Donohue & Associates, Inc.
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217.352.9990 | donohue-associates.com

January 19, 2015

South Sangamon Water Commission
P. O. Box 83
New Berlin, IL 62670

Attention: Mike Williamsen, P.E.

Re: New Water System
Treatment System Selection Process

Dear Mike:

As you know, Donohue & Associates, Inc. was the engineer of record for the design of the water treatment facility that the Water Commission placed into service in April 2012. Recently you indicated to me that one of the Water Commission's communities, the Village of Chatham, has experienced finished water quality problems in its distribution system and because of that, the Water Commission requests that Donohue provide a recap of how the existing water treatment processes were selected and what other processes were considered.

To initiate the project's planning, the Village of Chatham retained Donohue by a Master Agreement for Professional Services that was executed on December 5, 2006. Task Order #1 for that agreement authorized Donohue to complete the Preliminary Study for the project. In accordance with the Scope of Services of Task Order #1, Donohue then gathered population data and water demands for the Village of Chatham's customer base and we reviewed the studies that other consultants had previously completed for the project. Included in that review was a review of the existing raw groundwater characteristics and a review of the findings of the 2003 well field opinion/report that Bob Olson of Illinois State Water Survey completed for the groundwater supply.

In November 2006 Donohue met with Bob Olson and discussed his previous findings on the well field and to discuss issues such as the recommended distances between wells and the issue of whether there is a confining layer of clay above the aquifer to protect it from surface contamination. At that time, Mr. Olson indicated that he believed that the aquifer is subject to surface influences. He further noted that during his field work on his 2003 study, he observed that precipitation that fell on the well field during the study's seven-day well-drawdown test caused the water levels in the aquifer to rise, which caused him to conclude that the aquifer is affected by surface water.

On December 5, 2006 Donohue compiled and presented to the Project Team, consisting of representatives from Donohue, EMC and the Village, draft Technical Memorandum #1 which in part defined the raw water quality to be used as the design basis. That study was reviewed with the project team members, including Environmental Management Corporation, who served as the Village's Agent and Project Manager for the study. Table TM1-3 of that study forecasted that raw water iron concentrations would be in the 0.07 to 2.60 mg/l range and manganese in the 0.06 mg/l to 0.588 mg/l range. Those concentrations were derived from raw water sampling taken between 1988 and 2003 by previous consultants. That raw water data were then later conveyed on to all of the process treatment system manufacturers that Donohue subsequently dealt with on the project.

Based on the water demands and raw water characteristics provided in Tech. Memo #1 described above, in November 2006 Donohue's staff compiled basis of design calculations, flow schematics and conceptual building layouts for two scenarios for treating the raw water. The first scenario examined was for source water that is not considered "groundwater under the influence of surface water" (a.k.a. "GUI"). Attachment "A-1" to this letter provides Donohue's file copy of the handout provided to the attendees of the December 19, 2006 meeting at which this scenario was discussed. As page 5 of Attachment "A-1" shows, Donohue had proposed conventional pressure filtration, by proposing the use of six 10 ft. diameter pressure filters, similar to what is often used in central Illinois for filtering groundwater that contains moderate levels of iron and manganese. At that early stage, the detailed decision of whether to use conventional sand media vs. greensand media was not yet broached.

During the December 19, 2006 meeting, Donohue also reviewed with the project team members the second scenario, which was for the situation where IEPA classifies the Source Water being considered as "groundwater under the influence of surface water". Attachment "A-2" to this letter provides Donohue's file copy of the handout for this scenario. As pages 5 and 6 of Attachment "A-2" show, Donohue had proposed flocculation, sedimentation, and conventional gravity filtration for treating the GUI water. Donohue proposed this treatment in lieu of conventional pressure filtration because Article 4.2.2 of the Ten States Standards for Water Works states that pressure filters shall not be used for the filtration of surface waters or other polluted waters. See Attachment "B" for a copy of this standard's page, which was distributed to the project team during the December 19, 2006 meeting.

On December 7, 2006 Donohue contacted Jerry Kuhn, P.E., the Manager of the Permit Section of IEPA' s Public Water Supply Section to review the GUI issue from a permitting standpoint. At that time, Mr. Kuhn indicated that IEPA's methodology for determining whether we have GUI is contained in Chapter I of Title 35. Mr. Kuhn indicated that extensive groundwater sampling over a year of time is needed with temperature and turbidity readings to be provided. He also noted that the regulations require that 3 years' worth of negative coliform data on the raw water is needed to make the determination. Donohue noted that none of these data existed in December 2006. Mr. Kuhn also noted that if the Chatham well field is considered by IEPA to be GUI, then IEPA will not allow pressure filtration but will require open gravity filtration similar to a surface water plant and that the plant could not be run unattended. At that time, EMC commented that a 24-hour/7 day per week staffing plan was not affordable to the Village.

During the December 19, 2006 project meeting, the project team decided to consider the groundwater as being GUI partly based on ISWS's commentary and based on the extensive data needed to prove otherwise. The decision to classify the aquifer as GUI eliminated the ability to permit pressure filtration, regardless of whether the filters would contain conventional sand media or greensand type media. At that time, the Project Team then began discussing the option of using "alternative technologies", i.e., the microfiltration process for filtration. See page 3 of Attachment "C" to this letter, which refers to this matter. Shortly thereafter, Donohue looked into alternative technologies, and on February 12, 2007 EMC reported (see Attachment "D") that as the result of the information provided by the alternative technology vendors' data, the budgetary challenges associated with conventional treatment were no longer a concern. From that date forward, the design proceeded using microfiltration for part of the treatment train.

The project proceeded to design in August 2007 and on September 18, 2007 Donohue, EMC and the Village staff met with IEPA to review the design procedures for utilizing the microfiltration process. Attachment “E” provides the minutes of that meeting. As the minutes show, IEPA confirmed that the groundwater being used is to be considered “GUI” and IEPA directed that the microfiltration process be pilot-tested for three cold-weather months, to make sure that the units’ flux rate (the ability to pass water) be stress-tested on cold water. At that time, the group reviewed the raw water quality with IEPA and no concerns were expressed by IEPA about the concentrations of iron and manganese in the raw water.

After the decision to proceed with microfiltration in 2007, the Village directed Donohue to compile bid specifications to procure the microfiltration units. On June 16, 2008, the Village took bids from three microfiltration manufacturers and the bid from WesTech Engineering, Inc. using their AltaFilter unit was considered the most responsive bid. All three microfiltration unit vendors were required to include piloting of their equipment as part of their pricing and on August 12, 2008 the Village awarded a purchase order to WesTech for the microfiltration unit procurement.

In the Winter of 2008-09, EMC arranged to have WesTech provide their pilot unit to the Chatham well field area and the pilot unit was operated by EMC and the Village from November 4, 2008 thru April 29, 2009. During piloting, parameters such as turbidities, membranes pressures, water temperatures, flux rate, forward flow rates, and backwash frequencies were monitored and recorded every 5 minutes every day. WesTech’s pilot plant protocol also recommended monthly testing for iron and manganese on both the raw and finished water from the microfiltration pilot unit.

In planning for the piloting effort, Donohue coordinated with EMC to ensure that sufficient constituent testing was done on the water routed into the pilot microfiltration unit and the finished water produced. Attachment “F” provides e-mail correspondence with EMC which notes our concern about manganese oxidation rates and also documents that WesTech was not concerned about this issue.

After the piloting was completed in April 2009, the Pilot Test Report was submitted to IEPA. On September 15, 2009 representatives from EMC, Donohue, and the Village met with IEPA’s Permit Section to review project status with them. Attachment “G” provides the minutes of that meeting. Item #9 of the minutes notes that IEPA restated that the groundwater supplying the plant will be treated as surface water. Item #15 notes that IEPA approved the pilot testing report submitted earlier in 2009, with no concerns expressed about iron and manganese removals.

Once the microfiltration piloting effort was completed and approved by IEPA, Donohue proceeded to completing the design and on November 29, 2009 Donohue submitted the IEPA Construction Permit Application for the treatment plant to IEPA. IEPA issued the Construction Permit on December 23, 2010. Donohue notes that IEPA utilized the 2007 Ten States Standards for Water Works as the standard for regulating the design of water treatment plants at the time the permit was applied for. Section 4.6.1.2 of that standard (see Attachment “H”) requires that a minimum of 30 minutes of detention time be provided after aeration to achieve complete oxidation of iron and manganese and Donohue’s design complied with this parameter. Also, during design Donohue coordinated closely with WesTech, the manufacturer of the microfiltration units and WesTech understood that 30 minutes of detention time would be provided ahead of their units and they took no exception to that provision at any time.

Attachment "I" provides page 8 from WesTech's O&M manual for the microfiltration units, which documents their understanding that 30 minutes of detention time would be provided ahead of their units and that the raw water iron and manganese concentrations were the same as those anticipated during project planning.

I hope this transmittal letter provides you with the back-up documentation of how the decision-making process transpired for selecting the treatment processes that were ultimately installed at the Water Commission's facilities. Please contact me at 217-352-9990 if you have any questions about this response.

Very truly yours,

DONOHUE & ASSOCIATES, INC.

