# CITY OF ANGOLA

## Wastewater Treatment

Physical Address: 1095 Redding Road
Mailing Address: 210 North Public Square
Angola, IN 46703

**Craig A. Williams**
**Superintendent**
Phone: 260.624.2699
Cell: 260.905.6123
Fax: 260.624.2699
cwilliams@angolain.org


***"Making Clean Water & Protecting Public Health. All Day. Every Day. Period."***

September 15, 2014

Indiana Department of Environmental Management
Office of Water Quality, MC 65-42
Municipal Permits Section
100 North Senate Avenue
Indianapolis IN 46204-2251

RE: NPDES Permit No. IN0021296

City of Angola Chloride Variance Application

Addendum 1

Mr. Stenner –

This letter is in response to your request for additional information regarding the completion of PMPP actions in our variance application. Please find the requested information in the chart below:

| Action Item | Date of Completion | Reference in 2013 Annual Report |
|---|---|---|
| **Source Identification** | Aug. –Oct. 2013 | Pages 2 – 6, 15 – 24 |
| **Public Awareness Program** | Oct. 2013 | Pages 7, 25 |
| **Water Treatment Plant Optimization** | Continuous Process Improvement | Page 8 |
| **Non-Residential Users Program** | Chloride Monitoring Quarterly for Significant Industrial Users.<br>Work with identified high chloride discharger since original variance application; process change | Pages 11, 26 |

| | | |
|---|---|---|
| | planned in October 2013, process change completed in 2014. | |
| **Annual Report** | Most recent Annual Report (CY 2013) submitted March 2014. | CY 2013 Report included with variance application (Identified as Attachment 2-B-2) |

Please contact me at your convenience if you need any clarification of the items submitted.

Respectfully,

Craig A. Williams, Superintendent
Angola Wastewater Treatment

# CITY OF ANGOLA

## Wastewater Treatment

Physical Address: 1095 Redding Road
Mailing Address: 210 North Public Square
Angola, IN 46703

**Craig A. Williams**
**Superintendent**
Phone: 260.624.2699
Cell: 260.905.6123
Fax: 260.624.2699
cwilliams@angolain.org


***"Making Clean Water & Protecting Public Health. All Day. Every Day. Period."***

August 8, 2014

Indiana Department of Environmental Management
Office of Water Quality, MC 65-42
Municipal Permits Section
100 North Senate Avenue
Indianapolis IN 46204-2251

RE: NPDES Permit No. IN0021296

City of Angola Chloride Variance Application

The City of Angola owns and operates a Class III conventional activated sludge treatment plant serving a resident population of more than 8,500 and more than 3,000 students at Trine University, as well as more than 650 commercial and 80 industrial customers. The wastewater treatment plant has been located at the current site since the early 1910's. The City has had a secondary treatment facility at this site since the early 1970's, and the most recent facility expansion occurred in 2001. Treated effluent is discharged to Lake Michigan via the St. Joseph River; the St. Joseph River via Pigeon River/Pigeon Creek; Pigeon River/Pigeon Creek via the H.D. Wood ditch.

The H.D. Wood Ditch has a Q7,10 of 0.0 cfs, and the Angola Wastewater Treatment Plant is the single largest contributor to the ditch. Approximately 70% of H.D.Wood Ditch's flow was attributed to the Angola WWTP, 19% from the headwater tributaries, and the remaining 11% from extraneous sources (i.e. ground water recharge)[1]. As a result, "the receiving stream concentration will be equal to the effluent concentration."[2] This is an important factor in the assessment of the treatment plant discharge and its interaction with the receiving stream and the impairments being addressed by the chloride limitations in our permit. It is noted that without flow from the Wastewater Treatment Plant, the H.D. Wood ditch would not support any (or very limited) aquatic wildlife because it would not experience any stream flow except wet weather flows. The City takes seriously its responsibility to minimize its impact on receiving streams, however it is important to note that the absence of flow from the WWTP would have an even more deleterious effect on the aquatic biota found in the H.D. Wood Ditch.

[1] 2006 Water Quality Assessment Branch report on Mud Creek Water Chemistry Impairments.
[2] 2004 Angola NPDES Permit fact sheet.

Potable water is supplied by two municipal water treatment plants with source water from multiple well fields in proximity to the water treatment plants. As is the case for other groundwater supplies in the St. Joseph aquifer, the City's source water is characterized by high alkalinity, high hardness, mostly basic pH, and composed of calcium, magnesium, sodium, bicarbonate, sulfate and chloride. A majority of this aquifer exhibits groundwater hardness in excess of 300 mg/L[3] .

The City's Water Utility began softening water in the 1950's, and brine was discharged to an adjacent ditch until the 1970's, when the Water Utility's NPDES Permit expired. It was at this time that municipal softener waste began to be discharged to the POTW. Softening of the municipal water supply is a necessary function of the water utility – transmission of unsoftened (or insufficiently softened) water through the City's water mains results in scaling, which can plug service laterals and water main isolation valves. Additionally, the general public expects a certain level of delivered water softness, and water softening companies have a fiscal interest in selling the general public salt for their softeners.

As described herein, the Water Utility experimented with distributing finished water with a hardness of 10 grains, as opposed to 5 – 6 grains. Anecdotal reports indicate that after this change, many utility customers purchased home water softening systems. Generally, private water softening systems are less efficient than large scale treatment, which has the potential net result of increasing chloride concentrations to the treatment plant.

Conventional wastewater treatment does not remove chlorides. Wastewater Treatment Plant effluent chloride will generally equal influent chloride plus any internal chloride addition. Since Angola is in the Great Lakes river basin, effluent limitations include not only concentration limits, but loading limits, as well. Since dilution methods (effluent dilution, stream flow augmentation, etc.) cannot address loading issues, there are only two general methods to meet the WQBEL's: (1) limit chlorides discharged to the treatment plant (source reduction); (2) use tertiary treatment to remove chlorides post WWTP treatment.

Problems arise with both general methods. No single source reduction method will reduce chlorides to the treatment plant enough to allow it to meet the established permit limitations. Implementation of tertiary treatment at the WWTP would require at least a 70% reduction of chlorides. While this is technically possible, treatment would consist of reverse osmosis and would require disposal of concentrated brine, likely through deep well injection. Regardless of the method, the costs to meet the chloride limits calculated by IDEM would result in significant financial hardship to not only residential customers, but to industrial, institutional (hospital, university, etc) and likely provide little net benefit to the aquatic biota in the receiving stream due

[3] "Water Resource Availability in the St. Joseph River Basin, Indiana", by Indiana DNR, ca. 1987, http://www.in.gov/dnr/water/files/sj_introduction.pdf

to the chemical nature (low pH, little to no buffer capacity, minimal nutrients, minerals, etc.) of water treated through reverse osmosis.

Currently, all physical removal options for removing chlorides from the sources or from the treatment effluent require significant capital and operation and maintenance costs, which would pose a significant economic burden on the utility and its rate payers. The City cannot meet the limits that are being proposed for it NPDES Permit, and submits this Chloride Variance Application and supporting documentation.

Should you have any questions or need additional information regarding this application, please contact Craig Williams at 260-624-2699.

Respectfully submitted,

Craig A. Williams, Superintendent
Angola Wastewater Treatment

**APPLICATION FOR VARIANCE FROM THE WATER QUALITY STANDARD FOR CHLORIDE**

State Form 55044 (7-12)
Approved by State Board of Accounts, 2012
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
Office of Water Quality, Municipal NPDES Permits

Name of Facility: City of Angola – Wastewater Treatment Plant
Facility Address *(number and street)*: 1095 Redding Road
City or Town: Angola
State: IN ZIP Code: 46703
County: Steuben
National Pollutant Discharge Elimination System (NPDES) Permit Number: IN0021296
Owner or Person in Responsible Charge (i.e., Town Board President/Mayor)
Name: Richard M. Hickman
Title: Mayor
Address *(number and street)*: 210 N. Public Sq.
City or Town: Angola
State: IN ZIP Code: 46703
E-mail Address: rhickman@angolain.org
Primary Contact Person: Craig A. Williams
Address *(number and street)*: 210 N. Public Sq.
City or Town: Angola
State: IN ZIP Code: 46703
Telephone Number: 260-624-2699
E-mail Address: cwilliams@angolain.org

Signature Block:

This application must be signed by a person in responsible charge (see 327 IAC 5-2-22) to be valid. This signature attests to the following:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Craig A. Williams
(Printed Name)

Wastewater Superintendent
(Title)

(Signature)

August 8, 2014
(Date Signed *(month, day, year)*)

Return the completed variance application and a $50 application fee in accordance with IC 13-18-20-12(a)(4) to:

Indiana Department of Environmental Management
Office of Water Quality – Mail Code 65-42
NPDES Permits Branch
100 North Senate Avenue
Indianapolis, Indiana 46204-2251

This application for variance from the Water Quality Standard for Chloride is available to facilities required to obtain a municipal NPDES permit as defined in IC 13-11-2-132. The variance provides for relaxed effluent limitations for chloride in situations where compliance with the chloride water-quality based effluent limitations (WQBELs) will result in both an undue hardship or burden (327 IAC 5-3-4.1(e)), and in substantial and widespread economic and social impact (Paragraph C.1 of Procedure 2 in Appendix F of 40 CFR Part 132) on the applicant.

Indiana's variance application requirements and procedures are outlined in 327 IAC 5-3-4.1.
327 IAC 2-1.5-17 (GLI dischargers) and 327 IAC 2-1-8.8 (non-GLI dischargers) outline the criteria IDEM evaluates when making a variance determination. IC 13-14-8-9 includes a requirement for a pollutant minimization plan specific to the pollutant for which a variance is requested, and requires compliance with federal GLI variance regulations in 40 CFR 132, Appendix F, Procedure 2.C.

In accordance with 327 IAC 5-3-4.1(b)(1), this application may be submitted at any time during the period beginning on the date an application is submitted for the issuance, reissuance, or modification of the NPDES permit that incorporates the chloride WQBELs for which a variance is sought, and ending ninety (90) days following the effective date of the NPDES permit. An additional ninety (90) day period for submittal of the application may be available upon request.

If the variance application is submitted prior to the issuance, reissuance, or modification date of the NPDES permit, the chloride WQBELs will not become effective until IDEM makes a determination on the variance. In the event that the variance application is submitted after the issuance date of the permit, the variance applicant must appeal the issuance or modification of the permit in accordance with IC 4-21.5 and IC 13-15-6, if applicable, in order to be eligible for a stay of the chloride WQBELs.

**Part I: General Information:**

A. Provide a narrative description and a map identifying the state water(s) in which the chloride criterion is expected to be exceeded as a result of the proposed variance.

The City of Angola Wastewater Treatment Plant discharges treated effluent to the Pigeon Creek via the H.D. Wood Ditch/Mud Creek. According to Chad Hoover, GIS Manager for Steuben County, the H.D. Wood Ditch (or Hugh Wood Ditch) is the proper identification of the waterway from the confluence of the WWTP discharge and the John Leach drain all the way to the confluence of the Pigeon Creek. The segment of the H.D. Wood Ditch between Mud Lake and Pigeon Creek is also referred to as *Mud Creek*. For the purpose of clarity and consistency, this application will refer only to the H.D. Wood ditch (except in reference citations), with the understanding that different sources identify this same water body as Mud Creek.

The only water body that is affected by this variance is the 2.5 mile stretch of the H.D. Wood Ditch (See Attachment 1-A-1). The H.D. Wood Ditch has a $Q_{7,10}$ of 0.0 cfs and drains approximately 3500 acres of land with multiple land uses. Land Usage and relative drainage are identified on Attachment 1-A-2.

It is noted that absent flow from the Wastewater Treatment Plant, the H.D. Wood ditch would not support any ( or very limited) aquatic wildlife because it would not experience any significant stream flow except for wet weather flows. Commenting on the source of chlorides to the H.D. Wood Ditch in the 2008 Source Identification Program report on the Mud Creek, the author states "…it can be deducted the Angola WWTP is the primary contributor to the stream's WQS exceedances." While the City takes seriously its responsibility to minimize its impact on receiving streams, it is important to note that the absence of flow from the WWTP would have an even more deleterious effect on the aquatic biota found in the H.D. Wood Ditch.

B. Provide all monitoring data for chloride accumulated during the past three-year period from the permitted facility. At a minimum, this should include effluent data from all outfalls for which a variance is being requested. Include any influent data for chloride for the same time period, if available.

WWTP influent and effluent chloride concentration and flows are included as Attachment 1-B-1.

C. Provide all available in-stream data for chloride, hardness and sulfate, including the date the sample was taken.

The City does not have any in-stream data for chloride, hardness and sulfate in the receiving stream; however sulfate was analyzed in the effluent from January 2011 through July 2012 – this data is included on the chloride data sheet (Attachment 1-B-1).

D. Identify the date the wastewater treatment plant began discharging from the present outfall location.

The Wastewater Treatment Plant began discharging to the H.D. Wood ditch around 1910. The drinking water utility began discharging brine/softener regeneration waste to the POTW around 1975; prior to 1975, brine was discharged directly to the ditch that feeds the Center Lakes and Crooked Lake, which are in the Fawn River Watershed.

**Part II: Identification and Ranking of Control Methodologies:**

A. Identify the wastewater treatment technology capable of achieving compliance with the water quality-based effluent limitations (WQBELs) for chloride included in the NPDES permit (generally, the treatment technologies capable of achieving compliance with chloride WQBELs are reverse osmosis; nanofiltration; ultrafiltration; or microfiltration).

IDEM Permitting staff has notified the City that the revised WQBEL's for chlorides will be:

380 mg/L – Monthly Average
760 mg/L – Daily Maximum

Currently, the only known wastewater treatment technology that is capable of achieving compliance with the WQBELs for chloride is by utilization of reverse osmosis of the wastewater treatment plant effluent and deep well injection of the resulting permeate. Based on information from the Koch Membrane Systems[4] and Safe Drinking Water Foundation[5] websites, reverse osmosis is the only membrane technology that will remove monovalent ions such as chloride (see chart below).

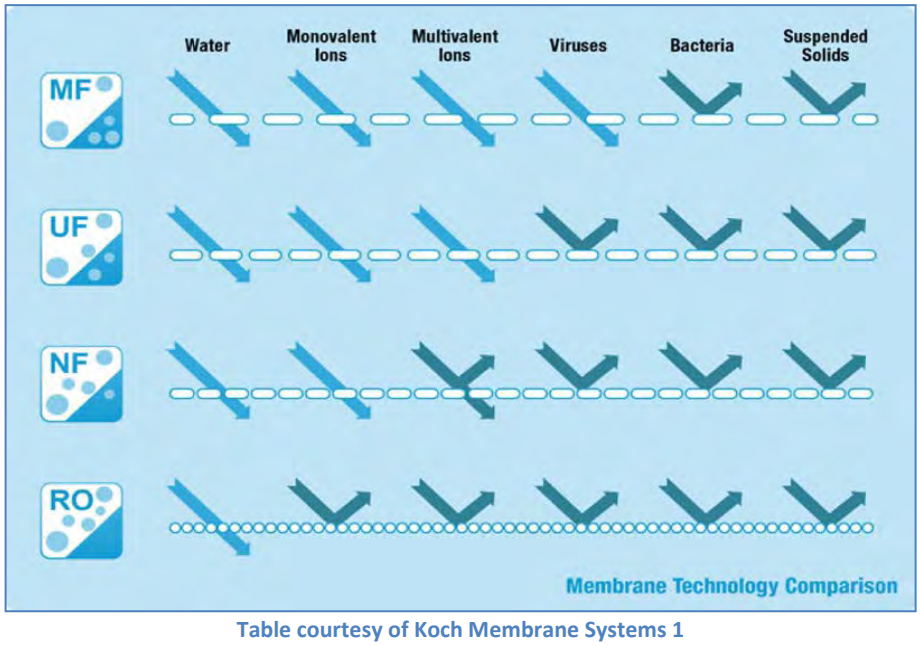



Table courtesy of Koch Membrane Systems 1

B. Provide a pollutant minimization program plan (PMPP) for chloride. The PMPP should include a preliminary identification of chloride sources to the collection system, and the proposed control measures intended to reduce chloride from the identified sources. At a minimum, the proposed control measures should include a public awareness program, an industrial user awareness program (if applicable), and a program that addresses additional measures intended to reduce chloride from other significant sources.

The complete PMPP is included as attachment 2-B-1, but includes the following basic elements.

1. Identify Sources of Chloride
2. Collection System Monitoring Program
3. Water Treatment Plant Monitoring
4. Industrial User Monitoring/Awareness Program
5. Influent/Effluent Monitoring
6. Revisions to Chloride Mass Balance
7. Public Awareness Program
8. Water Treatment Plant Optimization
9. Reducing Non-Point Source Contribution.

C. Identify any other known feasible control methodologies (i.e., treatment technologies) capable of reducing chloride concentrations in the effluent.

1. Convert Water Treatment Plants from ion exchange softening to reverse osmosis treatment plants, deep well injection of permeate.
2. Convert Water Treatment Plants from ion exchange softening to lime soda softening plants, landfill lime

[4] www.kochmembrane.com/Learning-Center/Technologies.aspx
[5] www.safewater.org

sludges.

3. Capture Water Treatment Plants softener waste and treat with reverse osmosis membrane, landfill of permeate.
4. Dilute Wastewater Treatment Plant effluent by blending with pumped groundwater.
5. Augment stream flow of H.D. Wood Ditch to dilute effluent.

D. Identify any control methodologies potentially capable of reducing chloride concentrations in the effluent that are considered to be technically infeasible. Include any documentation supporting the technical infeasibility.

The City is currently unaware of control methodologies that are technically infeasible.

E. Provide a ranking of feasible control methodologies (including the PMPP for chloride) from greater to lesser overall control effectiveness by the estimated reduction in chloride concentrations and loadings (percent of chloride removed) subsequent to their application.

| Control Methodology | Potential Loading Reduction | Estimated Monthly Cost/EDU |
|---|---|---|
| **Method 1 - Wastewater Treatment Plant - Effluent Reverse Osmosis Add Deep Well Injection of Permeate** | 70% | $30.41 |
| **Method 2 - Water Treatment Plant – Convert to Reverse Osmosis Membrane Softening, Deep Well Injection of Permeate** | 40% - 50% | $10.59 |
| **Method 3 - Water Treatment Plant – Convert to Lime Soda Softening** | 40% - 50% | $8.60 |
| **Method 4 - Water Treatment Plant – Install Reverse Osmosis Membrane to Treat *only* softener Brine, Landfill Permeate** | 40% - 50% | $5.54 |
| **Method 5 - Effluent Dilution** | -- | $2.97 |
| **Method 6 - Stream Flow Augmentation** | -- | $7.12 |
| **Method 7 - Implementation of PMPP Elements** | 3% | $0.50 |

**Part III: Environmental Evaluation**

For each control methodology under Part II. A, B and C, provide the following:

A. An identification of the adverse or beneficial environmental impacts resulting from each methodology, including the net impacts on the receiving water.

A comprehensive discussion of elements A, B and D through G are included in Attachment 3-AG-1.

B. An identification of the impacts to the aquatic community, wildlife, and plant life.

A comprehensive discussion of elements A, B and D through G are included in Attachment 3-AG-1.

C. An evaluation of impacts on rare, threatened, or endangered species including net impacts on the receiving water. The evaluation should include consideration of any endangered or threatened species listed under Section 4 of the Endangered Species Act in the area; this information can be found at: http://www.in.gov/dnr/fishwild/2356.htm. The variance application should include confirmation that the Indiana Natural Heritage Data Center of the Indiana Department of Natural Resources, and U.S. Fish and Wildlife Service were consulted.

Indiana Department of Natural Resources
Division of Nature Preserves
402 W. Washington Street, Room W267
Indianapolis, Indiana 46204-2739

U.S. Department of the Interior
Fish and Wildlife Service
Bloomington Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121

The Indiana Division of Nature Preserves and the U.S. Department of the Interior have been consulted as required; see Attachment 3-C-1a and 3-C-1b.

D. An identification of the impacts resulting from the discharge of toxic contaminants, where applicable.

A comprehensive discussion of elements A, B and D through G are included in Attachment 3-AG-1.

E. An identification of the energy impacts (BTU and kWH), where applicable.

A comprehensive discussion of elements A, B and D through G are included in Attachment 3-AG-1.

F. An identification of the risks to human health, where applicable.

A comprehensive discussion of elements A, B and D through G are included in Attachment 3-AG-1.

G. An identification of the impacts to other media, including air or land, where applicable.

A comprehensive discussion of elements A, B and D through G are included in Attachment 3-AG-1.

**Part IV: Economic Evaluation**

For each control methodology identified under Part II. A and C, provide the following information:

A. The capital costs associated with the construction of the control methodology.

Capital costs for each item are included in Attachments 3-A.G-1 and 4-A.G-1.

B. Any additional capital costs associated with the control methodology, including costs associated with disposal of waste generated by the control methodology (e.g., deep well injection of side stream reverse osmosis waste).

Additional costs for each item are included in Attachments 3-A.G-1 and 4-A.G-1.

C. An itemized list of the annual operating and maintenance (O & M) costs associated with the control methodology, including associated monitoring, inspection, permitting fees, waste disposal charges, repair, administration, and replacement costs.

O&M costs for each item are included in Attachments 3-A.G-1 and 4-A.G-1.

D. The amortized capital costs associated with operation of the control methodology, including an identification of loan term and interest rate.

Amortized costs for each item are included in Attachments 3-A.G-1 and 4-A.G-1.

E. The total annual cost of the control methodology (annual O & M costs plus amortized capital costs).

Total costs for each item are included in Attachments 3-A.G-1 and 4-A.G-1.

F. The estimated annual costs associated with the implementation of the PMPP for chloride required under Part II. A.

Labor and material costs will be the primary expenses related to the implementation of the PMPP elements. It is estimated that PMPP implementation will cost less than $35,000 per year.

G. The source or basis for the costs provided in Parts IV.A through G (i.e., quotes from suppliers, costs from similar facility, etc.).

The source/bases for all costs provided in Part IV A through E are identified on the cost summary table for each control methodology (Table 1 through Table 8). All costs have been adjusted to the current Engineering News Record construction cost index (ENRCCI) of 9835 (July 2014).

H. The estimated cost effectiveness of the control methodology (i.e., the cost per pound of chloride removed from wastestream).

The estimated cost effectiveness of each control technology (estimated cost per pound of chloride removed) is provided in the respective table for the control methodology (Attachment 4-A.G-1), as applicable.

I. The current annual pollution control costs associated with the WWTP.

The current (2013) annual pollution control cost for the Angola Wastewater Treatment Plant was $4,078,934. The total cost was determined as the sum of the Total Operation and Maintenance Expense and the Total Other Uses of Funds from the attached "Comparison of 2014 Budget to 2013 Actual Results" summary document for the Angola, Indiana Municipal Wastewater Utility.

J. The average monthly fee associated with wastewater collection and treatment per residential customer.

The Wastewater Utility's most recent financial report indicates the average monthly fees for all utility customers; see Attachment 4-J-1.

K. The total number of households in the service area.

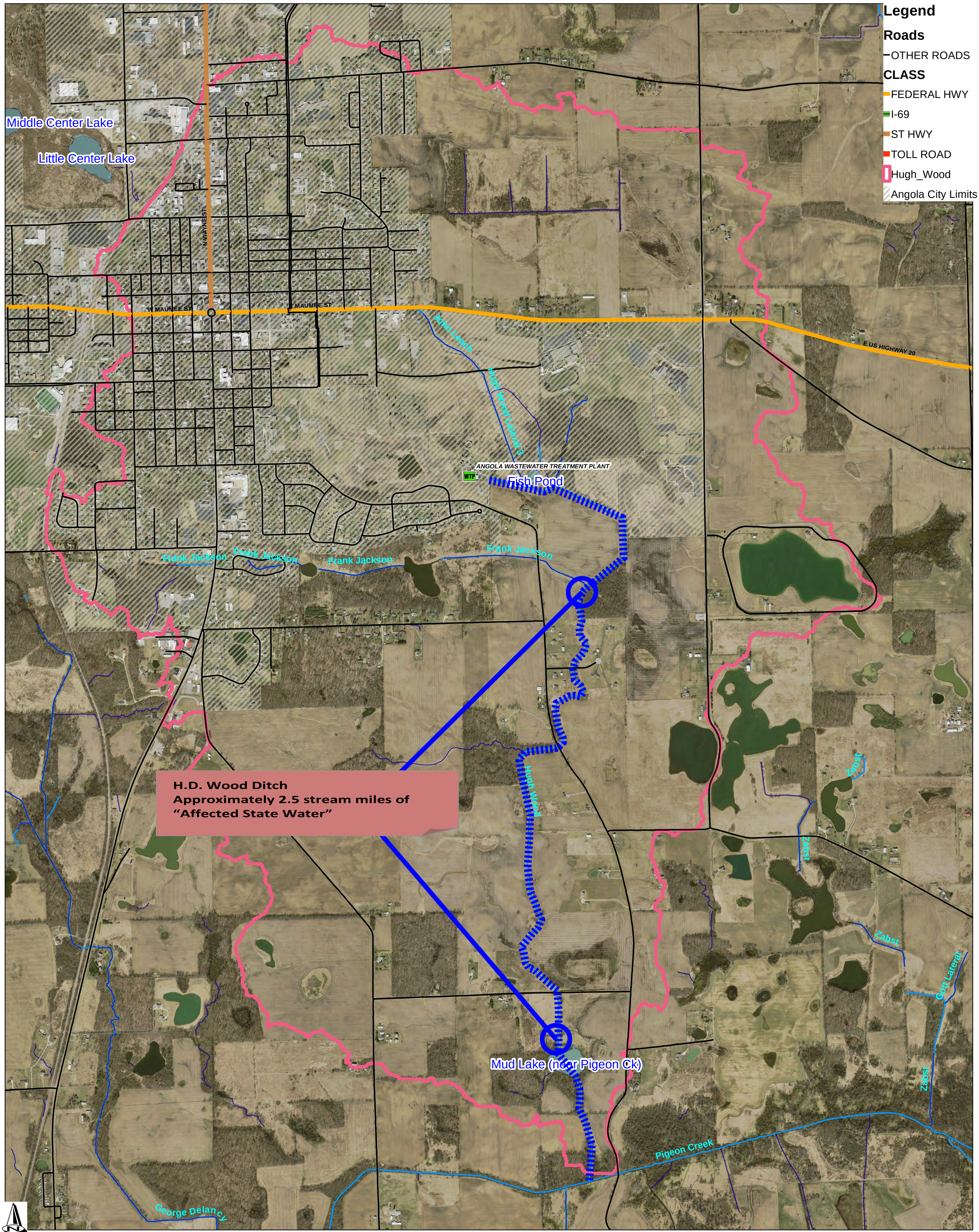
The average number of household accounts served by the Wastewater Utility for 2013 was 2,321. In 2013, residential accounts made up approximately 38% of water usage and 32% of the income to the Utility.

