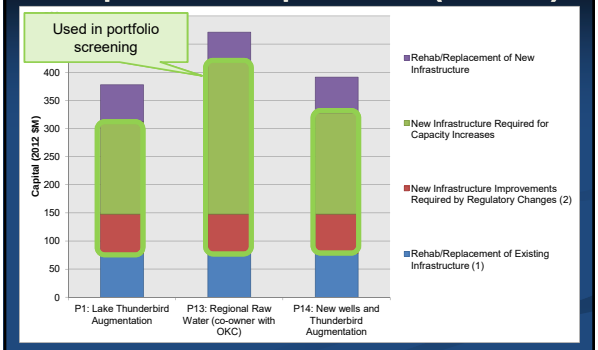
Phased Capacity Increases to Meet Growing Demand: Portfolio 14



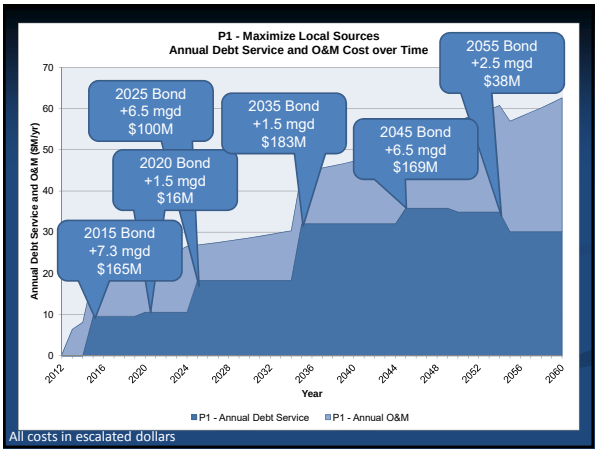
Phased Capacity Increases to Meet Growing Demand: Portfolio 14



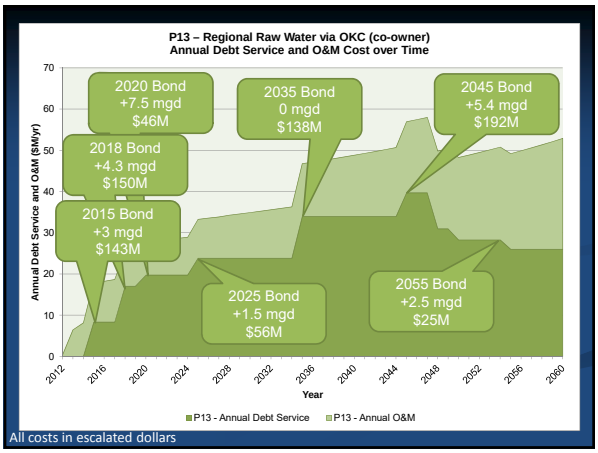
Comparison of Capital Costs (2012 $M)

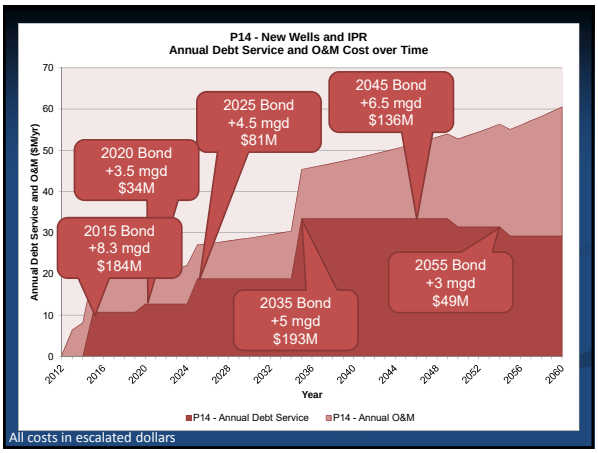


Notes:
1. Existing infrastructure includes Vernon Campbell WTP, raw water piping, and treated water connection to OKC.
2. Infrastructure required because of anticipated regulatory changes includes treatment for active Garber-Wellington Aquifer wells.

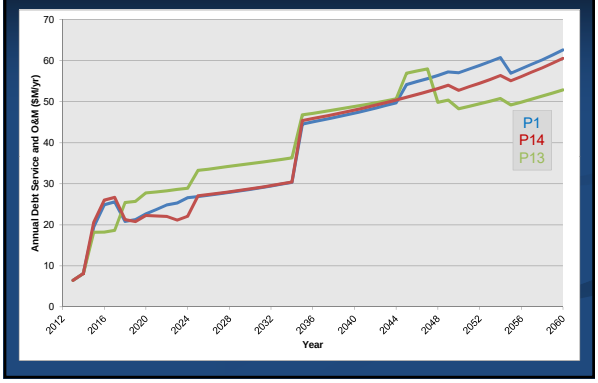


All costs in escalated dollars





Comparison of Annual Costs



Key Attributes of Recommended Portfolios

P1: Thunderbird Augmentation	P13: Regional Raw Water (co-owner with OKC)	P14: New Wells and Thunderbird Augmentation
▪ Discharge permitting uncertainties ▪ Efficient use of water resources ▪ Greater phasing potential than P13	▪ Local control over treatment ▪ Contingent on OKC projects	▪ Local control over sources ▪ Discharge permitting uncertainties ▪ Efficient use of water resources ▪ Greater phasing potential than P1

AGENDA
Status and Progress Update
Recommended Portfolios
Implementation Planning for Recommended Portfolios
Path Forward

Norman Utilities Authority

2060 Strategic Water Supply Plan

Public Meeting #4

July 16, 2013

Strategic Water Supply Plan Public Meeting #4
Minutes
July 16, 2013
6:30 p.m.

The City Council of the City of Norman, Cleveland County, State of Oklahoma, attended the Strategic Water Supply Plan Public Meeting #4 at 6:30 p.m. at the Norman Municipal Building on the 16th day of July, 2013, and notice of the public meeting was posted at the Municipal Building at 201 West Gray 48 hours prior to the event. Although this meeting was not a regularly scheduled meeting of Council a quorum of Council was present; therefore, a summary of the meeting was recorded as required by the Open Meeting Act.

Attendance

- Strategic Water Supply Plan Project Team: John Rehring and Amber Wooten
- Councilmembers: Castleberry, Griffith, Heiple, Holman, Kovach, Miller, Williams, Mayor Rosenthal
- Staff: Ken Komiske, Mark Daniels, Chris Mattingly, Charlie Thomas, Scott Aynes, Gay Webb

Status and Progress Update

Mayor Rosenthal welcomed the citizens in attendance and television audience to the fourth and final scheduled public meeting of the Strategic Water Supply Plan (SWSP). This process is to plan for our intermediate and long term water supply future. The Mayor acknowledged and thanked the Ad Hoc Committee for their work and input over the last year during this process. The Mayor stated additional public meetings will be held as we move forward and refine these options. She encouraged citizens to let Council know their preferences, concerns and questions about the three water supply plan options that Council will be considering. Mayor Rosenthal introduced John Rehring with Carollo Engineers to lead the presentation.

Mr. Rehring thanked those in attendance and gave a brief overview of the SWSP process which began over a year ago. Seven Ad Hoc Committee meetings have been held and this is the fourth and final scheduled public meeting in the process. He stated the goal of this process has been to select the best two or three water supply portfolios and tonight we will discuss the three recommended options.

Mr. Rehring explained the process began by looking at existing supply sources, new local sources and new regional sources. Screening criteria was applied to the supply sources to determine which were more viable for Norman. The criteria used included: supply availability, reliability, certainty and timeliness, and cost-effectiveness. A short-list of supply options was then developed from the most viable and cost-effective options, which became "building blocks" for the water supply portfolios. A portfolio is a combination of different sources that together can meet our long term average water needs of approximately 29 million gallons per day (mgd) through 2060.

Recommended Portfolios

Fourteen supply portfolios were reviewed, taking into consideration capital costs, operational cost and the non-economic attributes outlined by the Ad Hoc Committee and Council. Of the fourteen reviewed, the final three portfolios that best meet our objectives include:

- Portfolio 1 – Maximizes local supplies
  Lake Thunderbird firm yield (6 mgd)
  Existing wells (8 mgd)
  Additional conservation and non-potable reuse (2 mgd)
  Lake Thunderbird Augmentation (13 mgd)
  Capital Cost – $250 Million
  Operations and Maintenance – $21 Million per year

- Portfolio 13 – Regional raw water (co-owner with Oklahoma City)
  Lake Thunderbird firm yield (6 mgd)
  Existing wells (8 mgd)
  Additional conservation and non-potable reuse (2 mgd)
  Regional supplies via Oklahoma City (13 mgd)
  Capital Cost - $340 Million
  Operations and Maintenance - $23 Million per year

- Portfolio 14 – New wells and Lake Thunderbird Augmentation
  Lake Thunderbird firm yield (6 mgd)
  Existing wells (8 mgd)
  New groundwater wells (2 mgd)
  Additional conservation and non-potable reuse (2 mgd)
  Lake Thunderbird Augmentation (11 mgd)
  Capital Cost - $270 Million
  Operations and Maintenance - $22 Million per year

Implementation Planning

Mr. Rehring discussed the implementation possibilities of each of the recommended portfolios to include: phasing, how capacity could be added over time and financing increments. Mr. Rehring concluded the presentation with a summary of key attributes of the three recommended portfolios and asked for questions from the audience.

Feedback and discussion

Mr. Rehring answered the following questions:

- On slide titled Use Already Exceeds Local Supply, what causes the drop in yellow dashed line (annual average supply)?

It is based on anticipated drop in allocation from Lake Thunderbird. The allocation is currently based on the reservoir's conjunctive yield (firm yield of the watershed plus groundwater wells), but we anticipate that the allocation will be reduced to the firm yield of the reservoir only. Right now, the yield of the wells is double-counted in our permits.

- What does "Lake Thunderbird Augmentation" mean? Please distinguish whether this is augmentation with water from Oklahoma City, reclaimed wastewater, etc.

  For the SWSP project, Lake Thunderbird Augmentation means using reclaimed, highly treated, wastewater effluent to increase the yield of Lake Thunderbird. We would then pump the additional water from Lake Thunderbird as a source of potable supply. In the SWSP project, raw water from Oklahoma City would not be stored in Lake Thunderbird.

- Why was there such a push from local agencies to get authorization from the Federal government to get permission to store raw water from Oklahoma City in Lake Thunderbird?

  The Lake was authorized for construction and storage of water originating in the Lake Thunderbird tributary area (i.e., its watershed). In light of Norman's forecasted increases in demand and existing limitations on Thunderbird's yield, Central Oklahoma Master Conservancy District (COMCD) sought approval for augmenting the lake's supplies, including releases from Oklahoma City supplies to Lake Thunderbird or from other future sources. Changing the allowable uses of Lake Thunderbird required an act of Congress.

- Why is there an initial steep jump in the demand projection, then a flat period, followed by a demand growth period? Are you saying that low flow fixtures are being replaced as they age (retrofit)? What is the source of population projections used in the SWSP?

  This pattern is caused by how demand projections were estimated in previous studies and the change to the projection method made in the SWSP project. For the SWSP project, we are using the highest per capita demand from recent years (accounts for drought and Norman's existing conservation programs) plus a 10 percent contingency (to account for potential new industries and other planning uncertainties). The flat portion of the projection is result of passive conservation measures (retrofits of older higher-flow fixtures, driven by plumbing code requirements). The passive conservation savings were derived from the Oklahoma Comprehensive Water Plan. They represent a gradual replacement of old, high water use fixtures, but the retrofits and water savings are expected to be in place by around 2030. The population projections are based on the Norman 2025 Plan.

The population is not projected to grow at a steady percentage each year, but generally, population is projected to grow by about 1,500 people each year.

- We have heard the Garber-Wellington aquifer may be losing water (withdrawal rate is higher than recharge rate). We are looking at 50-year planning period and should think beyond that too. What is the possibility of this supply not being available in the future?