Joseph V. Pisula, P.E.
Vice President

Cc: Ed Nevers, P.E., Executive Vice President

Village of Chatham, Illinois
Chatham Water Supply Study
Design Basis Memorandum
Source Water: Ground Water

Attachment "A-1"
Groundwater not under the influence of surface water + pressure filters

(Chatham only)

		Proposed Plant
Daily Design Water Demands (Year 2029)		
Average	1.90 mgd	
Maximum	3.30 mgd	
Flow Rate		
Well Flow Rate		
Well 1		235 gpm
Well 2		235 gpm
Well 3		235 gpm
Well 4		235 gpm
Well 5		235 gpm
Well 6		235 gpm
Well 7		235 gpm
Well 8		235 gpm
Well 9		235 gpm
Well 10		235 gpm
Well 11		235 gpm
Design Flow Rates		
Well 1		235 gpm
Well 2		235 gpm
Well 3		235 gpm
Well 4		235 gpm
Well 5		235 gpm
Well 6		235 gpm
Well 7		235 gpm
Well 8		235 gpm
Well 9		235 gpm
Well 10		235 gpm
Well 11		235 gpm
Total		2,585 gpm
Firm Capacity (one unit out of service)		2,350 gpm 3.38 MGD

Paragraph 3.2.1.1 of Ten States Stds. Indicates that the total developed groundwater source capacity must equal max. daily demand OR exceed the design avg demand with the largest well out of service. Verify that adequate source capacity exists:

		Proposed Plant
Total raw water production with largest well out of service	=	2,350 gpm
	=	2,350 gpm
	=	3.38 MGD

OK - production with one unit out > avg day demand

		Proposed Plant
Total raw water production of all wells combined	=	2,585 gpm
	=	2,585 gpm
	=	3.72 MGD

OK - production of all wells> max day demand

	Proposed Plant
Raw Water Characteristics	
Hardness (mg/L as CaCO3)	
Average	
Well 1	400 mg/L as CaCO2
Well 2	400 mg/L as CaCO3
Well 3	400 mg/L as CaCO4
Well 4	400 mg/L as CaCO5
Well 5	400 mg/L as CaCO6
Well 6	400 mg/L as CaCO7
Well 7	400 mg/L as CaCO3
Well 8	400 mg/L as CaCO3
Well 9	400 mg/L as CaCO4
Well 10	400 mg/L as CaCO5
Well 11	400 mg/L as CaCO3
Maximum	
Well 1	498 mg/L as CaCO2
Well 2	498 mg/L as CaCO3
Well 3	498 mg/L as CaCO4
Well 4	498 mg/L as CaCO5
Well 5	498 mg/L as CaCO6
Well 6	498 mg/L as CaCO7
Well 7	498 mg/L as CaCO3
Well 8	498 mg/L as CaCO3
Well 9	498 mg/L as CaCO4
Well 10	498 mg/L as CaCO5
Well 11	498 mg/L as CaCO3
Alkalinity	
Average	
Well 1	270 mg/L as CaCO2
Well 2	270 mg/L as CaCO3
Well 3	270 mg/L as CaCO3
Well 4	270 mg/L as CaCO3
Well 5	270 mg/L as CaCO3
Well 6	270 mg/L as CaCO3
Well 7	270 mg/L as CaCO3
Well 8	270 mg/L as CaCO3
Well 9	270 mg/L as CaCO4
Well 10	270 mg/L as CaCO5
Well 11	270 mg/L as CaCO3
Maximum	
Well 1	278 mg/L as CaCO2
Well 2	278 mg/L as CaCO3
Well 3	278 mg/L as CaCO3
Well 4	278 mg/L as CaCO3
Well 5	278 mg/L as CaCO3
Well 6	278 mg/L as CaCO3
Well 7	278 mg/L as CaCO3
Well 8	278 mg/L as CaCO3
Well 9	278 mg/L as CaCO4
Well 10	278 mg/L as CaCO5
Well 11	278 mg/L as CaCO3

	Proposed Plant
Iron	
Average	
Well 1	1 mg/L as Fe
Well 2	1 mg/L as Fe
Well 3	1 mg/L as Fe
Well 4	1 mg/L as Fe
Well 5	1 mg/L as Fe
Well 6	1 mg/L as Fe
Well 7	1 mg/L as Fe
Well 8	1 mg/L as Fe
Well 9	1 mg/L as Fe
Well 10	1 mg/L as Fe
Well 11	1 mg/L as Fe
Maximum	
Well 1	2.6 mg/L as Fe
Well 2	2.6 mg/L as Fe
Well 3	2.6 mg/L as Fe
Well 4	2.6 mg/L as Fe
Well 5	2.6 mg/L as Fe
Well 6	2.6 mg/L as Fe
Well 7	2.6 mg/L as Fe
Well 8	2.6 mg/L as Fe
Well 9	2.6 mg/L as Fe
Well 10	2.6 mg/L as Fe
Well 11	2.6 mg/L as Fe
Combined Raw Water Characteristics	
Hardness (mg/L as CaCO3)	
Average	400 mg/L as CaCO3
Maximum	498 mg/L as CaCO3
Alkalinity	
Average	270 mg/L as CaCO3
Maximum	278 mg/L as CaCO3
Iron	
Average	1.00 mg/L as Fe
Maximum	2.60 mg/L as Fe
Finished Water Characteristics	
Hardness (mg/L as CaCO3)	
Average	124 mg/L as CaCO3
Maximum	155 mg/L as CaCO3
Alkalinity	
Average	270 mg/L as CaCO3
Maximum	278 mg/L as CaCO3
Iron	
Average	<0.3 mg/L as Fe
Maximum	<0.3 mg/L as Fe

		Proposed Plant
WATER TREATMENT FACILITIES		
Water Flow Rates		
Average	1.90 mgd	
Maximum	3.30 mgd	
Plant Operation Hours		
Average	12.3 hours/day	
Maximum	21.3 hours/day	
AERATION		
Process Flow Rates		
Water Flow through Aerators		2292 gpm
Bypass Flow		0 gpm
Total Flow		2,292 gpm
Design Criteria from 10 States Standards		
Loading Rate	1 to 5 gpm/ft2 total tray area	
Min. No. trays	5	
Aerator Manufacturers include Tonka and US Filter		
Aerators		
No. Units		1
Type	Forced Draft	
Materials of Construction	Aluminum/Steel	
No. Trays		10
Tray Dimensions		10 ft x 10 ft
Area per Tray		100 ft2
Total Area per Aerator		1000 ft2
Total Tray Area		1,000 ft2
Aerator Loading Rate		23 gpm/ft2
Tray Loading Rate		2.3 gpm/ft2 total tray area
Horsepower		2
Drive		Constant Speed
Detention Tank		
Design Criteria from 10 States Standards		
Minimum Detention Time	30 minutes	
No. Units		1
Detention Time		30 minutes
Volume		68,760 gallons
Diameter		35 ft
Sidewall Height		10 ft

	Proposed Plant
PRESSURE FILTRATION	
Process Flow Rates	
Filter Water Flow	2,292 gpm
Bypass Flow	0 gpm
Total Flow	2,292 gpm

Design Criteria from 10 States Standards

Loading Rate 3 gpm/ft2 (higher rates are acceptable when demonstated. Not uncommon to achieve 6 gpm/ft2)
Backwash Rate 15 gpm/ft2

Pressure Filter Manufacturers include Hungerford and Terry, Tonka, and US Filter

Pressure Filters

No. Units	6
Diameter	10 ft
Sidewall Height	6 ft
Media Depth	2.5 ft
Media Volume Each	196.3 ft3
Total Media Volume	1,178 ft3
Surface Area Each	78.5 ft2
Total Surface Area	471.2 ft2
Loading Rates	
All Units in Service	4.9 gpm/ft2
One Unit Out of Service	5.8 gpm/ft2

ION-EXCHANGE SOFTENING

Process Flow Rates

Softened Water Flow	1,581 gpm
Bypass Flow	711 gpm
Total Flow	2,292 gpm

Design Criteria from 10 States Standards

Max Loading Rate 7 gpm/ft2
Resin Manufacturer will typically determine a site specific loading rate of *4 to 7* gpm/ft2

Ion Exchange unit Manufacturers include Hungerford and Terry, Tonka, and US Filter

Softener Capacity Required

Total Hardness Removed *(assumes maximum hardness occurs during maximum flow)*

Average	4,376 lb/day as CaCO3
	30,630,463 gr/day
Maximum	9,445 lb/day as CaCO3
	66,114,838 gr/day

Salt Required for Regeneration
Regeneration Ratio 0.3 lb/kgr hardness removed

Average	9,189 lb salt/day
Maximum	19,834 lb salt/day

		Proposed Plant
Ion Exchange Softeners		
No. Units		5
Diameter		10 ft
Sidewall Height		9 ft
Resin Depth		4.5 ft
Resin Volume Each		353.4 ft3
Total Resin Volume		1,767 ft3
Surface Area Each		78.5 ft2
Total Surface Area		392.7 ft2
Loading Rates		
All Units in Service		4.0 gpm/ft2
One Unit Out of Service		5.0 gpm/ft2
Resin Capacity	20,000 gr/ft3	
Resin Capacity Per Softener		7,068,578 gr
Total Resin Capacity		35,342,888 gr
Throughput per Softener per Cycle		
Average		302,182 gal
Maximum		242,716 gal
Recharges per Softener per Day		
Average		0.9 recharges
Maximum		1.9 recharges
Brine Usage		
Saturated Brine Solution Strength in Make-up Tank	30 percent	
Regenerant Brine Solution Strength	15 percent (diluted to prveent osmotic shock of the resin)	
Brine Specific Gravity	1.2	
Brine Rinse Cycle Time	15 min	
Salt Used per Cycle		2,121 lb
Brine Used per Cycle		1,413 gal
Daily Brine Use		
Average		6,127 gal
Maximum		13,248 gal
Evaporation of Spent Brine		
USGS shows evaporation rate of 38 inches per year for this region.		
Area required to evaporate spent brine solution (no rinse water)		
Maximum		4.7 acres
		452 feet (width and length)

		Proposed Plant
Backwash Cycles		
Initial High Rate		
Loading Rate	5 gpm/ft2	
Duration	10 min	
Flow Rate		393 gpm
Waste Generated per Cycle		3,927 gal
Daily Waste Generated		
Average		17,032 gal/day
Maximum		36,829 gal/day
Slow Rinse		
Loading Rate	1.2 gpm/ft2	
Duration	60 min	
Flow Rate		94 gpm
Waste Generated per Cycle		5,655 gal
Daily Waste Generated		
Average		24,526 gal/day
Maximum		53,034 gal/day
Fast Rinse		
Loading Rate	4.7 gpm/ft2	
Duration	10 min	
Flow Rate		369 gpm
Waste Generated per Cycle		3,691 gal
Daily Waste Generated		
Average		16,010 gal/day
Maximum		34,619 gal/day
Total Regeneration Waste Produced		
Average		63,694 gal/day
Maximum		137,730 gal/day
Regeneration Waste as Percentage of Water Treated		
Average		5.48%
Maximum		6.82%

