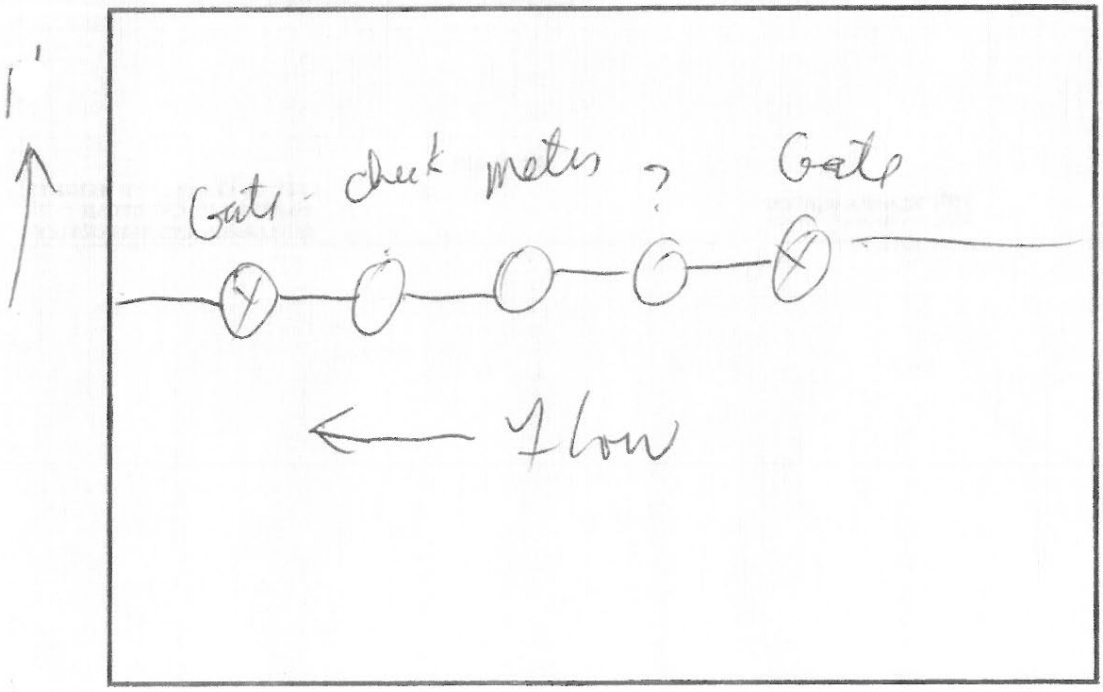
#21

ESG ENERGY SYSTEMS GROUP Building Performance with Energy

CLEVELAND HEIGHTS – METER SURVEY FORM

Date 9-24-14 9:20 Am		Name	Lancashire
Physical Location		Register Reading	
Meter size, manufacturer	Badger	Gate Valve (y/n) Open/closed?	
Pit description / Qty. of Meters		Strainer	
		Pit dimension (L x W x H) inches	12 x 6 6 H

Sketch pipe and meter orientation with direction of flow



#12

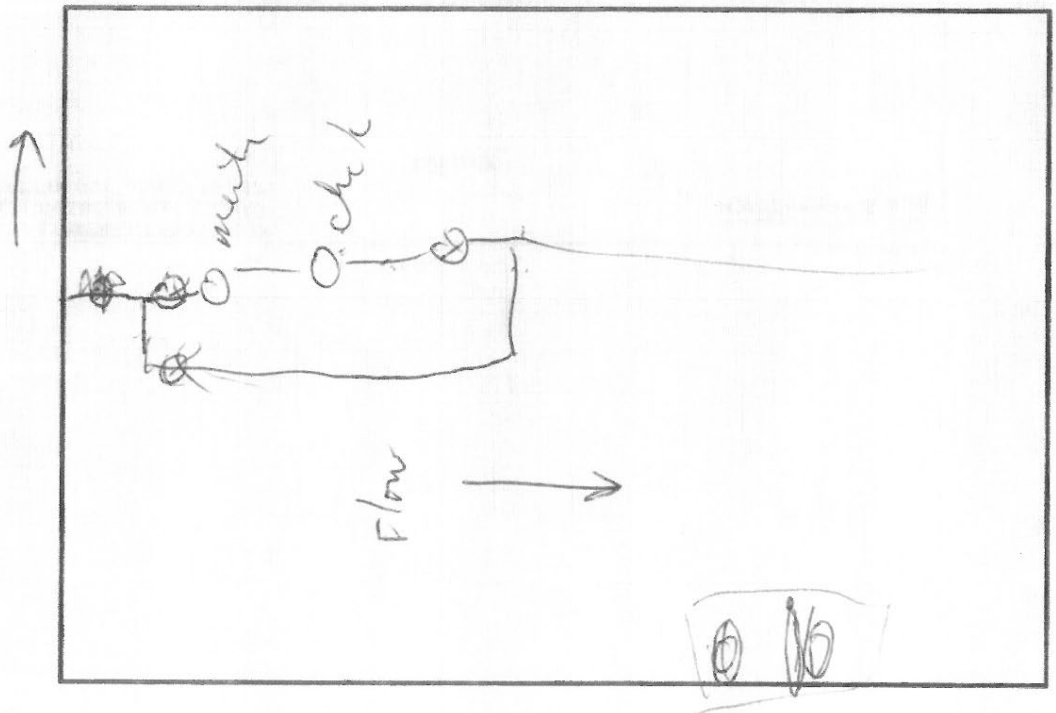
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

CLEVELAND HEIGHTS – METER SURVEY FORM

Date 9-24	943	Name	Murray Hill Wash
Physical Location	Murray Hill & Ceda	Register Reading	041 89900
Meter size, manufacturer	36456709	Gate Valve (y/n) Open/closed?	
Pit description / Qty. of Meters		Strainer	
		Pit dimension (L x W x H) inches	5x12 5'H

82462683

Sketch pipe and meter orientation with direction of flow



#11

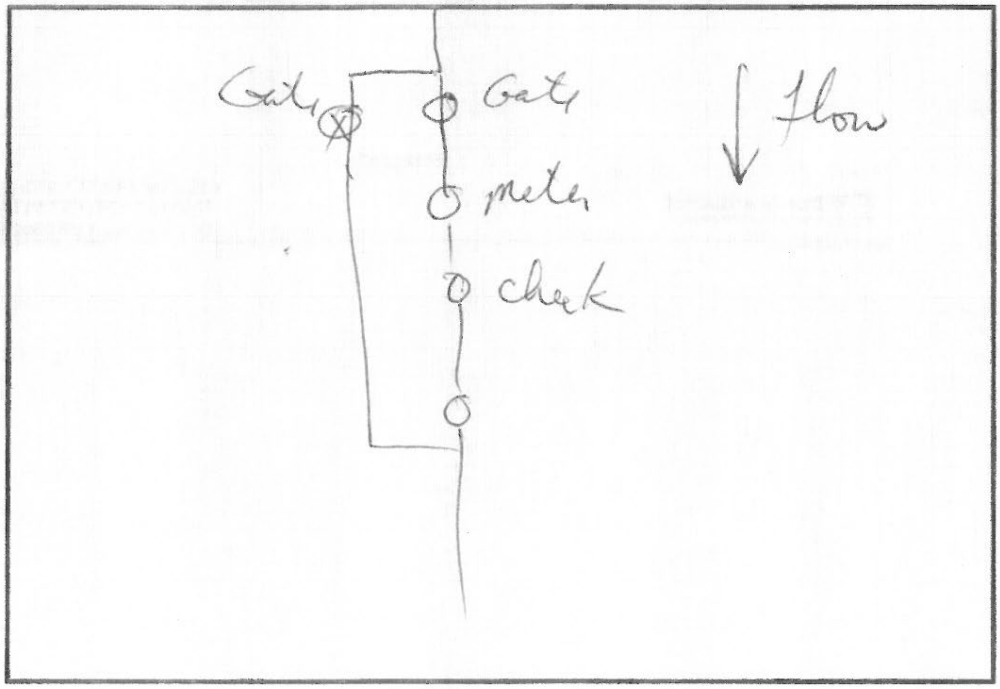
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

CLEVELAND HEIGHTS – METER SURVEY FORM

Date 9-24	10" m	Name	Murray Hill - Fire Line
Physical Location		Register Reading	0000724
Meter size, manufacturer	Badger	Gate Valve (y/n) Open/closed?	
Pit description / Qty. of Meters		Strainer	
		Pit dimension (L x W x H) inches	12 x 6 Concrete Slab 4 in

2980118

Sketch pipe and meter orientation with direction of flow



DW

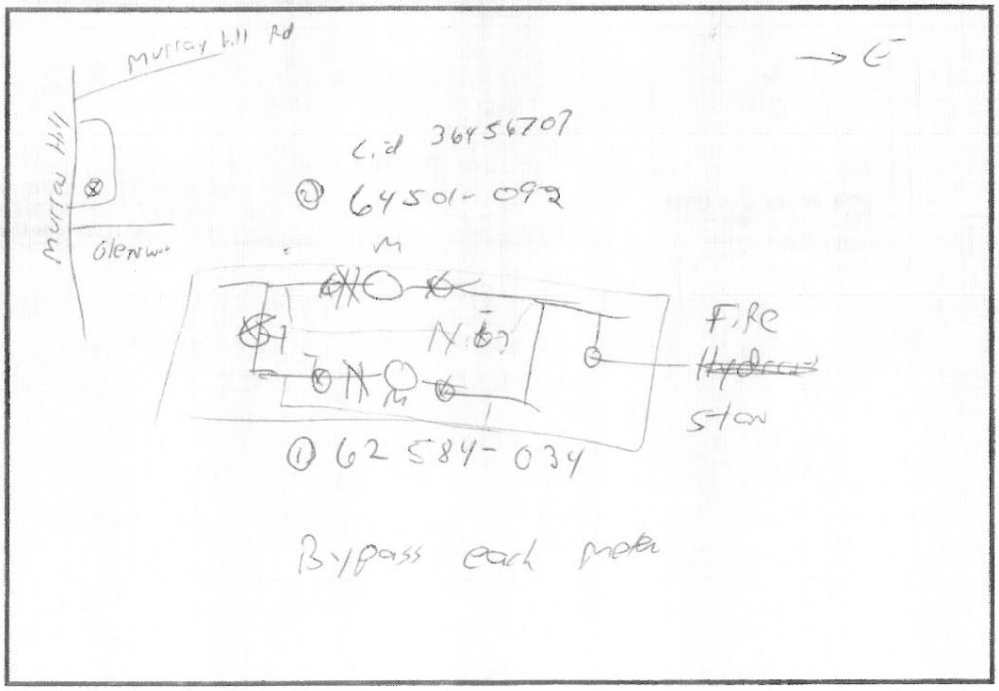
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

