KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

1. Refer to the Application, paragraph 10, which provides the amount and percentage of the proposed revenue increase for all customer classes except industrial, which includes only the amount. Provide the percent of the proposed rate increase that is allocated to the industrial customer class.

Response:

2.62 percent of the proposed revenue increase is allocated to the industrial customer class.

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb and John M. Watkins

2. Refer to the Application, Exhibit 37 and the response to Item 1 of the Commission Staff's First Request for Information.

   a. Identify each calculation of operating expense item in the forecasted test year that had used a different methodology for calculating the pro forma adjustment from the previous rate Case No. 2018-00358. Explain the difference in the methodology between the two cases and why the methodology has changed.

   b. Identify each calculation of operating expense in the forecasted period of the base year that has used a different methodology from the previous rate Case No. 2018-00358. Explain the difference in the methodology between the two cases and why the methodology has changed.

   c. Identify each item of rate base in the forecasted year that has used a different methodology for calculating the forecasted amount from the previous rate Case No. 2018-00358. Explain the difference in the methodology between the two cases and why the methodology has changed.

Response:

a. KAW filed general rate cases on November 28, 2018, and June 30, 2023.

- The development of the forecasted test year in the 2018 rate case (12 months ended June 30, 2020) was completed using the same assumptions and methodologies as used in the 2019 forecast developed by management (in 2018), updated for timing differences, more recent information, and other management goals. The Company also made pro forma adjustments to the base period for any known or projected increases or decreases to arrive at the forecasted test year expenses and investments upon which KAW proposed to base its rates.
- The development of the forecasted test year in the 2023 rate case (12 months ended January 31, 2025) was completed using the same assumptions and methodologies as used in the forecasts developed by management updated for timing differences, more recent information, any known or projected increases or decreases, and other management goals.

In both the 2018 and 2023 cases, the Company used the same assumptions and methodologies used in the forecasts developed by management during those respective periods. The Company continuously develops and improves its forecasting capabilities, but the Company does not track or maintain a compendium of every change to its assumptions or methodologies for every forecast over time (e.g., from 2018 through the present).

b. KAW filed a 2018 general rate case on November 28, 2018.

- The base year for that case was the 12 months ended February 28, 2019.
- The base year data reflected six months of actual data (March – August 2018 and six months of forecasted data (September 2018 – February 2019).
- Because the Company developed its 2019 operating plan at the same time it was developing the forecasted period of the base year, the Company used its 2019 operating plan for the forecasted period of the base year.

KAW filed a 2023 general rate case on June 30, 2023.

- The base year was the 12 months ended September 30, 2023.
- The base year data reflected six months of actual data (October 2022 – March 2023) and six months of forecasted data (April 2023 – September 2023).
- Because of the timing difference between the forecasts developed for the 2023 operating plan and the forecasted period of the base year in the 2023 rate case, the Company's 2023 base year forecast included more current information than was available at the time the operating plan was prepared.

In the 2018 rate case, the timing of the forecast for the operating plan and rate case were coincident, so the company was able to use the same forecasts for both. In the 2023 rate case, the timing of the forecast for the operating plan and rate case were far enough apart that the Company did not rely on the operating plan forecast for the forecasted period of the base year.

In both the 2018 and 2023 cases, the Company used the same assumptions and methodologies used in the forecasts developed by management at that time, updated for timing differences, more recent information, and other management goals. The Company continues to develop and improve its forecasting capabilities, but the Company does not track or maintain a compendium of each change to its assumptions or methodologies for forecasts over time (e.g., from 2018 through the present).

c. See the responses to a and b above.

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

3. Refer to the Application, paragraph 31. Also refer to the Application, Exhibit 2, Sheet Nos. 48-49, and the Direct Testimony of Ann E. Bulkley (Bulkley Direct Testimony), page 50, lines 8-14.

   a. Confirm that the capital tracking mechanism is the Qualified Infrastructure Program Rider (QIP Rider).

   b. The tariff states, "The QIP Rider will be updated annually in a filing that includes incudes the (1) projected costs for each QIP period and (2) a balancing adjustment that trues up the projected program costs and revenues with the actuals for the preceding annual QIP period." With the proposed changes to the QIP program and the program's structure generally, taken together, confirm that these factors reduce the risks associated with large capital spending programs. If this cannot be confirmed, explain why the factors do not reduce the risk associated with large capital spending programs.

   c. Explain the additional risks faced by Kentucky-American that warrant awarding the same return on equity (ROE) to the QIP rider program as awarded to the Kentucky-American's rate base overall.

Response:

a. Confirmed.

b. Ms. Bulkley's analysis of business and operating risk compares the risk of the subject company, in this case KAWC, to the operating utilities of the proxy group companies. This is the necessary comparison for the purposes of establishing a recommended ROE because the data relied upon in the ROE estimation models is market data for the proxy group companies. Therefore, it is not reasonable to evaluate the Company's risk on a stand-alone basis, with and without the QIP. The appropriate analysis is the Company's risk as compared to the proxy group companies. Ms. Bulkley's analysis, as presented in Exhibit AEB-8 reviews the infrastructure cost recovery mechanisms implemented by the utility operating companies of the proxy group and concludes that approximately 79 percent of those companies also have infrastructure cost recovery. Therefore, as discussed on page 50, lines 4 through 7 of Ms. Bulkley's Direct Testimony, KAWC's QIP results in the Company being more comparable to the proxy group.

c. Please see the response to part b above.