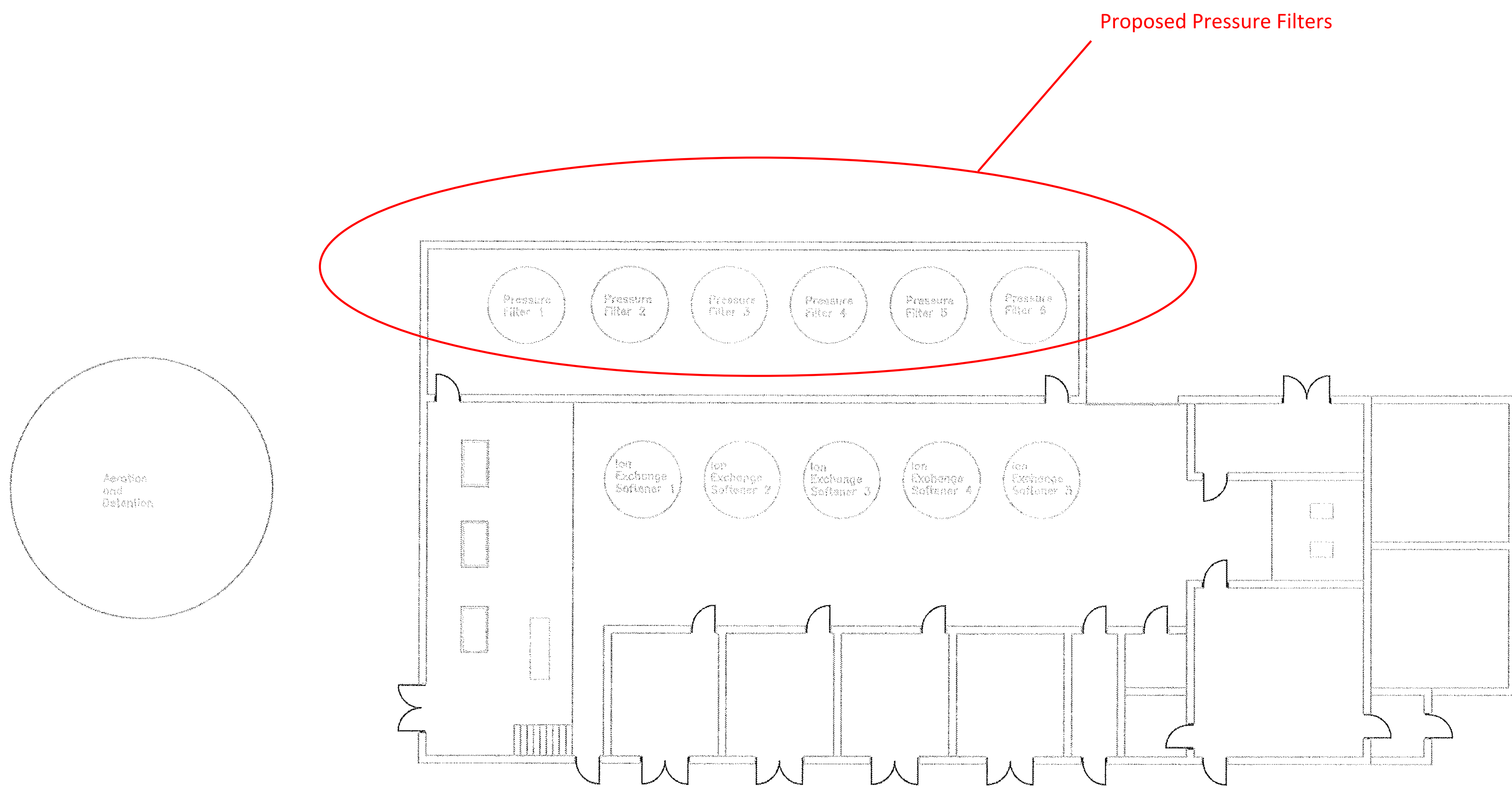
		Proposed Plant
Brine Tank		
Salt Storage Required	30 days	275,674 lb
Salt Bulk Density	72 lb/ft3	
Delivery Truck Quantity	40,000 lb	
Brine Tank		
No. Units		2
Dimensions per Cell		
Length		16 ft
Width		16 ft
Sidewater Depth		8.5 ft
Volume Each		16,276 gal
Total Volume		32,553 gal
No. Truckloads		4
Salt Depth		4.3 ft
Gravel Depth		2 ft
Maximum Water Level		8.5 ft
Brine Volume Available		31,465 gal
Gravel Void Ratio	0.33	
Salt Void Ratio	0.33	
Brine Pumps		
No. Units		2 (one standby)
Type		Centrifugal
Capacity		50 gpm
Horsepower		2 hp
Drive		

HIGH SERVICE PUMPING

		Proposed Plant
High Service Pumps		
No. Units		3 (one standby)
Type		Split Case
Capacity Each		1,150 gpm
Firm Capacity		2,300 gpm
Total Capacity		3,450 gpm
Total Head		220 ft
Drive		Constant or Adjustable Speed
Horsepower		100

	Proposed Plant
REGENERATION WASTE HANDLING	
Regeneration Waste Holding Tank	
No. Units	1
Diameter	40 ft
Sidewater Depth	15 ft
Volume	140,995 gal
CHEMICAL STORAGE AND FEED SYSTEMS	
1. Chlorine Storage and Feed Facilities	
Chlorine Usage	
Chlorine Dosage (as Cl2)	2 mg/L
Chemical	Chlorine gas
Average	32 lb/day
Maximum	55 lb/day
Days storage Required for 30 Day Supply	951 lb
Chlorine Storage Facilities	
Type of Cylinder	150 lb
Total Cylinders Onsite	7
Total Chlorine Onsite	1,050 lb
Days Storage at Average Day	33.1 days
Chlorine Scale	
No. Units	1
Type	Dual Cylinder Scale
Output	4-20 mA
Chlorine Vacuum Regulators	
No. Units	2 (one standby)
Capacity Each	100 lb/day

	Proposed Plant
Chlorinators	
No. Units	2 (one standby)
Capacity	100 lb/day
Chlorine Ejectors	
No. Units	2 (one standby)
Capacity	100 lb/day
Makeup Water Flow Rate	
Chlorine Solution Concentration	3,000 mg/L
Makeup Water Flow Rate (maximum)	2.8 gpm
Makeup Water Source	Finished Water
Chlorine Booster Pumps	
No. Units	2 (one standby)
Type	Centrifugal
Capacity	28 gpm
Horsepower	3
Drive	Constant Speed
Chlorine Leak Detector	
No. Units	2
Location	Chlorine Storage Room Chlorine Feed Room



Building Size for Ground Water
Approximatly 9,000 sq feet

Scale
Approximatly $\frac{1}{2}$" = 10'

Revision Number	Revision Description	Drawn By	Checked By	Date

Designed By:
Drawn By:
Checked By:
Approved By:
Filename:
Project No. 11155
Project Date 12/13/2006

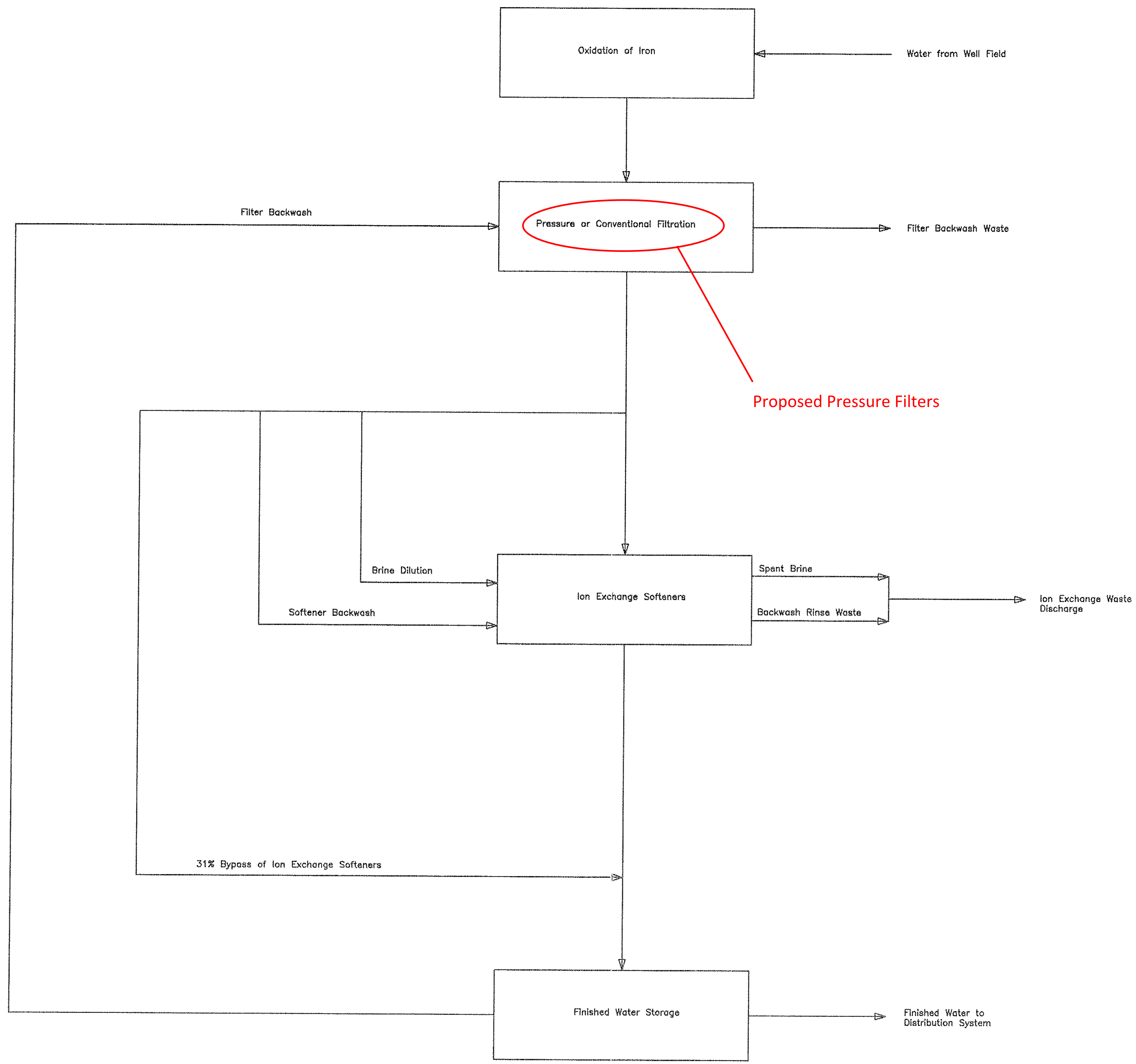
VILLAGE OF CHATHAM
CHATHAM WATER SUPPLY STUDY