9-10

CLEVELAND HEIGHTS – METER SURVEY FORM

Date	9-24-14	Name	Murray Hill NDS
Physical Location	Cove Wester	Register Reading	30 38 8000
Meter size, manufacturer	Badger (x2)	Gate Valve (y/n) Open/closed?	Yes, Closed
Pit description / Qty. of Meters	Brick, two Trans 30289705 ① 82462320 ②	Strainer	N
		Pit dimension (L x W x H) inches	8 x 6 x [illegible]

Sketch pipe and meter orientation with direction of flow



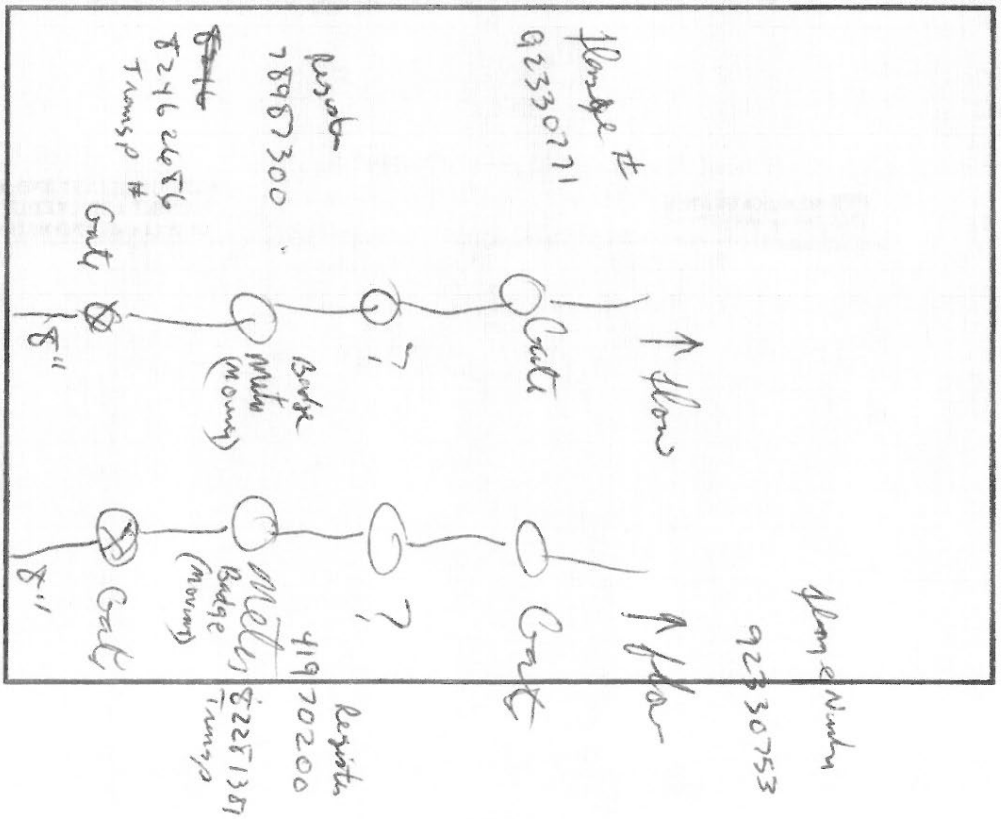
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

#17
= 18

CLEVELAND HEIGHTS – METER SURVEY FORM

Date 7.24	10:40	Name	Fairhill
Physical Location		Register Reading	
Meter size, manufacturer		Gate Valve (y/n) Open/closed?	
Pit description / Qty. of Meters		Strainer	
		Pit dimension (L x W x H) inches	6 x 8 6' Hi

Sketch pipe and meter orientation with direction of flow



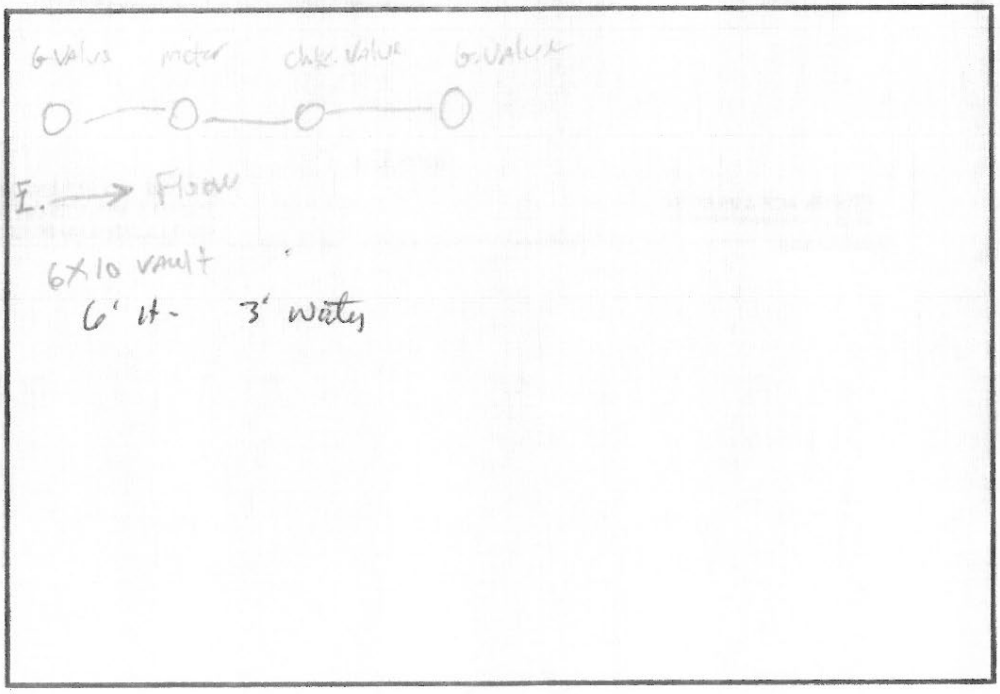
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

"- 20

CLEVELAND HEIGHTS – METER SURVEY FORM

Date 9-24	11⁰⁰	Name	N. Woodland
Physical Location		Register Reading	12995100 ~~1295~~
Meter size, manufacturer	12"	Gate Valve (y/n) Open/closed?	
Pit description / Qty. of Meters	T- 82 48 2529 R-	Strainer	
		Pit dimension (L x W x H) inches	

Sketch pipe and meter orientation with direction of flow



ESG ENERGY SYSTEMS GROUP Building Performance with Energy

22

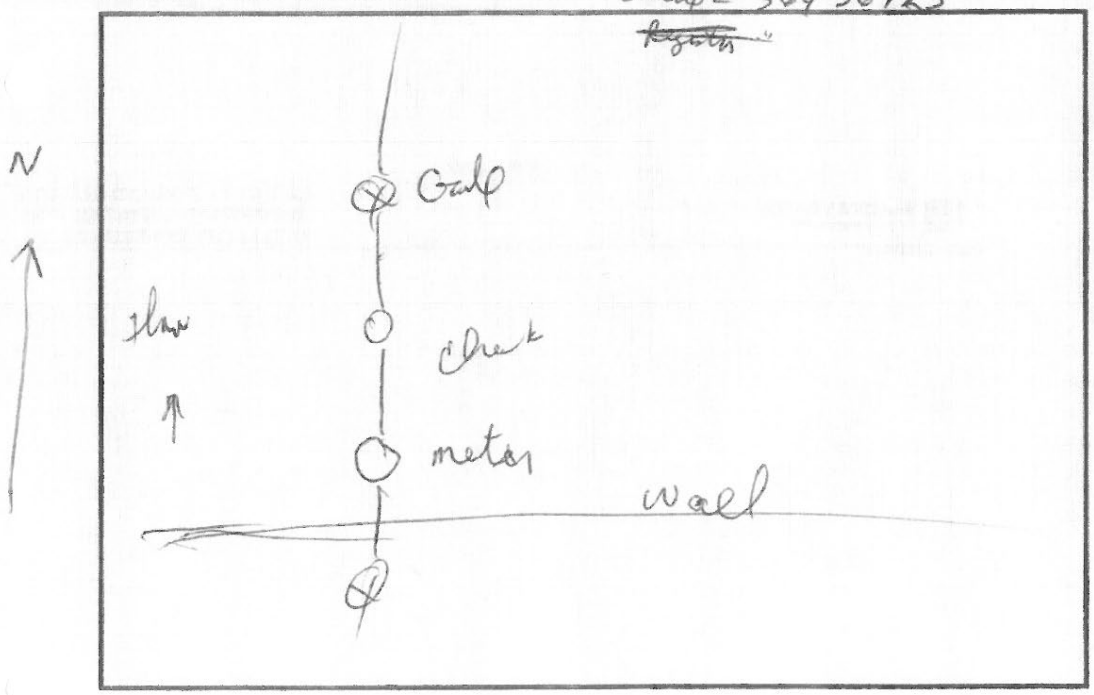
CLEVELAND HEIGHTS – METER SURVEY FORM

Date 9-24	1'4	Name	Renfield @ Bluestone
Physical Location		Register Reading	8472000 8472000
Meter size, manufacturer	Badger	Gate Valve (y/n) Open/closed?	
Pit description / Qty. of Meters		Strainer	
		Pit dimension (L x W x H) inches	8x4 5'hi