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Witness: Jeffrey Newcomb

4. Refer to Kentucky-American's current tariffs on file with the Commission, First Sheet No. 47 and to the Application, Exhibit 1, First Sheet Nos. 47 and 49. Explain why the QIP Rider is not listed on the Kentucky-American's sample bill.

Response:

To Kentucky-American's knowledge, there is no regulation or Commission order that delineates the contents of the sample bill that is included in its tariff. In lieu of specific regulatory requirements, Kentucky-American assesses the sufficiency of the sample bill by the Commission's acceptance of the sample bill tariff, which last occurred in June 2019 as part of Case No. 2018-00358, which is the proceeding in which the QIP rider was first approved.

Should the Commission prefer that Kentucky-American update its sample bill to specifically include the QIP Rider, the Company will do so.

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Witness: Jeffrey Newcomb

5. Refer to the Application, Exhibit 2, Original Sheet Nos. 47 and 49. Explain why the QIP Rider is not listed on the Kentucky-American's sample bill.

Response:

Please see Kentucky-American's response to PSC 2-4.

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Witness: Jeffrey Newcomb

6. Refer to the Application, Exhibit 2, Sheet Nos. 48-49.

   a. Explain the elements of the QIP Rider to which the ROE component is currently applied and how the ROE component is applied, including whether the ROE component is applied to actual capital expenditures only or to actual and forecasted amounts that have not yet been spent.

   b. Provide the Kentucky-American's most recent annual filing showing amounts actually spent, forecasted expenditures, true-up amounts and how the ROE component was applied.

   c. With the Kentucky-American's proposed changes to the QIP Rider, explain how that will affect the ROE component and its application to expenditures.

   d. Explain whether the return as applied inside the mechanism is compounded over time.

Response:

a. ROE is a component of the overall rate of return and is applied to net QIP-eligible plant in-service. The overall rate of return is applied to actual net-QIP eligible plant in-service for completed QIP periods and forecasted net-QIP eligible plant in-service for the current QIP period.

b. Kentucky-American's most recent annual filing, Case No. 2023-00030, can be found on the Commission's website: View Case Filings for: 2023-00030 (ky.gov).

c. Kentucky-American has not proposed changes to the QIP Rider that will affect the ROE component of the overall rate of return nor its application to net QIP-eligible plant in-service. The Company will, however, update the overall rate of return, including the ROE component of that overall rate of return, for post-rate case QIP filings to reflect what is authorized in the Commission's Final Order in this current proceeding, Case No. 2023-00191.

d. The return, as applied inside the mechanism, is not compounded over time.

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Witness: Melissa Schwarzell and David Hill

7. Refer to the Application, Exhibit A, Metering Infrastructure (AMI) Development Plan, page 4.

   a. Provide the current make, model and age of the advanced meter reading (AMR) that Kentucky-American currently has.

   b. Provide all costs associated with uninstalling the AMR meters if Kentucky-American is going to uninstall the current AMR meters and then install a new AMI meter.

Response:

a. See attached Spreadsheet called KAW_R_PSCDR2_NUM007_081823.

b. Application Exhibit A page 16 shows an installation cost of $58.50 per meter. This cost reflects the total replacement effort, which involves both removing the old meter and installing the new.

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Witness: Melissa Schwarzell and David Hill

8. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan. Also refer to the record in Case No. 2016-00394.

   a. Does Kentucky-American believe that the deviation from 807 KAR 5:006, Section 26(6)(b), granted by the Commission in Case No. 2016-00394 extends to the Advanced Metering Infrastructure?

   b. If so, explain how the AMI will satisfy the deviation requested in Case No. 2016-00394.

   c. If not, will Kentucky-American be requesting an additional deviation from 807 KAR 5:006, Section 26(6)(b)?

   d. If Kentucky-American will be requesting an additional deviation, when will that occur?

Response:

a. Yes.
b. The relevant deviation granted in Case No. 2016-00394 was related to the requirement that a utility physically inspect its meters and meter settings annually that is set forth in 807 KAR 5:006, Section 26(6)(b). The Commission's December 12, 2017 Order in that case granted a deviation to KAWC from having to comply with that annual physical inspection. The Order states, "Kentucky-American has asserted that the current AMR meters do not need regularly scheduled physical inspections. When the meters are read remotely through a monthly drive-by, data from the meter is collected and analyzed, and work orders are issued immediately for any issues arising from analysis of the data. Work orders are also issued if customers call in with concerns about their meters. Linda Bridwell, manager of rates and regulations for Kentucky-American, testified that there is no significant information about the meters that could be collected from a physical inspection that is not collected from a monthly drive-by reading of the meter. Ms. Bridwell asserted that the drive-by remote readings provide more data about the proper functioning of the meters than would a physical inspection." (Order, pp. 3-4)