  There are two aspects to consider when using groundwater as a supply source: quantity and quality. We have discussed some groundwater quality implications. Currently, the State of Oklahoma is studying the quantity of water that can be withdrawn (measured in acre-feet per year per acre of land dedicated) from the Garber-Wellington. (Norman currently uses groundwater under a permit with a temporary withdrawal rate.) Based on preliminary information, there will be a reduction in the permitted withdrawal rate. However, there is sufficient land available that Norman can choose to dedicate to groundwater wells (i.e., permit availability will not limit supply). However, just because you have a permit does not mean that you have water physically available to withdraw. Norman will need to continue to manage wells (well spacing, annual operation, etc.) to make sure that we do not see big reductions in well production.

- Understand Lake Thunderbird has a silting problem. How long will it be available?

  Lake Thunderbird's permitted yield already accounts for 100 years of assumed siltation. We are about half way through this period now. Analysis shows that siltation is on track with Bureau of Reclamation projections. The reliable yield assumes that 100 years of siltation has already occurred. Beyond about 2060 (when the 100 year period ends), siltation may cut back on available supply in drought years. There will be some tough decisions as this date approaches (dredging, raising lake, decreasing yield, etc.), but currently, no action is required to maintain the firm yield at Lake Thunderbird.

- If we do not tap into southeast Oklahoma water, is Texas likely to get it?

  The U.S. Supreme Court recently ruled in Oklahoma's favor in the north Texas agencies' litigation. This essentially gave Oklahoma the ability to control its own water supplies within the framework of the Red River interstate compact.

- Some of us are very concerned about conservation. The amount of conservation savings shown seems very small.

  Conservation is critically important in Norman (we saw this in feedback from Ad Hoc Committee members and during public meetings). The conservation savings build on Norman's current conversation programs. In communities with no

significant conservation, studies show that around a 10% reduction can often be achieved. However, in communities like Norman who have been proactive in implementing conservation, you would not expect to get this much of a reduction in demand. The 1 mgd presented here represents a 3% reduction in 2060 demand (in addition to what is already being done). If conservation takes hold more quickly, there is flexibility in plan to delay implementation of other supply sources. Norman is also planning an update to its Conservation Plan, which might drive further conservation efforts and programs.

- I am very concerned about maintaining local control. I did not see any reference to agreement made with Del City.

  The agreement with Del City is not a firm or permanent supply, but when it is available, it can be used.

- What do you mean when you refer to augmenting Lake Thunderbird? Is it possible to work with the Corps of Engineers to allow the lake level to rise and allow us to capture more water?

  See previous response regarding Lake Thunderbird augmentation. Around the country, some reservoir owners are conducting updated flood studies that may allow reallocation of water from the flood pool to the conservation pool where it could be used municipal purposes. Right now, we do not have authorization to store water in the flood pool. Updating the flood study would be expensive and complicated.

- Is anything in process now regarding an updated flood study?

  Not to my knowledge.

- The conservation projections seem low. I think that there is a lot more that can be done. I like Portfolio 14 because you can phase it in as you need it. For the pipeline from Lake Thunderbird to existing WTP, would it be designed for maximum flow (you would not want to phase this)?

  There is a current project that expands transmission capacity from Lake Thunderbird to the WTP to 17 mgd.

- What about the new pipeline from Lake Thunderbird to existing WTP under Lake Thunderbird augmentation?

  Yes, it would likely be constructed in a single phase, but because it is a shorter distance, it is not as costly to construct this all at once (relative to the 100-mile Atoka pipeline parallel).

- Supply slides through 2060 show a steady use of Lake Thunderbird yield, but you said that yield factored in 100 years of siltation. Why doesn't the use change over time as siltation occurs?

  When Bureau of Reclamation did its yield study, it assumed that 2060 siltation has already occurred. Norman's allocation of yield assumes that full 2060 siltation has occurred even though it is only part way there. The supply use was held constant at Norman's portion of the firm yield from Thunderbird.

- How do you augment the lake when silt is filling up the lake already?

  It is not a question of filling up the lake when it is full but of adding water to the lake when the water level is low (it is the "bottoming out" of the lake's conservation pool water level that dictates firm yield).

- We are using "reclaimed" water to mean highly treated wastewater. What makes it safe is that we are mixing it with lake water. However, there is less and less water in the lake.

  The relative proportion of effluent in the lake remains small, and we have included processes to make discharges to the lake be very high quality.

- Oklahoma Department of Environmental Quality (ODEQ) has shown no hint of approving augmentation. How can we count on this source?

  I wouldn't characterize it as "no hint" of approval. The City is in discussions with ODEQ along with other cities who are interested in augmenting sensitive water supplies. We are already doing something similar with users downstream of S. Canadian who use water from the river as a source of potable supply. It is common practice in other states and there is regulatory precedence in the United States. There are on-going discussions about this with ODEQ. Conservation and reuse are part of the Oklahoma Comprehensive Water Plan (OCWP). The Legislature adopted a resolution to use the same amount of fresh water in 2060 as was used in 2012. The only way this happens is if conservation/reuse is implemented. ODEQ has not come out with indirect potable reuse plans (IPR), but we are working with them to do so.

- If we put a lot of our eggs in one basket while waiting for ODEQ, do we risk losing the opportunity to form a regional partnership with Oklahoma City?

  Oklahoma City has not set a date for regional partners to make a commitment to the project. Oklahoma City may ultimately add a third parallel pipeline in the future. If we decide to collaborate with them, it may change the date of that future pipeline. This is all something that will need to be negotiated with Oklahoma City.

- Would it not be possible for Norman to have more aggressive conservation plan?

  Yes, it is possible and should be reflected in an updated conservation plan. For planning, we need to be conservative and prepare for potential worst-case conditions. We have a flexible plan that allows for delaying other projects if conservation is adopted more rapidly or widely than is assumed here. For planning purposes and looking at other communities, it seems that 1 mgd is a reasonable planning number.

- This is a 50-year plan, but nowhere in plan is addressed the issue between serving non-potable demands with potable water. Right now, we treat all water like drinking water even though there is a large percentage of water used that we do not drink. Is there a reason that we did not include ultimate separation of potable non-potable water?

  Each recommended portfolio includes additional direct non-potable reuse (DNPR). It helps us cut back peak day demand (5 mgd of 55 mgd for 2060). However, DNPR systems are expensive to implement in developed areas. It is essentially a parallel pipe system going through urbanized areas. You often see them implemented in new developments near the source of supply (water reclamation facilities). The SWSP reframed the question to ask we have an effluent source, how do we use it efficiently? This is reflected in Lake Thunderbird augmentation (IPR) options. Communities are finding that a single pipe augmenting a supply source and a single diversion to existing treatment and distribution piping is much more cost effective than DNPR parallel systems. In recommended portfolios, you are seeing a combination of these efficient uses of resources.

- When we build new developments, we should keep this in mind – require division between potable/non-potable supplies.

  We need to keep in mind the ability to get from source (WRF) to the new development. Should the city choose, the DNPR system proposed is expandable. It is a question of whether expanding purple pipe is better use of resource than other options (like IPR).

- Why can we not pump arsenic contaminated water into Lake Thunderbird where it can be diluted (alternative way to augment Lake Thunderbird)?

  It is a question of what is the best way to use existing offline wells. We have shown here bringing these wells into a new centralized treatment facility. The United States Geological Survey (USGS) recently completed a study that looked at pumping arsenic wells into tributaries to mitigate arsenic on its way to Lake

Thunderbird. The study showed some promise but raised some concerns. The USGS is continuing to study this issue.

- When you talk non-potable water, are you talking gray water?

  Gray water refers to water collected from showers, sinks, etc. and used at the household level – different from use of treated effluent from a water reclamation facility.

- We are building 1,000 houses in north Norman. If you put gray water from all of these houses, you have maybe 80,000 gallons of water you can save. I did not see this in any of options discussed. It seems that conservation is something that we can do with stricter rules. Why isn't this been included for new homes?

  That absolutely could be used as part of updated conservation plan and Norman's future. Overall, it will not replace one of the larger projects that we need to do in the future.

- State bill 252, chapter 627 (water reuse regulations). I read it in great detail but it does not include drinking water. Did they pull out drinking water, did they not consider it, was it expunged in committee? Do you know why it wasn't included?

  Potable reuse brings a lot of concerns that we need to take care of (concerns that are not there for non-potable reuse). They held category 1 in reserve with intention of developing indirect potable reuse guidance. There is quite a bit of interest at the state level and in communities driving ODEQ to develop indirect potable reuse regulations.

- Demand growth at 1,500 per year results in about a year 2050 growth of 65% whereas graphs show water use up to 90% growth.

  Per capita use first was founded on the recent higher per capita use (reflects existing conservation savings, but also the need to meet dry year demands). It also includes a 10% reserve (ready for emergency or industry growth). Demand growth is function of population growth but is also impacted by what percentage of Norman's population is on city's water. In past we have shown high/low demand projections. Tonight we focused on the high demand projection (conservative sizing) that reflects 100% of residents are on city water service.

- Regarding chromium-6 and arsenic: we have already treated one well for arsenic. We can do that now. California has been treating for chromium-6 for years. Are you saying that it is 10 years down the road before we can do this here? Technology is improving (reverse osmosis, ultraviolet light) and it is capable of taking out pharmaceuticals, fecal, Cr6, etc., from water. We could treat wells now

and have more water now. All wells are not contaminated with chromium-6, was this a general statement?

Absolutely, we can treat individual wells for arsenic. However, it is debatable whether it is cost effective and operationally practical to treat wells individually. As technology develops, it becomes more cost effective to treat for arsenic, chromium-6, and other future potential regulated items. What we see is that the most effective and efficient way to address this is to bring wells together for treatment. Once centralized treatment and collection is in place, it makes sense to treat water from the currently inactive arsenic wells also. California does not have chromium-6 regulations, but the state is expected to issue them and is expected to issue them before the federal regulations. For the SWSP, we anticipated federal regulations in 2018. Depending on federal regulated level and using available data on Norman's wells, it is anticipated that a majority of wells will require chromium-6 treatment.

- Staying local is cheapest way. You sight 12% weighting ratio here for cost but I think that you have made an error in saying that cost is only 12% important. It seems more like 20%. Also, aren't bonds shown going to be about 25% higher than what is shown for paying bondsman?

  Costs we assumed for bond issuance are included here. The 12% weighting is based on feedback from Ad Hoc committee members, City Council members, Mayor, and city staff that chose to participate in the paired comparison exercise. We have not seen statistics indicating such a high percentage of bond fees, and there are other funding avenues (e.g., state revolving fund low-interest loans).

- Is there a way to consider which portfolio offers us more flexibility? Won't technology continue to change?

  Flexibility is factored into both phasing potential and timely implementation. Technology impacts treatment for any of these sources but technology changes are unlikely to change the availability of supply. There is uncertainty but our job is to sort through uncertainties, make best decision that we can, then continue to update the plan as we know more.

- It looks like there is excess capacity phased in early years (for Portfolio 13), is there a reason that it is not delayed to more closely match demands?

  In Portfolio 13, we participate as co-owner with Oklahoma City and need to build the pipeline at one time. We build a significant portion of capacity up front. Beyond that, the increases occur in community interest areas of DNPR. This could be delayed, depending on community interests. Buying into Oklahoma City raw water infrastructure sets a course of where we get a big portion of supply long-term (but does not significantly affect treatment decisions).

- I think that we are overlooking what we are going to do with tribal issues. The tribe has not decided what to do about Lake Sardis. It could be 50 years before that is decided. I believe that OWRB bought Sardis from Federal. What did OKC pay for Sardis water rights? If it is all federal, why can we not just buy Lake Thunderbird? We need to make non-potable mandatory.

  Acknowledged comments.