L. The median household income in the service area.

According to www.city-data.com, the median household income is: $39, 707; the median household income for the state is $46,974.

Attachment 1-A-1

# Hugh Wood Watershed



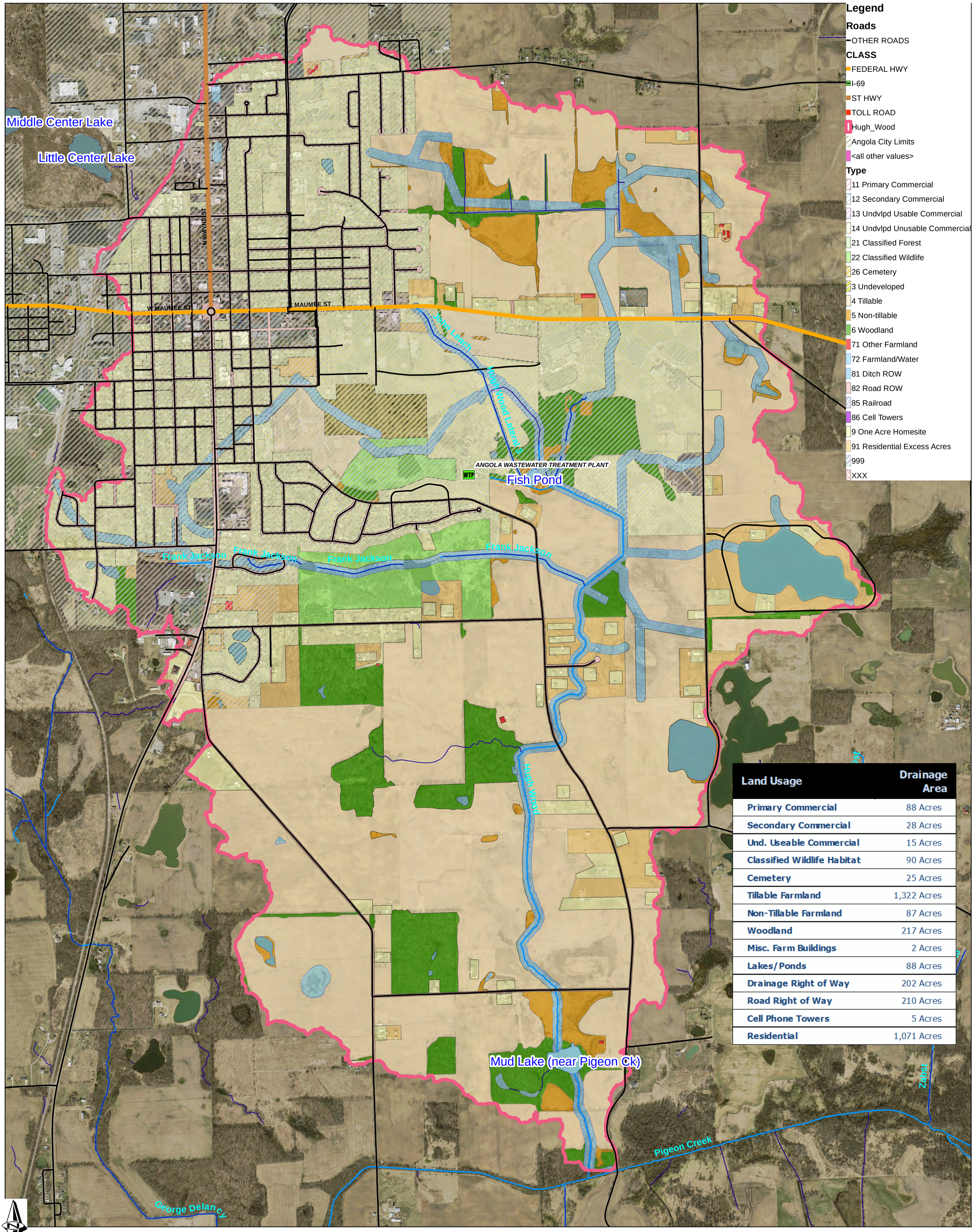

This map is a graphical representation of Land Ownership records on file in the Steuben County Auditor's Office, and records in the Steuben County GIS Database. They should be used for reference only and bare no legal representation, and should not be relied upon as legal survey documents.

Print Date: 7/8/2014

1 inch = 900 feet

Attachment 1-A-2

# Hugh Wood Watershed




| Land Usage | Drainage Area |
|---|---|
| Primary Commercial | 88 Acres |
| Secondary Commercial | 28 Acres |
| Und. Useable Commercial | 15 Acres |
| Classified Wildlife Habitat | 90 Acres |
| Cemetery | 25 Acres |
| Tillable Farmland | 1,322 Acres |
| Non-Tillable Farmland | 87 Acres |
| Woodland | 217 Acres |
| Misc. Farm Buildings | 2 Acres |
| Lakes/Ponds | 88 Acres |
| Drainage Right of Way | 202 Acres |
| Road Right of Way | 210 Acres |
| Cell Phone Towers | 5 Acres |
| Residential | 1,071 Acres |

This map is a graphical representation of Land Ownership records on file in the Steuben County Auditor's Office, and records in the Steuben County GIS Database. They should be used for reference only and bare no legal representation, and should not be relied upon as legal survey documents.

Print Date: 7/8/2014

1 inch = 900 feet

# Angola WWTP Influent Effluent Chloride Flow and Concentration

| | Influent | | Effluent | | |
|---|---|---|---|---|---|
| | Influent Flow Rate (MGD) | Total Chloride (mg/L) | Effluent Flow Rate (MGD) | Total Chloride (mg/L) | Sulfate (mg/L) |
| 1/5/2011 | 0.87 | 615 | 0.90 | 759 | 79 |
| 1/12/2011 | 0.87 | 479 | 0.74 | 714 | 63 |
| 1/19/2011 | 0.99 | 1360 | 0.99 | 697 | 68 |
| 1/26/2011 | 0.84 | 420 | 0.78 | 867 | 65 |
| 2/1/2011 | 0.58 | 375 | 0.82 | 658 | 57 |
| 2/9/2011 | 0.86 | 927 | 0.72 | 871 | 65 |
| 2/16/2011 | 1.16 | 494 | 1.13 | 767 | 66 |
| 2/23/2011 | 1.33 | 845 | 1.17 | 633 | 70 |
| 3/2/2011 | 1.60 | 638 | 1.46 | 599 | 67 |
| 3/9/2011 | 2.22 | 353 | 2.03 | 512 | 70 |
| 3/16/2011 | 1.42 | 605 | 1.33 | 637 | 66 |
| 3/30/2011 | 1.15 | 512 | 0.97 | 683 | 59 |
| 4/6/2011 | 1.10 | 618 | 0.89 | 496 | 86 |
| 4/13/2011 | 1.26 | 417 | 1.17 | 438 | 66 |
| 4/20/2011 | 1.63 | 331 | 1.53 | 441 | 60 |
| 4/27/2011 | 2.71 | 478 | 2.36 | 161 | 64 |
| 5/4/2011 | 1.31 | 451 | 1.21 | 432 | 63 |
| 5/11/2011 | 1.21 | 294 | 1.90 | 534 | 126 |
| 5/18/2011 | 1.52 | 367 | 1.61 | 378 | 73 |
| 5/25/2011 | 2.46 | 506 | 2.29 | 418 | 65 |
| 6/1/2011 | 1.66 | 389 | 1.50 | 399 | 130 |
| 6/8/2011 | 1.47 | 435 | 1.37 | 506 | 74 |
| 6/15/2011 | 1.02 | 988 | 0.99 | 634 | 57 |
| 6/22/2011 | 1.42 | 705 | 1.27 | 581 | 63 |
| 6/29/2011 | 0.98 | 586 | 0.89 | 659 | 49 |
| 7/6/2011 | 0.87 | 750 | 0.86 | 582 | 54 |
| 7/13/2011 | 1.17 | 471 | 1.13 | 422 | 71 |
| 7/20/2011 | 1.03 | 908 | 0.89 | 598 | 59 |
| 7/27/2011 | 0.94 | 575 | 0.97 | 624 | 76 |

| | Influent | | Effluent | | |
|---|---|---|---|---|---|
| | Influent Flow Rate (MGD) | Total Chloride (mg/L) | Effluent Flow Rate (MGD) | Total Chloride (mg/L) | Sulfate (mg/L) |
| 8/3/2011 | 1.04 | 490 | 0.86 | 572 | 78 |
| 8/10/2011 | 0.90 | 841 | 0.89 | 529 | 49 |
| 8/17/2011 | 0.80 | 1188 | 0.84 | 695 | 51 |
| 8/24/2011 | 1.36 | 1020 | 1.37 | 654 | 55 |
| 8/31/2011 | 0.95 | 929 | 0.96 | 566 | 68 |
| 9/7/2011 | 1.13 | 467 | 1.13 | 625 | 73 |
| 9/14/2011 | 1.08 | 446 | 1.05 | 566 | 71 |
| 9/21/2011 | 1.16 | 579 | 1.15 | 351 | 60 |
| 9/29/2011 | 1.64 | 286 | 1.58 | 390 | 61 |
| 10/5/2011 | 1.06 | 497 | 1.04 | 506 | 64 |
| 10/12/2011 | 0.84 | 629 | 0.86 | 667 | 70 |
| 10/19/2011 | 1.68 | 248 | 1.58 | 576 | 62 |
| 10/26/2011 | 1.30 | 479 | 1.22 | 441 | 67 |
| 11/2/2011 | 0.93 | 757 | 0.93 | 591 | 65 |
| 11/9/2011 | 1.25 | 502 | 1.09 | 401 | 75 |
| 11/15/2011 | 1.69 | 152 | 1.62 | 335 | 80 |
| 11/23/2011 | 1.89 | 137 | 1.78 | 255 | 72 |
| 11/29/2011 | 3.70 | 230 | 3.47 | 238 | 65 |
| 12/6/2011 | 2.67 | 222 | 2.43 | 191 | 68 |
| 12/13/2011 | 1.41 | 225 | 1.35 | 409 | 57 |
| 12/20/2011 | 1.56 | 252 | 1.49 | 310 | 62 |
| 12/28/2011 | 1.09 | 392 | 1.06 | 397 | 63 |
| 1/3/2012 | 1.19 | 357 | 1.10 | 408 | 59 |
| 1/11/2012 | 1.37 | 419 | 1.33 | 448 | 48 |
| 1/18/2012 | 1.51 | 307 | 1.43 | 395 | 64 |
| 1/24/2012 | 2.12 | 394 | 1.98 | 453 | 100 |
| 1/31/2012 | 1.53 | 425 | 1.51 | 469 | 68 |
| 2/14/2012 | 1.10 | 658 | 1.15 | 543 | 70 |
| 2/21/2012 | 1.21 | 567 | 1.15 | 554 | 60 |

# Angola WWTP Influent Effluent Chloride Flow and Concentration

| | Influent | | Effluent | | |
|---|---|---|---|---|---|
| | Influent Flow Rate (MGD) | Total Chloride (mg/L) | Effluent Flow Rate (MGD) | Total Chloride (mg/L) | Sulfate (mg/L) |
| 2/27/2012 | 1.44 | 504 | 1.38 | 497 | 66 |
| 3/6/2012 | 1.42 | 404 | 1.40 | 471 | 60 |
| 3/13/2012 | 1.66 | 322 | 1.63 | 400 | 88 |
| 3/21/2012 | 1.21 | 252 | 1.16 | 421 | 89 |
| 3/27/2012 | 1.09 | 331 | 1.03 | 460 | 77 |
| 4/4/2012 | 1.32 | 448 | 1.26 | 405 | 63 |
| 4/11/2012 | 0.97 | 306 | 0.92 | 389 | 81 |
| 4/18/2012 | 1.01 | 830 | 1.01 | 583 | 64 |
| 4/24/2012 | 1.04 | 762 | 1.01 | 456 | 72 |
| 5/1/2012 | 1.07 | 260 | 1.08 | 432 | 73 |
| 5/8/2012 | 1.06 | 521 | 1.08 | 457 | 78 |
| 5/15/2012 | 1.04 | 984 | 1.04 | 492 | 73 |
| 5/22/2012 | 0.86 | 641 | 0.86 | 614 | 69 |
| 5/30/2012 | 0.82 | 742 | 0.82 | 693 | 77 |
| 6/4/2012 | 0.97 | 748 | 0.97 | 738 | 60 |
| 6/11/2012 | 0.85 | 657 | 0.89 | 743 | 77 |
| 6/20/2012 | 0.80 | 346 | 0.87 | 545 | 64 |
| 6/24/2012 | 0.74 | 1320 | 0.80 | 892 | 70 |
| 7/5/2012 | 0.81 | 1150 | 0.86 | 865 | 74 |
| 7/10/2012 | 1.00 | 883 | 1.03 | 808 | 80 |
| 7/18/2012 | 1.36 | 721 | 1.22 | 823 | 78 |
| 7/25/2012 | 0.85 | 654 | 0.90 | 554 | 87 |
| 7/31/2012 | 0.97 | 577 | 1.01 | 399 | 81 |
| 8/8/2012 | 0.85 | 505 | 0.68 | 546 | 70 |
| 8/14/2012 | 1.07 | 278 | 1.07 | 413 | |
| 8/23/2012 | 0.86 | 921 | 0.91 | 642 | |
| 9/5/2012 | 1.19 | 417 | 1.06 | 504 | |
| 9/13/2012 | 1.06 | 204 | 1.10 | 511 | |
| 9/19/2012 | 0.80 | 273 | 0.84 | 501 | |

| | Influent | | Effluent | |
|---|---|---|---|---|
| | Influent Flow Rate (MGD) | Total Chloride (mg/L) | Effluent Flow Rate (MGD) | Total Chloride (mg/L) |
| 9/24/2012 | 0.97 | 227 | 0.97 | 462 |
| 10/3/2012 | 0.81 | 272 | 0.84 | 593 |
| 10/10/2012 | 0.86 | 356 | 0.87 | 671 |
| 10/17/2012 | 1.11 | 610 | 1.09 | 553 |
| 10/24/2012 | 0.88 | 509 | 0.93 | 87 |
| 10/31/2012 | 0.81 | 198 | 0.84 | 524 |
| 11/6/2012 | 1.20 | 549 | 1.14 | 596 |
| 11/14/2012 | 1.07 | 516 | 1.02 | 497 |
| 11/21/2012 | 0.82 | 256 | 0.83 | 566 |
| 11/26/2012 | 0.80 | 207 | 0.77 | 465 |
| 12/6/2012 | 0.84 | 665 | 0.85 | 467 |
| 12/13/2012 | 0.84 | 204 | 0.82 | 567 |
| 12/17/2012 | 0.77 | 995 | 0.77 | 508 |
| 12/26/2012 | 0.76 | 222 | 0.75 | 439 |
| 1/2/2013 | 0.86 | 506 | 0.80 | 531 |
| 1/8/2013 | 0.89 | 1230 | 0.89 | 634 |
| 1/16/2013 | 1.12 | 457 | 1.11 | 540 |
| 1/23/2013 | 0.92 | 223 | 0.80 | 515 |
| 1/31/2013 | 1.55 | 948 | 1.45 | 568 |
| 2/5/2013 | 0.96 | 501 | 0.95 | 664 |
| 2/13/2013 | 1.17 | 646 | 1.37 | 761 |
| 2/18/2013 | 1.08 | 306 | 1.11 | 604 |
| 2/26/2013 | 1.48 | 424 | 1.43 | 740 |
| 3/4/2013 | 1.00 | 638 | 0.97 | 642 |
| 3/12/2013 | 1.69 | 545 | 1.63 | 481 |
| 3/18/2013 | 1.08 | 800 | 1.05 | 875 |
| 3/28/2013 | 0.96 | 944 | 0.95 | 846 |
| 4/3/2013 | 0.90 | 575 | 0.89 | 531 |
| 4/8/2013 | 1.07 | 400 | 1.10 | 500 |

# Angola WWTP Influent Effluent Chloride Flow and Concentration

| | Influent | | Effluent | |
|---|---|---|---|---|
| | Influent Flow Rate (MGD) | Total Chloride (mg/L) | Effluent Flow Rate (MGD) | Total Chloride (mg/L) |
| 4/17/2013 | 2.16 | 600 | 2.06 | 600 |
| 4/25/2013 | 1.76 | 300 | 1.70 | 400 |
| 5/2/2013 | 1.94 | 400 | 1.89 | 450 |
| 5/7/2013 | 1.16 | 450 | 1.16 | 425 |
| 5/16/2013 | 0.90 | 1200 | 0.89 | 575 |
| 5/20/2013 | 1.07 | 509 | 1.07 | 538 |
| 5/28/2013 | 1.12 | 327 | 1.03 | 655 |
| 6/4/2013 | 0.92 | 350 | 0.98 | 450 |
| 6/12/2013 | 1.01 | 400 | 1.10 | 575 |
| 6/18/2013 | 0.89 | 1350 | 0.94 | 435 |
| 6/28/2013 | 1.16 | 500 | 1.16 | 400 |
| 7/4/2013 | 1.02 | 500 | 1.05 | 400 |
| 7/12/2013 | 1.23 | 550 | 1.25 | 300 |
| 7/19/2013 | 1.07 | 500 | 1.15 | 700 |
| 7/24/2013 | 0.91 | 450 | 0.93 | 450 |
| 7/31/2013 | 0.82 | 300 | 0.89 | 525 |
| 8/8/2013 | 0.88 | 1100 | 0.86 | 850 |
| 8/13/2013 | 0.83 | 226 | 0.92 | 642 |
| 8/20/2013 | 0.88 | 1020 | 0.95 | 820 |
| 8/27/2013 | 0.99 | 800 | 1.04 | 700 |
| 9/5/2013 | 0.91 | 1120 | 0.95 | 860 |
| 9/9/2013 | 0.89 | 400 | 0.95 | 700 |
| 9/18/2013 | | 630 | 0.91 | 730 |
| 9/24/2013 | 0.73 | 480 | 0.85 | 640 |
| 10/3/2013 | 0.80 | 900 | 0.91 | 650 |
| 10/10/2013 | 0.94 | 900 | 1.05 | 705 |
| 10/17/2013 | 0.92 | 300 | 0.68 | 600 |
| 10/21/2013 | 0.56 | 400 | 0.94 | 600 |
| 11/6/2013 | 0.91 | 400 | 0.99 | 600 |

| | Influent | | Effluent | |
|---|---|---|---|---|
| | Influent Flow Rate (MGD) | Total Chloride (mg/L) | Effluent Flow Rate (MGD) | Total Chloride (mg/L) |
| 11/14/2013 | 0.77 | 550 | 0.84 | 825 |
| 11/18/2013 | 1.05 | 400 | 1.08 | 625 |
| 11/25/2013 | 1.09 | 700 | 0.86 | 825 |
| 12/4/2013 | 0.93 | 500 | 1.01 | 700 |
| 12/11/2013 | 0.75 | 600 | 0.78 | 900 |
| 12/15/2013 | 0.68 | 600 | 0.72 | 800 |
| 12/25/2013 | 1.20 | 700 | 1.23 | 475 |
| 12/30/2013 | 0.82 | 500 | 0.84 | 500 |
| 1/8/2014 | 0.81 | 500 | 0.77 | 600 |
| 1/12/2014 | 1.46 | 700 | 1.48 | 600 |
| 1/20/2014 | 0.95 | 500 | 0.99 | 700 |
| 1/30/2014 | 0.98 | 800 | 1.04 | 800 |
| 2/5/2014 | 0.90 | 600 | 0.92 | 700 |
| 2/11/2014 | 0.90 | 1200 | 0.84 | 700 |
| 2/19/2014 | 1.11 | 850 | 1.14 | 1050 |
| 2/26/2014 | 1.43 | 700 | 1.43 | 675 |
| 3/5/2014 | 1.38 | 600 | 1.38 | 600 |
| 3/9/2014 | 1.03 | 750 | 1.04 | 700 |
| 3/19/2014 | 1.67 | 550 | 1.70 | 600 |
| 3/24/2014 | 2.01 | 550 | 1.99 | 550 |
| 4/3/2014 | 2.47 | 400 | 2.44 | 500 |
| 4/10/2014 | 1.96 | 500 | 1.94 | 650 |
| 4/16/2014 | 1.34 | 800 | 1.36 | 700 |
| 4/22/2014 | 1.15 | 550 | 1.07 | 625 |
| 4/30/2014 | 0.96 | 300 | 0.88 | 500 |
| 5/6/2014 | 0.90 | 900 | 0.93 | 700 |
| 5/13/2014 | 1.03 | 700 | 1.04 | 600 |
| 5/22/2014 | 1.26 | 450 | 1.25 | 500 |
| 5/27/2014 | 1.16 | 800 | 1.10 | 625 |

# *Angola Wastewater Treatment Pollutant Minimization Program Plan*

## PMPP Action Item 1 – Identify Sources of Chloride

The Wastewater Treatment Plant completed an initial assessment of chloride sources as part of the previous variance application. Subsequent monitoring has not identified any other significant sources of chloride discharge to the collection system. The chart below indicates the primary sources and the proposed control measures to reduce chloride discharge.

| Source | Proposed Control Method |
|---|---|
| **Water Utility – Softener Brine Discharge** | Water Treatment Plant Optimization (PMPP 8) |
| **Residential Sanitary Sewage** | Public Education and Outreach (PMPP 7) |
| **Residential Water Softening** | Public Education and Outreach (PMPP 7) |
| **Non-Point Sources** | Inflow & Infiltration Reduction, BMP's for De-icing Application (PMPP 9) |
| **Industrial Users** | Education & Outreach, Site Specific Chloride Reduction Strategies (PMPP 4, PMPP 7) |
| **WWTP Ferrous Chloride Addition** | Efficient use and delivery of product |

## PMPP Action Item 2 – Collection System Monitoring Program

The Angola WWTP completes regular monitoring of chlorides in the collection system. These samples are used to refine the chloride mass balance and to help better understand where chlorides are coming from so that public education and outreach efforts are more effective.

It has been noted in previous annual reports that wastewater staff utilizes conductivity dataloggers to gather chloride concentrations from the collection system. One of the primary issues with evaluating data from the dataloggers is that there are currently no monitors that will directly read chloride. The two dataloggers that measure conductivity, and chloride concentration is calculated based on curves that are established as part of the set-up procedure. What has been found is that it appears that calculated chloride concentration is generally lower than grab or composite samples that are analyzed using EPA-Method chemistry. The variation between the datalogger and actual concentration is not linear, and we have not been able to successfully identify an equation that will reliably adjust the curve to match actual observed chloride concentration.

Additionally, since both dataloggers require complete immersion for accurate readings, placement in low flow pipes that receive intermittent slug flows (from the Water Treatment Plant, for example) results in erratic values that make identifying correlation slopes even more difficult.

When reviewing data from the conductivity dataloggers, we generally see conductivity that varies ten to fifteen percent around an average value, with rare, short duration spikes that are no more than three or four times the average value and, when removing the high values from the average values, generally changes the average conductivity no more than a percent or two.

Given the inconsistencies in establishing reliable correlation curves between conductivity and chloride, the decision has been made to discontinue use of the conductivity dataloggers, and will instead conduct grab sampling as described below at the sites identified in this PMPP.

Beginning in July 2014, wastewater staff will complete semi-annual monitoring of the identified collection system sites. Sampling will be composed of no less than four grab samples taken over a period of no less than two days. Grab samples will be transported to the wastewater treatment plant laboratory and analyzed using Standard Method 4500-Cl B, 20$^{th}$ Edition. Bench sheets will be completed for every sample and results will be stored in a spreadsheet for further data analysis. It is the intention to complete semi-annual monitoring during the summer and winter months.

Sampling is completed at fifteen sites throughout the collection system. These sites include both of the Water Utility's treatment plants, residential systems with and without supplemental softening, commercial and industrial sites, and areas that receive flow from combined sewers. Many of these sites were sampled as part of the original assessment completed for our variance submittal. A map identifying the fifteen sites is included at the end of this PMPP.

## PMPP Action Item 3 – Water Treatment Plant Monitoring

Monitoring of discharge from the Water Treatment plants will continue on a quarterly basis. As described in PMPP Action Item 3, use of conductivity dataloggers is being discontinued. Wastewater staff will, at a minimum, collect four grab samples over a two day period at each water treatment plant every quarter (sixteen grab samples pre water treatment plant per year).

Wastewater staff is also evaluating the feasibility of installing an autosampler to take time-based grab samples over a twenty-four hour period. If this method is determined to be a feasible solution that will yield a better understanding of the chloride discharge from the water treatment plants, then this method will be implemented in place of collecting manual grab samples.