82459257 - Transponder

Sensus # 364 56723

Sketch pipe and meter orientation with direction of flow



#23

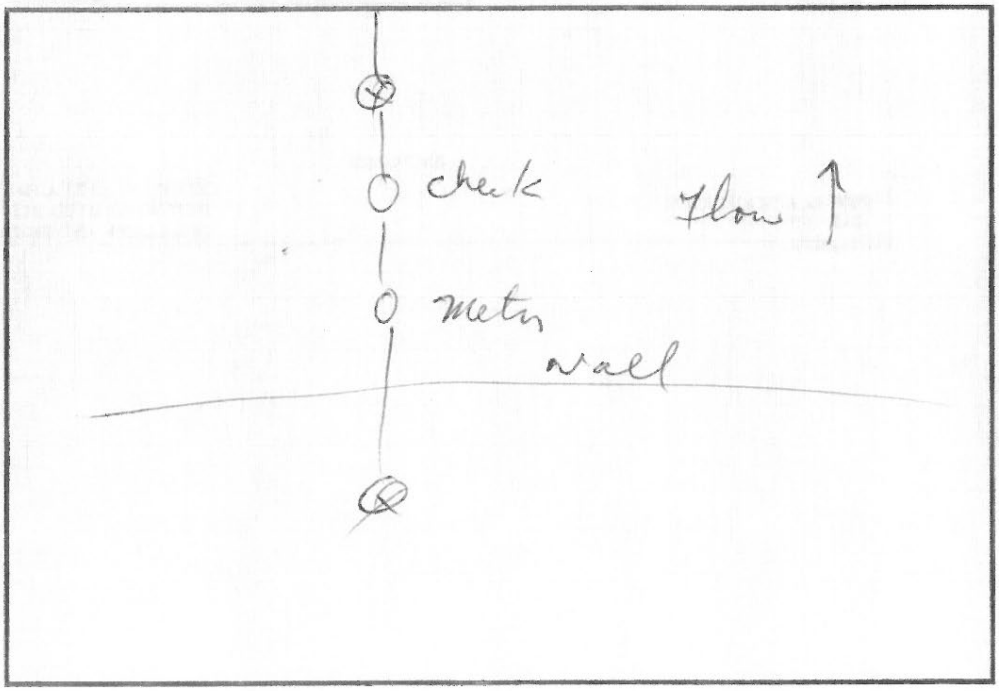
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

CLEVELAND HEIGHTS – METER SURVEY FORM

Date 9-24	120	Name	
Physical Location		Register Reading	2247000
Meter size, manufacturer	Badger	Gate Valve (y/n) Open/closed?	1 open
Pit description / Qty. of Meters		Strainer	—
		Pit dimension (L x W x H) inches	8 x 4 5'H

Transpark & 2462655

Sketch pipe and meter orientation with direction of flow



DW

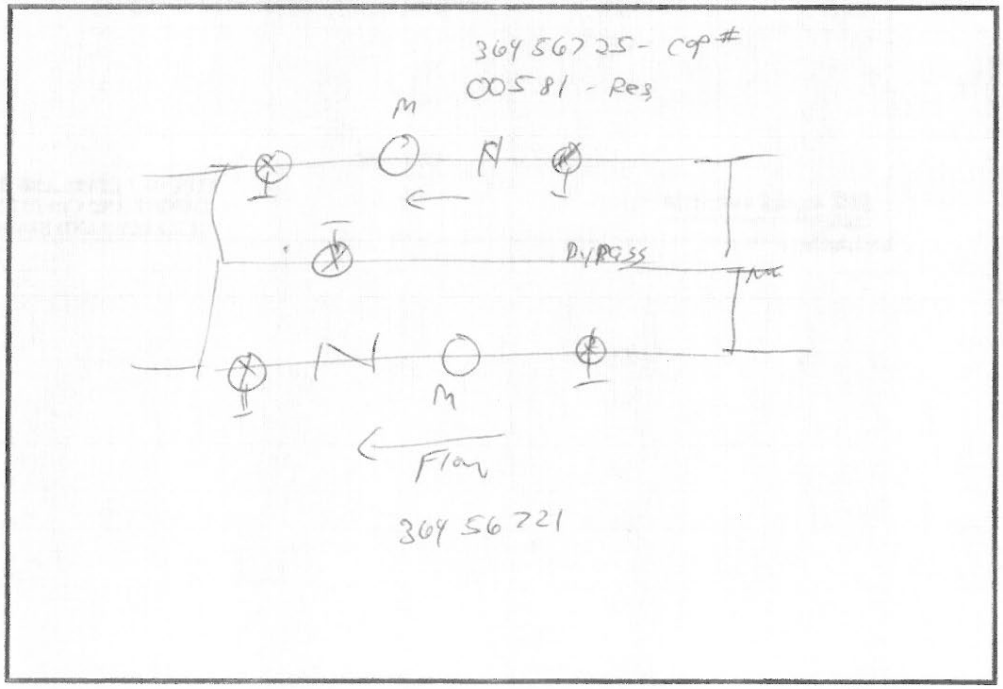
ESG ENERGY SYSTEMS GROUP Building Performance with Energy

#14

CLEVELAND HEIGHTS – METER SURVEY FORM

Date	9-24-14	Name	Colton
Physical Location	Colton Rd end of Cul-de-sac	Register Reading	018152
Meter size, manufacturer	Badger (x2)	Gate Valve (y/n) Open/closed?	yes open
Pit description / Qty. of Meters	2 meters	Strainer	ND
		Pit dimension (L x W x H) inches	10' x 8' x 5'

Sketch pipe and meter orientation with direction of flow



October 24, 2015

WATER UTILITY OPTIMIZATION – PROGRESS UPDATE

1 WORK COMPLETED

- Initial Master meter surveys were completed September 25. Data from surveys, testing data from City of Cleveland and billing data is continuing to be evaluated.
- Recorded readings from master meters for five years of data has been entered into spreadsheets for analysis.
- Maps developed for flow visualization
- Ongoing process of identifying billing anomalies/error
- Residential and commercial accounts have been identified for meter testing and notice letters have been sent, so that the work can be scheduled.

2 WORK SCHEDULED

- Meter testing: Residential meter testing will begin November 3. Commercial meter testing will being November 10. Results from both will be available by November 30.
- Billing software: Vendors are being interviewed for budget, scope and implementation schedule.
- Field investigation of billing anomalies using prioritized list which can be accomplished in current time frame. Of the 500 items identified ESG will complete the top 20 under this investigation.
- Projects requiring construction will be scoped and estimated
- Financing approach and Guarantee methodology being developed

3 PRELIMINARY RESULTS

Import and Credit Meters

- Three Import meters were determined to be incorrectly multiplied.
  - Lancashire (x10)
  - Quarry and Bluestone (x100)
  - Renfield and Bluestone (x100)

  [Note that Quilliams and Bridgeview is also incorrectly multiplied (x10). However this site is combined with a credit meter which is incorrectly sized. The system dynamics and true inflows and outflows are not well understood here therefore it is not included in this list.]

- A number of import and credit meters are incorrectly sized for the reported flow. They are generally over-sized (too large) and are likely to not read low flows correctly, including;
  - Import
    - Warrensville and Oakwood
    - Keystone and Bluestone

October 24, 2015

- Credit
  - Quilliams and Bridgeview
  - Carlton and Overlook
  - Hillcrest and Superior
  - Murray Hill and Cedar
  - Noble and Nelaview
- All meters (import and credit) are continuing to be evaluated.
- There is no internal control of the water system. The water imports are controlled by hydraulic conditions set by the Cleveland Water Department through their transmission network.
  - There is a need for an accurate GIS and hydraulic model to be constructed to allow for better understanding of the flow dynamics and plan for management of pressure and inflows into the Cleveland Heights system.
- Customer connections with no meters were discovered
- Incorrect sizing of commercial meters were discovered
- Inaccurate customer meters were found
- The leakage detection surveys conducted in 2014 were evaluated. The work was considered successful, but more full-time leakage detection needs to be conducted to manage real losses.

4 Possible Scope

The table below provides our best thoughts on scope of recommendations. Detailed cost estimates and savings will be assigned to each category. We anticipate providing a phased approach for some items. Some items may be able to be self-performed by City personnel for further cost savings.

Area	Evaluation	Recommendation
Residential Meters Replacement	Selection Bench Tested	Replace all meters with accuracy below TBD% accuracy
Commercial Meter Replacement	Selected Field Testing	Repair or replace if below TBD% accurate
AMI Data Collection	On-going	TBD
Billing Systems	Data anomalies	Rehabilitation of database or new system
Leakage repair	City crews, on-going	As needed
On-going Leak Detection	Leak report and results of water audit	Full time leakage detection staff member(s) or contractor
Pressure Management	Master meter surveys	Add PRV's and other infrastructure to selected sites. Develop pressure zones and District Areas

City of Cleveland Heights
9/23/14 WATER BILLING SELCOLS1
Print Selective Collection Report

Customer Type:

And/Or Greater Than Arre

F3=Exit

0006 Customer Type
Select Code: ____ Reset: ____
or 1=Select More: +

Opt	Code	Description
_	A	Apartment
_	B	Business
_	C	Condominium
_	D	Day Care
_	F	Federal
_	G	Garden line
_	L	Library
_	M	Municipal
_	N	Nursing Home
_	P	Pool
_	R	Residential

Search: _____ More...
F3=Exit F9=Sequence by Alternate F12=Cancel

City of Cleveland Heights SELCOLS1
9/23/14 WATER BILLING
Print Selective Collection Report

Customer Type:

And/Or Greater Than Arre

F3=Exit

0006 Customer Type
Select Code: ____ Reset: ____
or 1=Select More: _

Opt	Code	Description
_	S	School
_	W	Worship
_	Z	Re-Register

Search: _____ Bottom
F3=Exit F9=Sequence by Alternate F12=Cancel

Collette Clinkscale

From:	Margevicius, Alex <alex_margevicius@ClevelandWater.com>
Sent:	Tuesday, September 02, 2014 1:17 PM
To:	Collette Clinkscale
Cc:	Kaszian, David; Faust, Gregg
Subject:	RE: 2034 N TAYLOR

These five accounts are Hexagram accounts. Why did you install Hexagram here, but not use them ? Or did you use the Master Meter just for the credit calculation for Cleveland Heights, but use the individual meters to bill the individual units ?

Also, would drawings exist of the piping on the grounds ? I have speculated in red and yellow below what it might look like. Are there individual shutoffs ?