- From Oklahoma City to the Arkansas state line, the change in rainfall is equal to the change in rainfall between Arkansas to the east coast. If you want water, you go east.

  You can see that when we looked at regional sources, we did not look to western Oklahoma.

- I assume Oklahoma City makes money off supplying water to others.

  They are allowed to cover costs. There is some economy of scale in large regional projects.

- There is quite a bit of interest in conservation. I like that you are planning for supply reserve and are being conservative in demand projections. The way you pay for some of these projects are not necessarily bonds. Did the voters authorize OWRB an additional $300M that they can use for loans?

  Essentially, this authorization is for an expansion of their existing low cost loan program. It puts the State's resources as loan guarantees for borrowers. This translates to issuing more low interest loans. This is definitely a tool in our financial toolbox.

- What about groundwater recharge? Tucson has engineered wetlands that are marvelous. Their recharge does not include drilling new wells. They ripped ground about 5-feet where most of bacteria exist. They recharge using big ponds located on the ripped land. Arizona also has dual pipe system. Why can't something like this be implemented here?

  Arizona has sandy soils that are more conducive to percolating water than the clay soils that we have here and actually limit percolation. Arizona also has regulatory precedent for recharging groundwater with treated effluent. Oklahoma does not. When it does come, we anticipate that the regulations will be more stringent than what will be required to augment surface water.

- What about using wetlands? We have Little River running quite a distance into Lake Thunderbird. For several years, I have been trying to talk about engineered

wetlands (There is available land near Franklin and 60th.) Has anyone been talking about using these?

The applicability would be adding engineered wetlands as part of IPR treatment process. Our industry has found that getting reliable, year-round treatment from wetlands in order to meet discharge permits is challenging. It is possible to get good treatment in summer and poor or no treatment in winter.

The meeting adjourned at 8:45 p.m.

Items submitted for the record:

1. PowerPoint presentation entitled, 2060 Strategic Water Supply Plan Public Meeting #4, July 16, 2013

ATTEST:

Brenda Hall
City Clerk

Cindy S. Rosenthal
Mayor

CITY OF NORMAN CORPORATE SEAL OKLAHOMA

APPENDIX AD – PUBLIC PARTICIPATION – AD HOC COMMITTEE MEETING #8

Norman's 2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #8

12 noon, June 3, 2014

Building A, Conference Rooms C&D

201 W. Gray

- Introductions and Goals for Ad Hoc Committee Meeting #8

- Status and Progress Update
  - Review of Norman's future water needs
  - Review of SWSP planning process and source options considered
  - Comparison of shortlisted portfolios
    - Portfolio 1: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation
    - Portfolio 13: Diverse portfolio including regional raw water as co-owner with Oklahoma City
    - Portfolio 14: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation and new groundwater wells

- Recent State and National Regulatory and Policy Developments

- Path Forward for 2060 SWSP
  - Public Meeting #5 at 6:30 pm this evening
  - Water supply portfolio recommendation to City Council / Council action
  - Final Strategic Water Supply Plan

- Ad Hoc Committee Questions and Feedback on Preferred Portfolios

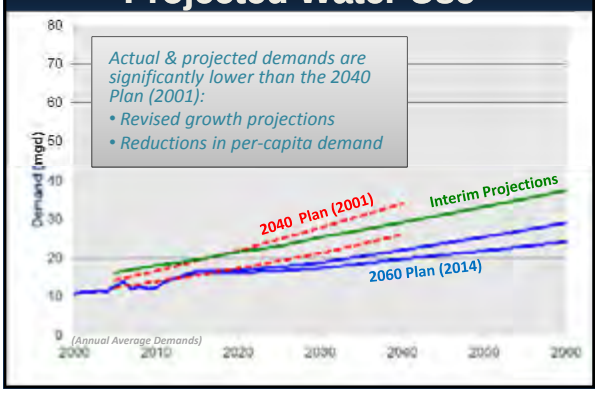
Norman Utilities Authority
2060 Strategic Water Supply Plan

Ad Hoc Committee Meeting #8
June 3, 2014

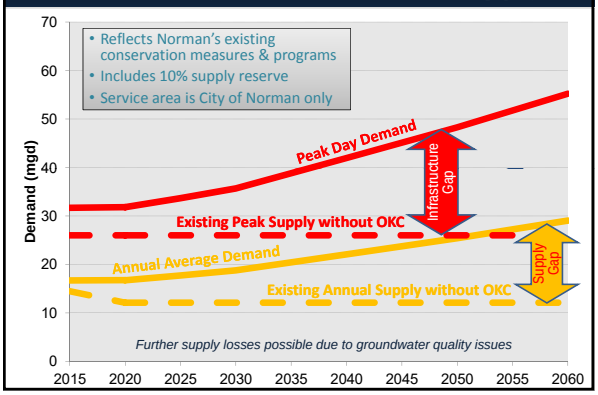
AGENDA

- Introductions and Goals for This Meeting
- Status and Progress Update
- Recent State and National Regulatory and Policy Developments
- Questions and Feedback on Preferred Portfolios
- Path Forward for 2060 SWSP

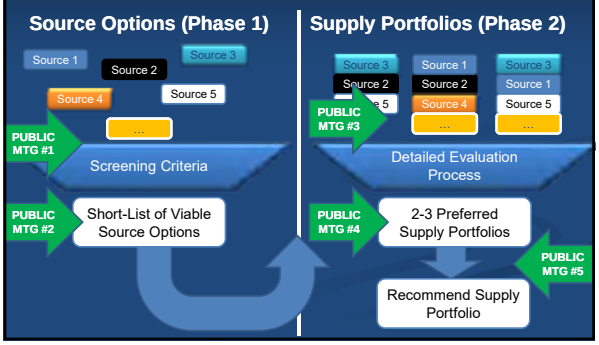
Projected Water Use



Use Already Exceeds Local Supply



SWSP Planning Process



Water Supply Options Considered

Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
Garber Wellington Aquifer Wells (with treatment)	Direct non-potable reuse (purple pipe)	Co-owner with OKC for SE Oklahoma raw water
Intermittent purchase of treated water from OKC (wholesale)	Lake Thunderbird Augmentation (indirect potable reuse)	Scissortail Reservoir
Conservation and reuse	Groundwater recharge (indirect potable reuse)	Parker Reservoir
	Stormwater capture and reuse	Kaw Lake
	Canadian River diversion	
	Capture Lake Thunderbird spillage	
	Dredging Lake Thunderbird	

Water Supply Options Considered

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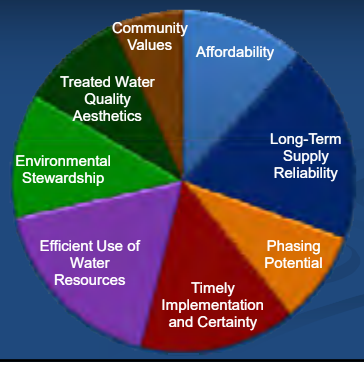
Conservation and reuse	~~Groundwater recharge (indirect potable reuse)~~	Parker Reservoir
	~~Stormwater capture and reuse~~	Kaw Lake
	~~Dredging Lake Thunderbird~~	

The most viable and cost-effective supply options became the "building blocks" for water supply portfolios

Weighted Criteria Were Used to Compare 14 Different Supply Portfolios

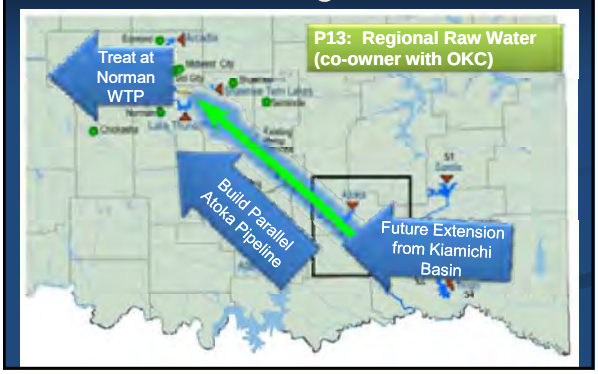


Portfolios that Best Meet Norman's Criteria

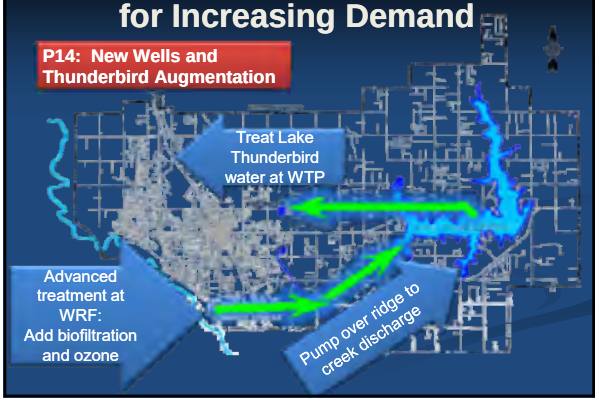
	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City	Capital and O&M Costs (2012$)
P1 Eliminated: Public / Council feedback indicates strong preference for including new wells to maintain existing groundwater supply proportions							
P13 Regional OKC	6	8		2		13	$340M $23M/yr
P14 Wells + TBird Aug.	6	8	2	2	11		$270M $22M/yr

Values are 2060 Annual Avg. Use (mgd) OKC deliveries are raw water treated by Norman

Key Difference: Source of Water for Increasing Demand



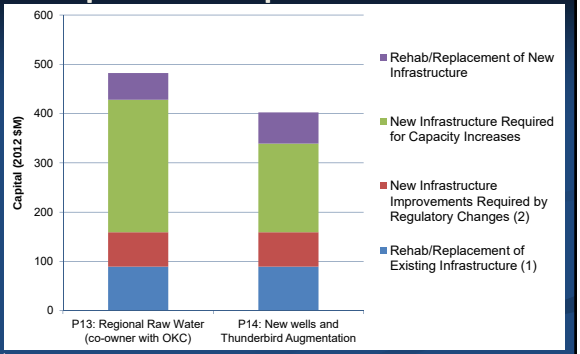
Key Difference: Source of Water for Increasing Demand



Key Attributes of Top Two Portfolios

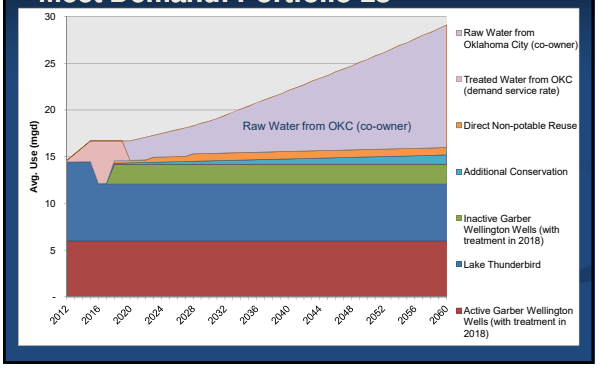
	P13: Regional Raw Water (co-owner with OKC)	P14: New Wells and Thunderbird Augmentation
Approach to meeting increasing demands	▪ Contingent on OKC project implementation ▪ Higher capital and operating costs than P14 ▪ Provides local control over treatment	▪ Permitting conditions and public acceptance of indirect potable reuse ▪ Local control over sources & efficient use of resources ▪ Greater phasing potential than P13
Source Diversity	▪ Lake Thunderbird at reduced (firm) lake yield ▪ Active & inactive existing wells with treatment ▪ Additional conservation ▪ Additional non-potable water reuse	

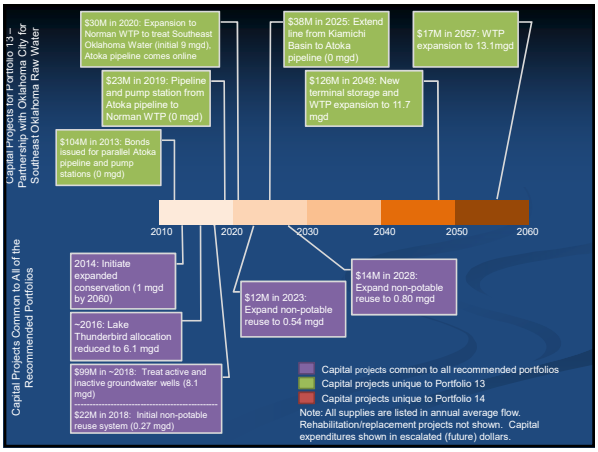
Comparison of Capital Costs



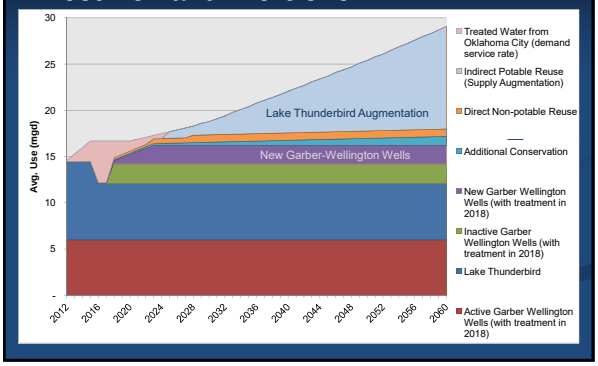
Notes:
1. Existing infrastructure includes Vernon Campbell WTP, raw water piping, and treated water connection to OKC.
2. Infrastructure required because of anticipated regulatory changes includes treatment for active Garber-Wellington Aquifer wells.