## PMPP Action Item 4 – Industrial User Monitoring/Awareness Program

The Angola WWTP current operates a non-delegated industrial pretreatment program. This program requires quarterly monitoring of Significant Industrial Users for certain parameters. In 2010, the Wastewater Utility made it standard procedure to add chlorides to the list of parameters sampled during quarterly sampling. Other non-significant industrial users are

periodically inspected and sampled, and the Wastewater Utility has made it standard procedure to add chlorides to the list of parameters sampled at these facilities.

Industrial users that have been identified through sampling to discharge a significant chloride load to the wastewater system will be included in the elements of this PMPP Action Item. The WWTP Pretreatment Coordinator will work with indentified dischargers to review their processes and identify areas where reductions in chloride discharges can be made. The Pretreatment Coordinator will document all pertinent details in identification of dischargers identified under this PMPP and all pertinent actions taken to implement improvements that will help the discharger reduce chloride loading to the wastewater system.

## PMPP Action Item 5 – Influent/Effluent Monitoring

The Wastewater Treatment Plant uses paced-flow refrigerated autosamplers to collect composite samples of raw influent and final effluent five days per week. Once weekly, Total Chloride analysis is completed on influent and effluent samples by our laboratory. Samples are collected and analyzed using Standard Method 4500-Cl B, 20$^{th}$ Edition. The results are recorded on the Monthly Report of Operations (MRO) and are used to help track chloride concentration and loading to and from the wastewater treatment plant. This analysis is currently occurring weekly.

## PMPP Action Item 6 – Revision to Chloride Source Mass Balance

Collection system monitoring was completed August – October 2013. The latest revision to the chloride mass balance was submitted in March 2014 with the Annual Report.

The Wastewater Treatment Plant will submit revised chloride source mass balances with its annual report utilizing the data collected as described in the influent/effluent monitoring and collection system monitoring sections of this PMPP.

The 2013 Annual Report, submitted in March 2014, is included as Attachment 2-B-2.

## PMPP Action Item 7 – Public Awareness Program

One of the key methods to reduce chloride discharges from the treatment plant is source reduction – keeping chlorides from entering the collection system. The purpose of the public awareness program is to inform and educate the public about what chlorides are, why chlorides are a problem, and how the public can be involved in reducing the amount chlorides discharged to the collection system.

Although the Water Utility softens the water distributed to utility customers, some residential and commercial customers choose to further soften their water. Generally, private water softeners are less efficient than the municipal system and private systems are rarely monitored and adjusted by the owner. Private water softeners are most often set up to soften the entire private water system, although softened water is only needed (wanted) at certain distribution points (i.e. kitchen sink tap, hot water feed, washer feed).

In 2011, the Water and Wastewater Utilities began a public education and outreach program. It is the intention of this program to educate utility customers for the long term goal of reducing chloride loading to the sewer system. As part of this initiative, any property owner or renter can

request the Water Department to inspect and analyze their water for hardness and make recommendations on how to reduce softener usage.

The Wastewater Department will continue to utilize one or more of the following methods to provide education and outreach to users of the wastewater system:

- Articles in the City's quarterly newsletter, distributed with utility bills;
- Information on the City's website;
- Information provided to the City Council, newpaper, radio, etc.;
- Tours of the Wastewater Treatment Plant;
- Presentations to local professional groups, homeowner associations, school groups, etc.;
- Assisting with implementation of Best Management Practices (BMPs) to industrial users who have been identified as a significant source of chlorides;
- Other outreach opportunities that are identified.

## PMPP Action Item 8 – Water Treatment Optimization

The Water Utility operates two water treatment plants, and continues to look for ways to improve the efficient operation of these facilities. Efficiency will not only reduce salt consumption (chloride discharge), but also reduces energy consumption and other costly resources (pump and valve maintenance, filter media replacement, etc). Improved operational efficiency reduces overall operating costs, providing an economic incentive to the Water Utility to implement and maintain practices that intentionally or incidentally reduce salt consumption.

During the initial variance process, the Water Utility dramatically increased finished water hardness to reduce salt consumption (chloride discharge). Customers were extremely dissatisfied in this change, and city management received a number of anecdotal reports of residents purchasing water softening systems. In 2013, the water utility began softening water back to previous levels and began a public education and outreach campaign to help customers adjust on-site softening systems to minimize salt usage. This information is being included in the PMPP because based on our experience, the best way to manage privately owned water softening systems is to place our customers preferences in water softness as a high priority goal for the water utility.

The Water Utility has identified the following process optimization methods that will help reduce chloride discharge to the wastewater treatment plant:

1. **Monitor and control regeneration practices, regeneration intervals and salt dosage.**
   Proper regeneration of the softeners depends on controlling the brine and displacement rinse rates. For optimum results a 30 min. contact (20 minute minimum) at 8% concentration of salt (30% Salometer) must be achieved. If the brine is applied too fast the contact time will be shortened and if it is applied too slowly the desired concentration cannot be reached. In either case inefficient regeneration results in loss of softening capacity. A brine curve can be made at start-up to ensure maximum operating efficiency. Operators can refer to the installation instructions for the initial setting of all

valves and flow rates. Operators will make a trial regeneration and at this time plot a brine curve, so that during the next regeneration adjustments can be made.

2. **Best management practices that focus on salt usage reduction.**
   Plant operating records should be maintained daily. It is important to the successful operation of the treatment plants that a continuous record of plant operations be maintained. By review of plant records and comparison of operating results an operator can determine the operating condition of the treatment plants.
3. **Good housekeeping measures that focus on preventing incidental releases of salt to the collection system (spills, storage practices, etc.) – Including an overview of the water treatment plant process optimization practices.**
   The two ion exchange water treatment plants utilize underground brine storage tanks for the injection of brine to the ion exchange softeners; each regeneration is metered for the proper amount of brine to be added. The brine waste is discharged to a detention tank and then pumped to the sanitary sewer system at a controlled rate. Both underground storage tanks are sealed and water is added to the tanks when needed, being controlled by a float switch and solenoid valve to maintain a constant level in the tank.

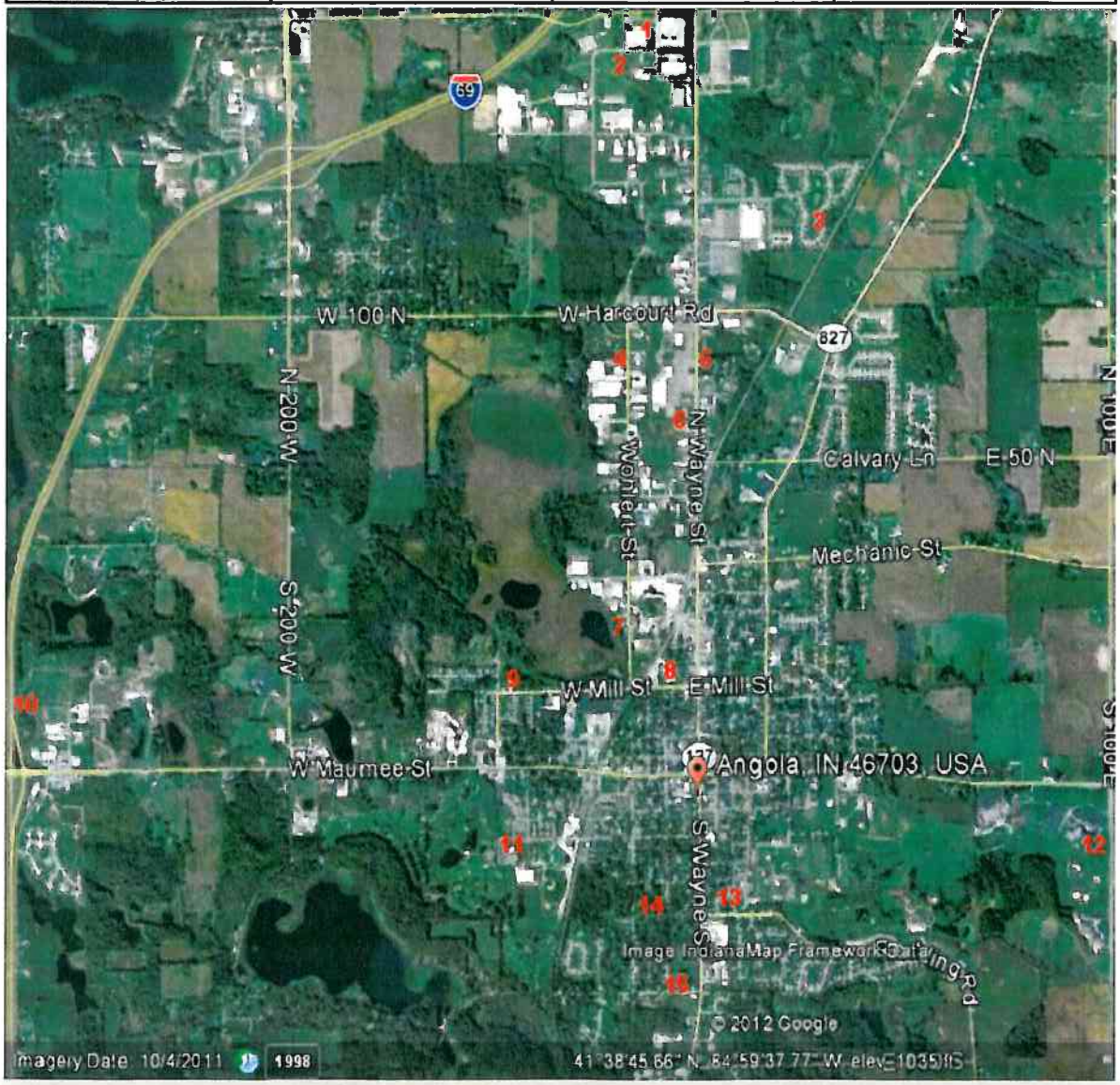
## PMPP Action Item 9 – Non-point Source Contribution

Non-point source contributions of chlorides come from areas of the collection system that still receive run-off from stormwater inlets that are connected to the combined sewer system. Calculated loading from the combined sewer system is very low, estimated to be less than 2% of the overall loading to the treatment plant. Loading from the combined sewer system can be reduced in two primary ways:

1. **Remove combined sewer inlets from the sanitary sewer.**
   The City of Angola maintains and operates a combined sewer system with an approved Combined Sewer Overflow Operation Plan (CSOOP) and has completed all of the required elements of its CSO Long Term Control Plan (LTCP). The City will continue to integrate separation of combined sewers when other projects (new construction, street resurfacing, etc) occur in the vicinity of combined sewers, and when there are feasible outlets to which the separated stormwater can be transported to.
2. **Minimize the use of de-icing materials.**
   The City of Angola is the county seat of Steuben County, with state highway and county roads providing access into the community. Approximately half of the right-of-way that drains through combined sewers are in the state highway. The City does not have jurisdiction over the State or County Highway Departments, and cannot impose any deicing restrictions on them.
   The City of Angola Street Department is responsible for applying deicing and abrasive materials to city streets. The Street Commissioner directs and oversees the application of salt and uses best management practices to minimize the use of salt in all areas. Best management practices are used to balance the needs for public safety, fiscal responsibility and the environment.

# SAMPLING SITES OVERVIEW

| Site Name | Site Number | Site Name | Site Number |
|---|---|---|---|
| Woodhull | 1 | Mill Street | 9 |
| North Water Plant | 2 | Buck Lake | 10 |
| Northcrest | 3 | Tri-State | 11 |
| Wohlert | 4 | MSD High School | 12 |
| Village Green | 5 | Prospect & Martha | 13 |
| Pizza Hut | 6 | Felicity & Superior | 14 |
| Kings | 7 | Fox Lake | 15 |
| South Water Plant | 8 | | |



Attachment 2-B-2

# CITY OF ANGOLA

## Wastewater Treatment

Physical Address: 1095 Redding Road
Mailing Address: 210 North Public Square
Angola, IN 46703

**Craig A. Williams**
**Superintendent**
Phone: 260.624.2699
Cell: 260.905.6123
Fax: 260.624.2699
cwilliams@angolain.org

***"Making Clean Water & Protecting Public Health. All Day. Every Day. Period."***

March 12, 2014

Indiana Department of Environmental Management
Office of Water Quality, MC 65-42
Municipal Permits Section
100 North Senate Avenue
Indianapolis IN 46204-2251

RE: NPDES Permit No. IN0021296

City of Angola Chloride Variance Annual Report

The City of Angola hereby submits its 2014 Chloride Variance Annual Report, pursuant to the requirements set forth within NPDES Permit No. IN0021296, Part 1.D.3 and Part 1.G.5.

The approved Pollutant Minimization Program Plan requires:

1. Source Identification – A revision to the mass balance of chloride sources based on the collection system monitoring program.
2. Public Awareness Program – Implementation of methods to inform utility customers of the negative impacts of chlorides from water softening and encouraging residents to reduce or eliminate water softening.
3. Water Treatment Plant Process Optimization – Implement operational methods and controls to reduce the amount of salt discharged from the water treatment plants.
4. Non-Residential User Program – Implement a program to reduce chloride discharges from non-residential users.
5. Annual Report – Submit an annual report describing the implementation of the plan and the results of the implementation.

Should you have any questions or need additional information regarding this report, please contact Craig Williams at 260-624-2699.

Respectfully submitted,

Craig A. Williams, Superintendent

Angola Wastewater Treatment

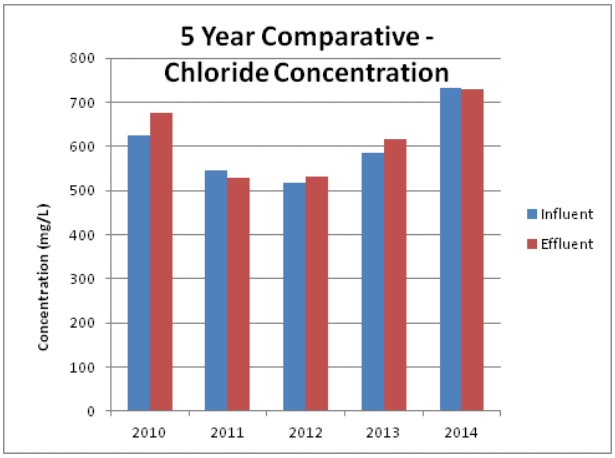
# PMPP Action Item 1 – Influent/Effluent Monitoring Data

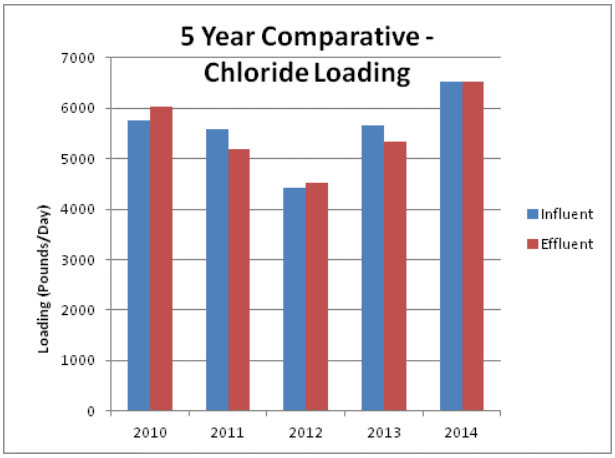
Chloride in the influent and effluent of the treatment plant is collected using a refrigerated pace-flow auto-sampler, and the composite is analyzed by our laboratory. Observed influent and effluent chloride concentration and loading are shown below.

| CY 2013 Concentration (mg/L) | Influent | Effluent |
|---|---|---|
| Minimum | 223 | 300 |
| Average | 584 | 616 |
| Maximum | 1230 | 900 |

| CY 2013 Loading (Pounds/Day) | Influent | Effluent |
|---|---|---|
| Minimum | 1718 | 3128 |
| Average | 5660 | 5339 |
| Maximum | 12247 | 10308 |

When comparing influent chloride levels over the last five years, average loading was trending downward during the first three years, but has sharply increased in the last two years. Salt usage from the water utility is certainly a portion of the experienced loading increase, but there is also anecdotal evidence that despite public education and outreach efforts, installation of residential water softeners is on the rise. Graphical representation of influent/effluent chlorides are included below.

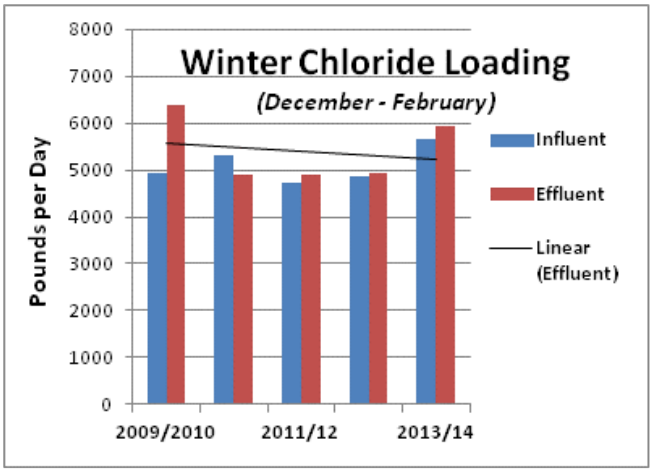


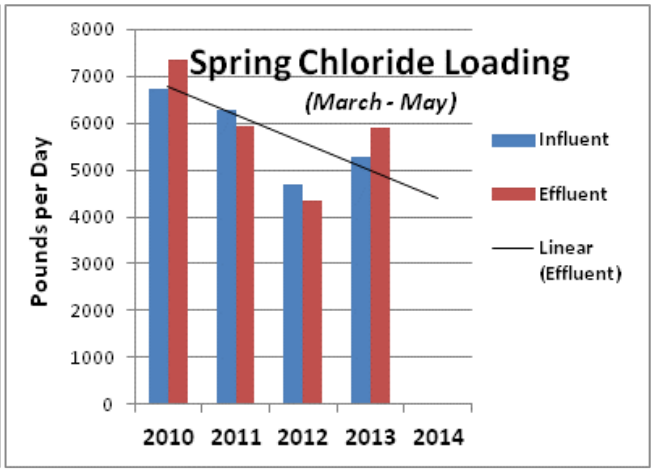



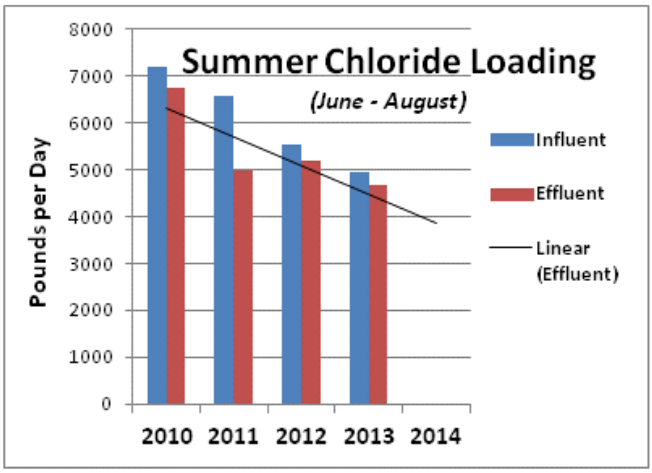

Seasonal variations of influent and effluent chlorides have also been reviewed to see if there are any obvious trends in chloride loading to the treatment plant. Spring and summer each show loading curves similar to the annual average loading; that is, the first three years of sampling show falling chloride loading, but 2013 show a marked increase in chloride loading. In both spring and summer sampling, the net trend is still downward. Chloride loading in the fall has oscillated annually, but the net trend is upward. Summer chloride loading is markedly different from the other three seasons. Summer chloride loading has strongly trended downward over the last four years.

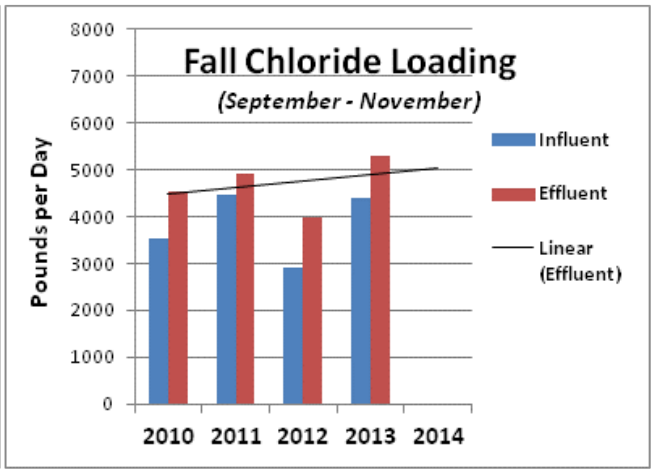
Although it is presumed that chloride loading in the winter is influenced by snowmelt and salt application to street and drives, this has not been confirmed. The Angola sewer system is

estimated to be less than 5% combined sewers, so net loading may actually be very low. The breakdown of seasonal chloride loading is included below.




In 2010, the Water Superintendent increased "finished" (water distributed to utility customers) water hardness by 80-100% (5-6 grains per gallon increased to 9-10 gpg). The purpose for this change was partially for cost savings, with annual salt cost reductions of $20,000 or more; however, the primary reason was to reduce chloride discharges to the sanitary sewer system. Throughout 2011 and 2012, utility customers were very vocal about the increased hardness. A number of customers reported installing water softeners during this period because of the increased hardness. After the Water Superintendent retired in 2013, new management began softening back to previous levels (6 gpg during the period sampled).

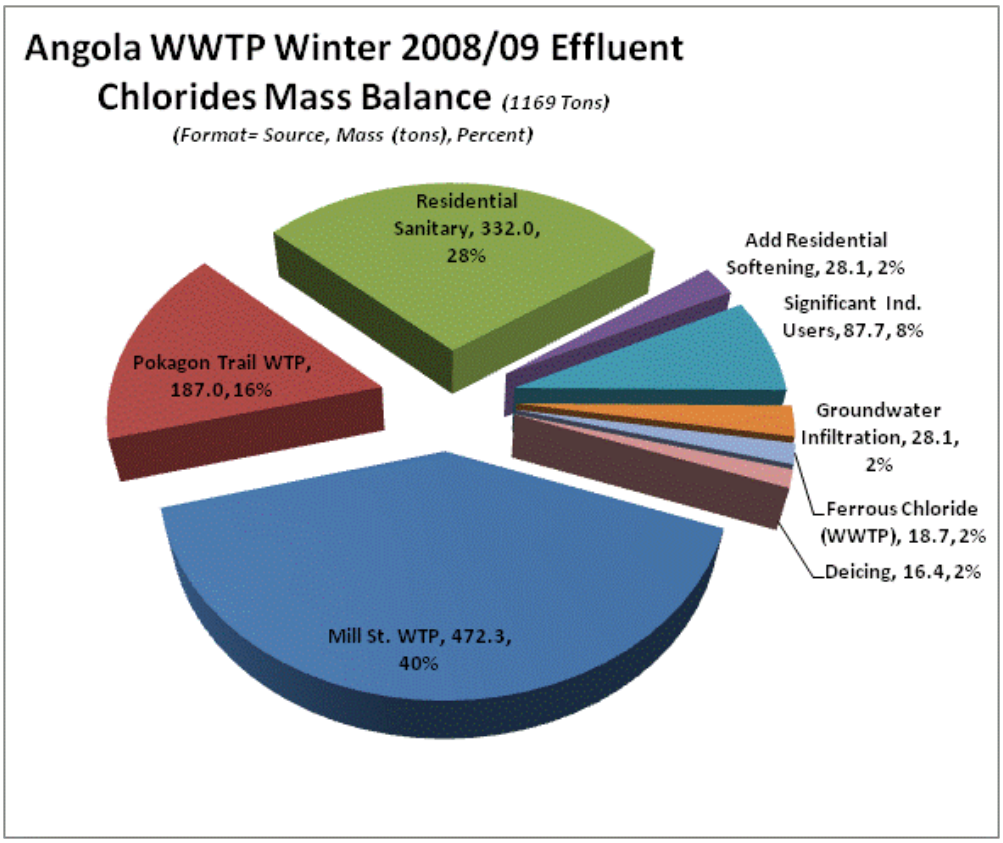
Although we believe that the effect of reducing municipal softening has actually caused a net increase to the treatment plant, the data suggest the exact opposite. During the initial assessment of chloride sources to the treatment plant, Jones & Henry Engineers estimated that residential softening accounted for approximately 2% of the total load, or 28.1 tons annually to the treatment plant. In the 2012/2013 assessment, we estimated that residential softening accounted for 1% or 9.1 tons annually; in 2013, this was estimated at 0.8%, or 6.4 tons annually. Future sampling efforts will be made to clarify the influence of residential softening.