CHATHAM, ILLINOIS

Chatham Ground Water Treatment Plant
Preliminary Building Size Estimate

DONOHUE & ASSOCIATES

Sheet No. Sheet Number
Drawing No.
Drawing Number



Revision Number	
Revision Description	
Drawn By	
Checked By	
Date	
Designed By	
Drawn By	
Checked By	
Approved By	
Filename	
Project No.	11155
Project Date	12/13/2006

VILLAGE OF CHATHAM
CHATHAM WATER SUPPLY STUDY

CHATHAM, ILLINOIS

PROCESS FLOW SCHEMATIC

DONOHUE & ASSOCIATES

Sheet No. Sheet Number

Drawing No.

Drawing Number

Initial: 12-04-2006
Revised: --2006
Final --2007
IEPA Rev = --2007

Village of Chatham, Illinois
Chatham Water Supply Study
Design Basis Memorandum
Source Water: Ground Water Under the Influence of Surface Water

Attachment "A-2"
Groundwater under the influence of surface water + gravity filter

Chatham only

		Proposed Plant
Daily Design Water Demands (Year 2029)		
Average	1.90 mgd	
Maximum	3.30 mgd	
Flow Rate		
Well Flow Rate		
Well 1		235 gpm
Well 2		235 gpm
Well 3		235 gpm
Well 4		235 gpm
Well 5		235 gpm
Well 6		235 gpm
Well 7		235 gpm
Well 8		235 gpm
Well 9		235 gpm
Well 10		235 gpm
Well 11		235 gpm
Design Flow Rates		
Well 1		235 gpm
Well 2		235 gpm
Well 3		235 gpm
Well 4		235 gpm
Well 5		235 gpm
Well 6		235 gpm
Well 7		235 gpm
Well 8		235 gpm
Well 9		235 gpm
Well 10		235 gpm
Well 11		235 gpm
Total		2,585 gpm
Firm Capacity (one unit out of service)		2,350 gpm 3.38 MGD

Paragraph 3.2.1.1 of Ten States Stds. Indicates that the total developed groundwater source capacity must equal max. daily demand OR exceed the design avg demand with the largest well out of service. Verify that adequate source capacity exists:

		Proposed Plant
Total raw water production with largest well out of service	=	2,350 gpm
	=	2,350 gpm
	=	3.38 MGD
		OK - production with one unit out > avg day demand

		Proposed Plant
Total raw water production of all wells combined	=	2,585 gpm
	=	2,585 gpm
	=	3.72 MGD
		OK - production of all wells> max day demand

	Proposed Plant
Raw Water Characteristics	
Hardness (mg/L as CaCO3)	
Average	
Well 1	400 mg/L as CaCO2
Well 2	400 mg/L as CaCO3
Well 3	400 mg/L as CaCO3
Well 4	400 mg/L as CaCO3
Well 5	400 mg/L as CaCO3
Well 6	400 mg/L as CaCO3
Well 7	400 mg/L as CaCO3
Well 8	400 mg/L as CaCO3
Well 9	400 mg/L as CaCO4
Well 10	400 mg/L as CaCO5
Well 11	400 mg/L as CaCO3
Maximum	
Well 1	498 mg/L as CaCO2
Well 2	498 mg/L as CaCO3
Well 3	498 mg/L as CaCO3
Well 4	498 mg/L as CaCO3
Well 5	498 mg/L as CaCO3
Well 6	498 mg/L as CaCO3
Well 7	498 mg/L as CaCO3
Well 8	498 mg/L as CaCO3
Well 9	498 mg/L as CaCO4
Well 10	498 mg/L as CaCO5
Well 11	498 mg/L as CaCO3
Alkalinity	
Average	
Well 1	270 mg/L as CaCO2
Well 2	270 mg/L as CaCO3
Well 3	270 mg/L as CaCO3
Well 4	270 mg/L as CaCO3
Well 5	270 mg/L as CaCO3
Well 6	270 mg/L as CaCO3
Well 7	270 mg/L as CaCO3
Well 8	270 mg/L as CaCO3
Well 9	270 mg/L as CaCO4
Well 10	270 mg/L as CaCO5
Well 11	270 mg/L as CaCO3
Maximum	
Well 1	278 mg/L as CaCO2
Well 2	278 mg/L as CaCO3
Well 3	278 mg/L as CaCO3
Well 4	278 mg/L as CaCO3
Well 5	278 mg/L as CaCO3
Well 6	278 mg/L as CaCO3
Well 7	278 mg/L as CaCO3
Well 8	278 mg/L as CaCO3
Well 9	278 mg/L as CaCO4
Well 10	278 mg/L as CaCO5
Well 11	278 mg/L as CaCO3

	Proposed Plant
Iron	
Average	
Well 1	1 mg/L as Fe
Well 2	1 mg/L as Fe
Well 3	1 mg/L as Fe
Well 4	1 mg/L as Fe
Well 5	1 mg/L as Fe
Well 6	1 mg/L as Fe
Well 7	1 mg/L as Fe
Well 8	1 mg/L as Fe
Well 9	1 mg/L as Fe
Well 10	1 mg/L as Fe
Well 11	1 mg/L as Fe
Maximum	
Well 1	2.6 mg/L as Fe
Well 2	2.6 mg/L as Fe
Well 3	2.6 mg/L as Fe
Well 4	2.6 mg/L as Fe
Well 5	2.6 mg/L as Fe
Well 6	2.6 mg/L as Fe
Well 7	2.6 mg/L as Fe
Well 8	2.6 mg/L as Fe
Well 9	2.6 mg/L as Fe
Well 10	2.6 mg/L as Fe
Well 11	2.6 mg/L as Fe
Combined Raw Water Characteristics	
Hardness (mg/L as CaCO3)	
Average	400 mg/L as CaCO3
Maximum	498 mg/L as CaCO3
Alkalinity	
Average	270 mg/L as CaCO3
Maximum	278 mg/L as CaCO3
Iron	
Average	1.00 mg/L as Fe
Maximum	2.60 mg/L as Fe
Finished Water Characteristics	
Hardness (mg/L as CaCO3)	
Average	124 mg/L as CaCO3
Maximum	155 mg/L as CaCO3
Alkalinity	
Average	270 mg/L as CaCO3
Maximum	278 mg/L as CaCO3
Iron	
Average	<0.3 mg/L as Fe
Maximum	<0.3 mg/L as Fe

		Proposed Plant

WATER TREATMENT FACILITIES

Water Flow Rates

Average	1.90 mgd	
Maximum	3.30 mgd	

Plant Operation Hours

Average	12.3 hours/day	
Maximum	21.3 hours/day	

AERATION

Process Flow Rates

Water Flow through Aerators	2292 gpm
Bypass Flow	0 gpm
Total Flow	2,292 gpm

Design Criteria from 10 States Standards

Loading Rate	1 to 5 gpm/ft2 total tray area
Min. No. trays	5

Aerator Manufacturers include Tonka and US Filter

Aerators

No. Units		1
Type	Forced Draft	
Materials of Construction	Aluminum/Steel	
No. Trays		10
Tray Dimensions		10 ft x 10 ft
Area per Tray		100 ft2
Total Area per Aerator		1000 ft2
Total Tray Area		1,000 ft2
Aerator Loading Rate		23 gpm/ft2
Tray Loading Rate		2.3 gpm/ft2 total tray area
Horsepower		2
Drive		Constant Speed

Detention Tank

Design Criteria from 10 States Standards

Minimum Detention Time 30 minutes

No. Units	1
Detention Time	30 minutes
Volume	68,760 gallons
Diameter	35 ft
Sidewall Height	10 ft

	Proposed Plant

CONVENTIONAL FILTRATION

Process Flow Rates

Filter Water Flow	2,292 gpm
Bypass Flow	0 gpm
Total Flow	2,292 gpm

Coagulant Rapid Mix

Design Criteria from 10 States Standards

Maximum Detention Time 30 seconds

Rapid Mix Basin (Design for 2 basins, plan to use independantly)
May require addition of substrate such as bentonite clay to support flocc growth

No. Units	2 (one back-up)
Length	5 ft
Width	4 ft
Depth	4 ft
Volume	80.0 ft3

Detention Time

Average	27.4 seconds
Maximum	15.7 seconds

Flocculation

Design Criteria from 10 States Standards

Minimum Detention Time 30 minutes
Flow-through Velocity 0.5 - 1.5 feet per minute
Initial Design for 2 basins, each with capacity to handle average day flow