1

				City of Cleveland Heights							
	ACCOUNT NUMBER	CH Number	CH Location	Oct to Dec 2008 Total (MCF)	2009 Total (Mcf)	2010 Total (MCF)	2011 Total (MCF)	2012 Total (MCF)	2013 Total (MCF)	Jan to July 2014 Total (MCF)	2009 to 2014 total
Import Meters	102299800500	**17150721**	**Quarry and Bluestone**	759	5,333	560	131	75	48	52	6,199
	102299800600	92330773	Keystone/Bluestone	219	1,185	1,532	113	70	163	221	3,284
	102299800700	**92330762**	**Renfield and Bluestone**	-	-	-	-	22	17	11	50
	102299801000	92330772	Mayfield/N. Taylor	10,044	34,647	55,906	51,607	44,293	49,739	32,685	268,877
	102299801100	92330756	Mayfield/N. Taylor	8,765	33,812	26,167	27,942	32,130	41,528	28,967	190,546
	102299801200	92330758	Warrensville/ Oakwood	1,031	4,563	5,576	4,523	2,824	2,456	1,439	21,381
	102299801500	92330761	Mayfield/Warrensville	6,827	26,076	29,805	27,905	26,334	27,705	16,693	154,518
	102299802000	92330752	Mayfield/Warrensville	8,874	36,868	39,361	46,877	44,448	45,681	26,222	239,457
	102299802100	92330779	Brookline/Rugby Ct.	2,011	8,459	9,608	9,878	11,317	11,989	6,826	58,077
	102299802500	92330769	Grosvenor/Revere	290	1,652	2,240	1,994	1,928	2,204	2,018	12,036
	102299803000	92330765	Cedar/Goodnor	8,263	52,659	66,495	56,280	58,831	67,908	55,461	357,634
	102299803200	93000234	Fairmount/Eaton	4,845	15,259	17,179	13,578	13,117	13,257	20,229	92,619
	102299807900	93000235	N Woodland	3,687	21,414	26,258	23,612	22,870	28,603	21,820	144,577
	102299808000	92330753	Fairhill/Coventry	1,060	7,185	9,027	7,609	6,671	9,224	7,241	46,957
	102299808500	92339771	Fairhill/Coventry	2,582	14,425	17,068	14,937	14,120	17,233	11,693	89,476
	102299808700										0
	102299810000	92330763	Murry Hill north??								0
	102299810500										0
	102299811000										0
	102299811500	92330766	Murray Hill/Cedar	129	509	279	537	902	1,116	904	4,247
	102299812000	**92330760**	**Carlton/Overlook**	17	81	18	-	-	76	-	175
	102299813000	**92330774**	**Lancashire**	-	607	-	-	1,314	-	530	2,451
	102299813500										0
	102299814000	93449112	North Park/Lee	518	3,251	3,222	2,530	2,464	2,956	1,768	16,191
	102299814500	**92330783**	**Quilliams/Bridgeview (In)**	-	69	368	1,160	1,366	738	753	4,454
Export Meters	102299812500	**92330764**	**Carlton/Overlook**	30	8	5	111	335	581	600	1,640
	102299815000	**92330782**	**Quilliams/Bridgeview (credit)**	994	3,159	11	7	5	23	19	3,224
		92330787	Murray Hill South	201	690	151	56	32	44	39	1,012
		92330781	1412 Superior (Credit Meter)	-	-	-	-	-	7	2	9
		18110404	2140 Noble (credit)	-	-	-	-	-	-	1	1
		82398544	16299 Northvale (credit)	138	578	311	117	350	2,303	6,312	9,971
		93000232	Owls Nest (Credit)	376	1,907	1,969	2,346	1,649	720	886	9,477
Total Import				59,921	268,054	310,669	291,213	285,096	322,641	235,533	1713206
Total Export				1,739	6,342	2,447	2,637	2,371	3,678	7,859	25334
Total All				58,182	261,712	308,222	288,576	282,725	318,963	227,674	1,687,872

	Cleveland Water Department							
CH Location	2008 Total (MCF)	December 2009 Total (MCF)	2010 Total (MCF)	2011 Total (MCF)	2012 Total (MCF)	2013 Total (Mcf)	Jan to Aug 2014 Total (MCF)	2009 to 2014 total
Quarry and Bluestone		141	507	131	73	50	36	938
Keystone/Bluestone		191	1,459	113	71	163	236	2,233
Renfield and Bluestone		0	8	25	20	17	13	83
Mayfield/N. Taylor		5,598	53,353	52,356	48,383	49,740	39,339	248,769
Mayfield/N. Taylor		5,082	24,732	27,942	32,131	41,529	32,616	164,032
Warrensville/Oakwood		529	4,301	4,523	2,824	2,456	1,603	16,236
Mayfield/Warrensville		3,384	28,346	27,905	26,334	27,705	18,608	132,282
Mayfield/Warrensville		4,228	41,339	46,878	44,229	45,690	29,155	211,519
Brookline/Rugby Ct.		1,103	9,134	9,878	11,317	11,989	7,622	51,043
Grosvenor/Revere		183	2,183	1,994	1,927	2,204	2,202	10,693
Cedar/Goodnor		5,690	64,488	61,570	58,825	65,042	59,527	316,142
Fairmount/Eaton		1,502	15,843	13,737	13,117	13,318	24,330	81,847
N Woodland		2,335	25,281	23,912	22,870	28,603	24,575	127,576
Fairhill/Coventry		739	8,721	7,609	6,671	9,224	8,177	41,141
Fairhill/Coventry		1,519	16,424	14,937	14,121	17,233	13,318	77,552
		0	0	0	0	0	0	0
Murry Hill north??		0	0	114	0	0	185	299
		71	0	56	33	34	41	235
		0	0	11	0	0	0	11
Murray Hill/Cedar		72	0	537	903	1,116	1,101	3,729
Carlton/Overlook		0	0	0	0	76	1	77
Lancashire		0	0	0	1,285	0	729	2,014
		0	0	0	0	0	0	0
North Park/Lee		360	0	2,530	2,464	2,956	1,921	10,231
Quilliams/Bridgeview (in)		61	346	1,171	1,367	738	838	4,521
Carlton/Overlook		(3)	0	(7)	0	(4)	0	(14)
Quilliams/Bridgeview (credit)		4	0	7	5	23	19	58
Murray Hill South	0	0	0	114	0	0	185	299
1412 Superior (Credit Meter)								0
2140 Noble (credit)								0
16299 Northvale (credit)								0
Owls Nest (Credit)								0
Total Import	0	33788.4	296464.6	297928.8	288965	319883	266173	1503202.8
Total Export	0	1	0	114	5	19	204	343
Total All	-	33,787	296,465	297,815	288,960	319,864	265,969	1,502,860

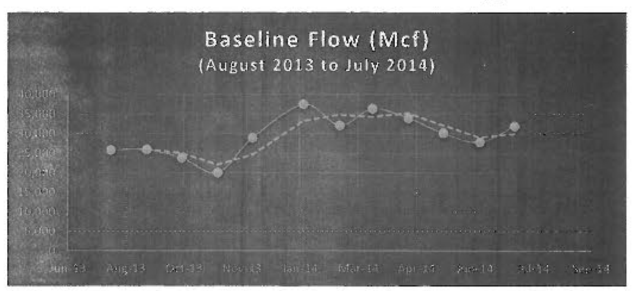
	Differences between CWD and CCH							
CH Location	Oct to Dec 2008 Total (MCF)	2009 Total (Mcf)	2010 Total (MCF)	2011 Total (MCF)	2012 Total (MCF)	2013 Total (MCF)	2014 Total (MCF)	2009 to 2014
Quarry and Bluestone	-759	-5192	-53	0	-2	2	-16	-5261
Keystone/Bluestone	-219	-994	-73	0	1	0	15	-1051
Renfield and Bluestone	0	0	8	25	-2	0	2	33
Mayfield/N. Taylor	-10044	-29049	-2553	749	4090	1	6654	-20108
Mayfield/N. Taylor	-8765	-28730	-1435	0	1	1	3649	-26514
Warrensville/Oakwood	-1031	-4034	-1275	0	0	0	164	-5145
Mayfield/Warrensville	-6827	-22691.6	-1459.4	0	0	0	1915	-22236
Mayfield/Warrensville	-8874	-32640	1978	1	-219	9	2933	-27938
Brookline/Rugby Ct.	-2011	-7356	-474	0	0	0	796	-7034
Grosvenor/Revere	-290	-1469	-57	0	-1	0	184	-1343
Cedar/Goodnor	-8263	-45969	-2007	5290	-6	-2866	4066	-41492
Fairmount/Eaton	-4845	-13757	-1336	159	0	61	4101	-10772
N Woodland	-3687	-19079	-977	300	0	0	2755	-17001
Fairhill/Coventry	-1060	-6446	-306	0	0	0	936	-5816
Fairhill/Coventry	-2582	-12906	-644	0	1	0	1625	-11924
	0	0	0	0	0	0	0	0
Murry Hill north??	0	0	0	114	0	0	185	299
	0	71	0	56	33	34	41	235
	0	0	0	10.8	0	0	0	10.8
Murray Hill/Cedar	-129	-437	-279	0	1	0	197	-518
Carlton/Overlook	-17	-81	-18	0	0	0	1	-98
Lancashire	0	-607	0	0	-29	0	199	-437
	0	0	0	0	0	0	0	0
North Park/Lee	-518	-2891	-3222	0	0	0	153	-5960
Quilliams/Bridgeview (in)	0	-8	-22	11	1	0	85	67
Carlton/Overlook	-30	-11	-5	-118	-335	-585	-600	-1654
Quilliams/Bridgeview (credit)	-994	-3155	-11	0	0	0	0	-3166
Murray Hill South	-201	-690	-151	58	-32	-44	146	-713
1412 Superior (Credit Meter)	0	0	-0	0	0	-7	-2	-9
2140 Noble (credit)	0	0	0	0	0	0	-1	-1
16299 Northvale (credit)	-138	-578	-311	-117	-350	-2303	+6312	-9971
Owls Nest (Credit)	-376	-1907	-1969	-2346	-1649	-720	-886	-9477
Total Impor	-59921	-234265.6	-14204.4	6715.8	3869	-2758	30640	-210003.2
Total Export	-1739	-6341	-2447	-2523	-2366	-3659	-7655	-24991
Total All	-61660	-240606.6	-16651.4	4192.8	1503	-6417	22985	-234994.2

City of Cleveland Heights
10/27/2014
Base year - Master Meters

	Read Date	Due Date	774	752	767	235	766	772	764 (export)	782	773	771	769	783 (export)	112
Aug-13	8/30/2013	9/30/2013	0	3791	0	2269	122	4245	-97	0	12	1297	172	-44	284
Sep-13	9/30/2013	10/28/2013	0	3528	0	2361	122	4310	-43	23	11	1320	195	-101	270
Oct-13	10/31/2013	11/25/2013	0	3238	0	2002	75	4117	-23	0	11	1187	190	-100	240
Nov-13	11/29/2013		0	312		1626	95	4059	-67	0	10	1168	198	-68	143
Dec-13	13/30/2013	1/28/2014	0	3743	0	2510	43	4604	-15	0	13	1597	234	-110	219
Jan-14	1/31/2014	1/31/2014	0	4284	0	4139	41	5145	-15	0	21	2207	417	-125	268
Feb-14	2/28/2014	3/27/2013	0	4096	0	2630	55	4730	-10	0	33	1389	264	-103	252
Mar-14	3/31/2014	4/23/2014	0	4441	0	3615	58	5160	-17	0	50	1920	300	-112	301
Apr-14	4/30/2014	5/27/2014	0	3865	0	3236	199	4741	-131	0	44	1670	278	-104	262
May-14	5/30/2014	6/26/2014	0	3046	0	2335	180	5564	-143	5	29	1263	282	-115	231
Jun-14	6/30/2014		451	3161	0	2841	181	5049	-131	0	26	1551	276	-104	265
Jul-14	7/31/2014	8/7/2014	142	3329	0	3029	190	4649	-153	14	18	1721	201	-90	212
									-845					-1176	