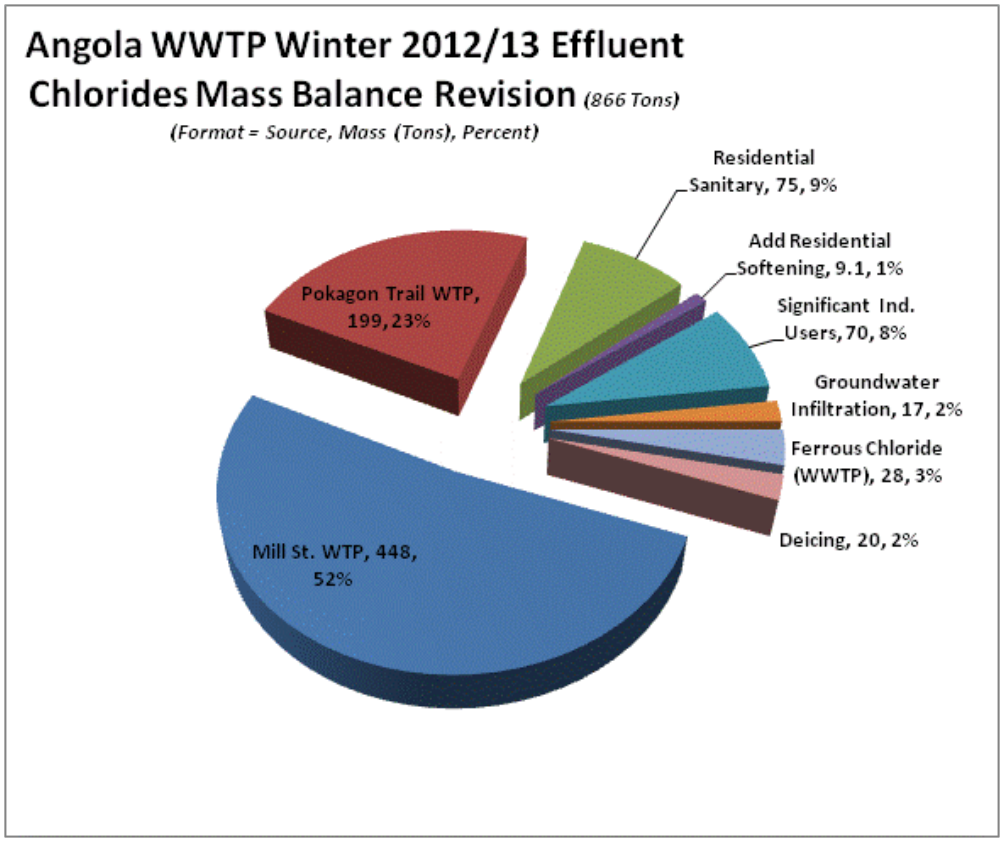
# PMPP Action Item 2 – Revision to Chloride Source Mass Balance

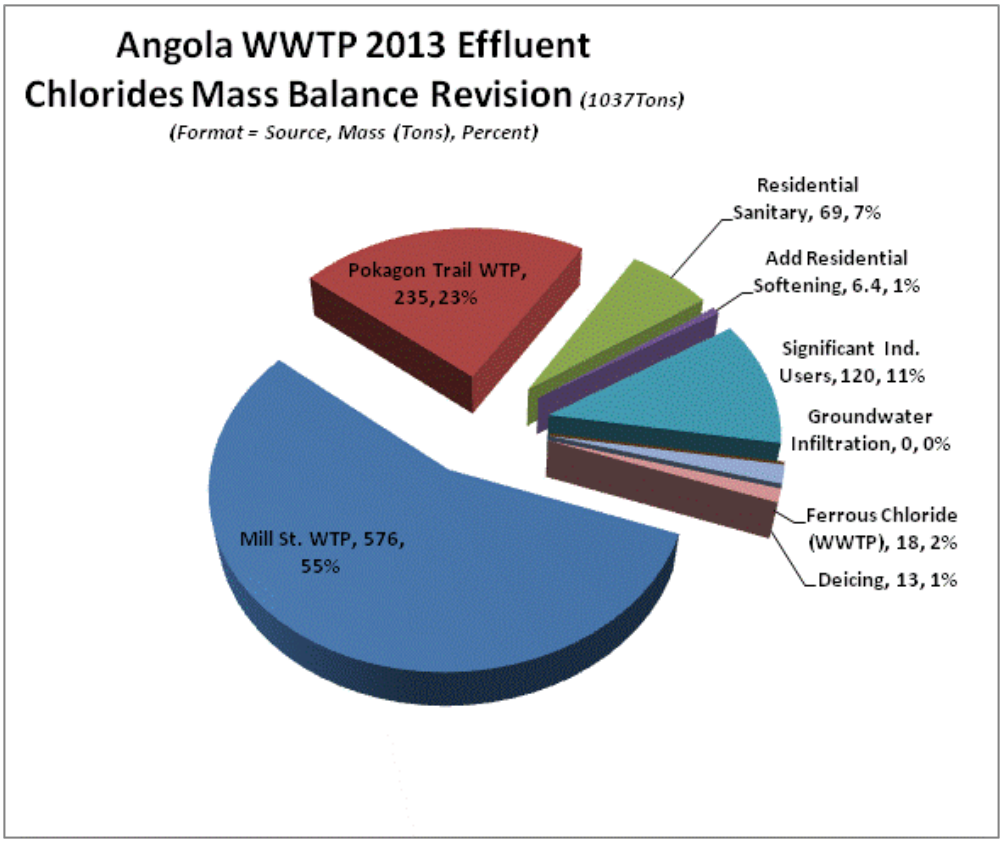
Collection system monitoring was completed during the August – October 2013 with direct read dataloggers that measure conductivity, which is used as a surrogate for chloride concentration. Once conductivity data is collected, correlation curves are established that will convert the conductivity data into chloride data. The revision to the mass balance of chloride sources is included in this report as Attachment 01, Mass Balance Report.

One of the primary issues that we have had with evaluating data from the dataloggers is that there are currently no monitors that will directly read chlorides. The two dataloggers that we use measure conductivity, and chloride concentration is calculated based on curves that are established as part of the set-up procedure. What we have found is that it appears that calculated chloride concentration seems to be consistently lower that grab or composite samples that are analyzed using EPA-Method chemistry. The variation between the datalogger and actual concentration is not linear, and we have not been able to successfully identify an equation that will reliably adjust the curve to match actual observed chloride concentration.

Graphical representation of the chloride mass balances is shown below:




Angola WWTP Winter 2012/13 Effluent
Chlorides Mass Balance Revision (866 Tons)
(Format = Source, Mass (Tons), Percent)
Residential Sanitary, 75, 9%
Add Residential Softening, 9.1, 1%
Significant Ind. Users, 70, 8%
Groundwater Infiltration, 17, 2%
Ferrous Chloride (WWTP), 28, 3%
Deicing, 20, 2%
Pokagon Trail WTP, 199, 23%
Mill St. WTP, 448, 52%


Angola WWTP 2013 Effluent
Chlorides Mass Balance Revision (1037Tons)
(Format = Source, Mass (Tons), Percent)
Residential Sanitary, 69, 7%
Add Residential Softening, 6.4, 1%
Significant Ind. Users, 120, 11%
Groundwater Infiltration, 0, 0%
Ferrous Chloride (WWTP), 18, 2%
Deicing, 13, 1%
Pokagon Trail WTP, 235, 23%
Mill St. WTP, 576, 55%

# PMPP Action Item 3 – Collection System Monitoring Program

The Angola WWTP completes regular monitoring of chlorides in the collection system. These samples are used to refine the chloride mass balance and to help us better understand where chlorides are coming from so that public education and outreach efforts are more effective.

It is the intention to complete annual monitoring in the late summer/early fall, with additional monitoring throughout the year as conditions warrant (snow melt on a combined sewer system, other events expected to characterize chloride loading to the collection system, etc.).

Sampling is completed at fifteen sites throughout the collection system. These sites include both water treatment plants, residential systems with and without supplemental softening, commercial and industrial sites, and areas that receive flow from combined sewers. Many of these sites were sampled as part of the original assessment completed for our variance submittal.

Each location is sampled at least once annually, generally for a period of 1-2 days. Additional sampling is conducted at sites when staff believes that:

1. There is a reasonable expectation that previous sampling efforts were not representative (i.e. calibration problem, faulty reading, etc);
2. Additional sampling will help clarify loading sources or cause, and/or;
3. Additional sampling will characterize a specific event not captured in previous samples (i.e. snowmelt on a combined sewer system, etc).

Sampling is conducted by using conductivity dataloggers placed directly into sewer flow lines and lift station wetwells. Conductivity is used as a surrogate for chloride concentration, and staff calibrates and calculates calibration curves based on standard operating procedures developed using methods identified from a number of published sources[1].

[1] *"Conductivity and Chloride Monitoring Summary 2007/2008"* D. Potts, D. Bounds, CDM for DuPage River Salt Creek Workgroup; *"Conductivity of Sodium Chloride and Water Solutions"* M. Gordey; *"Verifying the Use of Specific Conductance as a Surrogate for Chloride in Seawater Matrices"* R. Mooney; *"Chloride/Stream Gage Monitoring in the Hodgson Brook Watershed"* T. Walsh for New Hampshire Department of Environmental Services.

# PMPP Action Item 4 – Public Awareness Program

One of the key methods to reduce chloride discharges from the treatment plant is source reduction – keeping chlorides from entering the collection system. The purpose of the public awareness program is to inform and educate the public about what chlorides are, why chlorides are a problem, and how the public can be involved in reducing the amount chlorides discharged to the collection system.

Although the Water Utility softens the water distributed to utility customers, some residential and commercial customers choose to soften their water further. Generally, private water softeners are less efficient than the municipal system and private systems are rarely monitored and controlled by the owner. Private water softeners are most often set up to soften the entire water system, although softened water is only needed (wanted) at certain distribution points (i.e. kitchen sink tap, hot water feed, washer feed).

In 2011, the Water and Wastewater Utilities began a public education and outreach program. It is the intention of this program to educate utility customers for the long term goal of reducing chloride loading to the sewer system. During the fourth quarter of 2013, the Water and Wastewater utilities issued a joint notice to utility customers in the quarterly newsletter. In it, the WWTP addressed the problems that chlorides cause to downstream water bodies, and the water utility offered recommendations on how to assess if softening was needed, and if so, how to ensure that the softener was properly set. The water utility also offered to do onsite water testing and inspection of their softening systems. The newsletter is distributed to all utility customers served by the Water and Wastewater utilities.

A copy of the newsletter submission is included at the end of this report as Attachment 02, Newsletter Submission. The Water and Wastewater Utilities will continue working together to promote public education and outreach as it relates not only to chloride discharges, but to other parameters of concern as well (e.g. mercury, stormwater, etc).

# PMPP Action Item 5 – Water Treatment Optimization

During the development of the chloride variance application, the Water Treatment Utility completed an audit of its operations and modified its operations to reduce the amount of salt used in the process.

Currently, the Water Utility Superintendent is working with two engineering consultants to evaluate each critical element of the water treatment plants and is developing a multi-year plan to address operational deficiencies that have been identified. Overall process efficiency and treatment reliability is the primary goal for these improvements, but salt usage/chloride discharge is also an important consideration to treatment improvements.

Since 2010, additional process optimization methods have been taken at the Water Utility:

1. **Review of regeneration practices, regeneration intervals and salt dosage.**
   Proper regeneration of the softeners depends on controlling the brine and displacement rinse rates. For optimum results a 30 min. contact (20 minute minimum) at 8% concentration of salt (30% Salometer) must be achieved.
   If the brine is applied to fast the contact time will be shortened and if it is applied too slowly the desired concentration cannot be reached. In either case inefficient regeneration results in loss of softening capacity to some extent.
   A brine curve can be made at start-up to ensure maximum operating efficiency.
   Refer to the installation instructions for the initial setting of all valves and flow rates.
   Make trial regeneration and at this time plot a brine curve, so that during the next regeneration adjustments can be made.
2. **Best management practices that focus on salt usage reduction.**
   Plant operating records should be maintained daily.
   It is important to the successful operation of the treatment plants that a continuous record of plant operations be maintained.
   By review of plant records and comparison of operating results an operator can determine the operating condition of the treatment plants.
3. **Evaluation of the practicability of a brine reclamation program.**
   The City of Angola and Trine University previously explored the feasibility of a brine reclamation options to evaluate options that could have led to beneficial reuse of brine from the water treatment process as a deicing material. This project was abandoned due to what the City felt were unrealistic fiscal expectations from Trine University and a complete lack of follow through from IDEM officials when we requested guidance on what potential regulatory difficulties we might experience in this effort. At this time, the City of Angola has no intentions of proceeding with this option.
4. **Good housekeeping measures that focus on preventing incidental releases of salt to the collection system (spills, storage practices, etc.) – Including an overview of the water treatment plant process optimization practices.**
   The two ion exchange water treatment plants utilize underground brine storage tanks for the injection of brine to the ion exchange softeners; each regeneration is metered for the

proper amount of brine to be added. The brine waste is discharged to a detention tank and then pumped to the sanitary sewer system at a controlled rate.
Both underground storage tanks are sealed and water is added to the tanks when needed, being controlled by a float switch and solenoid valve to maintain a constant level in the tank.

5. **Other water softening efficiency measures intended to reduce the quantity of chloride discharged to the wastewater treatment plant.**
As noted previously, in 2013, new Water Utility management began softening back to previous levels (6 gpg during the period sampled). When the Water Utility made this adjustment, customers were notified in the City newsletter and on their utility bills about this change. The Water Utility is actively engaging customers to help them understand that additional softening is generally not necessary and how to increase the efficiency of their softening systems.

# PMPP Action Item 6 – Water Treatment Chloride Monitoring

Monitoring of discharge from the Water Treatment plants will continue on a quarterly basis. Monitoring will be completed with the conductivity dataloggers over a one week period (one week/quarter). Dataloggers will be installed immediately downstream of the final process of each treatment plant. It is noted that this element was not properly communicated to the staff responsible for quarterly monitoring at the Water Treatment plants. This has been corrected and quarterly monitoring will take place as described.

# PMPP Action Item 7 – Industrial User Monitoring

The Angola WWTP current operates a non-delegated industrial pretreatment program (a fully delegated program plan has been submitted to EPA for approval & implementation). This program requires quarterly monitoring of Significant Industrial Users for certain parameters. In 2010, the Wastewater Utility made it standard procedure to add chlorides to the list of parameters sampled during quarterly sampling. Other non-significant industrial users are periodically inspected and sampled and the Wastewater Utility has made it standard procedure to add chlorides to the list of parameters sampled at these facilities.

Currently, only one industrial user has been identified to have high levels of chlorides in their discharge stream. This elevated chloride is from additional softening that is completed onsite to further soften process water that is ultimately incorporated into their finished product.

Our Chloride Pollutant Minimization Program Plan includes the implementation of a non-residential users program that will address chloride reduction from non-residential users. As stated in last year's annual report, this program will initially target those non-residential users that contribute the highest load to the collection system.

In 2013, the Angola Industrial Pretreatment Coordinator began working with the significant industrial user that has been identified as having a high chloride content in their discharge. The summary of the actions taken and anticipated outcomes are included with this submission as Attachment 03, Industrial Action.

# PMPP Action Item 8 – Non-point Source Contribution

Non-point source contributions of chlorides come from areas of the collection system that still received run-off from stormwater inlets that are connected to the combined sewer system. Calculated loading from the combined sewer system is very low, generally around 2% of the overall loading to the treatment plant. Loading from the combined sewer system can be reduced in two primary ways:

1. **Remove combined sewer inlets from the sanitary sewer.**
   The City of Angola maintains and operates a combined sewer system with an approved Combined Sewer Overflow Operation Plan (CSOOP) and has completed all of the required elements of its CSO Long Term Control Plan (LTCP). The City continues to complete separation projects as resources permit. In 2012, approximately 1.2 acres of impervious surface was removed from the combined sewer system. This year more than 6 acres will be removed as part of an improvement project along US Highway 20 corridor.
2. **Minimize the use of de-icing materials.**
   The City of Angola is the county seat of Steuben County, with state highway and county roads providing access into the community. Because of this, controlling the application of de-icing materials from the state and county highway departments is not feasible. Approximately half of the right-of-way that is still served by combined sewers is in the state highway.
   The City of Angola Street Department is responsible for applying de-icing and abrasive materials to city streets. The Street Commissioner directs and oversees the application of salt and uses best management practices to minimize the use of salt in all areas. Best management practices are used to balance the needs for public safety, fiscal responsibility and the environment.

# PMPP Action Item 9 – Alternate Methods to Achieve WQBEL's

In the original variance submission, a number of methods to achieve the WQBEL's were submitted, many of which were considered infeasible. These methods included:

- Converting the Water Treatment Plant to Lime Soda Softening;
- Converting the Water Treatment Plant to Membrane Softening:
- Installing Membrane Filtration to Side Stream Wastes at the Water Treatment Plant;
- Various Methods to Modify Post-Treatment Discharge to the H.D. Wood Ditch;
- Various Methods to Discharge Directly to the Pigeon Creek.

All of these alternatives were considered infeasible due to prohibitive cost and/or because they provided no net benefit to the watershed. No substantive changes to the economies of these methods have been observed in the last four years, and these alternatives are still considered infeasible.

## List of Attachments:

- Attachment 01, Revised Mass Balance Report
- Attachment 02, 3rd Quarter 2013 City Newsletter Submission
- Attachment 03, Industrial User Action

# Mass Balance of Chloride Sources
# In the Wastewater Treatment Plant Effluent

*Revised: October 2013 by Alex Snyder, Trine University, intern with Angola WWTP*

## Introduction:

This chloride monitoring report contents and format for the WWTP represents a revision from a previous version produced by Jones & Henry Engineers.

The intent of this study was to determine the general contribution of chlorides from various sources in the wastewater collection system. Chloride monitoring was performed in select pump stations and manhole locations that predominantly represent the various users (i.e. newer residential, older residential, commercial, industrial and institutional). Most areas averaged from 80 mg/L to 270 mg/L of chlorides in the wastewater. We did find a large increase with very high peak discharges from an area that is a mix of industrial, commercial and some residential.

Based on the chloride monitoring performed and the City's sampling data and flow records, we were able to calculate the annual concentration of chlorides from significant sources within the collection system.

## Sampling:

Chloride monitoring was performed from August, 2013 through October, 2013 by a Trine University intern for the Angola WWTP. Monitoring was performed with two portable data loggers, HOBO Conductivity Logger U24 and Solinst Levelogger Model 3001, each with an electrode ion-select chloride monitoring probe. The portable meter was set to record at approximately 15 minute intervals and measured the μS/cm conductivity in the wastewater. The data loggers were continuously immersed in wastewater at each monitoring location and set to record throughout the monitoring period. The meter calibration was checked before installation and following data retrieval at various monitoring locations. Grab samples were obtained from sample locations and analyzed with titration of the sample.

## Chlorides in Softener Waste from Mill Street (South) Water Plant:

The City provided records for salt purchased from August 2013 through October 2013 for this water treatment plant. Records indicate the City used 147 tons of salt for this water plant during the period reviewed.

## Chlorides in Softener Waste from North Water Plant:

The City provided records for salt purchased from August 2013 through October 2013 for this water treatment plant. Records indicate the City used 60 tons of salt for this water plant during the period reviewed.

Average Sanitary Waste Without Softeners:

The Village Green Lift Station serves an apartment complex of 100 units. There are no additional water softeners located within these residential units therefore monitoring from this lift station was assumed to be typical of sanitary waste without additional residential water softening. The average contribution from sanitary waste without softeners was measured to be 127 mg/L.

Average Residential Water Softener Waste:

The Northcrest Pump Station serves a relatively new development. The majority of homes are believed to have water softeners. Water softener regeneration was indicated in the monitoring performed for this lift station. The average chloride concentration for flow tributary to this pump station was 174 mg/L. By subtracting the average concentration of chlorides from Village Green we were able to estimate the additional contribution of chlorides from home water softeners. The mass balance of annual chlorides within the collection system assumes that 25% of the homes in the City of Angola have residential water softeners.

Significant Industrial Waste:

Based on the 2$^{nd}$ quarter 2013 analysis and metered flows during that period, loading from the three Significant Industrial Users accounts for approximately 120 tons per year.

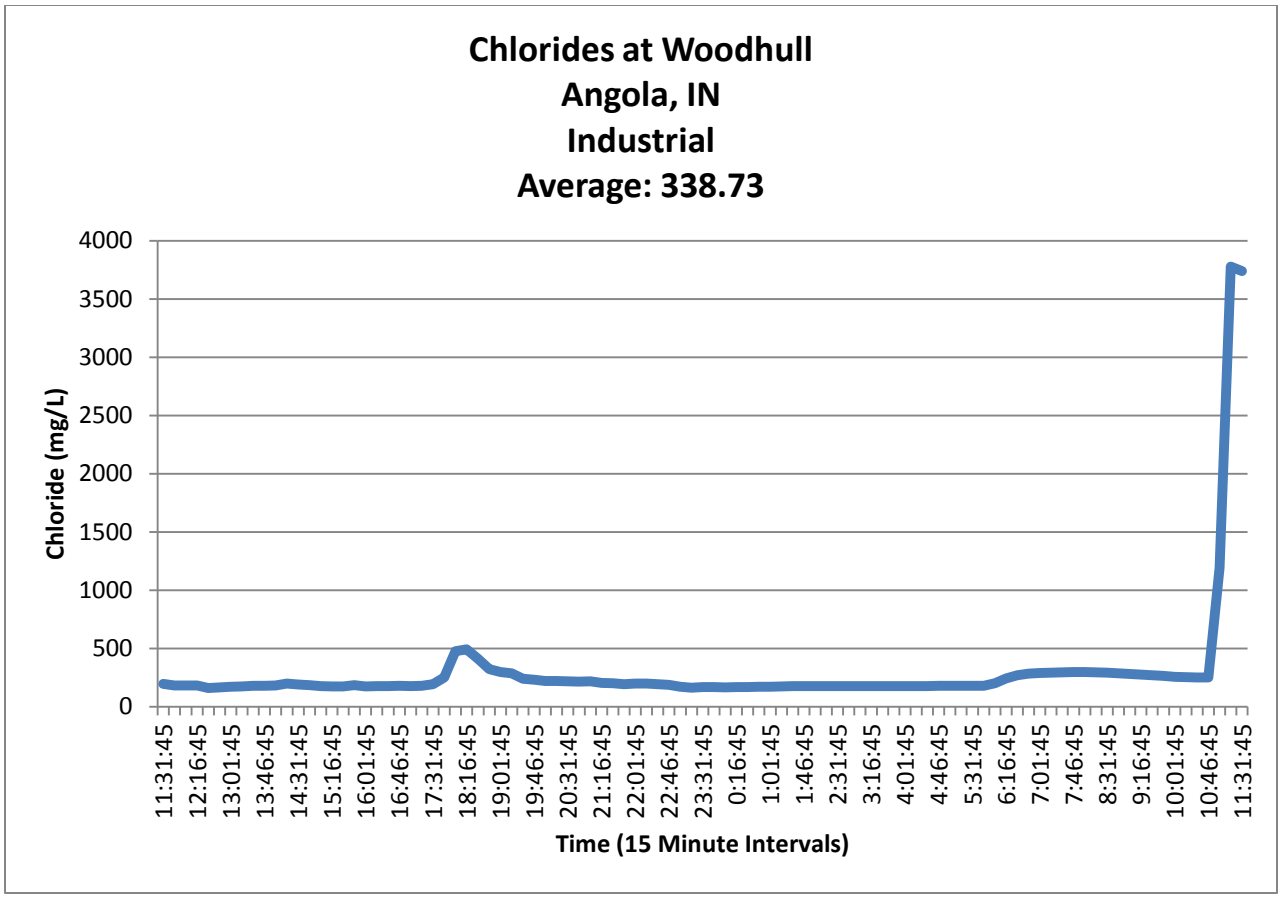
De-Icing Runoff in Combined Sewer Area:

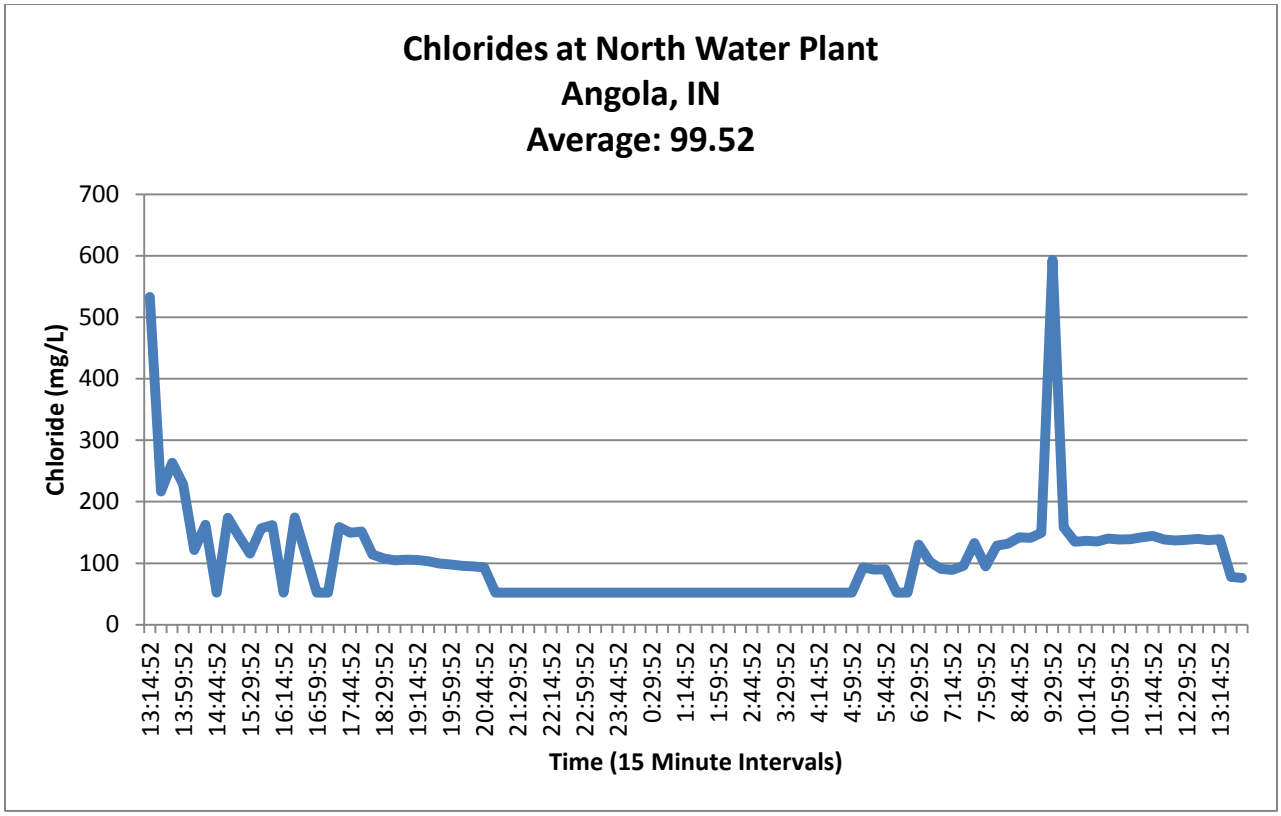
During the winter of 2013/2014, the City applied approximately 720 tons of salt for de-icing purposes in winter weather to approximately thirty miles of streets. Based on stoichiometric ratios of the salt being used and assuming a combined sewer area of 3%, this accounts for approximately 13 tons of chloride loading annually. Although private property application of deicing materials certainly represents a load to the POTW, we do not have any way to begin quantifying this load, and is not included in any calculations or estimations.