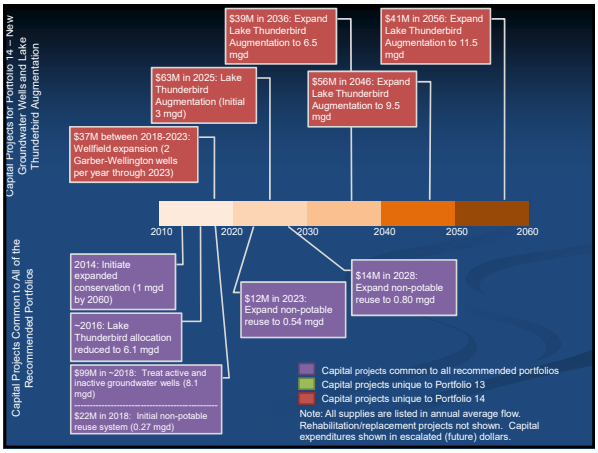
Phased Capacity Increases to Meet Demand: Portfolio 13





Phased Capacity Increases to Meet Demand: Portfolio 14





AGENDA

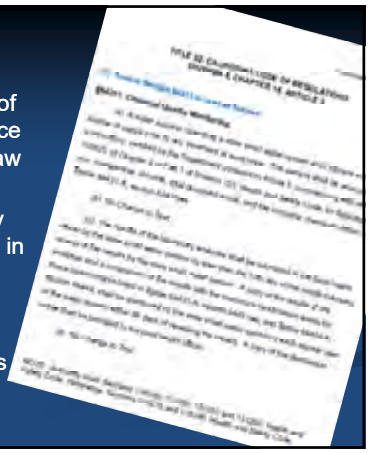
- Introductions and Goals for This Meeting
- Status and Progress Update
- Recent State and National Regulatory and Policy Developments
- Questions and Feedback on Preferred Portfolios
- Path Forward for 2060 SWSP

Recent State and National Regulatory & Policy Developments

- National:
  - Chromium-6 regulations
- Oklahoma:
  - Water for 2060
  - Potable reuse regulations
  - Sensitive water supply designation

Chromium-6

- California Cr6 limit of 10 ug/L sent to Office of Administrative Law 4/2014
- EPA Cr6 limit (likely >10 ug/L) expected in 2017
- Most of Norman's wells will not meet new Cr6 regulations without treatment



Oklahoma

WATER FOR 2060

...a goal of consuming **no more fresh water in 2060** than is consumed statewide in 2012...

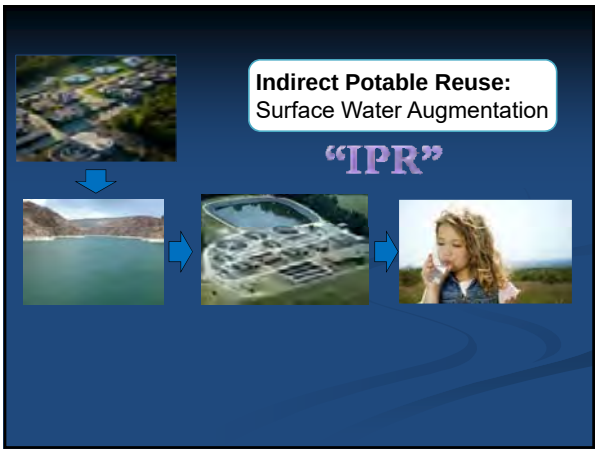
- Water for 2060 Act passed in 2012
- Advisory Council appointed to recommend incentives and voluntary initiatives for water efficiency
- Focus: water conservation and reuse
- Local conservation and marginal quality water analyses being conducted by OWRB later in 2014

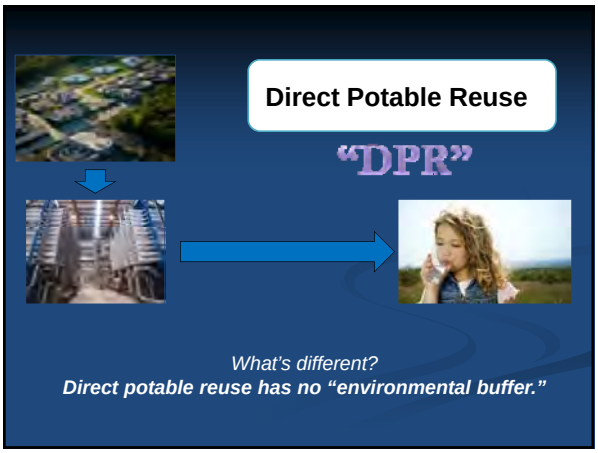
Cultural Shifts are Happening in the Water Industry and in Our Communities

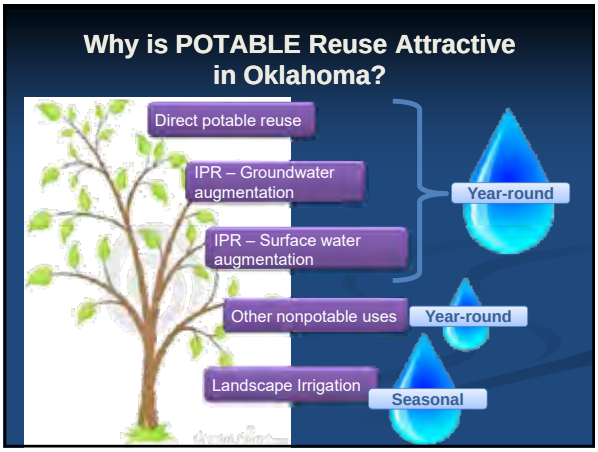
"WASTEWATER TREATMENT"

"WATER RECLAMATION" AND "RESOURCE RECOVERY"

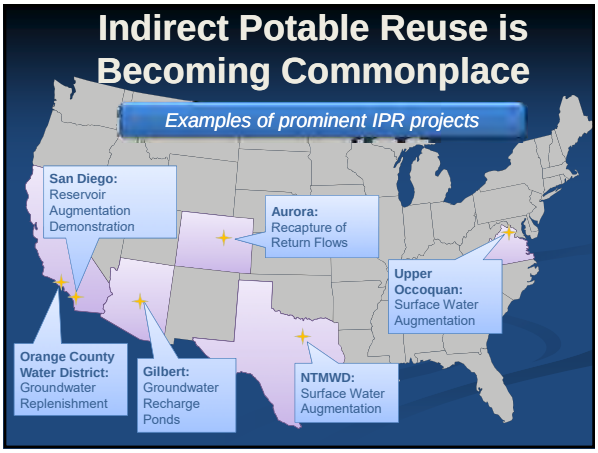
Nonpotable reuse is already meeting diverse needs across Oklahoma


Indirect Potable Reuse:
Surface Water Augmentation
"IPR"


Direct Potable Reuse
"DPR"
What's different?
Direct potable reuse has no "environmental buffer."


Why is POTABLE Reuse Attractive in Oklahoma?
Direct potable reuse
IPR – Groundwater augmentation
IPR – Surface water augmentation
Year-round
Other nonpotable uses
Year-round
Landscape Irrigation
Seasonal

Two major Oklahoma communities recently included IPR in their supply analyses


Indirect Potable Reuse is Becoming Commonplace
Examples of prominent IPR projects
San Diego: Reservoir Augmentation Demonstration
Aurora: Recapture of Return Flows
Upper Occoquan: Surface Water Augmentation
Orange County Water District: Groundwater Replenishment
Gilbert: Groundwater Recharge Ponds
NTMWD: Surface Water Augmentation

Direct Potable Reuse is Getting "Closer to Home"
Cloudcroft
[YOU ARE HERE]
Big Spring
Coming soon! Wichita Falls
Coming soon! Laguna Madre

Applied Research is Paving the Way for Potable Reuse Outreach, Treatment, and Monitoring

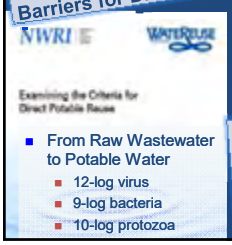
$6 million for cutting edge DPR research

WRRF 06019 & 02009: Removal of TOrCs in reclaimed water

WRRF 1302 – Model Public Communication Plan for DPR

WRRF 1303 – Reliability of Multiple Treatment Barriers for DPR

WRF 4536 – Blending Requirements for Water from DPR Treatment Facilities



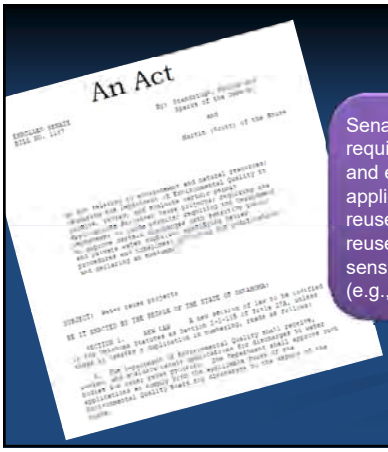
WRRF 1401 – Sensor Data for Real Time Decision Making and Response

WRRF 1102 – Finding lower cost treatment for potable reuse

Oklahoma's Reuse Regulations Are Being Expanded to Include Potable Reuse

Category	Examples of Authorized Uses
Potable 1	[RESERVED]
Non-Potable 2	Public access landscape irrigation, toilet flushing, fire protection, vehicle/equipment washing, range cattle watering, drip irrigation of vineyards/ orchards
Non-Potable 3	Restricted access landscape irrigation, new restricted access golf courses, cooling towers and various nonpotable commercial/industrial uses, livestock pasture, subsurface irrigation of vineyards/ orchards
Non-Potable 4	Soil compaction and existing restricted access golf courses
Non-Potable 5	Restricted access pasture irrigation and restricted access non-food crop irrigation

Treatment, Quality, BMPs



Senate Bill 1187 (enrolled) requires ODEQ to review and evaluate permit applications for water reuse and approve water reuse discharges into sensitive water supplies (e.g., Lake Thunderbird).