	765	753	758	787	234	721	760	761	779	498	763	762	756	Total MCF	Dollars		Bill Credits	
Aug-13	5294	655	213	0	1089	3	0	2294	993	0	0	1	3334	25,927	$816,657		97	44
Sep-13	5617	684	210	5	995	4	0	2160	979	0	0	1	3349	26,000	$819,911		43	101
Oct-13	5115	619	183	2	933	5	0	2006	905	0	0	1	3211	23,917	$754,277		23	100
Nov-13	4981	593	169	1.9	908	3	0	1931	895	0	0	2	3187	20,147	$722,784		67	98
Dec-13	6686	866	198	3	1384	4	0	2372	995	0	0	1	3615	28,962	$913,205		15	110
Jan-14	8513	1239	227	4	3404	5	0	2700	1058	0	0	2	3951	37,485	$1,219,407		0.5	14.5
Feb-14	7811	837	239	13	2636	4	0	2565	996	0	0	1	3700	32,138	$1,046,351		10	103
Mar-14	8438	1167	240	15	2908	4	0	2787	1116	0	0	2	4000	36,393	$1,184,766		17	112
Apr-14	7590	1060	203	4	3862	5	0	2447	998	0	0	1	3789	34,019	$1,107,540		131	104
May-14	5635	949	166	1	2829	4	1	1981	832	0	0	2	5100	30,177	$928,560		143	115
Jun-14	7010	990	173	1	3157	5	0	2058	947	0	0	1		27,908	$1,055,719		131	104
Jul-14	7571	999	191	1	2993	5	0	2155	879	0	0	2	3909	31,967	$1,055,719		153	90
														355,040	$11,624,896			

Base year 355,040 MCF
2655.7 Mg/yr
From audit 2375.0 Mg/yr



meter 234 Acct # 1022999072 Fairmont & Eaton

City of Cleveland Heights
Department of Finance
40 Severence Circle
Cleveland Heights,Ohio 44118-1567

2013 Master Meter Rates $31.50
2014 Master Meter Rates $32.53

ACCOUNT NUMBER	CONNECTION	LEVEL	BEGINNING READS	JANUARY CONSUMPTION	CHARGES	FEBRUARY CONSUMPTION	WATER CHARGES	MARCH CONSUMPTION	WATER CHARGES	APRIL CONSUMPTION	WATER CHARGES	MAY CONSUMPTION	WATER CHARGES	JUNE CONSUMPTION	WATER CHARGES	JULY CONSUMPTION	WATER CHARGES	AUGUST CONSUMPTION	WATER CHARGES	TOTAL CONSUMPTION	TOTAL
102299800500	**286157**	**2nd High**	**361.0**	**5.0**	**$ 162.49**	**4.0**	**$ 130.12**	**4.0**	**$ 130.12**	**5.0**	**$ 162.65**	**4.0**	**$ 130.12**	**5.0**	**$ 162.65**	**5.0**	**$ 162.65**	**4.0**	**$ 130.12**	**36.0**	**$ 1,170.92**
102299800600	351583	2nd High	1,997.0	21.0	$ 682.45	33.0	$ 1,073.49	50.0	$ 1,626.50	44.0	$ 1,431.32	29.0	$ 943.37	26.0	$ 845.78	18.0	$ 585.54	15.0	$ 487.95	236.0	$ 7,676.40
102299800700	**351584**	**2nd High**	**70.0**	**2.0**	**$ 65.02**	**1.0**	**$ 32.53**	**2.0**	**$ 65.06**	**1.0**	**$ 32.53**	**2.0**	**$ 65.06**	**1.0**	**$ 32.53**	**2.0**	**$ 65.06**	**2.0**	**$ 65.06**	**13.0**	**$ 422.85**
102299801000	284722	2nd High	209,430.0	5,145.0	$ 167,201.24	4,730.0	$ 153,866.90	5,160.0	$ 167,854.80	4,741.0	$ 154,224.73	5,564.0	$ 180,996.92	5,049.0	$ 164,243.97	4,649.0	$ 151,231.97	4,301.0	$ 139,911.53	39,339.0	$ 1,279,532.06
102299801100	471965	2nd High	131,416.0	3,951.0	$ 128,398.85	3,700.0	$ 120,361.00	4,000.0	$ 130,120.00	3,789.0	$ 123,256.17	5,100.0	$ 165,903.00	4,518.0	$ 146,970.54	3,909.0	$ 127,159.77	3,649.0	$ 118,701.97	32,616.0	$ 1,060,871.30
102299801200	389661	2nd High	14,633.0	227.0	$ 7,377.00	239.0	$ 7,774.67	240.0	$ 7,807.20	203.0	$ 6,603.59	166.0	$ 5,399.98	173.0	$ 5,627.69	191.0	$ 6,213.23	164.0	$ 5,334.92	1,603.0	$ 52,138.28
102299801500	163895	2nd High	113,674.0	2,700.0	$ 87,744.09	2,565.0	$ 83,439.45	2,787.0	$ 90,661.11	2,447.0	$ 79,600.91	1,981.0	$ 64,441.93	2,058.0	$ 66,946.74	2,155.0	$ 70,102.15	1,915.0	$ 62,294.95	18,608.0	$ 605,231.33
102299802000	163894	2nd High	177,754.0	4,284.0	$ 139,220.63	4,096.0	$ 133,242.88	4,441.0	$ 144,465.73	3,865.0	$ 125,728.45	3,046.0	$ 99,086.38	3,161.0	$ 102,827.33	3,329.0	$ 108,292.37	2,933.0	$ 95,410.49	29,155.0	$ 948,274.26
102299802100	369182	2nd High	43,421.0	1,058.0	$ 34,382.71	996.0	$ 32,399.88	1,116.0	$ 36,303.48	998.0	$ 32,464.94	832.0	$ 27,064.96	947.0	$ 30,805.91	879.0	$ 28,593.87	796.0	$ 25,893.88	7,622.0	$ 247,909.63
102299802500	260853	2nd High	8,491.0	417.0	$ 13,551.59	264.0	$ 8,587.92	300.0	$ 9,759.00	278.0	$ 9,043.34	282.0	$ 9,173.46	276.0	$ 8,978.28	201.0	$ 6,538.53	184.0	$ 5,985.52	2,202.0	$ 71,617.64
102299803000	286157	2nd High	256,615.0	8,513.0	$ 276,653.88	7,811.0	$ 254,091.83	8,438.0	$ 274,488.14	7,590.0	$ 246,902.70	5,635.0	$ 183,306.55	7,010.0	$ 228,035.30	7,571.0	$ 246,284.63	6,959.0	$ 226,376.27	59,527.0	$ 1,936,139.30
102299803200	000000	2nd High	138,838.0	3,404.0	$ 110,622.55	2,636.0	$ 85,749.08	2,908.0	$ 94,597.24	3,862.0	$ 125,630.86	2,829.0	$ 92,027.37	3,157.0	$ 102,697.21	2,993.0	$ 97,362.29	2,541.0	$ 82,658.73	24,330.0	$ 791,345.33
102299807900	176546	2nd High	103,001.0	4,139.0	$ 134,508.45	2,630.0	$ 85,553.90	3,615.0	$ 117,595.95	3,236.0	$ 105,267.08	2,335.0	$ 75,957.55	2,841.0	$ 92,417.73	3,029.0	$ 98,533.37	2,750.0	$ 89,457.50	24,575.0	$ 799,291.53
102299808000	176546	2nd High	32,964.0	1,239.0	$ 40,264.79	837.0	$ 27,227.61	1,167.0	$ 37,962.51	1,060.0	$ 34,481.80	949.0	$ 30,870.97	990.0	$ 32,204.70	999.0	$ 32,497.47	936.0	$ 30,448.08	8,177.0	$ 265,957.93
102299808500	176546	2nd High	64,234.0	2,207.0	$ 71,722.67	1,389.0	$ 45,184.17	1,920.0	$ 62,457.60	1,670.0	$ 54,325.10	1,263.0	$ 41,085.39	1,551.0	$ 50,454.03	1,721.0	$ 55,984.13	1,597.0	$ 51,950.41	13,318.0	$ 433,163.50
102299808700	28726	2nd High	0.0	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -
102299810000	401925	2nd High	145.0	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	185.0	$ 6,018.05	185.0	$ 6,018.05
102299810500	401924	2nd High	3,999.4	4.0	$ 129.99	13.0	$ 422.89	15.0	$ 487.95	4.0	$ 130.12	1.0	$ 32.53	1.0	$ 32.53	1.0	$ 32.53	2.0	$ 65.06	41.0	$ 1,333.60
102299811000	401926	2nd High	11.2	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -
102299811500	427258	2nd High	2,921.0	41.0	$ 1,332.41	55.0	$ 1,789.15	58.0	$ 1,886.74	199.0	$ 6,473.47	180.0	$ 5,855.40	181.0	$ 5,887.93	190.0	$ 6,180.70	197.0	$ 6,408.41	1,101.0	$ 35,814.21
102299812000	**427257**	**1st High**	**76.0**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**1.0**	**$ 32.53**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**1.0**	**$ 32.53**
102299812500	**427256**	**1st High**	**(968.0)**	**(15.0)**	**$ (487.46)**	**(10.0)**	**$ (325.30)**	**(17.0)**	**$ (553.01)**	**(131.0)**	**$ (4,261.43)**	**(143.0)**	**$ (4,651.79)**	**(131.0)**	**$ (4,261.43)**	**(153.0)**	**$ (4,977.09)**	**(159.0)**	**$ (5,172.27)**	**(759.0)**	**$ (24,689.78)**
102299813000	**451936**	**2nd High**	**1,285.0**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**451.0**	**$ 14,671.03**	**142.0**	**$ 4,619.26**	**136.0**	**$ 4,424.08**	**729.0**	**$ 23,714.37**
102299813500	000000	2nd High	0.0	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -
102299814000	000000	2nd High	11,364.0	268.0	$ 8,709.41	252.0	$ 8,197.56	301.0	$ 9,791.53	262.0	$ 8,522.86	231.0	$ 7,514.43	265.0	$ 8,620.45	212.0	$ 6,896.36	130.0	$ 4,228.90	1,921.0	$ 62,481.50
102299814500	**000000**	**2nd High**	**(3,683.0)**	**(125.0)**	**$ (4,062.23)**	**(103.0)**	**$ (3,350.59)**	**(112.0)**	**$ (3,643.36)**	**(104.0)**	**$ (3,383.12)**	**(115.0)**	**$ (3,740.95)**	**(104.0)**	**$ (3,383.12)**	**(90.0)**	**$ (2,927.70)**	**(85.0)**	**$ (2,765.05)**	**(838.0)**	**$ (27,256.12)**
102299815000	**000000**	**2nd High**	**50.0**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**0.0**	**$ -**	**5.0**	**$ 162.65**	**0.0**	**$ -**	**14.0**	**$ 455.42**	**0.0**	**$ -**	**19.0**	**$ 618.07**
Totals 1st High				0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	1.0	$ 32.53	0.0	$ -	0.0	$ -	0.0	$ -	1.0	$ 32.53
Subtotals Credit 1st High				(15.0)	$ (487.46)	(10.0)	$ (325.30)	(17.0)	$ (553.01)	(131.0)	$ (4,261.43)	(143.0)	$ (4,651.79)	(131.0)	$ (4,261.43)	(153.0)	$ (4,977.09)	(159.0)	$ (5,172.27)	(759.0)	$ (24,689.78)
Subtotals Detail 1st High																				0.0	$ -
Subtotals 2nd High				37,625.0	$ 1,222,730.24	32,251.0	$ 1,049,125.03	36,522.0	$ 1,188,060.66	34,254.0	$ 1,114,282.62	30,434.0	$ 990,018.02	32,661.0	$ 1,062,462.33	32,210.0	$ 1,047,791.30	29,396.0	$ 956,251.88	265,353.0	$ 8,630,722.08
Subtotals Credit 2nd High				(125.0)	$ (4,062.23)	(103.0)	$ (3,350.59)	(112.0)	$ (3,643.36)	(104.0)	$ (3,383.12)	(115.0)	$ (3,740.95)	(104.0)	$ (3,383.12)	(90.0)	$ (2,927.70)	(85.0)	$ (2,765.05)	(838.0)	$ (27,256.12)
Subtotals Detail 2nd High																				0.0	$ -
Arrears																				0.0	$ -
Adjustments		*																		(19.0)	$ (618.07)
Homestead Credit				0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -
Water Sampling Fee				0.0	$ 901.80	0.0	$ 901.80	0.0	$ 901.80	0.0	$ 901.80	0.0	$ 901.80	0.0	$ 901.80	0.0	$ 901.80	0.0	$ 901.80	0.0	$ 10,821.60
GRAND TOTALS				37,485.0	$ 1,219,082.33	32,138.0	$ 1,046,350.94	36,393.0	$ 1,184,766.09	34,019.0	$ 1,107,539.87	30,177.0	$ 982,559.61	32,426.0	$ 1,055,719.58	31,967.0	$ 1,040,788.31	29,133.0	$ 948,598.29	263,757.0	$ 8,578,808.71
				√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