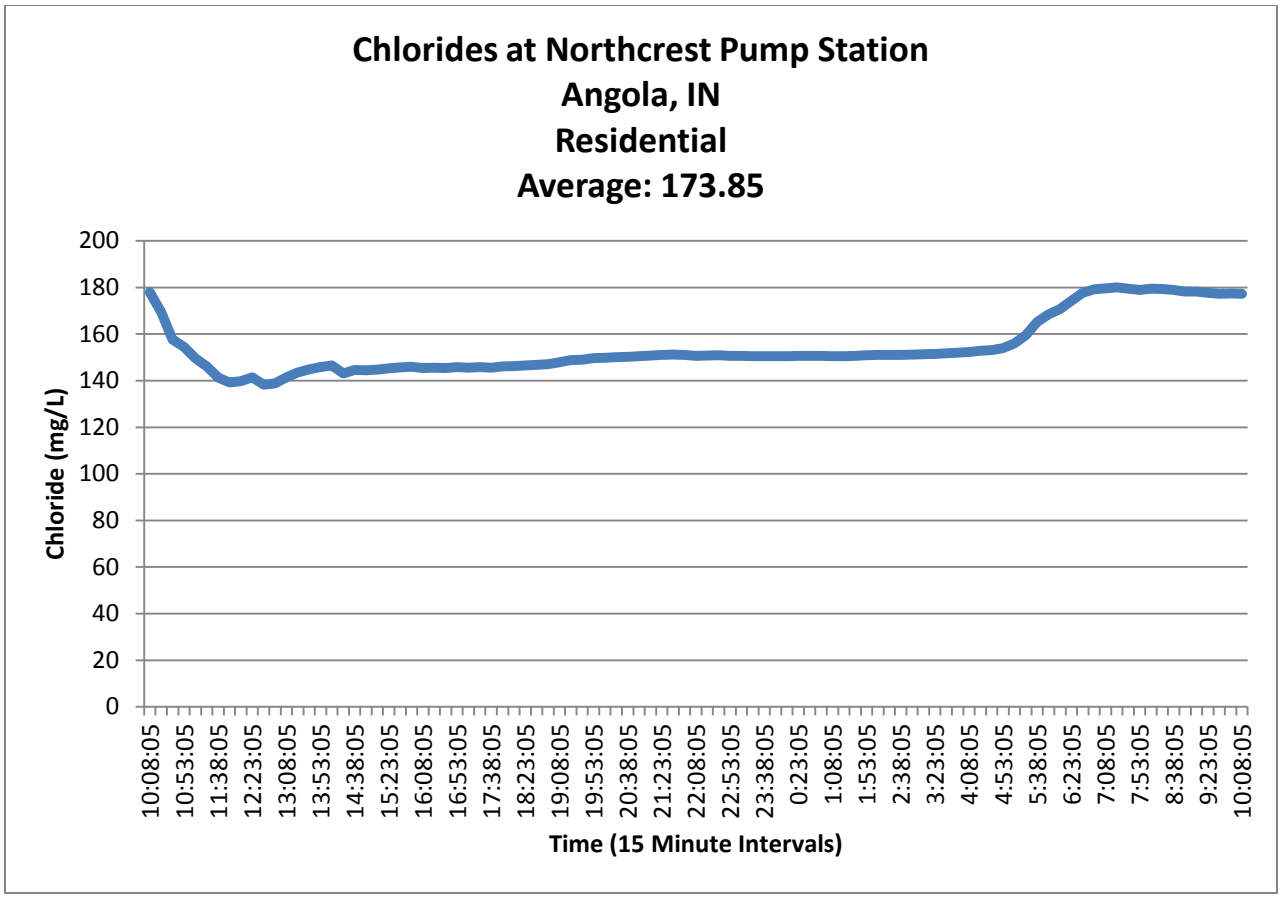
Ferrous Chloride at WWTP:

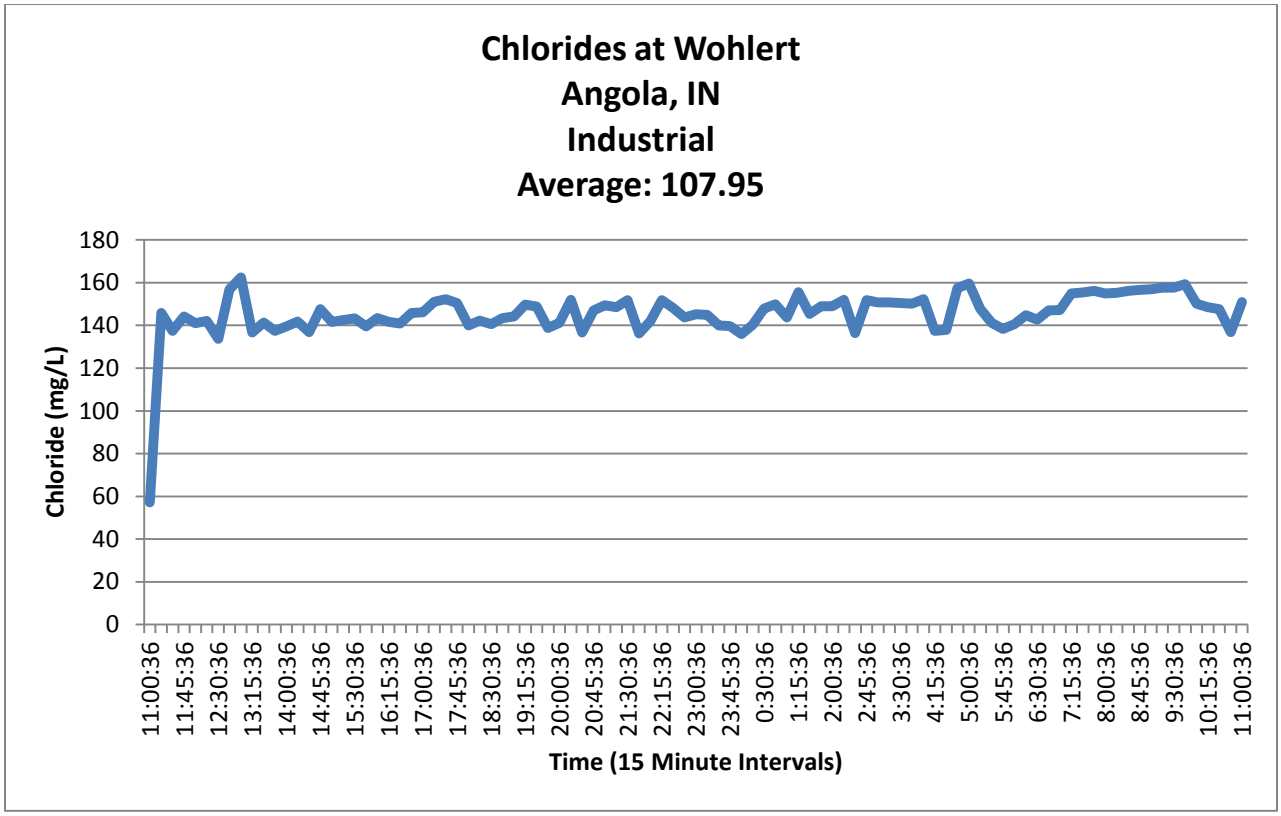
The City uses approximately 60 gallons per day of ferrous chloride for phosphorus removal at the wastewater treatment plant. Based on supplier-reported composition of each batch and stoichiometric ratios, it is calculated that the addition a of ferrous chloride accounts for an annual chloride load of approximately 18 tons.

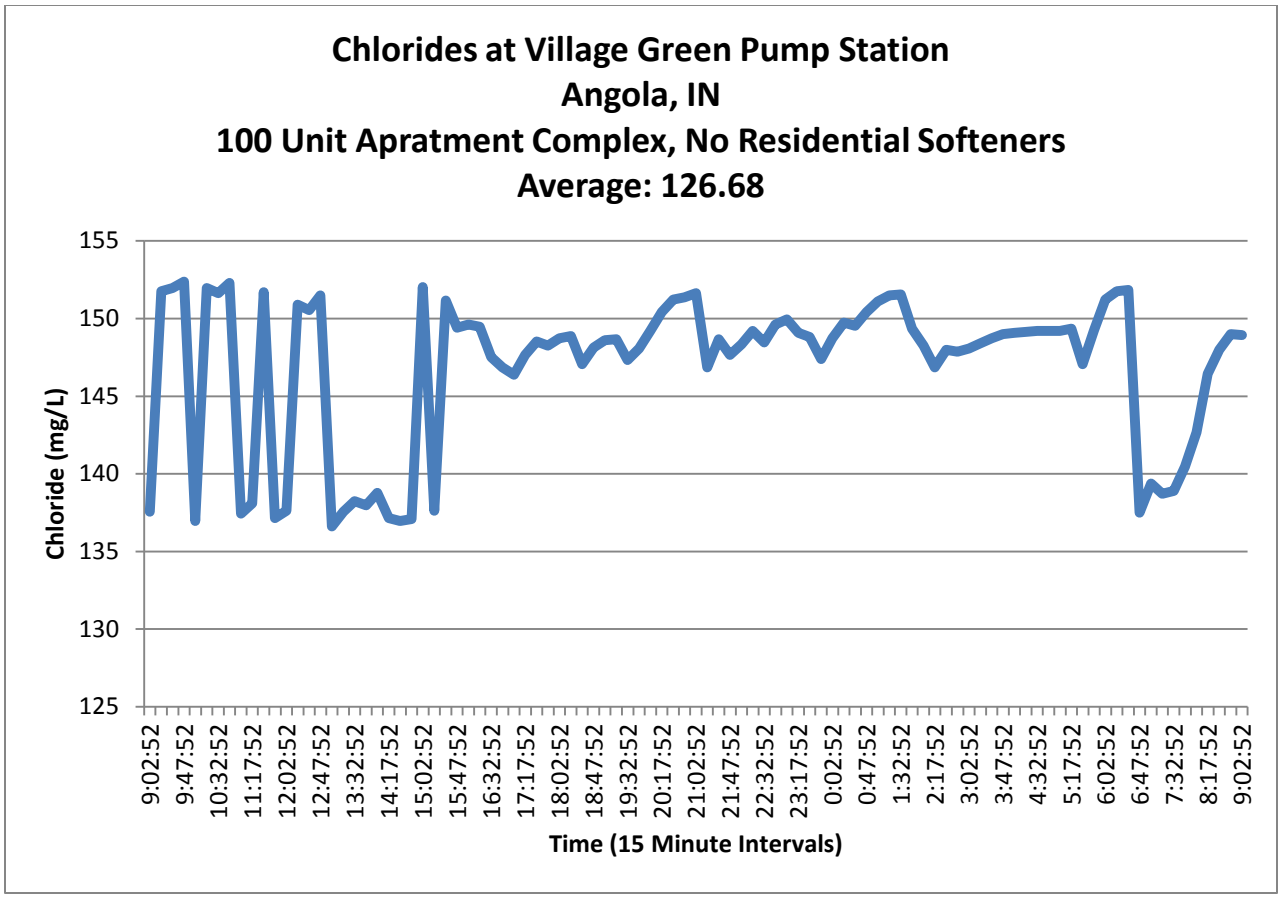
Graphical Representation of Collection System Monitoring:

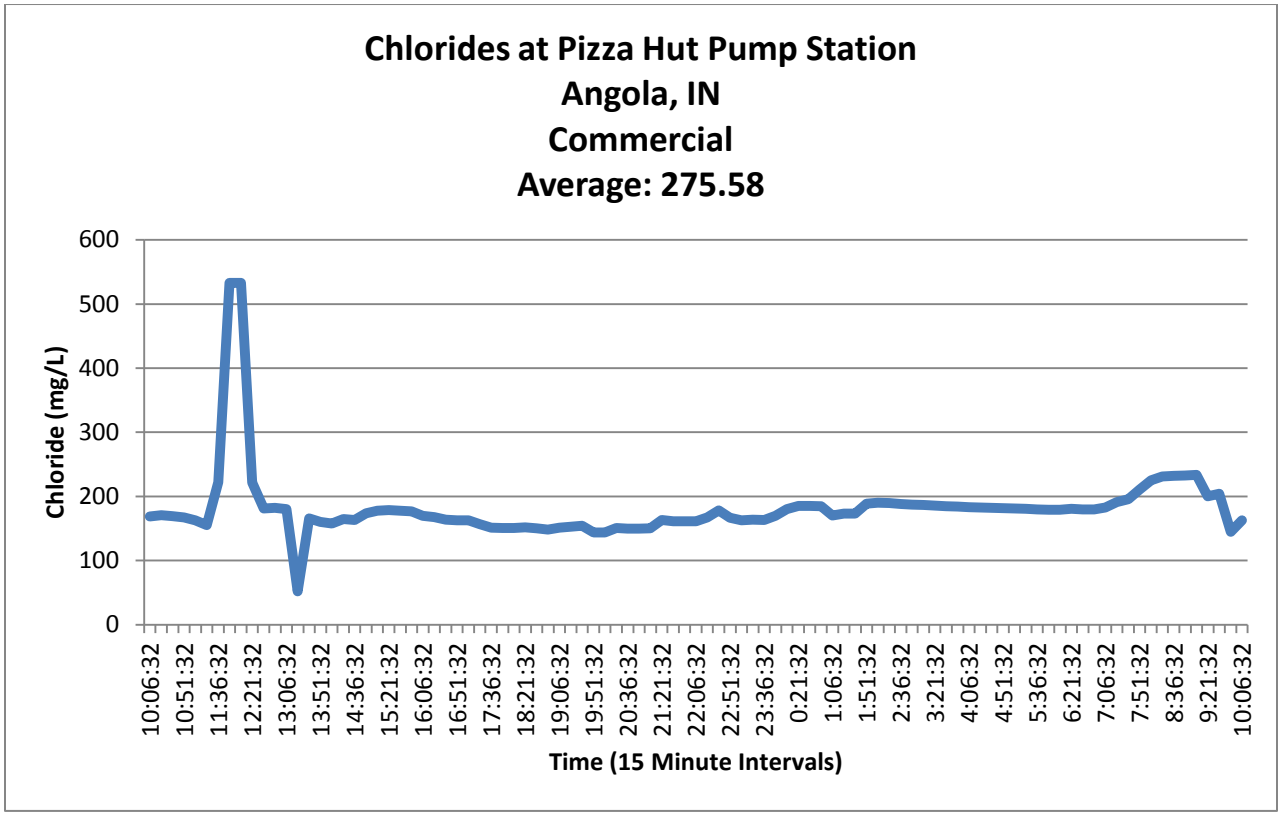

Chlorides at Woodhull
Angola, IN
Industrial
Average: 338.73
Chloride (mg/L)
4000
3500
3000
2500
2000
1500
1000
500
0
11:31:45
12:16:45
13:01:45
13:46:45
14:31:45
15:16:45
16:01:45
16:46:45
17:31:45
18:16:45
19:01:45
19:46:45
20:31:45
21:16:45
22:01:45
22:46:45
23:31:45
0:16:45
1:01:45
1:46:45
2:31:45
3:16:45
4:01:45
4:46:45
5:31:45
6:16:45
7:01:45
7:46:45
8:31:45
9:16:45
10:01:45
10:46:45
11:31:45
Time (15 Minute Intervals)

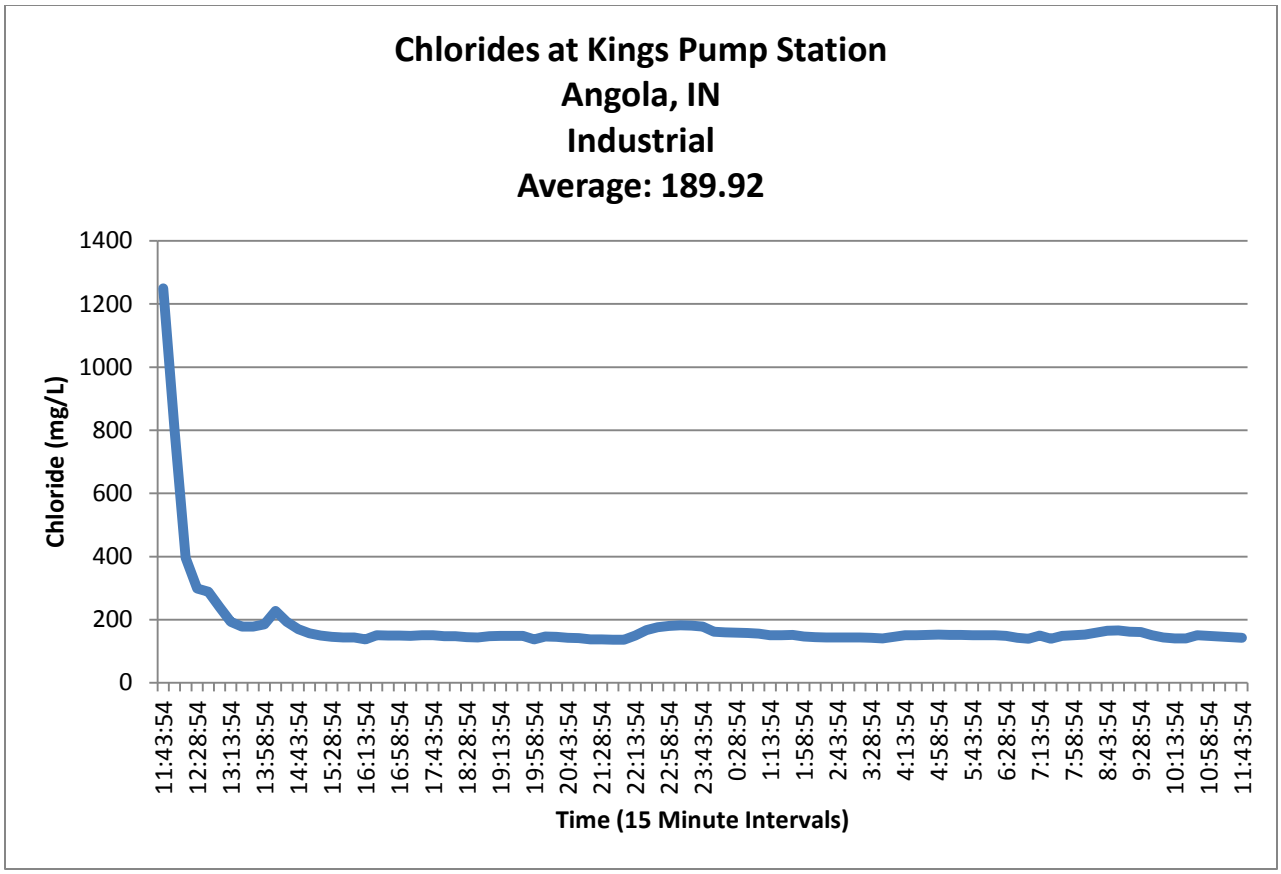

Chlorides at North Water Plant
Angola, IN
Average: 99.52
Chloride (mg/L)
700
600
500
400
300
200
100
0
13:14:52
13:59:52
14:44:52
15:29:52
16:14:52
16:59:52
17:44:52
18:29:52
19:14:52
19:59:52
20:44:52
21:29:52
22:14:52
22:59:52
23:44:52
0:29:52
1:14:52
1:59:52
2:44:52
3:29:52
4:14:52
4:59:52
5:44:52
6:29:52
7:14:52
7:59:52
8:44:52
9:29:52
10:14:52
10:59:52
11:44:52
12:29:52
13:14:52
Time (15 Minute Intervals)

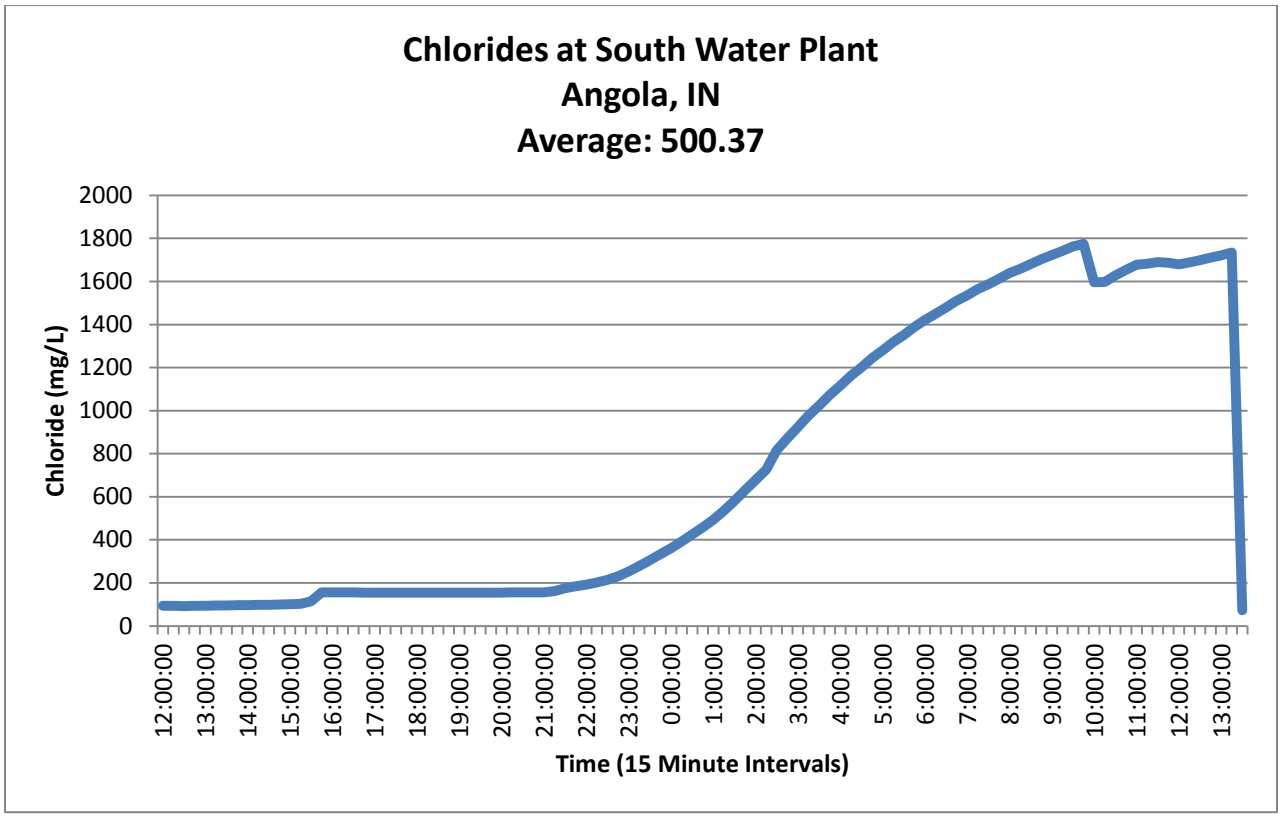

Chlorides at Northcrest Pump Station
Angola, IN
Residential
Average: 173.85
Chloride (mg/L)
200
180
160
140
120
100
80
60
40
20
0
10:08:05
10:53:05
11:38:05
12:23:05
13:08:05
13:53:05
14:38:05
15:23:05
16:08:05
16:53:05
17:38:05
18:23:05
19:08:05
19:53:05
20:38:05
21:23:05
22:08:05
22:53:05
23:38:05
0:23:05
1:08:05
1:53:05
2:38:05
3:23:05
4:08:05
4:53:05
5:38:05
6:23:05
7:08:05
7:53:05
8:38:05
9:23:05
10:08:05
Time (15 Minute Intervals)