AGENDA
Introductions and Goals for This Meeting
Status and Progress Update
Recent State and National Regulatory and Policy Developments
Questions and Feedback on Preferred Portfolios
Path Forward for 2060 SWSP

Discussion and Input

- "Do nothing" alternative?
  - Increase treated water purchases from Oklahoma City
    - Physical constraint of existing connection
    - Purchase costs higher than sales cost
  - Lose existing groundwater wells when future chromium-6 groundwater regulations implemented

7/7/2014

Discussion and Input

- Which portfolio best meets the community's priority objectives? Why?
  - Long term reliability
  - Efficient use of supplies
  - Timely implementation and certainty
- What concerns you about these portfolios?
- How critical is local control?
- Will the community support potable reuse?
- Additional questions & ideas

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City	Capital and O&M Costs (2012$)
P13 Regional OKC	6	8		2		13	$340M $23M/yr
P14 Wells + TBird Aug.	6	8	2	2	11		$270M $22M/yr

Values are 2060 Annual Avg. Use (mgd)

AGENDA

- Introductions and Goals for This Meeting
- Status and Progress Update
- Recent State and National Regulatory and Policy Developments
- Questions and Feedback on Preferred Portfolios
- Path Forward for 2060 SWSP

Path Forward

- Public meeting today
- Water supply portfolio recommendation to City Council
- Council action
- Finalize Strategic Water Supply Plan
- Implement plan

Norman Utilities Authority

2060 Strategic Water Supply Plan

June 3, 2014

Strategic Water Supply Plan Ad Hoc Committee Meeting #8
Minutes
June 3, 2014
Building A, Conference Rooms C and D

Attendees

- Presenters: John Rehring, Amber Wooten
- Councilmembers: Mayor Rosenthal, Miller, Holman
- Ad Hoc Committee Members: Sandy Bahan, Roger Frech, Jim Gasaway, Stephen Tyler Holman, Samantha Kahoe, Matthew Leal, Curtis McCarty, Lynne Miller, Amanda Nairn, Judith Wilkins
- Public: Tessa Breder, Jay Cervi, Jacy Crosbie,
- Staff: Mark Daniels, Bryan Hapke, Ken Komiske, Chris Mattingly, Debbie Smith, Charlie Thomas, Gay Webb

Mr. Komiske thanked Committee members for attending the meeting today and announced a public meeting will be held tonight at 6:30 p.m. to review the final portfolios.

Presentation

Mr. Rehring said the goal of this meeting is to get feedback from the Committee to help make a recommendation to Council. Mr. Rehring gave a status and progress update on the Strategic Water Supply Plan (SWSP). Based on feedback received from previous meetings, the focus has narrowed to two water supply portfolios, Portfolio 13 and 14. Both portfolios share many of the same existing water supplies. The major difference between them is Portfolio 13 focuses on partnering with Oklahoma City for regional water supplies from Southeast Oklahoma while Portfolio 14 focuses on taking highly treated water from the Water Reclamation Facility and augmenting Lake Thunderbird.

- Portfolio 13 – Regional raw water (co-owner with Oklahoma City)
  Lake Thunderbird firm yield (6 mgd)
  Existing wells (8 mgd)
  Additional conservation and non-potable reuse (2 mgd)
  Regional supplies via Oklahoma City (13 mgd)
  Capital Cost - $340 Million
  Operations and Maintenance - $23 Million per year

- Portfolio 14 – New wells and Lake Thunderbird Augmentation
  Lake Thunderbird firm yield (6 mgd)
  Existing wells (8 mgd)
  New groundwater wells (2 mgd)
  Additional conservation and non-potable reuse (2 mgd)
  Lake Thunderbird Augmentation (11 mgd)
  Capital Cost - $270 Million
  Operations and Maintenance - $22 Million per year

Mr. Rehring discussed capital costs, phasing timelines and recent state and national regulatory and policy developments relevant to the 2060 Strategic Water Supply Plan discussion.

Path Forward

Mr. Rehring said feedback gathered from this meeting and the public meeting scheduled tonight will be used to make a recommendation to City Council. We anticipate Council will consider it for action and finalize the SWSP and move forward towards implementation.

Mr. Rehring asked members for their input on which portfolio meets the community's priority objectives and asked what concerns they may have associated with these portfolios.

Questions and Feedback on Preferred Portfolios

Comment: I am leaning towards Portfolio 14. My biggest concern is what will happen to Lake Thunderbird if we discharge treated water to it. How do we reassure the public that reuse is safe?
Response: The intent of the regulations being developed by the Oklahoma Department of Environmental Quality (ODEQ) is to provide public safety and protect the water quality in Lake Thunderbird.

Comment: Are there any commitments to downstream users that would prevent us from reusing our Water Reclamation Facility effluent?
Response: This hasn't been tested in Oklahoma yet, but, based on the amount that we discharge, we have good reasons to believe that it would be possible for us to reuse the effluent. Portfolio 14 includes continued discharge of a portion of Norman's treated effluent at all times through at least 2060.

Comment: Senate Bill 1187 states that no water can be added to Lake Thunderbird which has a pollutant that exceeds the concentration in the Lake. The water added can only be cleaner.

Comment: Do we have enough storage capacity in Lake Thunderbird for augmentation?
Response: The intent of augmentation is that you would add water to the lake when it is not full, essentially extending the amount of time that it takes to empty the reservoir volume that is allocated to our use. When the lake is full, all of the plant's effluent could be discharged to the South Canadian River as it currently is permitted. There would likely be two trains at the Water Reclamation Facility so that water receives treatment appropriate for its intended use (higher treatment is being used for reuse, current treatment if discharged to the South Canadian).

Comment: Why does Portfolio 13 not have any new groundwater wells?

Response: Technically, we could add a few new wells to Portfolio 13 and reduce the supply from the partnership with Oklahoma City. However, the savings of reducing the Oklahoma City supply does not offset the increase in cost to add a few new wells. You would see a net increase in the cost of Portfolio 13.

Comment: Will medicinals flushed down the toilet be passed on to Lake Thunderbird or will they be removed during treatment?
Response: There are elements of medicinals that are currently discharged into the river now. There is a lot of science going on right now to determine concentration levels that would be allowable. Applied research is helping.

Comment: Do recent Oklahoma City water supply shortages affect their willingness to partner with us?
Response: There have been no indications of this. Increasing supplies through the Atoka pipeline will further increase supply reliability.

Comment: You mentioned that we were already seeing a possible reduction in our groundwater supply; please explain further.
Response: Recently, there have been a few wells that have arsenic levels nearing the regulated level and these could potentially have to be taken offline. Also, there are three wells that are nearing the regulated level for gross-alphas (measurement of various naturally-occurring radionuclides).

Comment: How have we positioned ourselves to accommodate future regulations?
Response: An example would be adding Biofiltration and ozone treatment for reclaimed water to our Water Reclamation Facility. These processes are not required for current discharge, and depending on the final ODEQ regulations on reuse, may or may not be required. However, evidence shows that these processes are successful at meeting stringent treatment requirements of other states (including effective treatment for some non-regulated contaminants such as pharmaceuticals and personal care products).

Comment: Where do we go from here?
Response: The intent of today's Ad Hoc Committee meeting and tonight's Public meeting is to get a clear direction about which portfolio should be recommended to the City Council. If the direction is not clear, that lack of preference will be presented to Council.

Comment: It is the local control component of Portfolio 14 that causes me to favor it.

Comment: How does the cost of treating groundwater compare to water from Southeast Oklahoma? I am in favor of local control, water reuse, increase wells and a smaller participation in the pipeline just so we are not locked out of it.
Response: Our local groundwater supplies have very low operational costs relative to our other sources, although costs will go up when we have to treat for chromium-6.

Comment: When presenting recommendations to the Council, I have two suggestions: present a summary analysis of pros/cons and consider scenario planning.

Comment: How was population growth projected?
Response: We used the population projections from the Norman 2025 Land Use Plan and growth rate of about 1500 people per year to project beyond 2025. This value is consistent with historical growth patterns. If growth occurs faster or slower than projected, the water supply projects could be moved up or delayed.

Comment: If we decide to pursue Lake Thunderbird augmentation now, will we still be able to buy water from Oklahoma City in the future?
Response: Maybe. It depends on how large Oklahoma City builds the pipeline and how they choose to allocate its use, but even if we are not able to buy water continuously, we may be able to buy it intermittently as we do now.

Comment: I favor Portfolio 14. It does not make sense to keep flushing our water down the South Canadian River while building a 100 plus mile pipeline to bring in water.

Comment: Is there concern about how reuse will affect lake ecology in terms of lake level and water quality?
Response: The lake level is variable based on current usage. Reuse would add water to the lake reducing the amount of time that the lake is at low levels. Water quality impacts will be addressed and protected by the regulations.

Comment: What is the length of the Atoka parallel pipeline?
Response: About 100 miles

Comment: I worry that we will not be able to implement Lake Thunderbird augmentation fast enough. I would like to see the implementation moved up sooner.
Response: The date shown in the SWSP is conservative based on assumptions regarding regulatory timelines, but recent actions by the Legislature and ODEQ indicate that implementation could happen sooner than 2025 (current timeline in SWSP).

Comment: What happens if we do not select a portfolio?
Response: Essentially, taking no action will result in purchasing more treated water from Oklahoma City as a wholesale customer. The current wholesale agreement with Oklahoma City allows Norman to buy water when available at a rate of $5.23 per thousand gallons. Norman sells water for approximately $2.10 per thousand gallons (with rates depending on amount used). This is not a sound business model. Additionally, there is limited capacity in the existing Oklahoma City connection. There is no capital money available for new groundwater wells or a new connection with Oklahoma City.

Comment: We need to let the people know the cost to do nothing.

Comment: Oklahoma City is in the process of increasing their rates by six percent per year for the next five years.

Comment: On the regional solution, would we receive untreated water?
Response: Yes, we looked at both raw and treated water but, with feedback we received, the preference is raw water that we would treat ourselves.

Comment: What is the cost of untreated water?
Response: Oklahoma City is finishing a rate study now to determine costs.

Comment: Would we partially own the line from Southeast Oklahoma?
Response: You would own capacity in the line.

Comment: Did you figure in maintenance costs of the pumps and line?
Response: Yes.

Comment: What do you think the cost will be to treat for chromium-6 and arsenic issues?
Response: There will be capital costs and operating costs. We do have assumptions built in.

Comment: If we were to choose P13, when we are planning for future facility upgrades, would we still plan for Lake Thunderbird augmentation and have that option later down the road?
Response: At the Water Reclamation Facility you probably wouldn't put in Biofiltration or ozone treatment unless there was some other regulatory driver but there would be nothing to preclude you from doing that in the future.

Comment: Are there other communities talking about buying into the Southeast Oklahoma pipeline?
Response: In 2009, there were 11 communities in the metro considering it; since that time, some communities have opted not to join.

Mr. Rehring said from comments received today, there seems to be a little more support for Portfolio 14. Mr. Komiske and Mr. Rehring thanked Committee members for their input and contributions over the past eight meetings.

The meeting adjourned at 1:25 p.m.

Items submitted for the record:

1. Power Point presentation entitled, 2060 Strategic Water Supply Plan Ad Hoc Committee Meeting June 3, 2014

APPENDIX AE – PUBLIC PARTICIPATION – PUBLIC MEETING #5

Press Release

2060 Strategic Water Supply Plan Public Meeting #5

A public meeting will be held Tuesday, June 3, 2014 at 6:30 p.m. at City Council Chambers, 201 W. Gray, Norman, Oklahoma. This meeting will be the fifth in a series of public meetings to provide the public with information about the making of its 2060 Strategic Water Supply Plan (SWSP) and gather public input regarding key aspects of the plan.

The City of Norman is updating its plans for supplying long term water solutions to its customers. The SWSP builds on previous planning efforts discussing water demands, supply options, and infrastructure as well as significant new developments in water supply regulations, new technology and availability of water.

The City is evaluating a wide range of potential water supply sources and identifying those that will best meet the community's short and long-term needs. The long-term water supply "portfolio" for Norman will likely include a combination of existing sources and new sources. Sources that passed the initial screening criteria have been combined into portfolios for evaluation in the final phase of the project.