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Cost of Water

What does 1 MCF (thousand cubic foot) of water cost a customer

	Rate Code	water	local sewer	Total
Regular	1	70.04	11.05	$81.09
homestead	7	42.77	3.6	$46.37
university heights - regular	9	56.6	0	$56.60
university heights - homestead	10	42.77	0	$42.77

Dollars per thousand Gallon

	Rate Code	water	local sewer	Total
Regular	1	9.36	1.48	$10.84
homestead	7	5.72	0.48	$6.20
university heights - regular	9	7.57	0.00	$7.57
university heights - homestead	10	5.72	0.00	$5.72

[redacted]

CH supplies water CWD bills CH bills (29)

BLUESTONE ROAD DIRECT SERVICE

Cleveland Heights supplies water to these accounts. They are in the Cleveland Water service territory. Cleveland Heights bills these accounts, gets paid in full retail costs for water consumed.

NORTH SIDE

109	E.	1st hyd. N. of Belvoir		4185	
79	E.	" " " " "	BV	950	So. BELVOIR.
56	E.	" " " " "		4181	
7	E.	" " " " "		4175	
95	W.	" " " " "		4159	
160	W.	" " " " "		4155	
175	W.	" " " " "			C PLUGGED 3/11/87
108	E.	2nd hyd. N. of Belvoir		4149	
29	E.	" " " " "		4145	
7	W.	" " " " "			C
46	W.	" " " " "			C
82	W.	" " " " "		4143	
46	E.	of E.P.L. of Quarry			C
30	W.	of W.P.L. of Quarry		4115	
59	W.	" " " " "		4109	
109	W.	" " " " "		4105	
138	E.	of E.P.L. of Keystone		4099	
83	E.	" " " " "		4095	
34	E.	" " " " "		1037	KEYSTONE
30	W.	of W.P.L. of Keystone			C
57	W.	" " " " "		4077	
104	W.	" " " " "			C
152	W.	" " " " "		4069	
87	E.	of E.P.L. of Renfield		4065	
35	E.	" " " " "		1061	RENFIELD
24	W.	of W.P.L. of Renfield		4051	
86	W.	" " " " "		4049	
136	W.	" " " " "		4045	

SOUTH SIDE

3/4	105	E.	of E.P.L. of Allston		4046

cleveland heights supplies water & Bills
cleveland water owns service territory

City of Cleveland Heights
Revenue Enhancement Calculation

ECM # 3, 5

baseline for data is 12-1-2013 to 11-30-2014

Meter Replacement	Number of Water Meters Affected	Total Annual Gallons (Baseline period 12-1-13 to 11-30-14)	Unrecorded Flow % *(Reference meter test results)*	Theoretical Baseline (gpy)	Calculated losses per meter from low flow errors (gpy)	Proposed New Gallons per year minus inaccuracies	Revenue Enhancement ($9.36 $/kgal)	Sewer Enhancement (1.48 $/kgal)	NEORSD New Revenue ($.63 $/KGAL)
5/8-inch	600	30,551,551	3.3%	31,579,439	1,027,888	1,027,888	$9,621	$1,521	$8,871
3/4-inch	99	7,479,252	0%	0	0	0	$0	$0	$0
1-inch	925	95,651,248	0%	0	0	0	$0	$0	$0
1.5-inch	188	66,180,048	0%	0	0	0	$0	$0	$0
2-inch	238	132,081,840	20.0%	165,102,300	33,020,460	33,020,460	$309,072	$48,870	$284,967
3-inch	20	9,893,048	40.0%	16,488,413	6,595,365	673,881	$6,308	$997	$5,816
4-inch	12	29,347,780	40.0%	48,912,967	19,565,187	11,753,646	$110,014	$17,395	$101,434
6-inch	8	16,225,616	40.0%	27,042,693	10,817,077	7,581,690	$70,965	$11,221	$65,430
8-inch	10	5,422,252	40.0%	9,037,087	3,614,835	2,394,828	$22,416	$3,544	$20,667
		392,832,635		298,162,899	74,640,812	56,452,393	$528,394	$83,550	$487,184

$108,947

Meter Replacement	Number of Meters	Total Annual Gallons (Actual) Baseline	Weighted Meter Acuracy (from testing program)	Gallons per lost due to inaccurate meters	Revenue Enhancement ($9.36 $/kgal)	Sewer Enhancement (1.48 $/kgal)	NEORSD New Revenue ($.63 $/KGAL)
5/8-inch	600	30,551,551	0.985	-	$0	$0	$0
3/4-inch	99	7,479,252	0.985	-	$0	$0	$0
1-inch	925	95,651,248	0.985	-	$0	$0	$0
1.5-inch	188	66,180,048	0.985	-	$0	$0	$0
2-inch	238	132,081,840	0.985	-	$0	$0	$0
3-inch	20	9,893,048	0.386	5,921,484	$55,425	$8,764	$51,102
4-inch	12	29,347,780	0.719	7,811,541	$73,116	$11,561	$67,414
6-inch	8	16,225,616	0.786	3,235,388	$30,283	$4,788	$27,921
8-inch	10	5,422,252	0.760	1,220,007	$11,419	$1,806	$10,529
		392,832,635		18,188,419	$170,244	$26,919	$156,966

	Meters Incaccuracy (guaranteed)	Increased consumption (agreed upon)	TOTALS
Residential (5/8")	$0	$9,621	$9,621
Commerical (3/4" to 8")	$170,244	$518,773	$689,017
Totals	$170,244	$528,394	$698,638

	Sewer Enhancement (1.48 $/kgal)	NEORSD New Revenue (8.63 $/KGAL)
	$1,521	$8,871
	$108,947	$635,280

Volume

	Meters Incaccuracy (guaranteed)	Increased consumption (agreed upon)	TOTALS
Residential (5/8")	-	1,027,888	1,027,888
Commerical (3/4" to 8")	18,188,419	55,424,505	73,612,924
Totals	18,188,419	56,452,393	74,640,812

Annual Guaranteed	74.64	MG/yr
	$698,638	$/YR

ECM # 7

Pressure Management

Install pressure reduction valves to reduce distribution system pressure. There real losses are directly proportional to system pressure. ESG will measure the distribution pressure before and after installation. Leak rate is agreed upon.