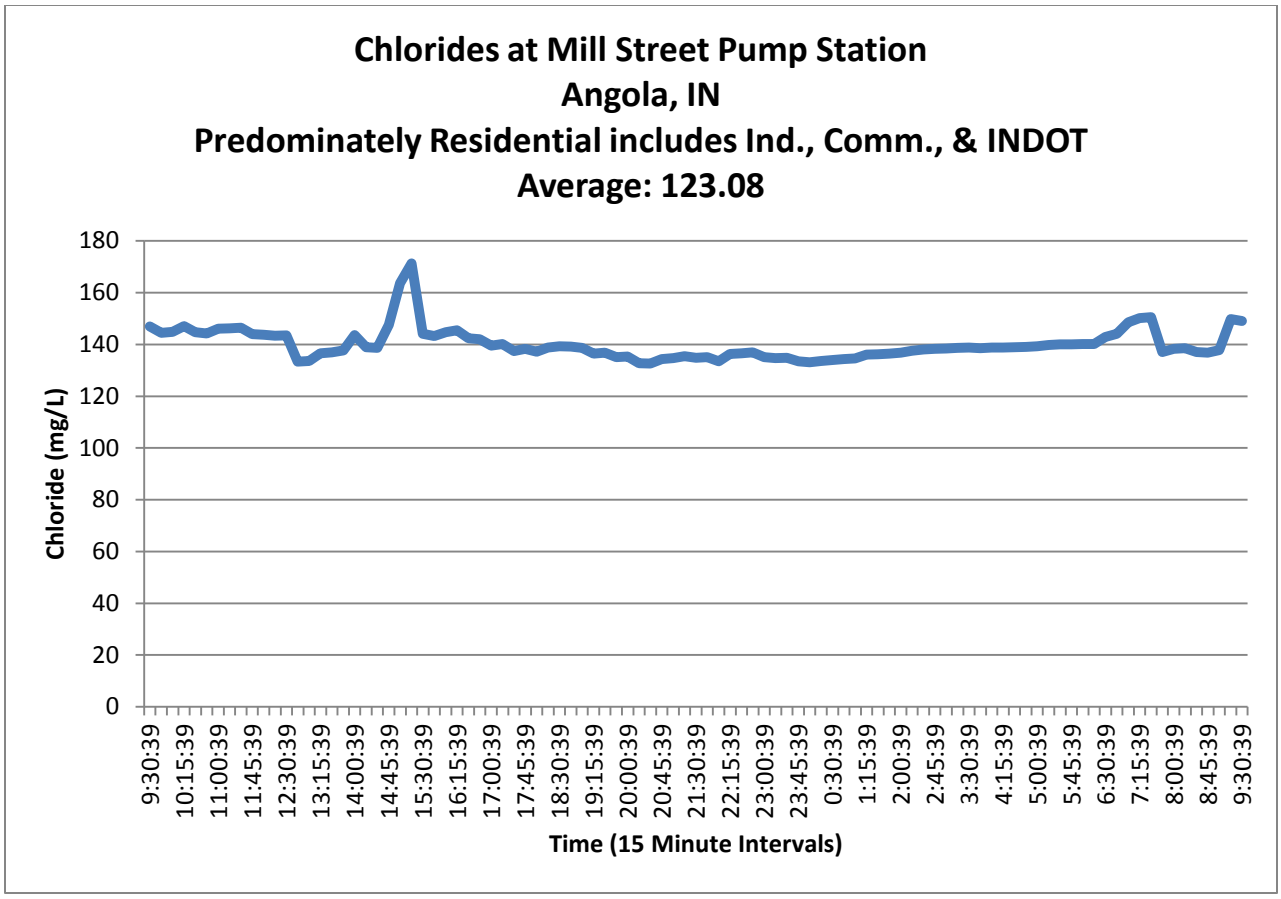

Chlorides at Wohlert
Angola, IN
Industrial
Average: 107.95
Chloride (mg/L)
180
160
140
120
100
80
60
40
20
0
11:00:36
11:45:36
12:30:36
13:15:36
14:00:36
14:45:36
15:30:36
16:15:36
17:00:36
17:45:36
18:30:36
19:15:36
20:00:36
20:45:36
21:30:36
22:15:36
23:00:36
23:45:36
0:30:36
1:15:36
2:00:36
2:45:36
3:30:36
4:15:36
5:00:36
5:45:36
6:30:36
7:15:36
8:00:36
8:45:36
9:30:36
10:15:36
11:00:36
Time (15 Minute Intervals)

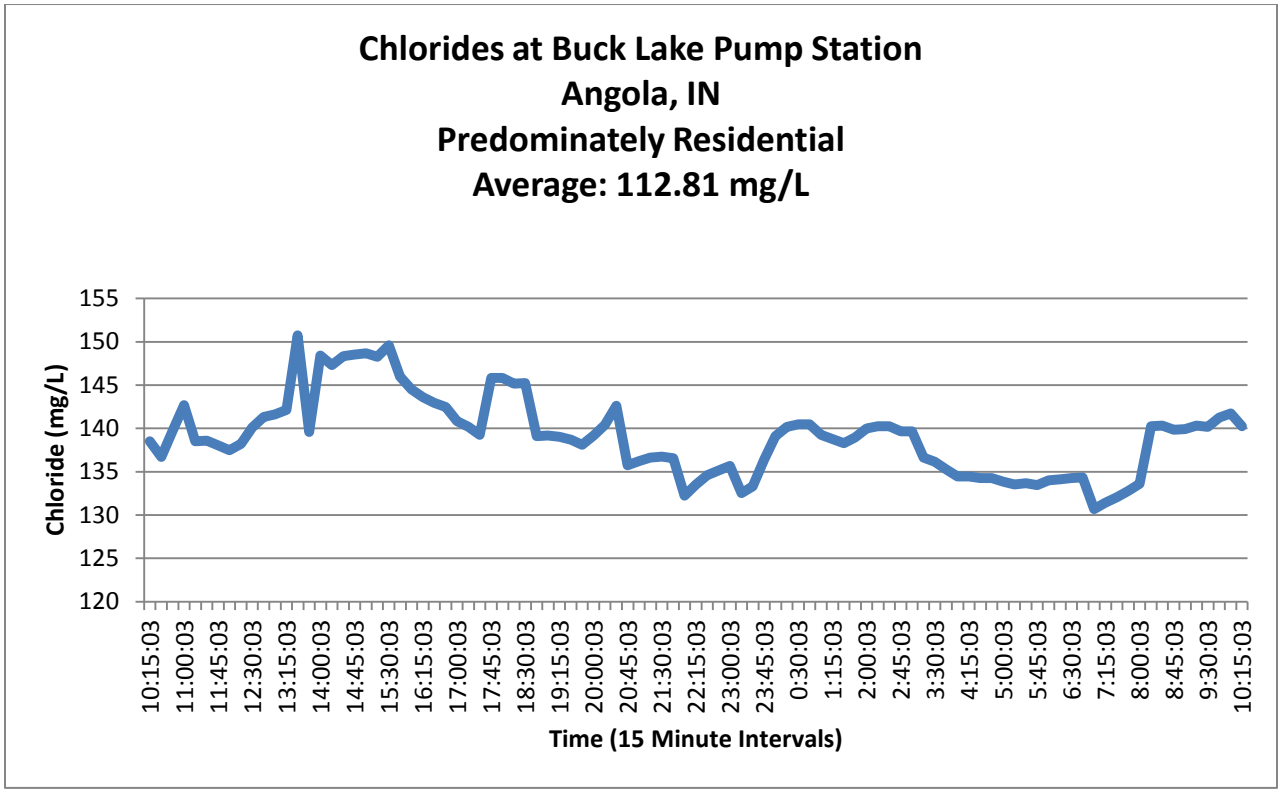

Chlorides at Village Green Pump Station
Angola, IN
100 Unit Apratment Complex, No Residential Softeners
Average: 126.68
Chloride (mg/L)
155
150
145
140
135
130
125
9:02:52
9:47:52
10:32:52
11:17:52
12:02:52
12:47:52
13:32:52
14:17:52
15:02:52
15:47:52
16:32:52
17:17:52
18:02:52
18:47:52
19:32:52
20:17:52
21:02:52
21:47:52
22:32:52
23:17:52
0:02:52
0:47:52
1:32:52
2:17:52
3:02:52
3:47:52
4:32:52
5:17:52
6:02:52
6:47:52
7:32:52
8:17:52
9:02:52
Time (15 Minute Intervals)

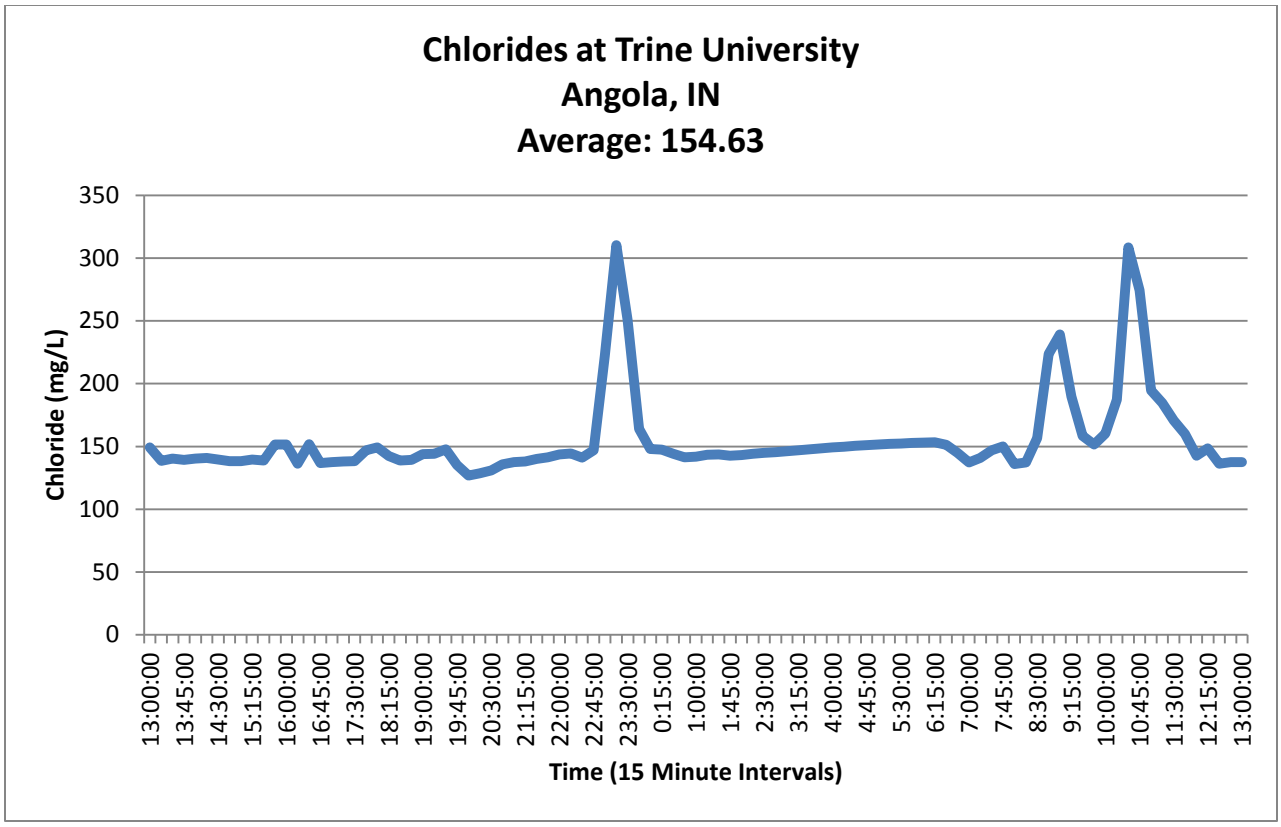

Chlorides at Pizza Hut Pump Station
Angola, IN
Commercial
Average: 275.58
Chloride (mg/L)
600
500
400
300
200
100
0
10:06:32
10:51:32
11:36:32
12:21:32
13:06:32
13:51:32
14:36:32
15:21:32
16:06:32
16:51:32
17:36:32
18:21:32
19:06:32
19:51:32
20:36:32
21:21:32
22:06:32
22:51:32
23:36:32
0:21:32
1:06:32
1:51:32
2:36:32
3:21:32
4:06:32
4:51:32
5:36:32
6:21:32
7:06:32
7:51:32
8:36:32
9:21:32
10:06:32
Time (15 Minute Intervals)

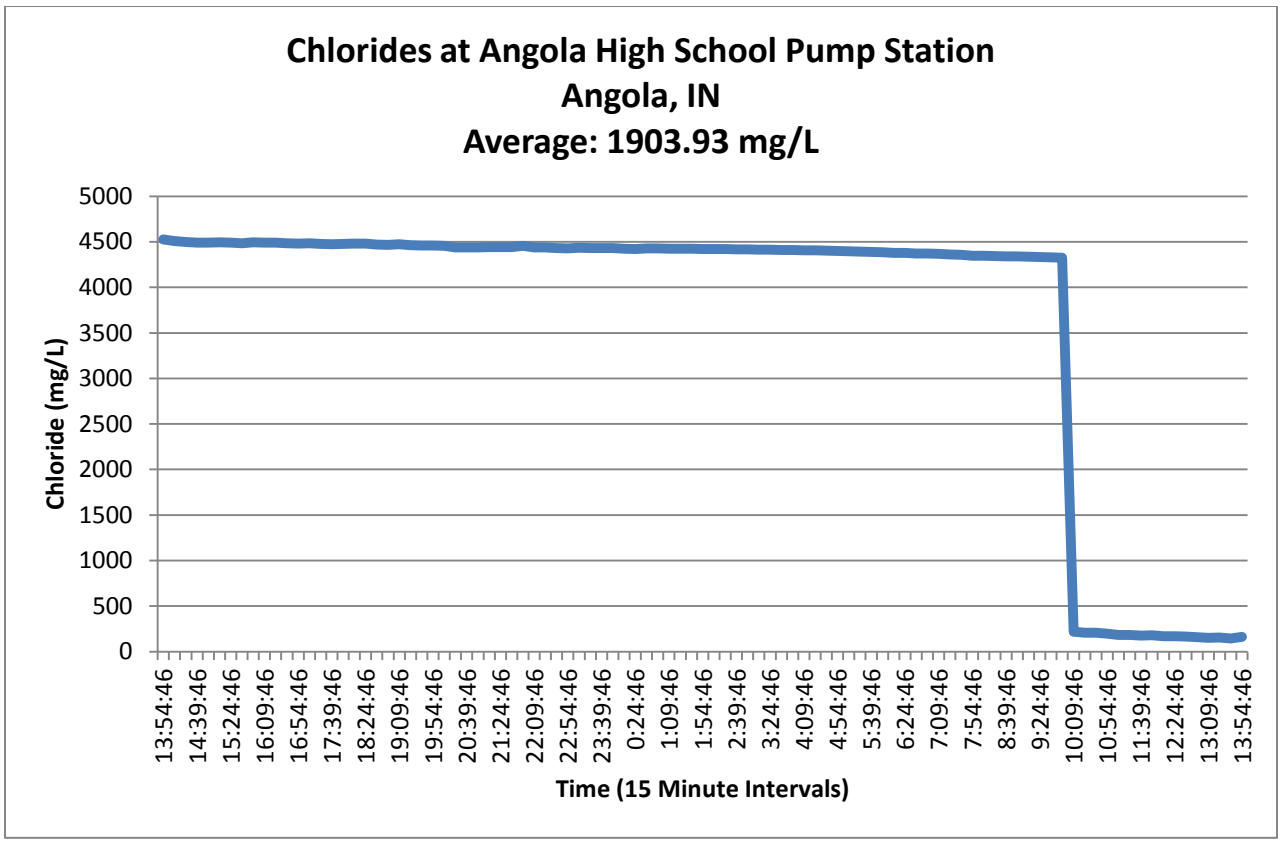

Chlorides at Kings Pump Station
Angola, IN
Industrial
Average: 189.92
Chloride (mg/L)
1400
1200
1000
800
600
400
200
0
11:43:54
12:28:54
13:13:54
13:58:54
14:43:54
15:28:54
16:13:54
16:58:54
17:43:54
18:28:54
19:13:54
19:58:54
20:43:54
21:28:54
22:13:54
22:58:54
23:43:54
0:28:54
1:13:54
1:58:54
2:43:54
3:28:54
4:13:54
4:58:54
5:43:54
6:28:54
7:13:54
7:58:54
8:43:54
9:28:54
10:13:54
10:58:54
11:43:54
Time (15 Minute Intervals)

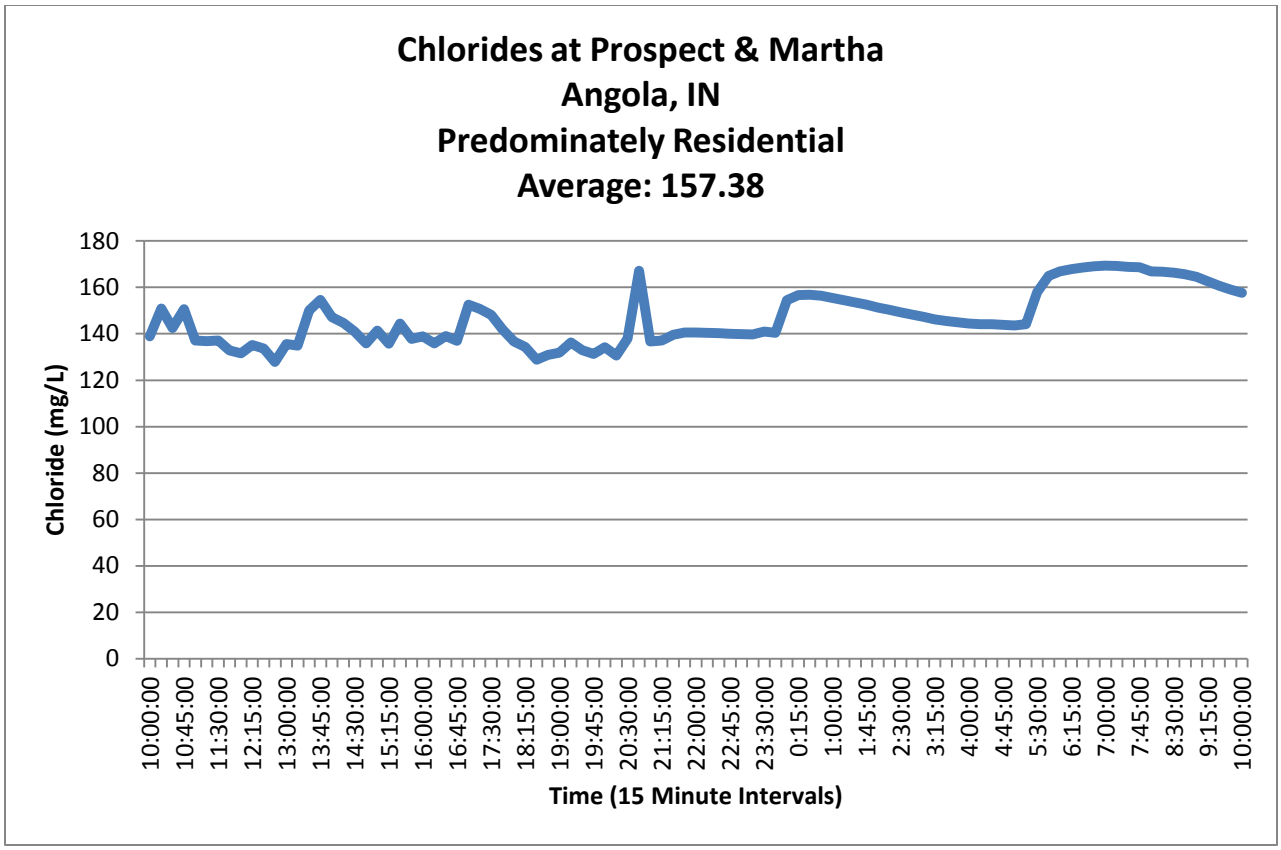

Chlorides at South Water Plant
Angola, IN
Average: 500.37
Chloride (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
12:00:00
13:00:00
14:00:00
15:00:00
16:00:00
17:00:00
18:00:00
19:00:00
20:00:00
21:00:00
22:00:00
23:00:00
0:00:00
1:00:00
2:00:00
3:00:00
4:00:00
5:00:00
6:00:00
7:00:00
8:00:00
9:00:00
10:00:00
11:00:00
12:00:00
13:00:00
Time (15 Minute Intervals)

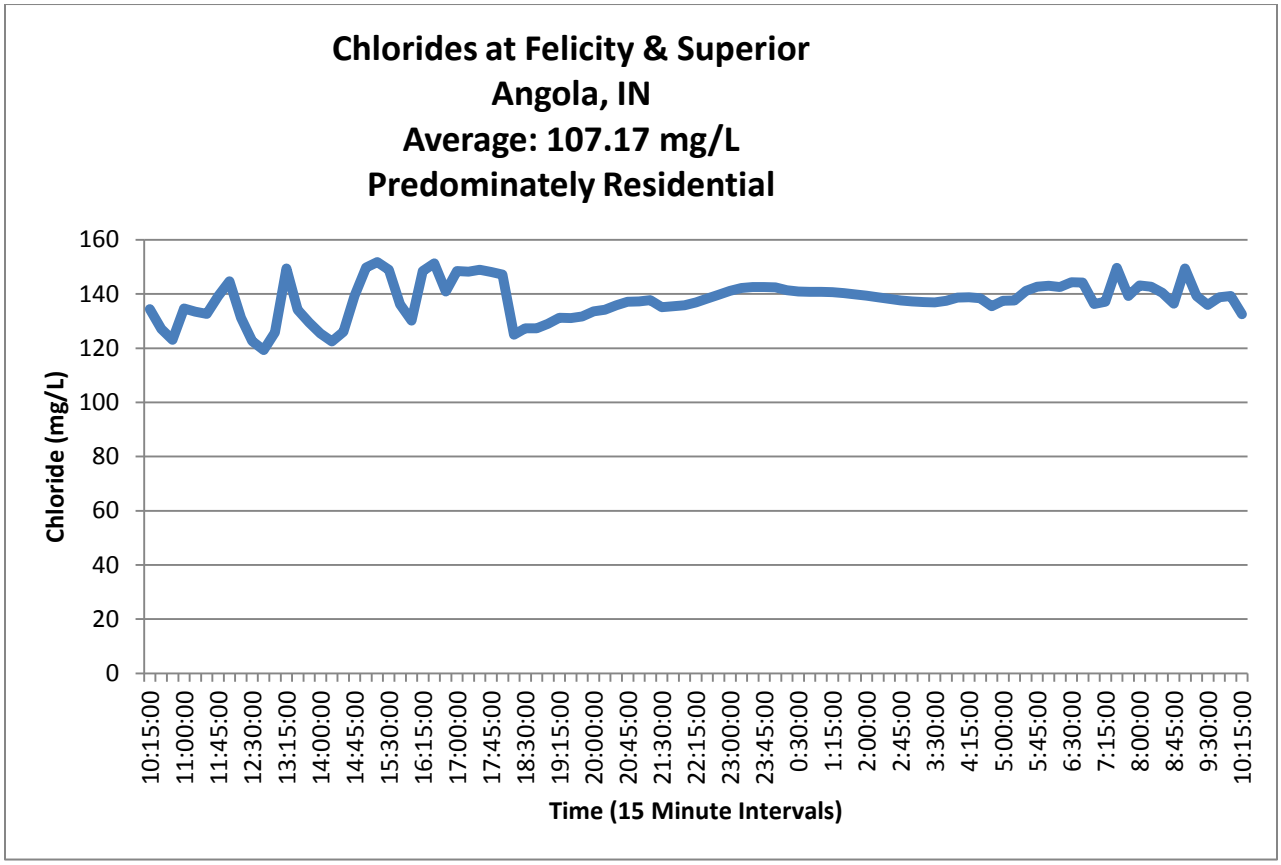

Chlorides at Mill Street Pump Station
Angola, IN
Predominately Residential includes Ind., Comm., & INDOT
Average: 123.08
Chloride (mg/L)
180
160
140
120
100
80
60
40
20
0
9:30:39
10:15:39
11:00:39
11:45:39
12:30:39
13:15:39
14:00:39
14:45:39
15:30:39
16:15:39
17:00:39
17:45:39
18:30:39
19:15:39
20:00:39
20:45:39
21:30:39
22:15:39
23:00:39
23:45:39
0:30:39
1:15:39
2:00:39
2:45:39
3:30:39
4:15:39
5:00:39
5:45:39
6:30:39
7:15:39
8:00:39
8:45:39
9:30:39
Time (15 Minute Intervals)

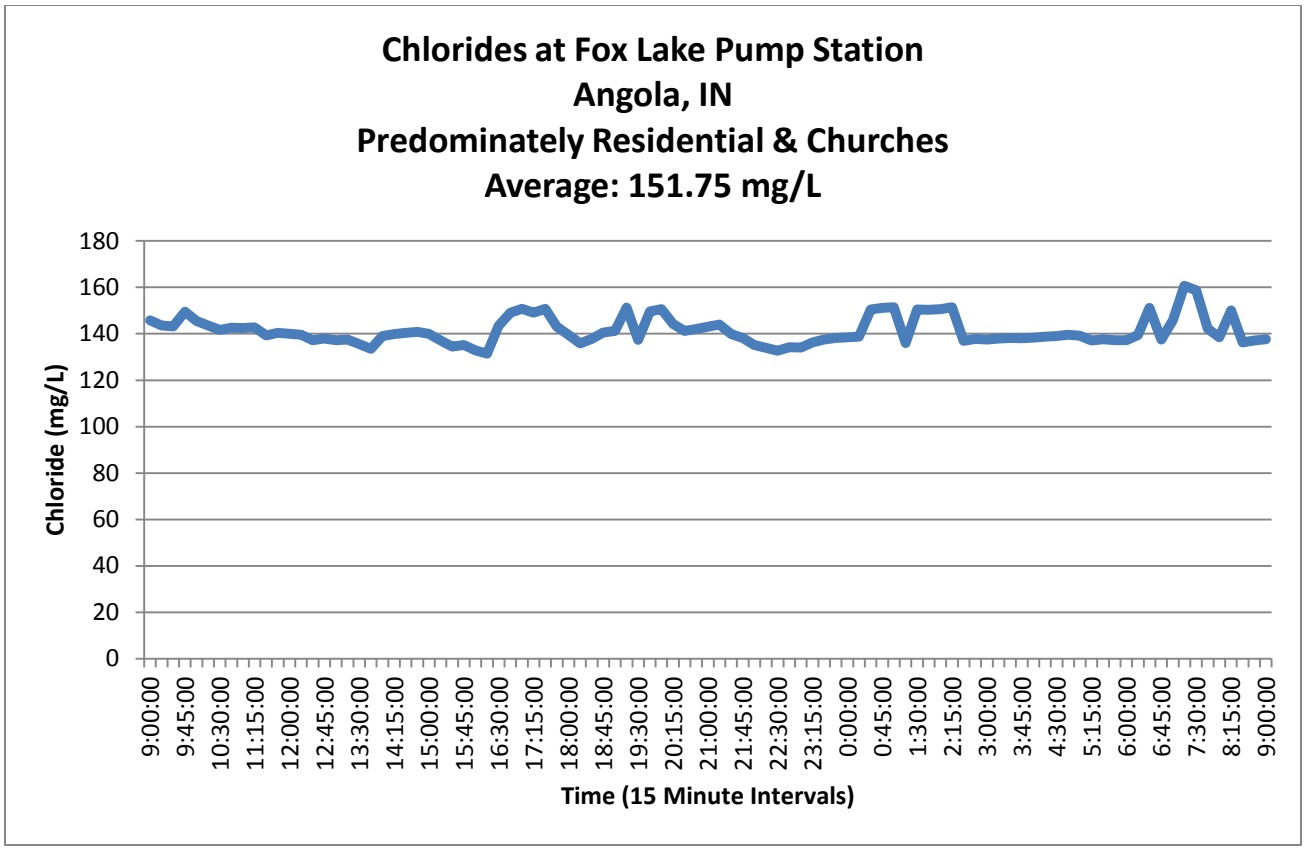

Chlorides at Buck Lake Pump Station
Angola, IN
Predominately Residential
Average: 112.81 mg/L
Chloride (mg/L)
155
150
145
140
135
130
125
120
10:15:03
11:00:03
11:45:03
12:30:03
13:15:03
14:00:03
14:45:03
15:30:03
16:15:03
17:00:03
17:45:03
18:30:03
19:15:03
20:00:03
20:45:03
21:30:03
22:15:03
23:00:03
23:45:03
0:30:03
1:15:03
2:00:03
2:45:03
3:30:03
4:15:03
5:00:03
5:45:03
6:30:03
7:15:03
8:00:03
8:45:03
9:30:03
10:15:03
Time (15 Minute Intervals)