Flocculation Basin

No. Units	2
Length	45 ft
Width	10 ft
Depth	12 ft
Volume of each basin	5,400 ft3
Total Volume	10,800 ft3

Detention Time

Average (utilizing one basin)	30.8 minutes
Maximum (utilizing both basins)	35.2 minutes

Flow-through Velocity

Average (utilizing one basin)	1.46 ft per minute
Maximum (utilizing both basins)	1.28 ft per minute

		Proposed Plant
Sedimentation		
Design Criteria from 10 States Standards		
Minimum Detention Time	4 hours	
Maximum Flow-through Velocity	0.5 feet per minute	
Initial Design for 2 basins, each with capacity to handle average day flow		
Sedimentation Basin		
No. Units		2
Length		120 ft
Width		30 ft
Depth		12 ft
Volume of each basin		43,200 ft3
Total Volume		86,400 ft3
Detention Time		
Average (utilizing one basin)		4.1 hours
Maximum (utilizing both basins)		4.7 hours
Flow-through Velocity		
Average (utilizing one basin)		0.49 ft per minute
Maximum (utilizing both basins)		0.43 ft per minute
Rapid Rate Gravity Filters		
Design Criteria from 10 States Standards		
Loading Rate	3 gpm/ft2	
Backwash Rate	15 gpm/ft2 for minimum of 15 minutes	
Media Manufacturers include Roberts Filters and US Filter		
Gravity Filters		
No. Units		5
Length		14 ft
Width		14 ft
Sidewall Height		9 ft
Media Depth		2.5 ft
Media Volume Each		490.0 ft3
Total Media Volume		2,450 ft3
Surface Area Each		196.0 ft2
Total Surface Area		980.0 ft2
Loading Rates		
All Units in Service		2.3 gpm/ft2
One Unit Out of Service		2.9 gpm/ft2

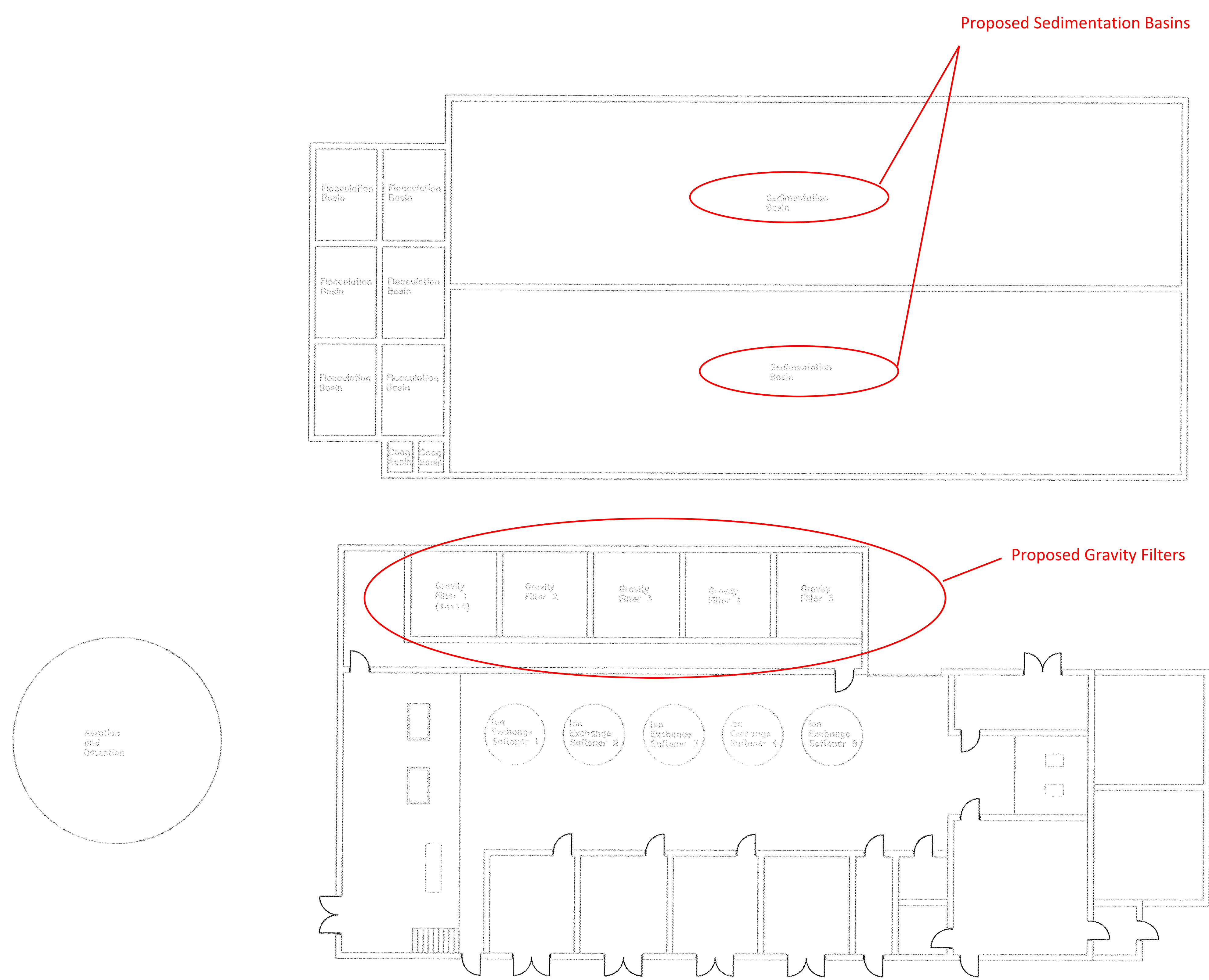
		Proposed Plant
ION-EXCHANGE SOFTENING		
Process Flow Rates		
Softened Water Flow		1,581 gpm
Bypass Flow		711 gpm
Total Flow		2,292 gpm
Design Criteria from 10 States Standards		
Max Loading Rate	7 gpm/ft2	
Resin Manufacturer will typically determine a site specific loading rate of *4 to 7* gpm/ft2		
Ion Exchange unit Manufacturers include Hungerford and Terry, Tonka, and US Filter		
Softener Capacity Required		
Total Hardness Removed *(assumes maximum hardness occurs during maximum flow)*		
Average		4,376 lb/day as CaCO3 30,630,463 gr/day
Maximum		9,445 lb/day as CaCO3 66,114,838 gr/day
Salt Required for Regeneration		
Regeneration Ratio	0.3 lb/kgr hardness removed	
Average		9,189 lb salt/day
Maximum		19,834 lb salt/day
Ion Exchange Softeners		
No. Units		5
Diameter		10 ft
Sidewall Height		9 ft
Resin Depth		4.5 ft
Resin Volume Each		353.4 ft3
Total Resin Volume		1,767 ft3
Surface Area Each		78.5 ft2
Total Surface Area		392.7 ft2
Loading Rates		
All Units in Service		4.0 gpm/ft2
One Unit Out of Service		5.0 gpm/ft2
Resin Capacity	20,000 gr/ft3	
Resin Capacity Per Softener		7,068,578 gr
Total Resin Capacity		35,342,888 gr

		Proposed Plant
Throughput per Softener per Cycle		
Average		302,182 gal
Maximum		242,716 gal
Recharges per Softener per Day		
Average		0.9 recharges
Maximum		1.9 recharges
Brine Usage		
Saturated Brine Solution Strength in Make-up Tanl	30 percent	
Regenerant Brine Solution Strength	15 percent (diluted to prveent osmotic shock of the resin)	
Brine Specific Gravity	1.2	
Brine Rinse Cycle Time	15 min	
Salt Used per Cycle		2,121 lb
Brine Used per Cycle		1,413 gal
Daily Brine Use		
Average		6,127 gal
Maximum		13,248 gal
Evaporation of Spent Brine		
USGS shows evaporation rate of 38 inches per year for this region.		
Area required to evaporate spent brine solution (no rinse water)		
Maximum		4.7 acres 452 feet (width and length)
Backwash Cycles		
Initial High Rate		
Loading Rate	5 gpm/ft2	
Duration	10 min	
Flow Rate		393 gpm
Waste Generated per Cycle		3,927 gal
Daily Waste Generated		
Average		17,032 gal/day
Maximum		36,829 gal/day
Slow Rinse		
Loading Rate	1.2 gpm/ft2	
Duration	60 min	
Flow Rate		94 gpm
Waste Generated per Cycle		5,655 gal
Daily Waste Generated		
Average		24,526 gal/day
Maximum		53,034 gal/day

		Proposed Plant
Fast Rinse		
Loading Rate	4.7 gpm/ft2	
Duration	10 min	
Flow Rate		369 gpm
Waste Generated per Cycle		3,691 gal
Daily Waste Generated		
Average		16,010 gal/day
Maximum		34,619 gal/day
Total Regeneration Waste Produced		
Average		63,694 gal/day
Maximum		137,730 gal/day
Regeneration Waste as Percentage of Water Treated		
Average		5.48%
Maximum		6.82%
Brine Tank		
Salt Storage Required	30 days	275,674 lb
Salt Bulk Density	72 lb/ft3	
Delivery Truck Quantity	40,000 lb	
Brine Tank		
No. Units		2
Dimensions per Cell		
Length		16 ft
Width		16 ft
Sidewater Depth		8.5 ft
Volume Each		16,276 gal
Total Volume		32,553 gal
No. Truckloads		4
Salt Depth		4.3 ft
Gravel Depth		2 ft
Maximum Water Level		8.5 ft
Brine Volume Available		31,465 gal
Gravel Void Ratio	0.33	
Salt Void Ratio	0.33	
Brine Pumps		
No. Units		2 (one standby)
Type		Centrifugal
Capacity		50 gpm
Horsepower		2 hp
Drive		