Public input is being sought through meetings that have been held at key milestones throughout the development of the SWSP. An Ad Hoc committee has been appointed by City Council to help guide this planning process and enhance feedback and communications. The June 3rd public meeting presentation will include a project update, review of supply options and evaluation criteria, and portfolio evaluations. Meeting participants will have an opportunity to review supply options and provide feedback on the portfolios being evaluated.

For more information, please contact the City of Norman Utilities Administration at (405) 366-5443 or Gay.Webb@NormanOK.gov.

Norman's 2060 Strategic Water Supply Plan

Public Meeting #5
6:30 PM, June 3, 2014
City Council Chambers, City Hall
201 W. Gray

- Introductions and Goals for Public Meeting #5

- Status and Progress Update
  - Review of Norman's future water needs
  - Review of SWSP planning process and source options considered
  - Comparison of shortlisted portfolios
    - Portfolio 1: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation
    - Portfolio 13: Diverse portfolio including regional raw water as co-owner with Oklahoma City
    - Portfolio 14: Diverse portfolio that maximizes use of local supplies including Lake Thunderbird augmentation and new groundwater wells

- Recent State and National Regulatory and Policy Developments

- Path Forward for 2060 SWSP
  - Public Meeting #5 at 6:30 pm this evening
  - Water supply portfolio recommendation to City Council / Council action
  - Final Strategic Water Supply Plan

- Questions and Feedback on Preferred Portfolios

***

The City Council has been invited to attend this meeting. This is not an official meeting of the City Council. This notice is being posted to comply with the Open Meeting Act in the event a quorum of the City Council is present. No formal action of the City Council will take place.

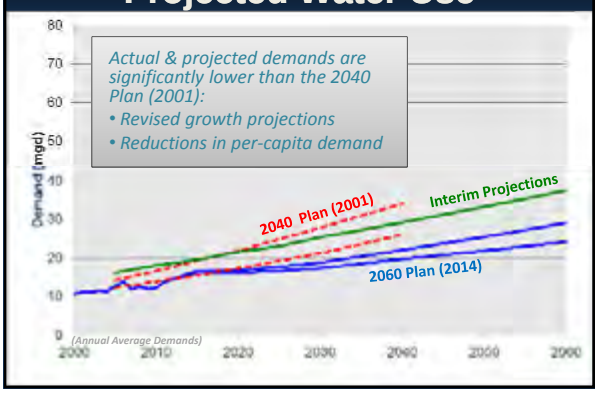
Norman Utilities Authority
2060 Strategic Water Supply Plan

Public Meeting #5
June 3, 2014

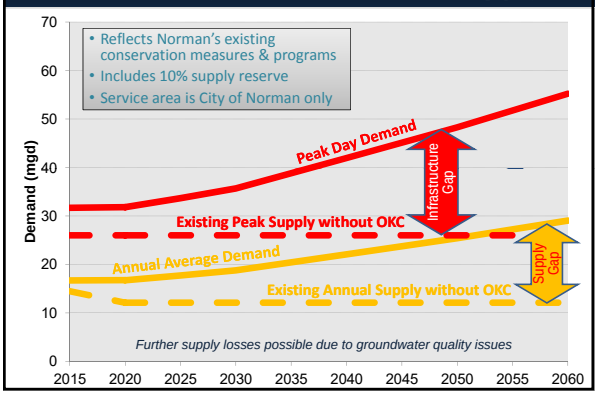
AGENDA

- Introductions and Goals for This Meeting
- Status and Progress Update
- Recent State and National Regulatory and Policy Developments
- Questions and Feedback on Preferred Portfolios
- Path Forward for 2060 SWSP

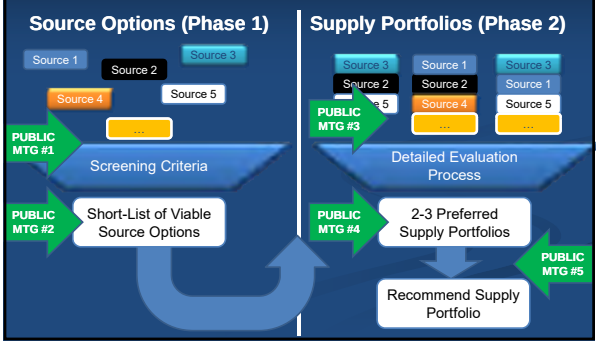
Projected Water Use



Use Already Exceeds Local Supply



SWSP Planning Process



Water Supply Options Considered

Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
Garber Wellington Aquifer Wells (with treatment)	Direct non-potable reuse (purple pipe)	Co-owner with OKC for SE Oklahoma raw water
Intermittent purchase of treated water from OKC (wholesale)	Lake Thunderbird Augmentation (indirect potable reuse)	Scissortail Reservoir
Conservation and reuse	Groundwater recharge (indirect potable reuse)	Parker Reservoir
	Stormwater capture and reuse	Kaw Lake
	Canadian River diversion	
	Capture Lake Thunderbird spillage	
	Dredging Lake Thunderbird	

Water Supply Options Considered

Existing Sources	New Local Sources	New Regional Sources
Lake Thunderbird (at firm yield)	Additional conservation	Co-owner with OKC for SE Oklahoma treated water
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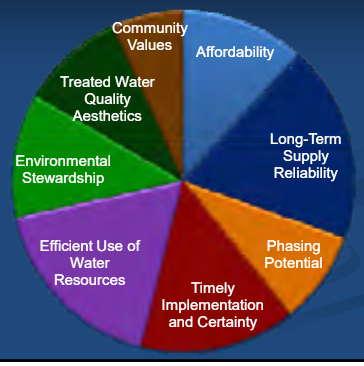
Conservation and reuse	~~Groundwater recharge (indirect potable reuse)~~	Parker Reservoir
	~~Stormwater capture and reuse~~	Kaw Lake
	~~Dredging Lake Thunderbird~~	

The most viable and cost-effective supply options became the "building blocks" for water supply portfolios

Weighted Criteria Were Used to Compare 14 Different Supply Portfolios

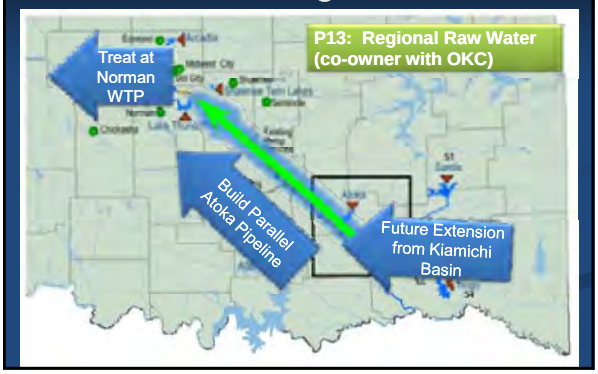


Portfolios that Best Meet Norman's Criteria

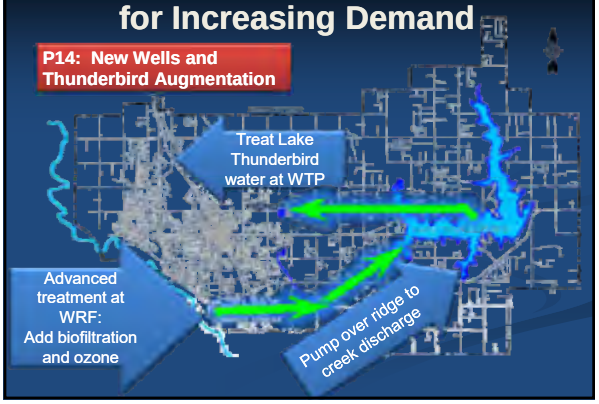
	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City	Capital and O&M Costs (2012$)
P1 Eliminated: Public / Council feedback indicates strong preference for including new wells to maintain existing groundwater supply proportions							
P13 Regional OKC	6	8		2		13	$340M $23M/yr
P14 Wells + TBird Aug.	6	8	2	2	11		$270M $22M/yr

Values are 2060 Annual Avg. Use (mgd) OKC deliveries are raw water treated by Norman

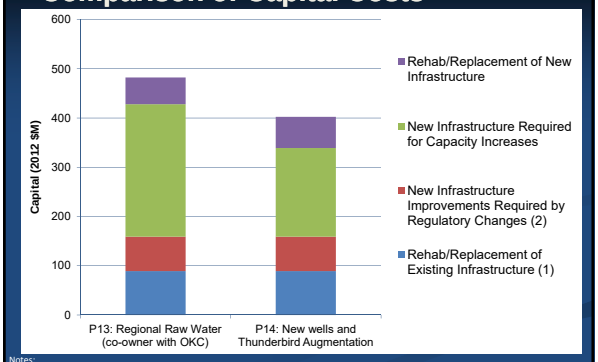
Key Difference: Source of Water for Increasing Demand



Key Difference: Source of Water for Increasing Demand

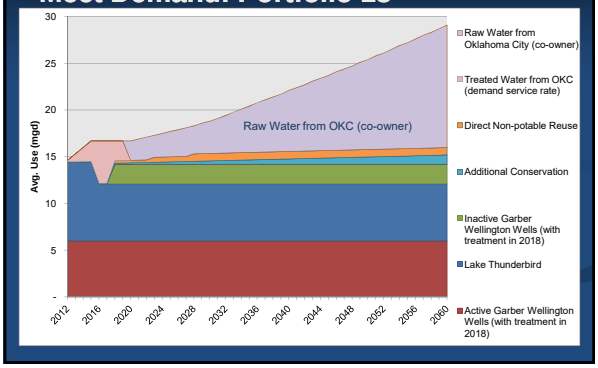


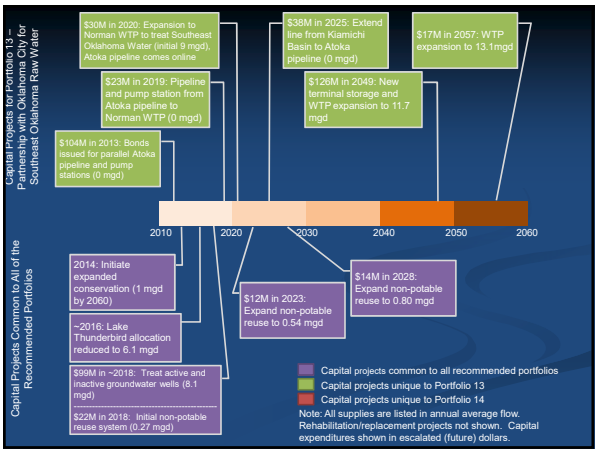
Comparison of Capital Costs



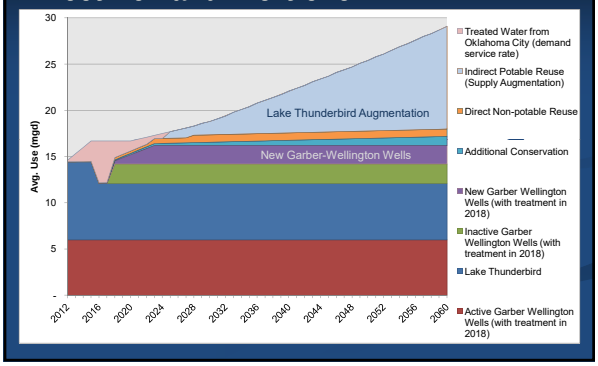
Notes:
1. Existing infrastructure includes Vernon Campbell WTP, raw water piping, and treated water connection to OKC.
2. Infrastructure required because of anticipated regulatory changes includes treatment for active Garber-Wellington Aquifer wells.