Calculation			
Current Average System Pressure	125.3	PSI	
Total Annual Real Losses	1,621.0	MG/Yr	*from AWWA water loss analysis*
Value of Real Losses	7,048,695	$/year	
Assumed Reduction in Average System Pressure	45.0	PSI	
Percent of distribution system affected	50%		
Calculated % Reduction in Average System Pressure	36%		
Real Loss Volume Saved Through Alternative Pressure Management Policy	291.2	MG/Yr	
Value of Real Loss Volume Saved Through Alternative Pressure Management Policy	1,266,233	$/Year	
Guarantee factor	78.8%		

Annual guarantee	229.6	MG/yr
	998,248	$/year

data	pressure
1	140
2	140
3	128
4	120
5	120
6	140
7	120
8	115
9	115
10	115
11	130
12	120
average	125.25

Leak Detection
ECM #9

Calculation

Total Annual Real Losses	1,621.0	MG/Yr	*from AWWA water loss analysis*
Value of Real Losses	7,048,695	$/year	
Real loss cost	4,348	$/MG	
Connections	15,925		
current real losses	278.9	gal/connection/day	
US average	63	gal/connection/day	
Proposed real losses	123	gal/connection/day	
Calculated savings	908.6	MG/yr	
Pressure management	291	MG/yr	*remove to eliminate double counting savings*
Available savings from leak repairs	617	MG/yr	
Annual calculated savings	$2,684,617	$/YR	

Guarantee factor	100%	

Annual Guaranteed Savings	617.39	MG/yr
	$2,684,617	$/YR

City of Cleveland Heights
ECM #8

Billing Anmolies and other Apparent Losses

	gals/month	MG/yr	Revenue Enhancement (9.36 $/kgal)	Sewer Enhancement (1.48 $/kgal)	NEORSD New Revenue (8.63 $/KGAL)
Incorrectly sized 2" meters	494,010	5.93	$ 55,487	$ 877	$ 51,160
2" meters with incorrect multiplier	494,010	5.93	$ 55,487	$ 877	$ 51,160
Meter with incorrect zero reads	741,846	8.90	$ 83,324	$ 1,318	$ 76,826
Accounts not billed	494,010	5.93	$ 55,487	$ 877	$ 51,160
Totals	2,223,876	27	$ 249,786	3,950	230,305

Cleveland Heights Water Feasibility Study
City of Cleveland Heights, OH

APPENDIX B – PROJECT DEVELOPMENT AGREEMENT

Project Development Agreement

Between

City of Cleveland Heights, OH
40 Severance Circle Cleveland Heights,
OH 44118Cleveland Heights

AND

Energy Systems Group, LLC
4655 Rosebud Lane
Newburgh, IN 47630

This Project Development Agreement ("PDA") is between Energy Systems Group, LLC ("ESG") and the **City of Cleveland Heights ("Cleveland Heights")**. ESG and Cleveland Heights hereby agree as follows:

1. DETAILED ENGINEERING EVALUATION

ESG agrees to perform a Detailed Engineering Evaluation (DEE) of Cleveland Heights water system infrastructure to develop a proposed project scope designed to reduce non-revenue water loss. Based on the results of the feasibility study that was conducted by ESG and Cleveland Heights, the DEE will focus on the following three components:

1. Replacement of the water utility billing software
2. Replacement of water meters and installation a new advanced metering infrastructure
3. Implementation of an aggressive leak detection and repair program

ESG will quantify potential cost reducing strategies and other financial benefits, including operational and equipment efficiencies that could be achieved through the project implementation. Cleveland Heights agrees to cooperate with ESG.

ESG will provide the services and documents described below as part of the DEE:

- A Scope of Work that describes the specific improvements and operational efficiency measures that ESG proposes to install as part of a to-be-developed implementation agreement.
- Analyze business process for billing functions and water supply operations. Identify data gaps, quantify systematic data inaccuracies associated to the management of billing data within the utility and develop cost proposal for replacement with modern software.
- Conduct leak loss measurement assessment on a representative portion of the distribution system to interpolate overall leak loss.
- Analyze master meter configuration and testing procedures.
- Investigate large commercial/industrial water meters for design and perform on-site meter testing on top 30 accounts. Spot other large meters for appropriate sizing versus flow.
- Remove and test representative sample of 50 residential meters for accuracy.
- Develop cost proposal for advanced metering infrastructure using fixed mast communication technology.
- Evaluate intelligent water management system to reduce system pressure and the corresponding real losses.
- Develop definitive executable proposal with cash flow analysis for implementation recommendations.

- Conduct workshop with key decision makers to present conclusion of investment grade audit and options with interactive model.

2. FINANCIAL AND UTILITY DATA COLLECTION

During the DEE, Cleveland Heights will furnish to ESG, upon its request, accurate and complete data concerning the existing water enterprise system including, but not limited to meter inventory (brand name, size, age and serial number), distribution system information, previous studies billing system data (meter information should be current and can be collected by Cleveland Heights during its next meter reading cycle), detailed operating costs, budgets, and other information deemed to be appropriate by both parties for the purposes of the DEE. ESG may provide a separate document to Cleveland Heights that outlines more specific required information and Cleveland Heights shall make every effort to provide that information to ESG within ten business days of ESG's request.

3. PREPARATION OF CONTRACT DOCUMENTS

ESG will prepare and submit to Cleveland Heights a contract (the "Contract") to implement a system-wide water meter replacement program and AMI system, a new billing software system, and a leak detention and repair program for Cleveland Heights. The Contract may also include additional water infrastructure improvements such as pumping station pumps, water service lines, leak detection systems, etc. The Contract will include a financial analysis that outlines the cost justification for the overall program. The Contract shall be prepared on standard ESG forms, sample copies of which will be made available to Cleveland Heights in advance of the actual Contract being delivered.

4. PRICE AND PAYMENT TERMS

Cleveland Heights agrees to pay to ESG the sum of $120,000 (One Hundred Twenty Thousand Dollars) within 45 days after Cleveland Heights has received the documentation described under Section 1 of this Agreement. However, Cleveland Heights will have no obligation to pay this amount if either of the following occur:

A. ESG and Cleveland Heights agree to enter into the Contract described in Section 3 above within 45 days after Cleveland Heights receives the documentation described in Section 1 above. In that case the charge for the Detailed Engineering Evaluation will be included in the cost of the Contract.

B. The energy and operational savings, avoided future costs and increased revenues identified in the DEE are inadequate to produce a positive annual cash flow, starting in the first year, greater than $250,000 against the costs associated with the design, installation, commissioning, measurement and verification and financing of the scope described in the contract and including all other annual operating costs incurred and paid for within the water utility fund.

5. CONTRACT IMPLEMENTATION AND TIMELINE

Cleveland Heights has selected ESG to implement this improvement project. Cleveland Heights agrees that if it proceeds with the plans and improvements developed by ESG under this PDA then Cleveland Heights will execute a Contract with ESG within 45 days after delivery of the Contract document to Cleveland Heights.

The parties agree to work diligently toward meeting or exceeding the following timeline goals:

Cleveland Heights approves **Project Development Agreement**	08/25/2014
ESG to commence Detailed Engineering Evaluation	08/26/2014
ESG to complete detailed evaluation and present recommendations	11/26/2014
Parties finalize Contract	12/1/2014
Cleveland Heights completes legal Contract review, approves and executes contract with ESG	12/15/2014
Commence implementation of Contract	12/18/2014

These timeframes are preliminary and may be modified by the parties involved.

6. CONFIDENTIALITY

This Agreement creates a confidential relationship between ESG and Cleveland Heights. Both parties acknowledge that while performing this Agreement, each will have access to confidential information, including but not limited to systems, services or planned services, suppliers, data, financial information, computer software, processes, methods, knowledge, ideas, marketing promotions, current or planned activities, research, development, and other information relating to the other party ("Proprietary Information"). Except as authorized in writing and except as is, in the opinion of Cleveland Heights' Legal Counsel, required by law, both parties agree to keep all Proprietary Information confidential. ESG may only make copies of Proprietary Information necessary for performing its services. Upon cessation of services, termination, or expiration of this Agreement, or upon either party's request, whichever is earlier, both parties will return all such information and all documents, data and other materials in their control that contain or relate to such Proprietary Information.

ESG and Cleveland Heights understand that this is a confidential project and insofar as permitted by law agree to keep and maintain confidentiality regarding its undertaking of this project. ESG shall coordinate its services only through designated Cleveland Heights representatives and shall provide information regarding this project to only those persons approved by Cleveland Heights. ESG will be notified in writing of any changes regarding the designated Cleveland Heights representative(s).

7. MISCELLANEOUS PROVISIONS

This Agreement cannot be assigned by either party without the prior written consent of the other party. This Agreement is the entire Agreement between ESG and Cleveland Heights and supersedes any prior oral understandings, written agreements, proposals, or other communications between ESG and Cleveland Heights with respect to this subject. Any change or modification to this Agreement will not be effective unless made in writing. This written instrument must specifically indicate that it is an amendment, change, or modification to this Agreement.

This is an Ohio agreement and shall be construed pursuant to Ohio law. Both parties consent to the jurisdictions of the courts of the State of Ohio or the United States Federal District Court having jurisdiction in Cuyahoga County, Ohio for any action to interpret or enforce this agreement and agree the venue for any such action shall be in the courts for Cuyahoga County, Ohio.

Cleveland Heights Water Feasibility Study
City of Cleveland Heights, OH

This document represents the intent of both parties and should be executed by people who would ultimately be signatory to the Contract.

Cleveland Heights Water Feasibility Study
City of Cleveland Heights, OH

ENERGY SYSTEMS GROUP, LLC	CITY OF CLEVELAND HEIGHTS, OH
Print Name:	Print Name: Tanisha Briley
Signature:	Signature: [signature]
Title:	Title: City Manager
Date:	Date: 9/8/2014

APPROVED AS TO LEGAL FORM
L. James Juliano by
Laure A. Wagner
DIRECTOR OF LAW
CITY OF CLEVELAND HEIGHTS, OHIO

Authorized by Resolution/Ordinance No. 112-2014
passed by Cleveland Heights City Council
on September 2, 2014

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1/12/2015

History

- Several years of revenue/cost challenges
- Increased rates to overcome losses
- No significant investment in the water utility in the past 21 years.
- System failures have been handled on a reactive basis
- ESG Selected from RFQ process May 2014
- ESG and Cleveland Heights began DEE in September 2014
  1. Diagnose system deficiencies
  2. Develop executable solutions
  3. Guarantee net annual savings of $250,000 or more

1/12/2015

Key Considerations

1. Water utility has the potential to generate $4-7M annually for Cleveland Heights
2. Strategic investment in infrastructure will produce attractive ROI based on current purchase price.
3. "Best in Class" condition could be achieved within 5 years

Project Outcomes

1. Significantly exceeds cash flow goal of $250k per year
2. Increases the value of the water utility
3. Set's the foundation for significant future revenue generation potential
4. Improves customer service

1/12/2015

Agenda


Areas of Focus


Findings


Master Meters


Recommendations

ESG Next Steps

AREAS OF FOCUS

	Issue			
Focus Area	Accuracy	Billing Errors	Leakage	High Pressure
1. Residential Meters	✓	✓		
2. **Commercial Meters**	✓	✓		
3. Master Meters	?	✓		
4. Credit Meters	?	✓		
5. **Distribution System**			✓	✓
6. Billing Process		✓		
7. Data Acquisition		✓		