	Proposed Plant
HIGH SERVICE PUMPING	
High Service Pumps	
No. Units	3 (one standby)
Type	Split Case
Capacity Each	1,150 gpm
Firm Capacity	2,300 gpm
Total Capacity	3,450 gpm
Total Head	220 ft
Drive	Constant or Adjustable Speed
Horsepower	100
REGENERATION WASTE HANDLING	
Regeneration Waste Holding Tank	
No. Units	1
Diameter	40 ft
Sidewater Depth	15 ft
Volume	140,995 gal
CHEMICAL STORAGE AND FEED SYSTEMS	
1. Chlorine Storage and Feed Facilities	
Chlorine Usage	
Chlorine Dosage (as Cl2)	2 mg/L
Chemical	Chlorine gas
Average	32 lb/day
Maximum	55 lb/day
Days storage Required for 30 Day Supply	951 lb
Chlorine Storage Facilities	
Type of Cylinder	150 lb
Total Cylinders Onsite	7
Total Chlorine Onsite	1,050 lb
Days Storage at Average Day	33.1 days

	Proposed Plant
Chlorine Scale	
No. Units	1
Type	Dual Cylinder Scale
Output	4-20 mA
Chlorine Vacuum Regulators	
No. Units	2 (one standby)
Capacity Each	100 lb/day
Chlorinators	
No. Units	2 (one standby)
Capacity	100 lb/day
Chlorine Ejectors	
No. Units	2 (one standby)
Capacity	100 lb/day
Makeup Water Flow Rate	
Chlorine Solution Concentration	3,000 mg/L
Makeup Water Flow Rate (maximum)	2.8 gpm
Makeup Water Source	Finished Water
Chlorine Booster Pumps	
No. Units	2 (one standby)
Type	Centrifugal
Capacity	28 gpm
Horsepower	3
Drive	Constant Speed
Chlorine Leak Detector	
No. Units	2
Location	Chlorine Storage Room Chlorine Feed Room



Building Size for Ground Water Under the Influence of Surface Water Approximatly 9,000 sq feet

Additional Basin Size (Coag/Flocc/Sed) Approximately 9,000 sq feet.

Scale
Approximatly $\frac{1}{2}$" = 10'

Designed By
Drawn By
Checked By
Approved By
Filename
Project No. 11155
Project Date 12/13/2006

VILLAGE OF CHATHAM
CHATHAM WATER SUPPLY STUDY
CHATHAM, ILLINOIS

Chatham GUISW Treatment Plant
Preliminary Building Size Estimate

DONOHUE & ASSOCIATES

Sheet No. Sheet Number
Drawing No.
Drawing Number

4.2.2 Rapid rate pressure filters

The normal use of these filters is for iron and manganese removal. Pressure filters shall not be used in the filtration of surface or other polluted waters or following lime-soda softening.

4.2.2.1 General

Minimum criteria relative to rate of filtration, structural details and hydraulics, filter media, etc., provided for rapid rate gravity filters also apply to pressure filters where appropriate.

4.2.2.2 Rate of filtration

The rate shall not exceed three gallons per minute per square foot of filter area (7.2 m/hr) except where inplant testing as approved by the reviewing authority has demonstrated satisfactory results at higher rates.

4.2.2.3 Details of design

The filters shall be designed to provide for

a. loss of head gauges on the inlet and outlet pipes of each battery of filters,

b. an easily readable meter or flow indicator on each battery of filters. A flow indicator is recommended for each filtering unit,

c. filtration and backwashing of each filter individually with an arrangement of piping as simple as possible to accomplish these purposes,

d. minimum side wall shell height of five feet. A corresponding reduction in side wall height is acceptable where proprietary bottoms permit reduction of the gravel depth,

e. the top of the washwater collectors to be at least 18 inches above the surface of the media,

f. the underdrain system to efficiently collect the filtered water and to uniformly distribute the backwash water at a rate not less than 15 gallons per minute per square foot of filter area (37 m/hr),

g. backwash flow indicators and controls that are easily readable while operating the control valves,

h. an air release valve on the highest point of each filter,

i. an accessible manhole to facilitate inspection and repairs for filters 36 inches or more in diameter. Sufficient handholds shall be provided for filters less than 36 inches in diameter. Manholes should be at least 24 inches in diameter where feasible,

j. means to observe the wastewater during backwashing,

k. construction to prevent cross-connection.

Attachment "C"
Meeting Minutes
December 19, 2006

Pisula, Joe

From: Faulds, Bill [Bill.Faulds@emcstl.com]
Sent: Tuesday, December 19, 2006 11:41 PM
To: dmccord@chathamil.net; Mwconsultant@aol.com; Nevers, Ed; Lawrence, Charles; Vogel, Dave; Pisula, Joe; garyk@greeneandbradford.com; jayj@greeneandbradford.com
Cc: Trader, Robert; Togna, Paul; JRMEMC@aol.com; Griese, Mark
Subject: Meeting Minutes - December 19,2006

Team:
Here are the minutes from this morning's design meeting. Please review and comment. Please consider the BIC Items you are responsible for.
Thanks for the good session I wish you all the best for Christmas and the New Year I don't think I will see most of you till January.
Best Regards,
Bill Faulds

Wm R Faulds
Sr. Owner's Engineer / Manager
Environmental Management Corporation
A member of the Linde Group
1001 Boardwalk Springs Place
O'Fallon, MO 63366
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Cellular 314.803.2992
bill.faulds@emcstl.com

EMC
A BOC GROUP COMPANY

Project Meeting Minutes

Project: Village of Chatham Water System
Meeting: Project Planning Meeting
Location: Greene & Bradford, Springfield, IL

Date: December 19, 2006

Attendees

EMC	Donohue & Assoc	Greene & Bradford	Village of Chatham
Bill Faulds (WmRF)	Edward S Nevers, PE	Jay Jesson, PE	Del McCord
Robert Trader (RNT)	Joseph V Pisula, PE	Gary Kuntzman	Michael A Williamsen, PE
	David Vogel, PE		
	Charles F Lawrence, PE		

Meeting

Item	Discussion	BIC	Due
1	The evening prior to the meeting the Water Team met with the wellfield property owners at the Mendenhall property for an informational session. G&B is to distribute a list of the participants to the Water Team and to those in attendance	GSK	12/22/06
2	Reviewed Technical Memo #1 revised according to our meeting of December 5, 2006 (attached)		
3	Discussed brine loads and flows. There are two brine streams a small flow of heavily loaded brine and a larger flow of lightly loaded rinseate brine. There may be wisdom in segregating the two brine flows. Team will review additional data from Tonca and from Monmouth. Will also review brine disposal options.	Tonca ESN Monmouth RNT	 1/16/07 1/16/07
4	Confirmed that all capacity consideration will be based on 110gpd/capita @ 1.75 peak		
5	Reviewed current project schedule agreed that there would be no change to the design efforts – see additional schedule discussion following		
6	Donohue had prepared two block flow diagrams representing the two filter options caused by consideration of Groundwater (Gwtr) vs. Groundwater Under the Influence (GwUI)		
7	Donohue had prepared a flow inventory map delineating line sizes for transmission to Chatham, to Buffalo Mechanicsburg and from Chatham to Curran Gardner and from Chatham to Loami. The transmission line to Chatham at 4Mgd was 24" ∅ David Vogel was requested to produce an analysis of the 24" line at 6Mgd	 DV	 1/16/07
8	Joe Pisula suggested that it would be valuable to have a pressure map of the transmission system – all agreed	DV	1/16/07

9	Donohue has produced two preliminary design data sheets for the treatment one fro Gwtr and one for GwUI. By ILEPA regulations Gwtr can be pumped through pressure filters and requires no constant manual supervision and monitoring. GwUI requires sedimentation, flocculation and gravity filtration all of which must occur under constant manual supervision and monitoring. Team members reviewed the various parameters that automatically determine that we are dealing with GwUI and find we have more than 3 factors – turbidity > 5 NtU – within 200 Ft of open water – turbidity fluctuations > 0.5 NtU – temperature fluctuation > 9°F Team consensus was to proceed to design the plant to GwUI conditions (we can remove the GwUI requirements for less than a dual design trac and we could better use additional design hours for considering alternate technologies) and consider alternatives to accommodate and minimize the effect of the additional capital of a GwUI system while protecting the operational costs of the system to make the program feasible on a rates basis		
10	Team Consensus to deal with GwUI requirements Include enough storage capacity to run the plant at maximum design rate to produce sufficient water in a single shift at startup to satisfy 2009 population @ 110 gpd/capita @ 1.75 factor Build sufficient footprint for the 20 year capacity but equip system for 2009 @ 110 @ 1.75 Sedimentation basins filter bays etc built to 2027 equipped for 2009.		
11	Sedimentation basins and treatment building to be assymetrical for future mirror image expansion	DV	1/16/07
12	There was considerable additional discussion of the brine situation and it was decided to consider the following options: Del McCord to make discreet confirmation of Springfield disposal capacity requirements for brine Search all public domain for disposal regulations and limits Consider Holmier option of oil well disposal 1 Mile pump and line – $0.50 / bbl ($0.0125 / gal) + $20K permitting	 DMcC DV WmRF/RNT	 1/16/07 1/16/07 1/16/07
13	Revise process to use NaCl rather than gaseous Cl	DV	1/16/07
14	Salt storage to be below grade		
15	Future capability for chelation and pH adjustment additions		
16	Include 30 minute detention after aeration		
17	EMC instructs design team to use clays and polymers not FeCl in the system. If these systems are cost prohibitive the EMC	DV	1/16/07

	Ops team can VE them with the design team		
18	There was a general discussion reviewing the team members preferences for basin and filter construction techniques and scour rates for the design team's consideration.		
19	Design team will review all contact time considerations according to our decision to continue according to GwUI parameters		
20	Team will continue with all treatment engineering and transmission design tasks according to the current project schedule. However, we will report to the client that the weather delays to the drilling program may delay the presentation of a completed report to the Village until April.		
21	Next team meeting as scheduled January 16, 2007		
22	Michael Williamsen suggests that the team obtain a map illustrating the aquifer that will service the wellfield. This will allow the landowners to see that they are not pulling from a perched or confined body of water but a wide flowing underground river. – all agreed	JVP	1/16/07

Attachment "D"

Pisula, Joe

From: Faulds, Bill [Bill.Faulds@emcstl.com]

Sent: Monday, February 12, 2007 2:55 PM

To: dmccord@chathamil.net; Mwconsultant@aol.com; jayj@greeneandbradford.com; garyk@greeneandbradford.com; Nevers, Ed; Froh, Dave; Vogel, Dave; Lawrence, Charles; Pisula, Joe

Cc: Trader, Robert; Thomas, Todd

Subject: Postpone meeting of February 13

Team:
In the interest of safety and due to delays beyond our control we are postponing the meeting scheduled tomorrow.
A quick status follows:

Well field – awaiting response from ISWS – Bob Olson is recalcitrant in answering our questions. Joe is scheduling a conference call for later this week, we will publish a time and call in number.