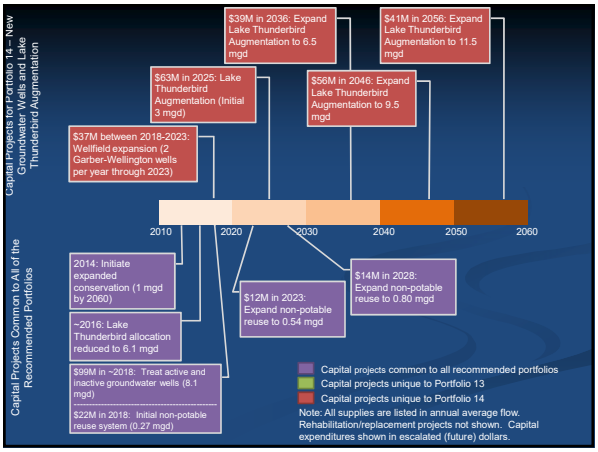
Phased Capacity Increases to Meet Demand: Portfolio 13





Phased Capacity Increases to Meet Demand: Portfolio 14





AGENDA

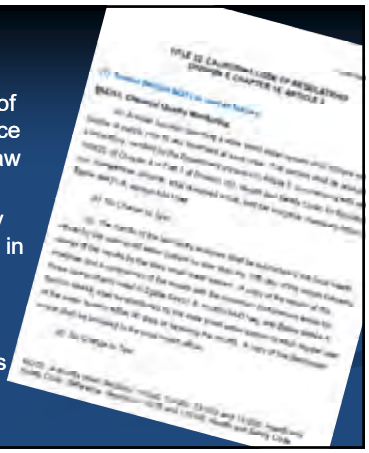
- Introductions and Goals for This Meeting
- Status and Progress Update
- Recent State and National Regulatory and Policy Developments
- Questions and Feedback on Preferred Portfolios
- Path Forward for 2060 SWSP

Recent State and National Regulatory & Policy Developments

- National:
  - Chromium-6 regulations
- Oklahoma:
  - Water for 2060
  - Potable reuse regulations
  - Sensitive water supply designation

Chromium-6

- California Cr6 limit of 10 ug/L sent to Office of Administrative Law 4/2014
- EPA Cr6 limit (likely >10 ug/L) expected in 2017
- Most of Norman's wells will not meet new Cr6 regulations without treatment



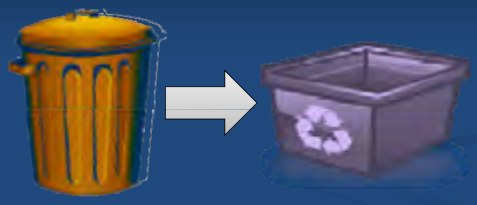
Oklahoma

WATER FOR 2060

...a goal of consuming **no more fresh water in 2060** than is consumed statewide in 2012...

- Water for 2060 Act passed in 2012
- Advisory Council appointed to recommend incentives and voluntary initiatives for water efficiency
- Focus: water conservation and reuse
- Local conservation and marginal quality water analyses being conducted by OWRB later in 2014

Cultural Shifts are Happening in the Water Industry and in Our Communities



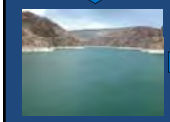
"WASTEWATER TREATMENT"

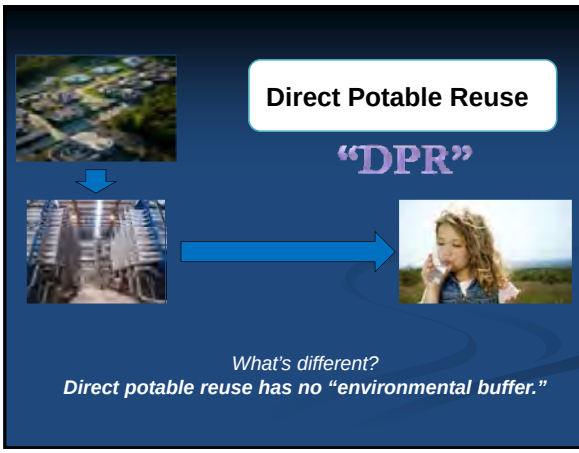
"WATER RECLAMATION" AND "RESOURCE RECOVERY"

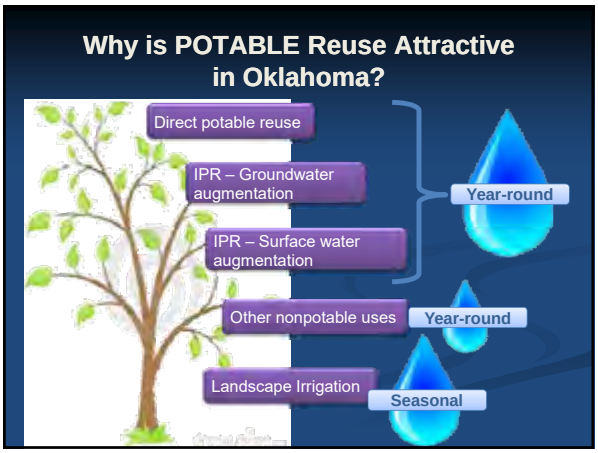
Nonpotable reuse is already meeting diverse needs across Oklahoma

Indirect Potable Reuse: Surface Water Augmentation

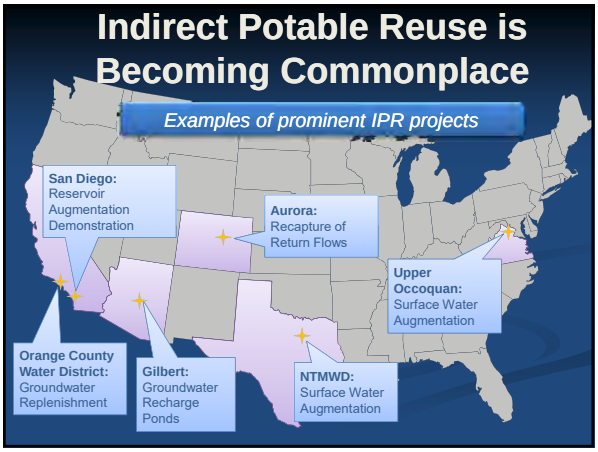
"IPR"




Direct Potable Reuse
"DPR"
What's different?
Direct potable reuse has no "environmental buffer."

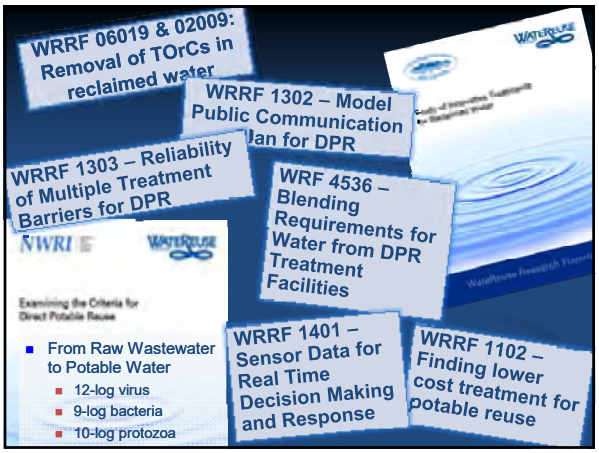

Why is POTABLE Reuse Attractive in Oklahoma?
Direct potable reuse
IPR – Groundwater augmentation
IPR – Surface water augmentation
Year-round
Other nonpotable uses
Year-round
Landscape Irrigation
Seasonal

Two major Oklahoma communities recently included IPR in their supply analyses


Indirect Potable Reuse is Becoming Commonplace
Examples of prominent IPR projects
San Diego: Reservoir Augmentation Demonstration
Aurora: Recapture of Return Flows
Upper Occoquan: Surface Water Augmentation
Orange County Water District: Groundwater Replenishment
Gilbert: Groundwater Recharge Ponds
NTMWD: Surface Water Augmentation

Direct Potable Reuse is Getting "Closer to Home"
Cloudcroft
[YOU ARE HERE]
Big Spring
Coming soon! Wichita Falls
Coming soon! Laguna Madre

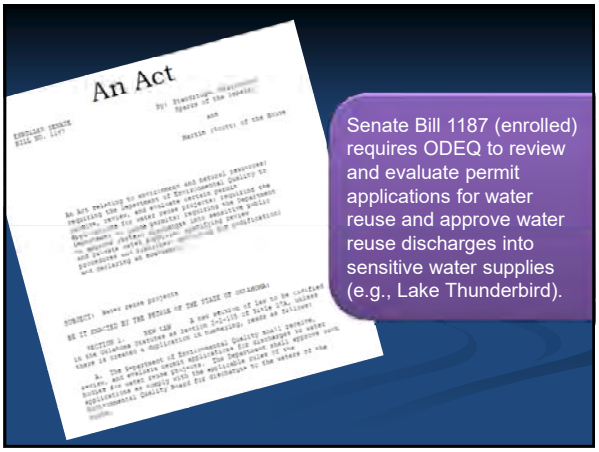
Applied Research is Paving the Way for Potable Reuse Outreach, Treatment, and Monitoring
Water Research Foundation
WERF
WATEREUSE
$6 million for cutting edge DPR research
REPORTING ON OUR PROGRESS



Oklahoma's Reuse Regulations Are Being Expanded to Include Potable Reuse

Category	Examples of Authorized Uses
Potable 1	[RESERVED]
Non-Potable 2	Public access landscape irrigation, toilet flushing, fire protection, vehicle/equipment washing, range cattle watering, drip irrigation of vineyards/ orchards
Non-Potable 3	Restricted access landscape irrigation, new restricted access golf courses, cooling towers and various nonpotable commercial/industrial uses, livestock pasture, subsurface irrigation of vineyards/ orchards
Non-Potable 4	Soil compaction and existing restricted access golf courses
Non-Potable 5	Restricted access pasture irrigation and restricted access non-food crop irrigation

Treatment, Quality, BMPs



Senate Bill 1187 (enrolled) requires ODEQ to review and evaluate permit applications for water reuse and approve water reuse discharges into sensitive water supplies (e.g., Lake Thunderbird).

AGENDA

- Introductions and Goals for This Meeting
- Status and Progress Update
- Recent State and National Regulatory and Policy Developments
- Questions and Feedback on Preferred Portfolios
- Path Forward for 2060 SWSP

Discussion and Input

- "Do nothing" alternative?
  - Increase treated water purchases from Oklahoma City
    - Physical constraint of existing connection
    - Purchase costs higher than sales cost
  - Lose existing groundwater wells when future chromium-6 groundwater regulations implemented

7/7/2014

Discussion and Input

- Which portfolio best meets the community's priority objectives? Why?
  - Long term reliability
  - Efficient use of supplies
  - Timely implementation and certainty
- What concerns you about these portfolios?
- How critical is local control?
- Will the community support potable reuse?
- Additional questions & ideas

	Lake Thunderbird Allocation	Existing Groundwater Wells	New Groundwater Wells	Conservation & Non-potable Reuse	Lake Thunderbird Augmentation	Regional Supplies via Oklahoma City	Capital and O&M Costs (2012$)
P13 Regional OKC	6	8		7		13	$340M $23M/yr
P14 Wells + TBird Aug.	6	8	2	2	11		$270M $22M/yr

Values are 2060 Annual Avg. Use (mgd)

AGENDA
Introductions and Goals for This Meeting
Status and Progress Update
Recent State and National Regulatory and Policy Developments
Questions and Feedback on Preferred Portfolios
Path Forward for 2060 SWSP

Path Forward

- Public meeting today
- Water supply portfolio recommendation to City Council
- Council action
- Finalize Strategic Water Supply Plan
- Implement plan

Norman Utilities Authority

2060 Strategic Water Supply Plan

June 3, 2014

Strategic Water Supply Plan Public Meeting #5
Minutes
June 3, 2014
6:30 p.m.

The City Council of the City of Norman, Cleveland County, State of Oklahoma, attended the Strategic Water Supply Plan Public Meeting #5 at 6:30 p.m. at the Norman Municipal Building on the 3rd day of June, 2014, and notice of the public meeting was posted at the Municipal Building at 201 West Gray 48 hours prior to the event. Although this meeting was not a regularly scheduled meeting of the Council a quorum was present; therefore, a summary of the meeting was recorded as required by the Open Meeting Act.