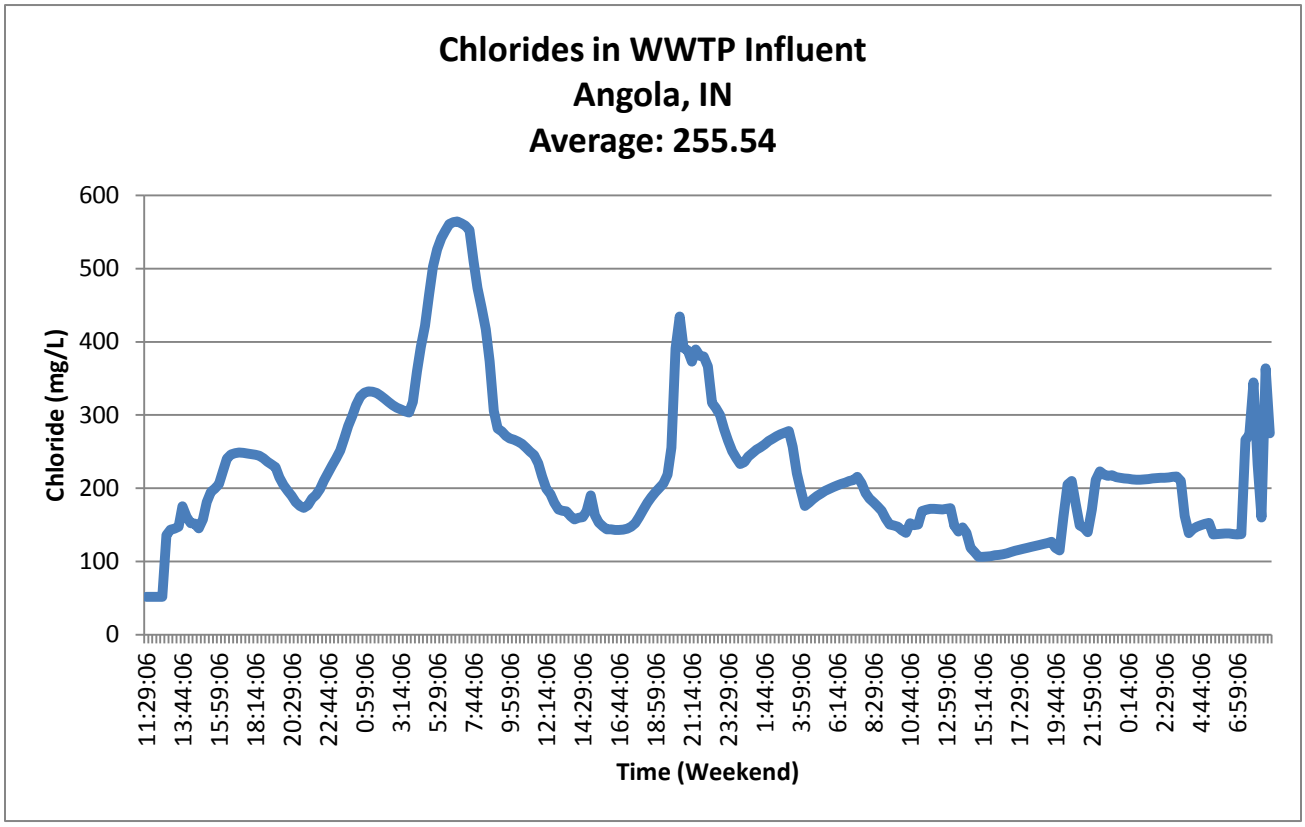

Chlorides at Trine University
Angola, IN
Average: 154.63
Chloride (mg/L)
350
300
250
200
150
100
50
0
13:00:00
13:45:00
14:30:00
15:15:00
16:00:00
16:45:00
17:30:00
18:15:00
19:00:00
19:45:00
20:30:00
21:15:00
22:00:00
22:45:00
23:30:00
0:15:00
1:00:00
1:45:00
2:30:00
3:15:00
4:00:00
4:45:00
5:30:00
6:15:00
7:00:00
7:45:00
8:30:00
9:15:00
10:00:00
10:45:00
11:30:00
12:15:00
13:00:00
Time (15 Minute Intervals)


Chlorides at Angola High School Pump Station
Angola, IN
Average: 1903.93 mg/L
Chloride (mg/L)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
13:54:46
14:39:46
15:24:46
16:09:46
16:54:46
17:39:46
18:24:46
19:09:46
19:54:46
20:39:46
21:24:46
22:09:46
22:54:46
23:39:46
0:24:46
1:09:46
1:54:46
2:39:46
3:24:46
4:09:46
4:54:46
5:39:46
6:24:46
7:09:46
7:54:46
8:39:46
9:24:46
10:09:46
10:54:46
11:39:46
12:24:46
13:09:46
13:54:46
Time (15 Minute Intervals)


Chlorides at Prospect & Martha
Angola, IN
Predominately Residential
Average: 157.38
Chloride (mg/L)
180
160
140
120
100
80
60
40
20
0
10:00:00
10:45:00
11:30:00
12:15:00
13:00:00
13:45:00
14:30:00
15:15:00
16:00:00
16:45:00
17:30:00
18:15:00
19:00:00
19:45:00
20:30:00
21:15:00
22:00:00
22:45:00
23:30:00
0:15:00
1:00:00
1:45:00
2:30:00
3:15:00
4:00:00
4:45:00
5:30:00
6:15:00
7:00:00
7:45:00
8:30:00
9:15:00
10:00:00
Time (15 Minute Intervals)


Chlorides at Felicity & Superior
Angola, IN
Average: 107.17 mg/L
Predominately Residential
Chloride (mg/L)
160
140
120
100
80
60
40
20
0
10:15:00
11:00:00
11:45:00
12:30:00
13:15:00
14:00:00
14:45:00
15:30:00
16:15:00
17:00:00
17:45:00
18:30:00
19:15:00
20:00:00
20:45:00
21:30:00
22:15:00
23:00:00
23:45:00
0:30:00
1:15:00
2:00:00
2:45:00
3:30:00
4:15:00
5:00:00
5:45:00
6:30:00
7:15:00
8:00:00
8:45:00
9:30:00
10:15:00
Time (15 Minute Intervals)


Chlorides at Fox Lake Pump Station
Angola, IN
Predominately Residential & Churches
Average: 151.75 mg/L
Chloride (mg/L)
180
160
140
120
100
80
60
40
20
0
9:00:00
9:45:00
10:30:00
11:15:00
12:00:00
12:45:00
13:30:00
14:15:00
15:00:00
15:45:00
16:30:00
17:15:00
18:00:00
18:45:00
19:30:00
20:15:00
21:00:00
21:45:00
22:30:00
23:15:00
0:00:00
0:45:00
1:30:00
2:15:00
3:00:00
3:45:00
4:30:00
5:15:00
6:00:00
6:45:00
7:30:00
8:15:00
9:00:00
Time (15 Minute Intervals)


Chlorides in WWTP Influent
Angola, IN
Average: 255.54
Chloride (mg/L)
600
500
400
300
200
100
0
11:29:06
13:44:06
15:59:06
18:14:06
20:29:06
22:44:06
0:59:06
3:14:06
5:29:06
7:44:06
9:59:06
12:14:06
14:29:06
16:44:06
18:59:06
21:14:06
23:29:06
1:44:06
3:59:06
6:14:06
8:29:06
10:44:06
12:59:06
15:14:06
17:29:06
19:44:06
21:59:06
0:14:06
2:29:06
4:44:06
6:59:06
Time (Weekend)

**From the WWTP**

Water softeners are commonly used to remove the “hardness” from water caused by naturally occurring minerals, including calcium and magnesium. Softening reduces the deposit of minerals in pipes and on fixtures and allows soap to clean better in applications such as laundry and bathing.

Water softeners in the city are discharged to the wastewater treatment plant (WWTP). Current conventional wastewater treatment technology removes very little chloride from the treated wastewater. Since chlorides are not removed from the wastewater treatment processes, high levels of chlorides are discharged from the treatment plant to the receiving stream. This can be harmful to aquatic plants and animals.

The City of Angola softens its water at the water treatment plant. Water softeners may not be necessary for those using city water supplies. A water hardness test can determine whether softening is necessary. If using a water softener, make sure that the correct amount of salt is used. Homeowners frequently use more than what is necessary to soften their water. This is costly and causes excess chloride to be discharged to the WWTP and ultimately the water bodies downstream.

**From the Water Department**

Several years ago, the Water Department decreased its softening in an effort to reduce salt usage and residual salt being discharged into wastewater. Due to customer response, previous softening levels have been restored. As a result of this, residential water softening may no longer be necessary, or possibly reduced. Softening at the correct levels not only benefits water quality, it reduces the operating expenses of your water softener.

- **Determine if a water softener is necessary**: Before investing in a water softener, water hardness should be determined. The water department will provide free hardness testing. To schedule an appointment, please contact the City Utilities office at 665-3422.
- **Use less salt**: Many homeowners use at least twice as much salt to soften their water than necessary.
- **Correctly set the recharge / backwash cycle**: Many softeners are set to recharge or backwash too frequently. Adjusting the backwash cycle to the appropriate time period between each backwash may significantly reduce the amount of sodium and chloride discharged into the sewer system.
- **Soften wisely**: Toilets, outdoor hose bibs, and other sources not used for bathing, laundry or cleaning do not need to be softened.

The Water and Wastewater Departments have been working together to meet the needs of the customer while achieving the highest level of water quality.

To schedule an appointment for free water hardness testing, please contact the City Utilities office at 665-3422.

Non-Residential Users Program: [redacted]

[redacted] is classified as a significant industrial user. Routine quarterly lab samples revealed that [redacted] is a significant chloride contributor. Concentrations of chlorides ranged from 32,600 mg/L to 52,900 mg/L for the 2013 sampling year. These values are the largest of any industrial user in the collection system. During investigations with [redacted] operations manager it was discovered that an operational change from hydrochloric acid to sulfuric acid was a possibility. Angola WWTP asked [redacted] to do an analysis on the chloride effects without using hydrochloric acid. The following table was provided by [redacted] summarizing the chlorides used from January 2013 to September 2013.

| ***Year to date-September 2013*** | | | | |
|---|---|---|---|---|
| **Waste Stream** | **Batch Info** | | **Chlorides (lbs)** | **Comments** |
| Nickel Waste Stream | # of Batches | 20 | 2430 | Based on 40 gallons of 32% Hydrochloric Acid per batch |
| Copper Cyanide Waste Stream | # of Batches | 31 | 1443 | Based on 75 gallons of 12.5% bleach per batch |
| | | | 3766 | Based on 40 gallons of 32% Hydrochloric Acid per batch |
| Water Softener | 10,080 | | 6,117 | Directly into the sewer from RO water softeners |
| Evaporated Salt (Copper Cyanide Production) | 21,400 | | 12,986 | Salt is washed out of product and introduced into the copper cyanide waste stream |
| **Total lbs of Chloride Year to Date** | | | **26,742** | |
| **Without Hydrochloric pH Adjustment** | | | **20,546** | |
| **Net Chloride Reduction** | | | **23%** | |

Based on the findings from October 2013, it was determined that a 23% net chloride reduction could be achieved by switching [redacted] operations from hydrochloric acid to sulfuric acid. [redacted] agreed that this operational switch could occur with minimal cost increases and therefore finalize the switching of acids by February 2014. The switch will require different piping and plumbing connections and subtle changes to the chemistry of the process. The anticipated cost of the process change is $2000.

# *Part III – Environmental Evaluation of Control Methodologies*

## Method 1 – Tertiary Treatment of Wastewater Treatment Plant Effluent by Reverse Osmosis, Deep Well Injection of Permeate.

### SUB-SECTION A, ENVIRONMENTAL IMPACTS

Potential Benefits:

- This method is the only method that would allow the WWTP to meet the proposed concentration and loading discharge limits.
- In addition to chloride removal, Tertiary treatment through reverse osmosis could reduce Total Suspended Solids, Total Phosphorus and other substances.

Potential Impacts:

- A significant increase in the amount of energy consumed will result in a large amount of $CO_2$ and other 'greenhouse' gas production.
- Finished water through an R/O system has limited minerals, nutrients and hardness, that aquatic life need to support growth and reproduction, which may negatively impact aquatic life in the receiving stream.
- Finished water through an R/O system is typically acidic (typically <6.0), and has very little buffering capacity. Adjustment of effluent pH would likely need to be done, but with little inherent buffer capacity, discharged effluent pH would be heavily influenced by other environmental factors, resulting in widely fluctuating pH. In this scenario, the only other significant source of flow in the H.D. Wood Ditch would be from stormwater, which is usually acidic[1] . During wet weather, with little buffering capacity the H.D. Wood ditch could quickly change pH which adversely affects aquatic life.

### SUB-SECTION B, AQUATIC, WILDLIFE AND PLANT LIFE IMPACTS

Potential Benefits:

- Consultation with the Indiana Department of Natural Resources and the U.S. Fish and Wildlife Service have indicated that there are no known endangered, proposed endangered, threatened, nor candidate species that would be adversely affected by the City's proposed application.
- As stated in the previous section, tertiary treatment through an R/O membrane (and any required pretreatment steps) will remove a significant fraction of the Total Suspended Solids and Total Phosphorus that currently exist in the effluent.

Potential Impacts:

- Finished water through an R/O system has limited minerals, nutrients and hardness, that aquatic life would need to support growth and reproduction, which may negatively impact aquatic life in the receiving stream.

[1] www.lenntech.com/aquatic/acids-alkalis.htm

- Finished water through an R/O system is typically acidic (typically <6.0), and has very little buffering capacity. Adjustment of effluent pH would likely need to be done, but with little inherent buffer capacity, discharged effluent pH would be heavily influenced by other environmental factors, resulting in widely fluctuating pH. In this scenario, the only other significant source of flow in the H.D. Wood Ditch would be from stormwater, which is usually acidic[2] . During wet weather, with little buffering capacity, the H.D. Wood ditch could quickly change pH which adversely affects aquatic life.

Additional Discussion:

- Since 1991, the Wastewater Treatment Plant has conducted Whole Effluent Toxicity (WET) testing as a requirement of its non-delegated pretreatment program. *Ceriodaphnia dubia* are generally cited as being the most chloride sensitive species utilized in WET analysis. This is an important element in the evaluation of this variance, because *Ceriodaphnia dubia* and fathead minnows are each tested for growth and reproduction. The growth and reproduction end result, when compared to a control group, must show "No Observable Effect Level". In the 23 years that the WWTP has administered this analysis, only one test has ever demonstrated an 0bservable effect. In June 2008, a decreased *Ceriodaphnia dubia* reproduction rate was noted, but a subsequent analysis showed "No Observable Effect Level." Mr. Greg Bright, Director of Biological Studies for Commonwealth Biomonitoring, noted that the WWTP effluent had a very high hardness which likely contributed to the observable effect in the June 2008 analysis.

### SUB-SECTION D, TOXIC CONTAMINANTS

The City does not anticipate that implementation of R/O treatment on the effluent would result in the release of any toxic contaminants. The R/O process will create a concentrated brine which may be classified as special or hazardous waste. This waste would need to be disposed of through surface disposal units or through deep well injection.

### SUB-SECTION E, ENERGY IMPACTS

A chart of the identified chloride reduction methodologies is included at the end of this section, but based on engineering estimates, an operational R/O system with deep well injection of the permeate would require an additional 705,000 kWh of power annually. This is a base estimate. Given the anticipated fouling issues with hardness and iron scale formation, there is a very good possibility that increased maintenance (such as backwash and chemical cleaning) would increase energy consumption, as well.

### SUB-SECTION F, HUMAN HEALTH RISKS

The primary concern of chlorides in surface water is not one of human health – elevated chlorides do not present a human health risk.

### SUB-SECTION G, OTHER IMPACTS

Commonly available documentation about R/O system operation discusses the fouling problems that generally are associated with treatment of water that has high levels of hardness and iron. The very nature of the interaction between the Water Treatment Plant and the Wastewater Treatment Plant ensures that effectively 100% of the hardness and iron found in the source water will end up in the wastewater, regardless of any source reduction strategies. In

[2] www.lenntech.com/aquatic/acids-alkalis.htm

other words, regardless of softening levels in the water treatment plant, 100% of the hardness in the source water is transmitted to the wastewater plant, as a direct discharge from the utility softeners or from the utility customer when the water is used and disposed.

According to the U.S. Department of the Interior "The Desalting and Water Treatment Membrane Manual", two cleaning regimens are necessary for membranes, one for organic and biological films and one for scaling. Organic fouling of the membrane will require a high temperature, high pH cleaning regimen, inorganic fouling (scaling) will require low temperature, low pH cleaning[3] . The cited guidance is designed for water treatment facilities, and given the nature of the source water (WWTP effluent), it is reasonable to anticipate membrane maintenance to be required at much more frequent intervals. Although the guide does not specifically describe the relative volume of cleaning chemicals that are needed, it is reasonable to anticipate the need to store a significant inventory of strong acid and bases, as well as detergents to clean the membranes.

## Method 2 – Convert Water Treatment Plant to Membrane Softening Plant, Deep Well Injection of Permeate.

### SUB-SECTION A, ENVIRONMENTAL IMPACTS

Potential Benefits:

- Reduction of chloride loading to Wastewater Treatment Plant will reduce chloride loading to the receiving stream.

Potential Impacts:

- Assuming 100% removal of chloride loading from the Water Treatment Plants, the Wastewater Treatment Plant would still not be able to meet the Monthly Average limitation based on the WQBEL.

### SUB-SECTION B, AQUATIC, WILDLIFE AND PLANT LIFE IMPACTS

Potential Benefits:

- Reduction of chloride loading to Wastewater Treatment Plant will reduce chloride loading to the receiving stream.

Potential Impacts:

- Assuming 100% removal of chloride loading from the Water Treatment Plants, the Wastewater Treatment Plant would still not be able to meet the Monthly Average limitation based on the WQBEL.

### SUB-SECTION D, TOXIC CONTAMINANTS

The City does not anticipate that implementation of R/O treatment at the Water Treatment Plant would result in the release of any toxic contaminants. The R/O process will create a concentrated brine which may be classified as special or hazardous waste. This waste would need to be disposed of through surface disposal units or through deep well injection.

[3] "The Desalting and Water Treatment Membrane Manual: A Guide to Membranes for Municipal Water Treatment (2nd Edition)", U.S. Department of the Interior, Bureau of Reclamation, ca. July 1998.

### SUB-SECTION E, ENERGY IMPACTS

A chart of the identified chloride reduction methodologies is included at the end of this section, but based on engineering estimates, an operational R/O system with deep well injection of the permeate would require an additional 410,000 kWh of power annually. This is a base estimate. Given the anticipated fouling issues with hardness and iron scale formation, there is a very good possibility that increased maintenance (such as backwash and chemical cleaning) would increase energy consumption, as well.

### SUB-SECTION F, HUMAN HEALTH RISKS

No potential human health risks have been identified with this method.

### SUB-SECTION G, OTHER IMPACTS

Commonly available documentation about R/O system operation discusses the fouling problems that generally are associated with treatment of water that has high levels of hardness and iron.

According to the U.S. Department of the Interior "The Desalting and Water Treatment Membrane Manual", two cleaning regimens are necessary for membranes, one for organic and biological films and one for scaling. Organic fouling of the membrane will require a high temperature, high pH cleaning regimen, inorganic fouling (scaling) will require low temperature, low pH cleaning[4] . Although the guide does not specifically describe the relative volume of cleaning chemicals that are needed, it is reasonable to anticipate the need to store a significant inventory of strong acid and bases, as well as detergents to clean the membranes.

## Method 3 – Convert Water Treatment Plant to Lime Softening Plant, Landfill Lime Sludge.

### SUB-SECTION A, ENVIRONMENTAL IMPACTS

Potential Benefits:

- Reduction of chloride loading to Wastewater Treatment Plant will reduce chloride loading to the receiving stream.

Potential Impacts:

- Assuming 100% removal of chloride loading from the Water Treatment Plants, the Wastewater Treatment Plant would still not be able to meet the Monthly Average limitation based on the WQBEL.

### SUB-SECTION B, AQUATIC, WILDLIFE AND PLANT LIFE IMPACTS

Potential Benefits:

- Reduction of chloride loading to Wastewater Treatment Plant will reduce chloride loading to the receiving stream.

Potential Impacts:

[4] "The Desalting and Water Treatment Membrane Manual: A Guide to Membranes for Municipal Water Treatment (2nd Edition)", U.S. Department of the Interior, Bureau of Reclamation, ca. July 1998.

- Assuming 100% removal of chloride loading from the Water Treatment Plants, the Wastewater Treatment Plant would still not be able to meet the Monthly Average limitation based on the WQBEL.

### SUB-SECTION D, TOXIC CONTAMINANTS

The City does not anticipate that implementation of lime softening at the Water Treatment Plant would result in the release of any toxic contaminants. The process does produce a large amount of sludge (estimated at almost 20,000 gallons per day) that would be transported to a landfill for disposal.

### SUB-SECTION E, ENERGY IMPACTS

A chart of the identified chloride reduction methodologies is included at the end of this section, but based on engineering estimates, a lime softening system would require an additional 1,500 kWh of power annually. Fuel costs and related carbon dioxide oxidized sulfur and nitrogen from hauling lime sludge to surface disposal units have not been assessed.

### SUB-SECTION F, HUMAN HEALTH RISKS

Hydrated lime is an alkaline material that is reactive in the presence of moisture. Lime can cause severe eye irritation or burning, including permanent damage. Eye protection (chemical goggles, safety glasses and/or face shield) should be worn where there is a risk of lime exposure. Contact lenses should not be worn when working with lime products. Lime can cause irritation and burns to unprotected skin, especially in the presence of moisture. Prolonged contact with unprotected skin should be avoided. Protective gloves and clothing that fully covers arms and legs are recommended. Particular care should be exercised with quicklime because its reaction with moisture generates heat capable of causing thermal burns. Lime dust is irritating if inhaled. In most cases, nuisance dust masks provide adequate protection. In high exposure situations, further respiratory protection may be appropriate, depending on the concentration and length of exposure (consult SDS for applicable exposure limits). Care should be taken to avoid accidental mixing of quicklime and water (in any form, including chemicals containing water of hydration) to avoid creating excessive heat. Heat released by this reaction can ignite combustible materials or cause thermal damage to property or persons.[5]

### SUB-SECTION G, OTHER IMPACTS

No other impacts have been identified by the City.

## Method 4 – Treat Water Utility Softener Waste with Reverse Osmosis, Landfill Permeate.

### SUB-SECTION A, ENVIRONMENTAL IMPACTS

Potential Benefits:

- Reduction of chloride loading to Wastewater Treatment Plant will reduce chloride loading to the receiving stream.

[5] http://www.lime.org/documents/lime_basics/fact-safety_precautions.pdf

Potential Impacts:

- Assuming 100% removal of chloride loading from the Water Treatment Plants, the Wastewater Treatment Plant would still not be able to meet the Monthly Average limitation based on the WQBEL.

### SUB-SECTION B, AQUATIC, WILDLIFE AND PLANT LIFE IMPACTS

Potential Benefits:

- Reduction of chloride loading to Wastewater Treatment Plant will reduce chloride loading to the receiving stream.

Potential Impacts:

- Assuming 100% removal of chloride loading from the Water Treatment Plants, the Wastewater Treatment Plant would still not be able to meet the Monthly Average limitation based on the WQBEL.

### SUB-SECTION D, TOXIC CONTAMINANTS

The City does not anticipate that implementation of R/O treatment of softener waste at the Water Treatment Plant would result in the release of any toxic contaminants. The R/O process will create concentrated brine which may be classified as special or hazardous waste. This waste would need to be disposed of through surface disposal units or through deep well injection.

### SUB-SECTION E, ENERGY IMPACTS

A chart of the identified chloride reduction methodologies is included at the end of this section, but based on engineering estimates, an operational R/O system using a landfill as a disposal method would require an additional 22,000 kWh of power annually. This is a base estimate. Given the anticipated fouling issues with hardness and iron scale formation, there is a very good possibility that increased maintenance (such as backwash and chemical cleaning) would increase energy consumption, as well.

### SUB-SECTION F, HUMAN HEALTH RISKS

No potential human health risks have been identified with this method.

### SUB-SECTION G, OTHER IMPACTS

Commonly available documentation about R/O system operation discusses the fouling problems that generally are associated with treatment of water that has high levels of hardness and iron.

According to the U.S. Department of the Interior "The Desalting and Water Treatment Membrane Manual", two cleaning regimens are necessary for membranes, one for organic and biological films and one for scaling. Organic fouling of the membrane will require a high temperature, high pH cleaning regimen, inorganic fouling (scaling) will require low temperature, low pH cleaning[6] . Although the guide does not specifically describe the relative

[6] "he Desalting and Water Treatment Membrane Manual: A Guide to Membranes for Municipal Water Treatment (2nd Edition)", U.S. Department of the Interior, Bureau of Reclamation, ca. July 1998.

volume of cleaning chemicals that are needed, it is reasonable to anticipate the need to store a significant inventory of strong acid and bases, as well as detergents to clean the membranes.