Treatment Plant – we have received data from the alternative technology vendors all of which appears to have overcome our budget challenge; however, Donohue still needs a little time to complete their due diligence.

We will advise of a revised date for this meeting.
Regards,
Bill Faulds

Wm R Faulds
Sr. Owner's Engineer / Manager
Environmental Management Corporation
A member of the Linde Group
1001 Boardwalk Springs Place
O'Fallon, MO 63366
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bill.faulds@emcstl.com

Attachment "E"

IEPA MEETING
VILLAGE OF CHATHAM, IL WATER SYSTEM PROJECT
September 18, 2007

1. **Introductions**

2. **Village Comments**

3. **Review of Water Supply Study**
   - Project Need
   - Capacity Required
   - Water Source – GWUI
   - Raw Water Quality – Iron, Manganese, hardness, TDS
   - Finished Water Quality – CWPL
   - WTP – Process
     - Aeration / Detention
     - Membranes
     - Ion Exchange
     - Disinfection
     - Brine Disposal
     - Hydraulic Profile

4. **Membrane Piloting**
   - Propose 3 month pilot with Pall Microfiltration
     - Piloting requirements?
     - Established protocol?
     - Reporting requirements?
   - Disinfection credits required for giardia, cryptosporidium & viruses?
   - Only piloted membrane may be specified?

5. **Miscellaneous**
   - Finished water monitoring requirements (turbidimeters, particle counting)?
   - Integrity testing requirements (air pressure tests, sonic testing)?
   - Other treatment requirements?
   - Redundancy of membrane skid and other equipment?
   - WTP does not need to be manned 24 hours/day?
   - Adequacy of Water Supply Study – other information required?
   - Other Agency submittal requirements?
   - Project Schedule

Village of Chatham, IL Water System
Notes of September 18, 2007
IEPA Meeting

Name	Company	Number	Email Address
Robert Trader	EMC	314-614-6196	rot@emcstl.com
Del McCord	Chatham, IL	217-483-2451	dmccord@chathamil.net
Randy Vanderwerf	Donohue	217-352-9990	
Joe Pisula	Donohue	217-352-9990	jpisula@donohue-associates.com
Todd Thomas	EMC	636-399-8283	ftthomas@emstl.com
Mike Williamsen		217-483-2863	mwconsultant@aol.com
Jerry Kuhn	IEPA		

1. Iron and Salt Brine – Possible to increase rinse to further dilute water and then discharge to ditch.

2. GWUI – Design based on GWUI.

3. Raw Water Quality: Iron – 1 to 2 ppm; Hardness – 280 ppm. Raw water data will be supplied to IEPA from testing completed on 3 separate times and test wells.

4. Membrane Piloting

   - Set up aeration and membrane for testing.
   - Pall to supply protocol and review by Donohue before submittal to IEPA.
   - 3 month pilot during cold weather months of November to February.
   - Will need to agree to reporting requirements of test.
     - Water Quality test results to IEPA from 2003 to 2007 in table form.
   - Effluent discharge from pilot to stream will be no more than 25 gpm.
   - Pilot Pall: IEPA will only allow Pall to be used in plant.
   - Need to verify disinfection credits
   - Need Protocols sent to IEPA for piloting to include turbidity, particle counters, filter integrity, air or sonic testing.
   - Redundancy of Membranes will be required. Initial flow will be 2.2 mgd. Membranes to be sized to maintain full flow with one unit out of service.
   - Water treatment plant does not have to be manned 24 hrs. per day. 8 hrs. per day will be allowed if an operator is present during startup period.

5. Well sites – Need to be 400’ from permitted gravel pit boundaries. Will need to verify permit requirements.

Attachment "F"

From: Trader, Robert [robert.trader@emcstl.com]
Sent: Thursday, November 06, 2008 4:36 PM
To: Pisula, Joe
Cc: Krause, Larry; Nevers, Ed
Subject: RE: Chatham
Joe

Yes, that was a concern of Westech also, but they feel with the water quality and the aeration we are doing that we should be alright. We will be taking our first samples next week. I will be on site to make sure everything goes good.

Robert Trader| Lead Engineer | **Environmental Management Corporation – A Member of LINDE North America, Inc.**
1001 Boardwalk Springs Place | O'Fallon, MO 63368 |direct: 636.561.9418 | mobile: 314.614.6196 | fax: 636.561.9481 | e-mail: robert.trader@emcstl.com

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From: Pisula, Joe [mailto:jpisula@donohue-associates.com]
Sent: Thursday, November 06, 2008 4:36 PM
To: Trader, Robert
Cc: Krause, Larry; Nevers, Ed
Subject: RE: Chatham

Robert:

I received your phone message about this earlier today and it sounds like Graeme Medworth from WesTech is on board with this and the lab testing needs. We hope to see some good results then. The thing we want to watch out for is the manganese and any un-oxidized iron that is going into the membranes.

Joe

From: Pisula, Joe
Sent: Wednesday, November 05, 2008 4:01 PM
To: 'Trader, Robert'
Cc: Krause, Larry
Subject: FW: Chatham

Robert:

Larry Krause and I reviewed the status of the WesTech unit and I told him where we are at on getting it set up. He had some valid concerns on lab testing of the raw and finished water testing needs and they are outlined below. As you can see, we need to see what the raw and pre-MF iron and manganese levels are, amongst other things. Should I relay this on to WesTech? If so, I will send to Graeme Medworth, their project manager.

As you can see, Larry is suggesting that we do some monthly testing of these parameters, which is beyond WesTech's scope of work. I'm assuming that the Village can use Prairie Analytical in Springfield to run these tests.

Joe

From: Krause, Larry
Sent: Wednesday, November 05, 2008 2:15 PM
To: Pisula, Joe
Cc: Nevers, Ed
Subject: RE: Chatham

Joe –

I looked through the procurement spec, and I do think some water chemistry analysis is in order for this pilot test. I am concerned about manganese, and potentially some limited calcium precipitation occurring (due to changes in equilibriums that may result from stripping CO2 out of the raw water).

Raw Water (before aeration):

Turbidity
pH
Alkalinity
Hardness (calcium and magnesium)
Iron
Manganese

Detention Tank Effluent

Turbidity
pH
Hardness (calcium and magnesium) (filtered and unfiltered samples)
Iron (filtered and unfiltered samples)
Manganese (filtered and unfiltered samples)

Pilot Plant Effluent

Turbidity
pH
Hardness (calcium and magnesium) (not necessary to filter)
Alkalinity
Iron (not necessary to filter)
Manganese (not necessary to filter)

These tests are not difficult, and should not be expensive. A decent lab should be able to turn this around in 2-3 days.

I believe that we added a chlorination point to the front end of the detention tank as part of the 30 percent design. This was done after the problems with Algonquin were discovered. We should definitely add hypochlorite at the front end of the detention tank for the pilot if manganese levels are elevated.

Discussion:

According to the water chemistry information we have, raw water manganese may run from 0.05-0.60 mg/L (secondary EPA standard for manganese is <0.05 mg/L, higher levels can cause fixture staining, laundry problems, etc.). Manganese will oxidize and precipitate with aeration, but the process takes much longer than it does for iron to oxidize and precipitate. As a result, we may end up with manganese precipitating on/in/after the membrane process, which may shorten membrane life significantly. Manganese will oxidize and precipitate faster if chlorine is used as the oxidant. It is important that the manganese be precipitated before it hits the membranes, as it is very difficult to remove if embedded in the membrane. In addition, the finished water quality may suffer if the manganese passes through the membranes, especially if the levels are as high as shown in the preliminary data.

The raw water pH is between 7.0 – 8.0. According to the limited data we have available, the raw water hardness (total hardness = calcium + magnesium) ranges from 230-500 mg/L. Looking at the carbonate chemistry, there is an equilibrium between the different carbonate ions and dissolved carbon dioxide in the water. With well water, aeration will typically strip out any dissolved carbon dioxide, which causes a shift in the carbonate equilibrium. The pH will normally increase, and the extent of the increase is determined by the buffering capacity of the water. Solubility of calcium carbonate decreases as pH increases. Therefore, it is possible that aeration will cause some precipitation of calcium carbonate, which can easily be filtered out by the membranes. We need to know this information for planning and scheduling maintenance washes and Clean-In-Place cycles with the appropriate chemicals.

The iron precipitation should be straight-forward, we do need to document the ability of the pilot to remove the iron. The pilot testing is only requiring monitoring of turbidity and particle counting (to document the ability to provide the required removals for the microbials).

We do not need to perform continuous testing for these parameters, but we should do this at least monthly. At the start of the run, weekly testing should be performed until we determine that everything is operating as expected. If this is a new well, chemical characteristics may change as the pilot study proceeds, so we need to keep an eye on this, also.