Attendance

Strategic Water Supply Plan Project Team: John Rehring, Amber Wooten
Councilmembers: Castleberry, Griffith, Heiple, Holman, Kovach, Miller Williams, Mayor Rosenthal
Staff: Mark Daniels, Ken Komiske, Steve Lewis, Shawn O'Leary, Chris Mattingly, Charlie Thomas, Kathryn Walker, Gay Webb

Introduction

Mayor Rosenthal welcomed those in the audience and the television viewing audience to the final public meeting regarding the update to the Strategic Water Supply Plan. The Mayor thanked the citizen advisory committee for their participation and guidance throughout this process. The Mayor said information gathered from this meeting will be presented to City Council next week at a Study Session. Council will then give staff direction on which option they wish to adopt as our long range Strategic Water Supply Plan. Mayor Rosenthal introduced John Rehring with Carollo.

Presentation

Mr. Rehring gave a status and progress update on the Strategic Water Supply Plan. Based on feedback received from previous meetings, the focus has narrowed to two water supply portfolios, Portfolio 13 and 14. Both portfolios share many of the same existing water supplies. The major difference between the two are Portfolio 13 focuses on partnering with OKC for regional water supplies from Southeast Oklahoma while Portfolio 14 focuses on taking highly treated water from the Water Reclamation Facility and augmenting Lake Thunderbird.

- Portfolio 13 – Regional raw water (co-owner with Oklahoma City)
  Lake Thunderbird firm yield (6 mgd)
  Existing wells (8 mgd)
  Additional conservation and non-potable reuse (2 mgd)
  Regional supplies via Oklahoma City (13 mgd)
  Capital Cost - $340 Million
  Operations and Maintenance - $23 Million per year

Portfolio 14 – New wells and Lake Thunderbird Augmentation
Lake Thunderbird firm yield (6 mgd)
Existing wells (8 mgd)
New groundwater wells (2 mgd)
Additional conservation and non-potable reuse (2 mgd)
Lake Thunderbird Augmentation (11 mgd)
Capital Cost - $270 Million
Operations and Maintenance - $22 Million per year

Mr. Rehring discussed capital costs, phasing timelines and recent state and national regulatory and policy developments relevant to the 2060 Strategic Water Supply Plan discussion. Mr. Rehring asked for feedback from the audience on which portfolio would best meet Norman's long-term water supply objectives.

Questions and Feedback on Preferred Portfolios

Comment: How is the natural siltation of Lake Thunderbird accounted for in the plan? How does it influence the availability of supply?
Response: When the Bureau of Reclamation calculates the yield for a reservoir, they assume 100 years of siltation and this space is not allocated as part of the firm yield. We use the conservation pool for water supply. Once the siltation has reached projected levels, we will need to make decisions about whether and how to address losses in storage from siltation (dredging, raising the dam, build additional storage, etc.).

Comment: What is the status of the lawsuit between the Tribes and Oklahoma City?
Response: The lawsuit was filed and has moved into mediation between the Tribes, Oklahoma City, and the State.

Comment: I received a letter from the Absentee Shawnee Tribe stating that they want to sell water in rural areas around Norman. Has Norman talked with the Tribe about water supply?
Response: We have had conversations with the Absentee Shawnee Tribe but the volume of water they were discussing is not enough to significantly impact the portfolios.

Comment: Where exactly would reclaimed water actually be discharged to the Dave Blue Creek? There is a federal stock tank just upstream.
Response: The exact location is not known yet.

Comment: Even if the State Legislature modifies or moves forward with Sensitive Water Supply and reuse, is whatever they do superseded by Federal regulations?
Response: It is not really superseded, but the State's actions will need to be consistent with Federal regulations including the Clean Water Act.

Comment: Do either of these portfolios take into account additional industrial water demands (like oil and gas)? How can you be sure that 10 percent reserve is sufficient?
Response: Projecting demands involves some uncertainty. For this study, we put in a 10 percent reserve that can help us with these types of uncertainties. This reserve is built into all demand projections. It would be highly unusual for demand to jump 10 percent in one year. You will need to continue to update the projections and the plan periodically to reduce uncertainty. The updates may cause a shift in timing for when we take specific actions, but will not affect which actions we take.

Comment: Are there any injection wells near any existing City groundwater supply wells?
Response: Injection wells put reject water several thousand feet deep and do not impact the aquifers we use for our groundwater supply.

Comment: Does Portfolio 13 put us at the whim of Oklahoma City? I would prefer to have more direct control of our water.
Response: There are things that we can do to help with local control. One of them is that, based on feedback we received during this process, we would treat the raw water delivered by Oklahoma City at a Norman treatment facility, rather than having Oklahoma City treat it for us. Another, that as a partner in the Atoka pipeline project, Norman would have some ownership in the infrastructure and operations. We also would seek a strong agreement between Oklahoma City and Norman to govern ownership and operational details.

Comment: I think Portfolio 14 is better. We have no controls over water rates with Oklahoma City under Portfolio 13. We should consider setting up chromium-6 treatment now, and bring back the wells that were shut down for arsenic. It will be critical, before a public vote, that we see a very careful breakdown of the costs. We should consider requiring all new homes have gray water systems. Portfolio 14 gives us local control and has lower costs. I think that we will encounter many obstacles if we pursue a Southeast Oklahoma water supply.

Comment: We are looking at a long stretch of time. The climate predictions are pretty grim. If we guarantee ourselves a piece of the action with Oklahoma City, Portfolio 13 gives us a more resilient situation.

Comment: Should Oklahoma City be considered a reliable supply in light of that fact that it used a majority of the Canton Lake supplies during the recent drought? Moore is not using all of their contracted supply from Oklahoma City due to reduced demands after the tornado, but is still paying for it. Have we considered collaborating with Moore?
Response: Reliability is one of the reasons that Oklahoma City is pursuing additional supplies from Southeast Oklahoma. What is currently constraining our supply from Oklahoma City is the physical limitations of the existing pipeline connection, not the amount we are contractually allowed to use.

Comment: I would favor a blend of Portfolio 13 and Portfolio 14. I agree with concerns about ongoing litigation, but if there are unforeseen regulations that would negatively affect the use of groundwater in the future, then as a partner with Oklahoma City we have another option.

Comment: Please address the cost implications of blending the portfolios.
Response: Technically, we can do a combination of the two. We can take a few less million gallons per day from the Oklahoma City partnership supply and implement a smaller amount of indirect potable reuse (IPR) at Lake Thunderbird. In terms of cost, however, the savings of reducing the supply from Southeast Oklahoma does not offset the increase in cost to implement IPR. You would see a net increase in the cost of Portfolio 13.

Comment: I like a little of both portfolios – but favor Portfolio 14. Want Norman to be independent and able to control water rates. We know that the tribes have never lost a lawsuit in Oklahoma; however, Oklahoma City anticipates they will build the pipeline. Suggests partnering with Absentee Shawnee Tribe to build a water reservoir. Supports diverse supply options.

Next Steps

Mayor Rosenthal reminded participants that comment cards are available to fill out after the meeting or forward comments to the action line or to councilmembers so we may have citizen input as we look at these options and take the next step forward.

Mr. Rehring said feedback will be presented to Council next week at a Study Session. We anticipate Council will consider it for action and finalize the Strategic Water Supply plan and move forward towards implementation.

The meeting adjourned at 8:00 p.m.

Item submitted for the record:

1. PowerPoint presentation entitled, 2060 Strategic Water Supply Plan Public Meeting #5, June 3, 2014

Written comments submitted at the meeting but not discussed:

Comment: In favor of Portfolio 14. Don't agree with using Oklahoma City… too much dependency. Local control is critical – it's a trust issue. The community will support potable reuse but a public education component will be essential. Is that cost figured in projected costs? Additional: Implementation of fines after warning of water use violations. Implementation of fines for blowing grass into streets (negatively effects water quality).

Comment: The Atoka line seems like a risky gamble and one that would jeopardize the towns that rely on the Atoka Reservoir. I favor Plan 14 and hope that is supported instead of Plan 13.

Comment: Indirect Potable Reuse through Thunderbird seems like the best option for Norman.

APPENDIX AF – NORMAN UTILITIES AUTHORITY RESOLUTION R-1314-146

Resolution

R-1314-146

A RESOLUTION OF THE NORMAN UTILITIES AUTHORITY DIRECTING CAROLLO ENGINEERS, INC. TO MOVE FORWARD WITH INCLUSION OF PORTFOLIO 14 IN THE 2060 STRATEGIC WATER SUPPLY PLAN.

§ 1. WHEREAS, the most recent long range water supply planning document is the 2040 Strategic Water Supply Plan, prepared and adopted in 2001; and

§ 2. WHEREAS, Norman's water supply has relied heavily on Lake Thunderbird and wells drilled into the Garber Wellington Aquifer; and

§ 3. WHEREAS, since the adoption of the 2040 Strategic Water Supply Plan, reductions by the Environmental Protection Agency ("EPA") in acceptable contaminant levels have negatively impacted Norman's well water supply, and recent years of drought have negatively impacted Norman's ability to draw on its allocation from Lake Thunderbird in certain years;

§ 4. WHEREAS, based on these factors and growing demand for water, the Norman Utilities Authority ("NUA") is currently unable to supply sufficient potable water to meet peak demands and is concerned about a reduction in Norman's groundwater resource due to future EPA mandated reductions of maximum contaminant levels for chromium, arsenic, or other contaminants; and

§ 5. WHEREAS, in response to these supply concerns, the NUA approved Contract No. K- 1112-114 with Carollo Engineers, Inc. ("Carollo") on March 13, 2012 for preparation of the 2060 Strategic Water Supply Plan (the "2060 Plan"); and

§ 6. WHEREAS, as part of the development of the 2060 Plan, Carollo explored all available supply options, defined baseline water demand projections through 2060, developed an inventory of existing water supplies, identified and developed options that utilized local sources of supply that are currently undeveloped or underdeveloped, and identified and characterized outside water source supply options, ultimately resulting in fourteen (14) supply portfolios for the public and NUA to weigh and consider; and

§ 7. WHEREAS, throughout the development of the 2060 Plan, Carollo worked with and gained input from the Strategic Water Supply Citizens Committee (the "Ad Hoc Committee"), a committee appointed to ensure open and two-way dialogue between the project and the community, to make sure the project continued on track and on schedule, to ensure the options and suggestions of the public for potential water supplies are addressed, to assist in evaluation of non-monetary criteria for potential water supply sources, and to understand and be able to communicate the objectives and conclusions of the Plan to the public; and

§ 8. WHEREAS, Carollo held eight (8) meetings with the Ad Hoc Committee and five (5) public meetings during the development of the Plan, in addition to updates provides to the NUA; and

§ 9. WHEREAS, on June 10, 2014, Carollo presented its latest update on the Plan development to the NUA, and stated that the based on input from the public and the Ad Hoc Committee two portfolio options (Portfolios 13 and 14) had been suggested as the best viable options for NUA and the City of Norman; and

§ 10. WHEREAS, in order to finalize the Plan, Carollo needs direction regarding which portfolio option to proceed with; and

§ 11. WHEREAS, upon examination and study of Portfolios 13 and 14 included in the Plan, the NUA has determined that Portfolio 14 best meets the needs of Norman.

NOW THEREFORE, BE IT RESOLVED BY THE NORMAN UTILITIES AUTHORITY:

§ 12. That, Carollo is directed to move forward with inclusion of Portfolio 14 as the adopted portfolio for planning purposes in the 2060 Strategic Water Supply Plan.

adopted June 24, 2014.

Cindy Rosatti

Chairman

ATTEST:

Brenda Hall

Secretary

NORMAN UTILITIES AUTHORITY OFFICIAL SEAL OKLAHOMA