Approximately 61% Non-Revenue Water Loss

1/12/2015

Improvement Opportunities

Area of Focus	Current Condition	Annual Estimated Revenue Loss	Revenue Loss Type	Revenue Generated	Proposed Solution
Water Meters	• Residential meter are accurate • Commercial meters are inaccurate • Antiquated data collection systems	($2.6M)	Apparent	$0.65M	• Replace commercial meters • Replace select Residential Meters • Upgrade data collection to AMI
Billing & Mngmt	• Deficient standard operating practices • Insufficient tools and training • Antiquated billing software	($0.5M)	Apparent	$0.25M	• Conduct Detailed Audit • Create GIS • Optimize process and SOP's
Water Distribution System	• Master meters not well understood • Oversized and inaccurate credit meters • High pressure zones increase leaks • Leaks are continuing	($7.05M)	Real	$3.7M	• Identify and fix major leaks • Implement leak detection program • Develop hydraulic model • Install Pressure Reducing Valves
	Total	**($10.2M)**		**$4.6M**	

Meter Testing

- Majority of the meter population is 21+ years old
- Residential Meters
  - There are approximately 14,500 residential meters
  - Most are within AWWA accuracy tolerances (>98.5%)
  - Approximately 4% (600) are outside acceptable tolerance or non-functional and should be replaced
- Commercial Meters
  - There are approximately 1400 commercial meters (1"-8")
  - These meters are:
    - Inaccurate
    - Oversized sized and allowing flow to pass undetected
    - Improper technology – turbine vs. compound
  - **Represents 1/3rd of total water sold**

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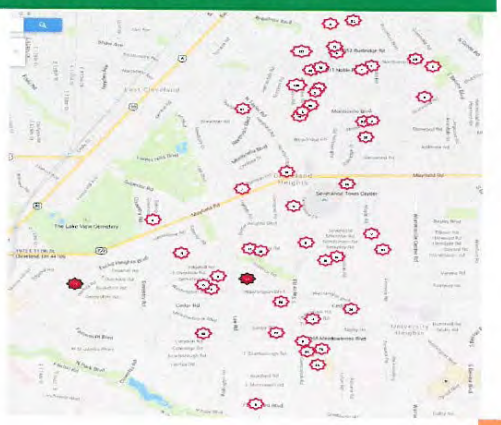
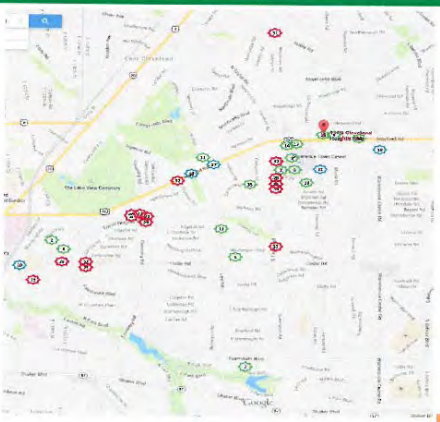
Residential Meter Tests



Commercial Meter Tests



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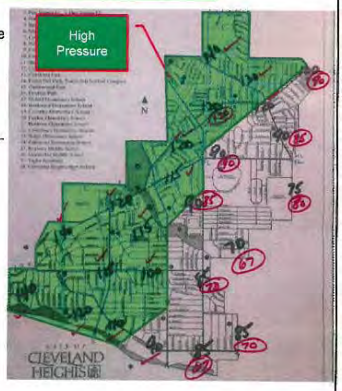
Turbine versus Compound Meters

Size	Low Flow Turbine (gpm)	Low Flow Compound (gpm)	Current Weighted Average Accuracy
2"	2.5	0.5	98.5%
3"	4	0.5	38.6%
4"	6	0.75	71.9%
6"	12	0.75	78.5%

Conclusion: Existing turbine meters significantly under-register low flow water leading to lost revenue

High Pressure Zones

- Real losses (leaks) are directly proportional to line pressure
- Average line pressure required is 70 psig versus 120 to 140 in 30% of the system
- Further analysis and modeling will allow for micro-sectorization



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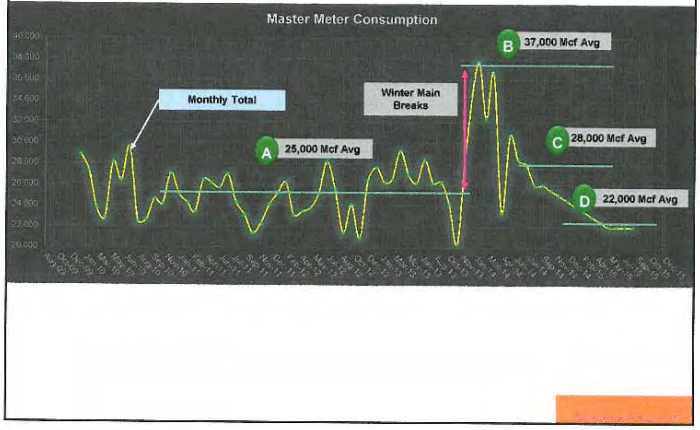
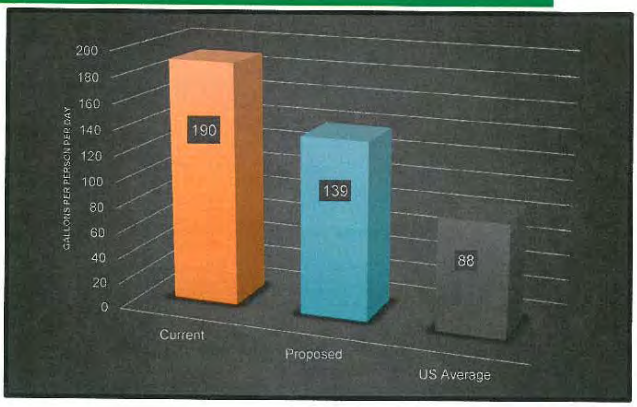
Baseline Water Consumption



Water Purchased



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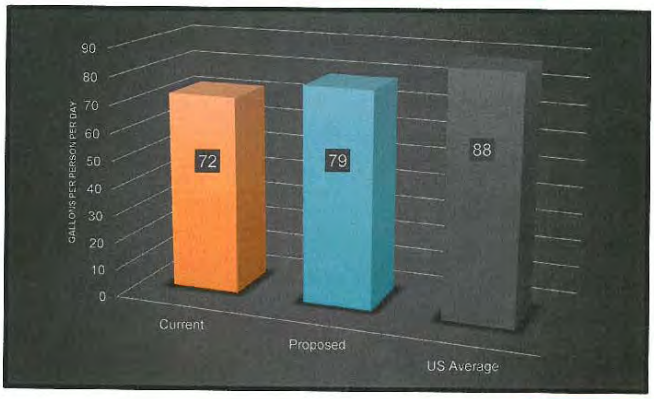
Water Sold



Non Revenue Water Summary

Category	Current	Proposed	Best Case
	Mg/yr		
Imported	3149	2,587.69	1,619.00
Exported	52	52	52
Billed metered:	1196	1,281.69	1,281.69
Aparent Losses	327	226	226
Real Losses	1,621.00	1,059.69	91
Non revenue Loss %	61.4%	49.5%	18.2%
Annual Non-Revenue Loss Savings	$0	$2,440,583	$6,652,440
Leak Repair Funds (20 year term)	$0	$10,000,000	$86,500,000

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Recommended Improvements

1. Replace all commercial meters 1" and larger
2. Install AMI data collection system across all meters
   - Enables simultaneous reading of all customer, import and export water meters to enable real-time water loss analysis
3. Optimize number of Import/Export points and install pressure control valves
4. Audit billing system and remediate errors
5. Find and repair major leaks
   - Main replacement (open cut)
   - Slip lining (trenchless technology)
   - Main repairs
   - Service line/Hydrant repairs
   - Engineering
   - Construction management
6. Develop tools and provide training
   - Dynamic Flow Model
   - Graphical Information System (GIS)
   - Leak Detection Surveying
   - Non revenue water loss analysis
   - Pressure modulation

MASTER METER ANALYSIS

- Confusion over import vs. credit meters
- (4) import meters misread by factor of 10 and 100 (dropped fixed zeros)
- **Total amount owed $1.37M - $1.02M**
- Credit meters should be changed to compound meters to record low flow.
- Any credit meter locations not recording any flow should be removed from the system (unless acting as emergency connection)
- Validate import vs. credit on dual meter configurations
- Verify boundary valves closed

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Baseline & Financial Summary

Handouts

Guarantee

- Firm Project Implementation Cost
  - Based on the agreed upon scope of work
- Savings reconciled annually - **$4,727,289**
  - Must meet or exceed total annual guaranteed savings
- Operational savings are agreed upon - **$497,580**
- Adjust baseline to account for changes in:
  - Minimum number and type of customers
  - Value of water
- Total guarantee capped at value of improvements - $19.9M
- **Additional actual project savings above the guarantee amount to be shared 50/50 for the guarantee period**

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Project Implementation Timeline

Project Item	Duration (Months)	Start Date	Completion Date
Water Meters	12	4/15	5/16
AMI	12	5/15	5/16
Optimize Import/Export Points and Pressure Control	10	7/15	5/16
Find and Repair Major Leaks	20	4/15	2/17
Engineering, Billing Audit, Tools & Training	15	2/15	5/16
Total	**24**	**2/15**	**2/17**

Why Proceed?

1. Financial Stability
   - Generate $750k+ revenue in first performance year (2017)

	Projected 5 Year Cash Flow	Projected 10 Year Cash Flow
Business as Usual	($14.8M)	($26.9M)
Recommended Project	$.9M	$4.7M

2. Increases the value of the water utility
3. Significant Future Revenue Generation Potential
   1. Puts key processes, tools and training in place for further improvement
   2. Enables surgical identification and remediation of losses
4. Improves customer service

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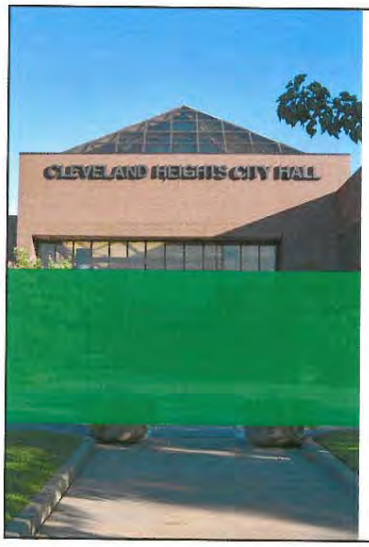
Next Steps

- Feedback
- Authorization to Proceed with Recommendations – 1/19/15
- Finalize Contract Documents – 2/6/15
- Contract Execution – 2/9/15
- Begin Implementation – 3/1/15
- Completion – 2/9/17



Thank You
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