## Methods 5 & 6 – Effluent Dilution, Stream Flow Augmentation.

### SUB-SECTION A, ENVIRONMENTAL IMPACTS

Potential Benefits:

- Both methods would reduce chloride concentration in the receiving stream to levels below the WQBEL.

Potential Impacts:

- The Angola Wastewater Treatment Plant is a Great Lakes Discharger, and has concentration and loading limits. Effluent dilution and stream flow augmentation would not change to total loading to the receiving stream, and would not be a feasible option.
- Both methods would increase the stream flow to the H.D. Wood Ditch significantly, and would directly contribute to downstream flooding during periods of wet weather.

### SUB-SECTION B, AQUATIC, WILDLIFE AND PLANT LIFE IMPACTS

Potential Benefits:

- Both methods would reduce chloride concentration in the receiving stream to levels below the WQBEL.

Potential Impacts:

- The Angola Wastewater Treatment Plant is a Great Lakes Discharger, and has concentration and loading limits. Effluent dilution and stream flow augmentation would not change to total loading to the receiving stream, and would not be a feasible option.
- Both methods would increase the stream flow to the H.D. Wood Ditch significantly, and would directly contribute to downstream flooding during periods of wet weather.

### SUB-SECTION D, TOXIC CONTAMINANTS

These methods do not pose any risk for release of toxic contaminants.

### SUB-SECTION E, ENERGY IMPACTS

A chart of the identified chloride reduction methodologies is included at the end of this section, but based on engineering estimates, effluent dilution and stream flow augmentation would require an additional 3,500 kWh and 8,850 kWh, respectively, of power every year.

### SUB-SECTION F, HUMAN HEALTH RISKS

No potential human health risks have been identified with these methods.

### SUB-SECTION G, OTHER IMPACTS

No other impacts have been identified by the City.

## Method 7 – Implement Pollutant Minimization Program Plan.

### SUB-SECTION A, ENVIRONMENTAL IMPACTS

Potential Benefits:

- Implementation of the PMPP may help utility customers understand how their use of the water and wastewater systems can impact the receiving stream, and may result is benefits to other pollution prevention efforts (combined sewers/downspout connections, mercury education, etc).

Potential Impacts

- Net chloride reduction from this method is anticipated to be less than 3%.

### SUB-SECTION B, AQUATIC, WILDLIFE AND PLANT LIFE IMPACTS

No aquatic impacts have been identified.

### SUB-SECTION D, TOXIC CONTAMINANTS

No toxic contaminants have been identified with this method.

### SUB-SECTION E, ENERGY IMPACTS

Minimal energy impacts are associated with implementation of the PMPP.

### SUB-SECTION F, HUMAN HEALTH RISKS

There are no human health risks associated with this method.

### SUB-SECTION G, OTHER IMPACTS

No other impacts have been identified with this method.

## Estimated Fiscal and Energy Impacts of Chloride Control Methodologies

| | Potential Removal | Energy Usage (kWh/Yr) | Heating Needs[1] (MBTU/Yr) | Carbon Dioxide Output[2] | Capital Cost | Annual O&M Cost | Cost per EDU |
|---|---|---|---|---|---|---|---|
| Method 1 – | | | | | | | |
| WWTP R/O of Effluent | | 590,000 | 205 | 460 | $12,155,902 | $916,202 | $23.06 |
| Deep Well Injection of Permeate | | 115,000 | 15 | 88 | $3,881,771 | $310,729 | $7.62 |
| **Total:** | **70%** | **705,000** | **220** | **548** | **$16,037,673** | **$1,226,931** | **$30.68** |
| Method 2 – | | | | | | | |
| WTP R/O Water Treatment | | 295,000 | 29 | 226 | $6,251,960 | $384,649 | $10.66 |
| Deep Well Injection of Permeate | | 115,000 | 15 | 88 | $3,881,771 | $310,729 | $7.62 |
| **Total:** | **40 – 50%** | **410,000** | **44** | **314** | **$10,133,731** | **$695,378** | **$18.28** |
| Method 3 – WTP – Lime Softening Treatment | **40 – 50%** | **1,500** | **--** | **1** | **$4,933,500** | **$349,150** | **$9.04** |
| Method 4 – WTP – R/O of Softener Waste | **40 – 50%** | **22,000** | **29** | **19** | **$1,175,818** | **$326,979** | **$5.54** |
| Method 5 – Effluent Dilution | **--** | **3,500** | **--** | **3** | **$1,242,513** | **$137,592** | **$2.97** |
| Method 6 – Stream Flow Augmentation | **--** | **8,850** | **--** | **7** | **$2,824,214** | **$340,158** | **$7.12** |

[1] Increased heating from additional building space required to house treatment equipment/processes. Estimation based on annual average of 100 BTU/sf of new process space.

[2] Estimation based on 0.00076 tons of $CO_2$/kWh; 117 pounds of $CO_2$ per MBTU (based on Natural Gas)

DNR
Indiana Department of Natural Resources

RECEIVED
JUL 24 2014
GREELEY AND HANSEN

Michael R. Pence, Governor
Cameron F. Clark, Director

Division of Nature Preserves
402 W. Washington St., Rm W267
Indianapolis, IN 46204-2739

July 22, 2014

Brett Barber
Greeley and Hansen, LLC
7820 Innovation Boulevard, Suite 150
Indianapolis, IN 46278

Dear Brett Barber:

I am responding to your request for information on the endangered, threatened, or rare (ETR) species, high quality natural communities, and natural areas documented from a project area, Angola Wastewater Treatment Plan NPDES Permit, Angola, Indiana. The Indiana Natural Heritage Data Center has been checked and there are no ETR species and significant areas documented within 0.5 mile of the project area.

The information I am providing does not preclude the requirement for further consultation with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act of 1973. If you have concerns about potential Endangered Species Act issues you should contact the Service at their Bloomington, Indiana office.

U.S. Fish and Wildlife Service
620 South Walker St.
Bloomington, Indiana 47403-2121
(812)334-4261

At some point, you may need to contact the Department of Natural Resources' Environmental Review Coordinator so that other divisions within the department have the opportunity to review your proposal. For more information, please contact:

Department of Natural Resources
attn: Christie Stanifer
Environmental Coordinator
Division of Fish and Wildlife
402 W. Washington Street, Room W273
Indianapolis, IN 46204
(317)232-8163

Please note that the Indiana Natural Heritage Data Center relies on the observations of many individuals for our data. In most cases, the information is not the result of comprehensive field surveys conducted at particular sites. Therefore, our statement that there are no documented significant natural features at a site should not be interpreted to mean that the site does not support special plants or animals.

Due to the dynamic nature and sensitivity of the data, this information should not be used for any project other than that for which it was originally intended. It may be necessary for you to request updated material from us in order to base your planning decisions on the most current information.

Thank you for contacting the Indiana Natural Heritage Data Center. You may reach me at (317)232-8059 you have any questions or need additional information.

Sincerely,

Ronald P. Hellmich

Ronald P. Hellmich
Indiana Natural Heritage Data Center

RECEIVED
Attachment 3-C-1b
AUG 08 2014
GREELEY AND HANSEN

# United States Department of the Interior
## Fish and Wildlife Service

Bloomington Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

August 4, 2014

Mr. Brett Barber
Greeley and Hansen LLC
7820 Innovation Boulevard, Suite 150
Indianapolis, Indiana 46278

Project: Angola Waste Water Treatment Plant NPDES Permit
Location: Angola, Steuben County

Dear Mr. Barber:

This responds to your letter dated July 15, 2014, requesting our endangered species comments on the aforementioned permit.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

ENDANGERED SPECIES

The proposed project is within the range of the Federally endangered Indiana bat (Myotis sodalis), the proposed endangered northern long-eared bat (Myotis septentrionalis), the threatened northern copperbelly water snake (Nerodia erythrogaster neglecta), and the candidate eastern massasauga rattlesnake (Sistrurus catenatus). The eastern massasauga is known to be present at Pokagon State Park, Trine State Recreation Area, and several other sites north of Angola, and the 2 bat species may be present at Pokagon and other sites within Steuben County where suitable habitat is available. The northern copperbelly is not known to be present within the Angola area. None of these species are known from the WWTP area or along its immediate receiving waters, although the bats may be present along Pigeon Creek. The U.S. Fish and Wildlife Service therefore concurs that the proposed permit is not likely to adversely affect these endangered, proposed endangered, threatened, and candidate species.

This precludes the need for further consultation on this project as required under Section 7 of the Endangered Species Act of 1973, as amended. However, should new information arise pertaining to project plans or a revised species list be published, it will be necessary for the Federal agency to reinitiate consultation.

For further discussion, please contact Elizabeth McCloskey at (219) 983-9753 or elizabeth_mccloskey@fws.gov.

Sincerely yours,

Elizabeth S. McCloskey

Scott E. Pruitt
for Supervisor

cc: IDEM, Office of Water Management, NPDES Permit Program, Indianapolis, IN

**TABLE 1**

| Water Treatment Plant Membrane Softening<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Demo existing units & piping | LS | 1 | $ 110,000 | $ 110,000 |
| 2 | Disposal costs | LS | 1 | $ 22,000 | $ 22,000 |
| 3 | RO membrane equipment (2) | MG | 2 | $ 1,700,000 | $ 3,400,000 |
| 4 | Piping & valves | lf | 1,000 | $ 330 | $ 330,000 |
| 5 | Housing | Existing | | | $ - |
| 6 | | | | | $ - |
| 7 | | | | | $ - |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 340,000 |
| 11 | Controls (5% of estimate) | | | | $ 170,000 |

| | |
|---|---|
| Subtotal construction = | $ 4,372,000 |
| Contingencies (10%)= | $ 437,200 |
| Engineering, Legal & Admin. (30%)= | $ 1,442,760 |
| Total Estimated Project Costs= | $ 6,251,960 |

| Annual O, M & R Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Cleaning consumables | | | | | | | $ 10,000 |
| 2 | Power Consumption @ 45 hp & $0.087/kwh | | | | | | | $ 25,584 |
| 3 | Operating labor | | | | | | | $ 21,000 |
| 4 | Maintenance | | | | | | | $ 8,400 |
| 5 | Annual Replacement Cost, membranes, 20%; 10 years: 2% | | | | | | | $ 62,084 |
| 6 | | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | | $ 257,581 |
| | | | | | | Total O, M & R Costs | | $ 384,649 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | | $ 384,649 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | | $ 382,620 |
| 3 | Total Annual Costs | | | | | | | $ 767,269 |
| 4 | Monthly Cost per EDU | | | | | | | $ 10.66 |
| 5 | Annual Cost per lb Chloride Removed (3) | | | | | | | $ 0.65 |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835.
(2) "Estimating Water Treatment Costs- Volume 3 Cost Curves for 2,500 gpd to 1 mgd Treatment Plants" USEPA August 1979 (ENRCCI = 2776); Current ENRCCI = 9835. Other costs from April 2010 variance application updated to ENRCCI 9835.
(3) Assumes 90% removal efficiency of water treatment facility.

**TABLE 2**

| Lime Soda Softening (Two 1 MGD Water Plants)<br>Cost Estimate<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Two 1 MGD Water Plants (1) | gpd | 2,000,000 | $ 1.50 | $ 3,000,000 |
| 2 | | | | | $ - |
| 3 | | | | | $ - |
| 4 | | | | | $ - |
| 5 | | | | | $ - |
| 6 | | | | | $ - |
| 7 | | | | | $ - |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 300,000 |
| 11 | Controls (5% of estimate) | | | | $ 150,000 |

| | |
|---|---|
| Subtotal construction = | $ 3,450,000 |
| Contingencies (10%)= | $ 345,000 |
| Engineering, Legal & Admin. (30%)= | $ 1,138,500 |
| Total Estimated Project Costs= | $ 4,933,500 |

| Annual O, M & R Costs | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Annual O&M, 3% of Construction Cost | | | | | | $ 113,850 |
| 2 | Disposal Costs, 4 cuyd/day, $450/20 cuyd dumpster | | | | | | $ 32,040 |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | $ 203,260 |
| | | | | | | Total O, M & R Costs | $ 349,150 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | $ 349,150 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | $ 301,930 |
| 3 | Total Annual Costs | | | | | | $ 651,080 |
| 4 | Monthly Cost per EDU | | | | | | $ 9.04 |
| 5 | Annual Cost per lb Chloride Removed (2) | | | | | | $ 0.55 |

(1) "Estimating Water Treatment Costs- Volume 3 Cost Curves for 2,500 gpd to 1 mgd Treatment Plants" USEPA August 1979 (ENRCCI = 2776); Current ENRCCI = 9835. Other costs from April 2010 variance application updated to ENRCCI 9835.

(2) Assumes 90% removal efficiency of water treatment facility.

**TABLE 3**

| Water Plant RO for Softening Waste<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Housing for units (@ both WTP) | sf | 800 | $ 165 | $ 120,000 |
| 2 | Site Work | LS | 1 | $ 20,000 | $ 20,000 |
| 3 | RO membrane equipment (2) | MG | 0.25 | $ 1,700,000 | $ 425,000 |
| 4 | Piping & valves | lf | 500 | $ 300 | $ 150,000 |
| 5 | | | | | $ - |
| 6 | | | | | $ - |
| 7 | | | | | $ - |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 71,500 |
| 11 | Controls (5% of estimate) | | | | $ 35,750 |

| | |
|---|---|
| Subtotal construction = | $ 822,250 |
| Contingencies (10%)= | $ 82,225 |
| Engineering, Legal & Admin. (30%)= | $ 271,343 |
| Total Estimated Project Costs= | $ 1,175,818 |

| Annual O, M & R Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Cleaning consumables | | | | | | | $ 9,600 |
| 2 | Power Consumption @ 2.5 hp & $0.087/kwh | | | | | | | $ 1,421 |
| 3 | Operating labor | | | | | | | $ 10,000 |
| 4 | Maintenance | | | | | | | $ 8,400 |
| 5 | Disposal Costs, tipping fees~$0.05/gal*13,500 gpd | | | | | | | $ 246,375 |
| 6 | Annual Replacement Cost, Membrane, 20%; 10 years, 2% | | | | | | | $ 2,739 |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | | $ 48,444 |
| | | | | | | Total O, M & R Costs | | $ 326,979 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | | $ 326,979 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | | $ 71,960 |
| 3 | Total Annual Costs | | | | | | | $ 398,939 |
| 4 | Monthly Cost per EDU | | | | | | | $ 5.54 |
| 5 | Annual Cost per lb Chloride Removed (3) | | | | | | | $ 0.34 |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835.
(2) "Estimating Water Treatment Costs- Volume 3 Cost Curves for 2,500 gpd to 1 mgd Treatment Plants" USEPA August 1979 (ENRCCI = 2776); Current ENRCCI = 9835. Other costs from April 2010 variance application updated to ENRCCI 9835.
(3) Assumes 90% removal efficiency of water treatment facility.

**TABLE 4**

| WTP - Deep Well Injection of Softener Waste<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Drilling, casting, & testing | lf | 4500 | $ 385 | $ 1,732,500 |
| 2 | Prefilters | LS | 1 | $ 55,000 | $ 55,000 |
| 3 | High pressure pump | LS | 1 | $ 110,000 | $ 110,000 |
| 4 | Piping & valves | lf | 1000 | $ 330 | $ 330,000 |
| 5 | Storage & containment (both plants) | ea | 2 | $ 44,000 | $ 88,000 |
| 6 | Site Work | LS | 1 | $ 22,000 | $ 22,000 |
| 7 | Housing | sf | 400 | $ 165 | $ 66,000 |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 218,500 |
| 11 | Controls (5% of estimate) | | | | $ 120,175 |

| | |
|---|---|
| Subtotal construction = | $ 2,566,175 |
| Contingencies (10%)= | $ 256,618 |
| Engineering, Legal & Admin. (30%)= | $ 846,838 |
| Total Estimated Project Costs= | $ 3,669,630 |

| Annual O, M & R Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Filter replacements | | | | | | | $ 20,000 |
| 2 | Power Consumption | | | | | | | $ 8,000 |
| 3 | Operating labor | | | | | | | $ 10,000 |
| 4 | Maintenance | | | | | | | $ 8,400 |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | | $ 151,189 |
| | | | | | | Total O, M & R Costs | | $ 197,589 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | | $ 197,589 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | | $ 224,581 |
| 3 | Total Annual Costs | | | | | | | $ 422,170 |
| 4 | Monthly Cost per EDU | | | | | | | $ 5.86 |
| 5 | Annual Cost per lb Chloride Removed (2) | | | | | | | $ 0.36 |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835.
(2) Assumes 90% removal efficiency of water treatment facility.

**TABLE 5**

| WWTP Effluent Dilution<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Drilling & Well Casing | lf | 600 | $ 275 | $ 165,000 |
| 2 | Screens | lf | 120 | $ 330 | $ 39,600 |
| 3 | Well Pumps | ea | 4 | $ 22,000 | $ 88,000 |
| 4 | Piping & valves | lf | 4000 | $ 110 | $ 440,000 |
| 5 | Platform | ea | 4 | $ 16,500 | $ 66,000 |
| 6 | Development & testing | ea | 4 | $ 27,500 | $ 110,000 |
| 7 | | | | | $ - |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 90,860 |
| 11 | Controls (5% of estimate) | | | | $ 45,430 |

| | |
|---|---|
| Subtotal construction = | $ 868,890 |
| Contingencies (10%)= | $ 86,889 |
| Engineering, Legal & Admin. (30%)= | $ 286,734 |
| Total Estimated Project Costs= | $ 1,242,513 |

| Annual O, M & R Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Cleaning | | | | | | | $ 20,000 |
| 2 | Power Consumption | | | | | | | $ 48,000 |
| 3 | Operating labor | | | | | | | $ 10,000 |
| 4 | Maintenance | | | | | | | $ 8,400 |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | | $ 51,192 |
| | | | | | | Total O, M & R Costs | | $ 137,592 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | $ 137,592 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | $ 76,042 |
| 3 | Total Annual Costs | | | | | | $ 213,633 |
| 4 | Monthly Cost per EDU | | | | | | $ 2.97 |
| 5 | Annual Cost per lb Chloride Removed | | | | | | NA |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835.

**TABLE 6**

| WWTP Steam Flow Augmentation<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Drilling & Well Casting | lf | 1,500 | $ 275 | $ 412,500 |
| 2 | Screens | lf | 300 | $ 330 | $ 99,000 |
| 3 | Well Pumps | ea | 10 | $ 22,000 | $ 220,000 |
| 4 | Piping & valves | lf | 8,000 | $ 110 | $ 880,000 |
| 5 | Platform | ea | 10 | $ 16,500 | $ 165,000 |
| 6 | Development & testing | ea | 10 | $ 27,500 | $ 275,000 |
| 7 | Ditch Cleaning | cy | 48,000 | $ 11 | $ 528,000 |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 234,500 |
| 11 | Controls (5% of estimate) | | | | $ 128,975 |

| | |
|---|---|
| Subtotal construction = | $ 1,974,975 |
| Contingencies (10%)= | $ 197,498 |
| Engineering, Legal & Admin. (30%)= | $ 651,742 |
| Total Estimated Project Costs= | $ 2,824,214 |

| Annual O, M & R Costs | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Cleaning | | | | | | $ 60,000 |
| 2 | Power Consumption | | | | | | $ 126,000 |
| 3 | Operating labor | | | | | | $ 21,000 |
| 4 | Maintenance | | | | | | $ 16,800 |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | $ 116,358 |
| | | Total O, M & R Costs | | | | | $ 340,158 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | $ 340,158 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | $ 172,842 |
| 3 | Total Annual Costs | | | | | | $ 513,000 |
| 4 | Monthly Cost per EDU | | | | | | $ 7.12 |
| 5 | Annual Cost per lb Chloride Removed | | | | | | NA |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835.

**TABLE 7**

| WWTP Effluent Reverse Osmosis<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Housing for units | sf | 5625 | $ 150 | $ 843,750 |
| 2 | Site work | LS | 1 | $ 20,000 | $ 20,000 |
| 3 | RO membrane equipment (2) | MG | 4 | $ 1,700,000 | $ 6,800,000 |
| 4 | Piping & valves | lf | 1000 | $ 300 | $ 300,000 |
| 5 | | | | | $ - |
| 6 | | | | | $ - |
| 7 | | | | | $ - |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 346,375 |
| 11 | Controls (5% of estimate) | | | | $ 190,506 |

| | |
|---|---|
| Subtotal construction = | $ 8,500,631 |
| Contingencies (10%)= | $ 850,063 |
| Engineering, Legal & Admin. (30%)= | $ 2,805,208 |
| Total Estimated Project Costs= | $ 12,155,902 |

| Annual O, M & R Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Cleaning consumables | | | | | | | $ 20,000 |
| 2 | Power Consumption @ 90 hp & $0.087/kwh | | | | | | | $ 51,169 |
| 3 | Operating labor | | | | | | | $ 21,000 |
| 4 | Maintenance | | | | | | | $ 168,000 |
| 5 | Amortized membrane replacement in 10 yrs | | | | | | | $ 155,210 |
| 6 | | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | | $ 500,823 |
| | | | | | | Total O, M & R Costs | | $ 916,202 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | | $ 916,202 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | | $ 743,941 |
| 3 | Total Annual Costs | | | | | | | $ 1,660,143 |
| 4 | Monthly Cost per EDU | | | | | | | $ 23.06 |
| 5 | Annual Cost per lb Chloride Removed (3) | | | | | | | $ 0.76 |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835, except as noted.
(2) "Estimating Water Treatment Costs- Volume 3 Cost Curves for 2,500 gpd to 1 mgd Treatment Plants" USEPA August 1979 (ENRCCI = 2776); Current ENRCCI = 9835. Other costs from April 2010 variance application updated to ENRCCI 9835.
(3) Assumes chloride removal to comply with monthly average permit limitation of 380 mg/l.

**TABLE 8**

| WWTP - Deep Well Injection of Side Stream RO Waste<br>Cost Estimate (1)<br>Angola, Indiana | | | | | |
|---|---|---|---|---|---|
| Item | Item Description | Unit | Qty | Unit Cost | Cost |
| 1 | Drilling, casting & testing | lf | 4500 | $ 385 | $ 1,732,500 |
| 2 | Prefilters | lf | 1 | $ 55,000 | $ 55,000 |
| 3 | High pressure pump | LS | 1 | $ 220,000 | $ 220,000 |
| 4 | Piping & valves | lf | 1000 | $ 330 | $ 330,000 |
| 5 | Storage & containment | LS | 2 | $ 44,000 | $ 88,000 |
| 6 | Site Work | LS | 1 | $ 22,000 | $ 22,000 |
| 7 | Housing | sf | 400 | $ 165 | $ 66,000 |
| 8 | | | | | $ - |
| 9 | | | | | $ - |
| 10 | Electrical (10% of estimate) | | | | $ 251,350 |
| 11 | Controls (5% of estimate) | | | | $ 125,675 |

| | |
|---|---|
| Subtotal construction = | $ 2,714,525 |
| Contingencies (10%)= | $ 271,453 |
| Engineering, Legal & Admin. (30%)= | $ 895,793 |
| Total Estimated Project Costs= | $ 3,881,771 |

| Annual O, M & R Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Filter replacements | | | | | | | $ 50,000 |
| 2 | Power Consumption | | | | | | | $ 63,000 |
| 3 | Operating labor | | | | | | | $ 21,000 |
| 4 | Maintenance | | | | | | | $ 16,800 |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | Annual Replacement Cost, 20 years, 2% | | | | | | | $ 159,929 |
| | | | | | | Total O, M & R Costs | | $ 310,729 |

| Economic Impact<br>2,917 users, avg. res.usage~3,000g/mo., EDU~6,000 equivalent users | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | Annual O,M & R costs | | | | | | | $ 310,729 |
| 2 | Amortized Capital Costs, 20 years, 2.0% | | | | | | | $ 237,564 |
| 3 | Total Annual Costs | | | | | | | $ 548,293 |
| 4 | Monthly Cost per EDU | | | | | | | $ 7.62 |
| 5 | Annual Cost per lb Chloride Removed | | | | | | | $ 0.25 |

(1) All costs from original variance application (April 2010; ENRCCI 8677) updated to ENRCCI 9835.
(3) Assumes chloride removal to comply with monthly average permit limitation of 380 mg/l.

# ANGOLA (INDIANA) MUNICIPAL WASTEWATER UTILITY

## COMPARISON OF BILLINGS OF INDIANA MUNICIPALITIES

| | City of Angola Population - 8,612 (1) Current Rates (2) | 2010 Census Group Population: 6,001 - 10,000 Average |
|---|---|---|
| Municipalities in study group | | 30 |
| First bracket price (per 1,000 gallons) | $9.20 | $5.11 |
| Last bracket price (per 1,000 gallons) | $9.20 | $4.35 |
| Gallons given for minimum price | 2,000 | 2,789 |
| Minimum charge for 5/8" meter | $18.40 | $19.58 |
| Monthly bill based on 2,000 gallons usage | $18.40 | $20.04 |
| Monthly bill based on 3,000 gallons usage | $27.60 | $23.83 |
| Monthly bill based on 4,000 gallons usage | $36.80 | $29.02 |
| Monthly bill based on 5,000 gallons usage | $46.00 | $34.28 |
| Monthly bill based on 10,000 gallons usage | $92.00 | $60.94 |

(1) Based on 2010 census data.

(2) Adopted January 9, 2014, per Rate Ordinance No. 1460-2014. The rates assume those applied to users within City corporate limits.

(See Accountants' Report and accompanying comments)
(Restricted for Management's Use Only)