From: Pisula, Joe
Sent: Wednesday, November 05, 2008 9:34 AM
To: Trader, Robert
Cc: Krause, Larry; Nevers, Ed
Subject: Chatham

Robert:

Here is the Basis of Design info for the MF membranes:

2009 Operation (Start-Up)

- Flux at avg day demand, all 3 units in service = 13.5 gfd
- Flux at avg day demand, one unit out of service = 20.2 gfd
- Flux at max day demand, all 3 units in service = 26.3 gfd
- Flux at max day demand, one unit out of service = 39.5 gfd
- This is assuming three units with 63 modules per unit.

2029 Operation

- Flux at avg day demand, all 3 units in service = 13.7 gfd
- Flux at avg day demand, one unit out of service = 20.7 gfd
- Flux at max day demand, all 3 units in service = 26.5 gfd
- Flux at max day demand, one unit out of service = 39.7 gfd
- This is assuming three units with 94 modules per unit.

This is from page 7 of Volume 1 of our Basis of Design Report dated February 2008. I agree that we should increase the pilot plant's well pump size from 20 gpm to around 40 gpm … to be able to achieve the 46 gfd flux rate that was in the protocol. If we don't achieve piloting results that demonstrate flux rates at or above the 39.7 gfd rate, IEPA will have problems with the design numbers that we had proposed.

Let me know how the numbers start coming out … once WesTech gets it going.

DONOHUE & ASSOCIATES, INC.
Joseph V. Pisula, P.E.

Attachment "G"

South Sangamon Water Commission

IEPA Meeting Notes

September 15, 2009

1. List of Attendees: (See attached sheet)
2. IEPA has issued the Commission with a public water ID number: 1670080
3. Discussion on the formation of the South Sangamon Water Commission. Chatham and New Berlin have executed intergovernmental agreement due to like interests. Sangamon County also has a representative on the Commission.
4. The Commission will be submitting all plans and specifications in its name for the water plant and transmission main. The transmission main plans where submitted approximately 40 days ago for permit. The water plant plans will be submitted for construction permit in November.
5. Update on the status of the design:
   a. Pilot plant study completed at the end of April and the report has been submitted to IEPA.
   b. Westech was selected for the pilot plant and will be the system used in the water plant design.
   c. Original production was 4.5 mgd, this was reduced to 3.3 mgd to reduce costs.
   d. No IEPA loan money will be used in the construction of this project.
6. IEPA asked the Commission members how sure this project is going to proceed, due to articles in the paper indicating Chatham would be staying with the City of Springfield water system. The Commission is 90% sure of continuing with the project.
7. IEPA indicated that due to the formation of the Commission, additional information will be required before a construction permit would be issued:
   a. A Capacity Demonstration Report will be required showing Financial, manager, and capacity ability. Sections 651.102 and 652.701 of the regulations. No construction permit will be issued until this is completed and submitted to IEPA. Can be submitted at the same time as the plans and specifications.
   b. SSWC provide a Cross Connection Policy
   c. Notification of Ownership to IEPA
8. IEPA asked what the Commission will own: They will own the plant, transmission main to Chatham, and the transmission main between Chatham and New Berlin. Final details are still being worked out.
9. IEPA restated that the system will be treated as a surface water plant, which includes NTU, THM, etc. All sampling and testing requirements of a surface water plant will be required of this system.
10. Basis of Design should be submitted with plan and specifications. (Chris Kohrmann of IEPA advised that it not be sent now.)
11. Discussion on the chloride discharge:
    a. 15-17,000 gpd to be hauled initially to MSD of Springfield. That will go to about 22,000 gpd eventually.
    b. Intergovernmental agreement between the Commission and Springfield Metro Sanitary District (SMSD) for the discharge is being reviewed by attorney.

c. IEPA requested that SSWC talk with Wastewater Permit Section on hauling the brine waste to the Chatham Area from the Rochester Area.

d. SMSD and the Commission have agreed that the high chloride brine water can be discharged into a manhole on an SMSD interceptor that runs under Illinois Route 4 in Chatham.

12. IEPA asked want the anticipated reject water amount will be from the membrane system
    a. Calculating 3-5%, or approximately 100-150,000 gpd.
13. NPDES permit will be required for the discharge from the Red Water Lagoons to River. This can be submitted at the same time as when submitting plans. A construction permit will not be issued for the water plant until this has been approved and permit issued for the discharge. SSWC will submit this now; data is available to submit for an NPDES permit. This will hopefully reduce any delays on getting the construction permit.
14. An "A" Water Operator will be required after review of the treatment system by IEPA.
15. IEPA was informed that it is estimated that the water plant will be on line approximately 18 months from ground breaking or 3rd quarter of 2011.
16. There will be a new booster station built to feed New Berlin and a new booster station will be built in Chatham to replace the existing older booster station. The well field, plant and booster stations will have backup generators.
17. Any permits submitted under the Village of Chatham will require a Permit Holder name change, once the Capacity Demonstration has been submitted and approved by IEPA. (This includes Contract F: Booster Pump Station, which has already been approved by IEPA)
18. Pilot Plant Report was approved by IEPA within the last week. Flux rate of 40 has been approved. Letter from IEPA should be received by Chatham shortly informing of them of the approval.
19. Well property has been secured. Currently testing is being conducted to confirm capacity. Design bases have 8 vertical wells of 235 gpm each. A collector well is being investigated that has a potential of 1.5 mgd. Reducing the number of required vertical wells. There will be enough wells to provide backup in case of failure of the collector well.
20. IEPA informed the Commission that no bacteriological testing will be required of the raw water main. No connections will be allowed on this main.
21. E-coli and Crypto long term testing will be required at the wells, once the plant is operational. This testing will be used to set limits on the plant. Jerry said this is required by USEPA's Long Term 1 Surface Water Treatment Rule (LT1ESWTR)

4.6 IRON AND MANGANESE CONTROL

Attachment "H"

Iron and manganese control, as used herein, refers solely to treatment processes designed specifically for this purpose. The treatment process used will depend upon the character of the raw water. The selection of one or more treatment processes must meet specific local conditions as determined by engineering investigations, including chemical analyses of representative samples of water to be treated, and receive the approval of the reviewing authority. It may be necessary to operate a pilot plant in order to gather all information pertinent to the design. Consideration should be given to adjusting pH of the raw water to optimize the chemical reaction. Testing equipment and sampling taps shall be provided as outlined in Sections 2.8 and 2.10.

4.6.1 Removal by oxidation, detention and filtration

4.6.1.1 Oxidation

We used both chlorine + aeration >>>

Oxidation may be by aeration, as indicated in Section 4.5, or by chemical oxidation with chlorine, potassium permanganate, sodium permanganate, ozone or chlorine dioxide.

4.6.1.2 Detention

a. Reaction - A minimum detention time of 30 minutes shall be provided following aeration to insure that the oxidation reactions are as complete as possible. This minimum detention may be omitted only where a pilot plant study indicates no need for detention. The detention basin may be designed as a holding tank without provisions for sludge collection but with sufficient baffling to prevent short circuiting.

b. Sedimentation - Sedimentation basins shall be provided when treating water with high iron and/or manganese content, or where chemical coagulation is used to reduce the load on the filters. Provisions for sludge removal shall be made.

4.6.1.3 Filtration

Filters shall be provided and shall conform to Section 4.2.

4.6.2 Removal by the lime-soda softening process

See Section 4.4.1.

4.6.3 Removal by manganese coated media filtration

This process, consists of a continuous or batch feed of potassium permanganate to the influent of a manganese coated media filter.

a. Provisions should be made to apply the permanganate as far ahead of the filter as practical and to a point immediately before the filter.

b. Other oxidizing agents or processes such as chlorination or aeration may be used prior to the permanganate feed to reduce the amount of the chemical oxidant needed.

c. An anthracite media cap of at least six inches or more as required by the reviewing authority shall be provided over manganese coated media.

d. Normal filtration rate is three gallons per minute per square foot (7.2 m/hr).

WESTECH AN EMPLOYEE-OWNED COMPANY

OPERATION & MAINTENANCE MANUAL

The following design conditions define the limitations for the performance of the AltaFilter™ ultrafiltration system designed by WesTech for SSWC Chatham WTP, project no. 21038A.

Design Parameters

This AltaFilter™ ultrafiltration system has been designed to treat well water, 2 mg/L chlorine, forced draft aerator, 30 minute detention time to precipitate Fe and Mn, pump through pre-filters to UF system. Provided that the membrane feed water quality does not change from or exceed:

Design Temp.. 10 to 20ºC

Turbidity

Low .... 1 ntu

Peak.. 20 ntu

Raw Water pH……………………………..7.0-8.0

Raw Water Alkalinity………………………210-280 mg/L

Raw Water Hardness……………………..230-250 mg/l

Raw Water Iron .... 0.1 – 2.6 mg/L

Raw Water Manganese......................... 0.05 – 0.60 mg/L

The UF system will be capable of producing a net daily flow of 1.98 million gallons, while achieving a recovery ratio [net/gross] of 95% or higher and a minimum CIP interval of 30 days. The maximum daily flow is 3.44 mgd net production.

If the feed water temperature falls below the minimum design temperature, the maximum gross flow rate will be limited to the maximum normalized flux of 62 gfd at 20ºC, calculated in accordance with the methods set forth in the US EPA *Membrane Filtration Guidance Manual*.

Installation Requirements

The AltaFilter is designed to be installed indoors. As a minimum the AltaFilter must be installed under a cover, protected from weather and direct sunlight.

The AltaFilter must be protected from extreme temperatures. The ambient temperature must be maintained between 50ºF and 95ºF [10ºC to 35ºC].

The AltaFilter is designed to be installed on a flat, level surface designed to bear the operating weight of the equipment. It is the installer’s responsibility to verify that the anchors used to secure the equipment to the foundation have been sized adequately to meet local seismic requirements.

Plant piping must be properly supported. The AltaFilter connections are not designed to bear plant piping loads.

The piping between the pre-filters, AltaFilter skids, backwash strainer, and CIP skid must be PVC, or similar material not subject to corrosion. Take care that any work done on these