   In granting the deviation, the Order further states, "Kentucky-American is performing monthly drive-by, remote readings of its AMR meters, which provide Kentucky-American with more frequent information on meter functioning than would an annual physical inspection." (Order, p. 6). Thus, the deviation was premised upon the fact that AMR technology provides better and more frequent information about meter functioning than an annual physical inspection would. AMI technology provides the ability for even more frequent data capture about meter functioning than an annual physical inspection or AMR technology. The AMI technology enables the meter to communicate data that would be captured multiple times daily, versus the monthly capture associated with AMR technology. So, for the same reason the deviation was granted in that case, the deviation should continue to apply to AMI meters.

c. Based on the response to part (b), KAWC does not believe an additional deviation is necessary, but, if the Commission disagrees, KAWC will seek one.

d. If the Commission believes an additional deviation is necessary, KAWC will request it as soon as possible after learning that the Commission believes it is necessary.

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Witness: Melissa Schwarzell and David Hill

9. Provide all changes to the number of employees expected in the transition from AMR to AMI.

Response:

KAW has not predicted any change to the number of employees expected in the transition from AMR to AMI. As noted in Exhibit A to the application on page 3, "implementation of AMI will allow KAWC to realign its business processes and redeploy personnel previously focused on meter reading to other work". Exhibit A to the application further states on page 7 that labor-related efficiencies "are not necessarily anticipated to result in a workforce reduction. Rather, AMI presents an opportunity for KAWC to have affected labor resources refocus their efforts on other high value work, such as achieving meter reading and other service order targets in the near term, accommodating the demands of a growing customer base in the long term, and on a continual basis, seeking operational and customer service improvements."

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Witness: Melissa Schwarzell, David Hill and Shelley Porter

10. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 5.

    a. Explain how Kentucky-American plans to limit the amount of capital costs associated with AMI.

    b. Explain whether the cellular AMI is considered to be the most reliable option as compared to the least cost option.

Response:

a. KAW plans to limit the amount of capital costs by purchasing products that have been priced through competitive, enterprise-wide negotiations with vendors. KAW has also selected a brand that provides lower cost endpoints and meters. Additionally, KAW will competitively bid third-party services for the installation of meters.

b. As discussed on pages 5 through 7 of Exhibit A to the Application, cellular AMI is expected to offer superior reliability and more timely, frequent accurate reads for customers service, compared to other options for metering.

   As shown in confidential Figure 12, on page 19 of Exhibit A to the Application, cellular AMI offers the best cost net of benefit proposition in the long term. In the near term, prior to accrual of meter reading labor benefits, existing technology has a more favorable annual cost net of benefit figure, however cellular AMI is indeed expected to offer more reliability, due to the nearly constant availability of meter reading and customer usage data, compared to single snapshot AMR reads that must be obtained by sending a person into the field. Cellular AMI also offers numerous safety, customer service, operational efficiency and environmental benefits. These are discussed in many places in Exhibit A, but are summarized on pages 3, 5, 6, and 7.

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell, David Hill, and Shelley Porter

11. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 13.

    a. Provide copies of the request for proposal (RFP) for the AMI system, the bid sheets, the criteria for selection, the bid tabulation sheet, and an explanation why the chosen vendor was selected.

    b. Explain in detail how the RFP was publicized and provide copies of notices for the RFP.

    c. If an RFP was not issued, explain in specific detail why an RFP was not issued, how potential vendors were notified that Kentucky-American was proposing to install an AMI system, the process Kentucky-American used to identify the vendors that it evaluated, and the names of all vendors that Kentucky-American contacted regarding the proposed AMI system.

Response:

a. As discussed on page 3 of Exhibit A, "[u]nlike some other proposed AMI deployments in the state, KAWC is not planning to accelerate the replacement of its entire meter reading system regardless of its age or condition. Rather KAWC will transition to an updated technology for meter reading equipment as it completes meter and endpoint replacements in the normal course of business." This process is expected to take approximately ten years and thus is not a single standalone project.

   That said, the AMI system that would evolve over the next decade is comprised of parts, including:

   - Meters and endpoints
     - In 2016 Badger and Neptune were selected as strategic partners for Meter and Endpoint hardware. The RFP process included multiple vendors, and included meter hardware and technology specifications. American Water referenced AWWA M6 specifications for Cold Water meters, and decided to pursue the RFP on Positive Displacement (nutating disc) meter technology. Badger and Neptune were the two vendors in the RFP that met this requirement. The available bid documents are attached to this response as Attachments 1 through 4. Attachment 4 is confidential and filed pursuant to a Petition for Confidential Protection.

    - Every two to three years, performance is evaluated and pricing for both meter manufacturers is re-negotiated. Therefore, each American Water operating subsidiary such as KAW may choose between these manufacturers for small meter hardware.
- Installation Labor
    - KAW is in the process of releasing an RFP for the installation labor. This is currently under development and is not yet finalized.

b. For meters and endpoints, see part a above. The installation labor RFP is still being finalized, but the process for releasing the information to vendors will be completed through a cloud-based procurement system called Coupa.

c. For meters and endpoints, see part a above. For the installation labor RFP, see part b above.

Request for Proposal
For
Water Meters and RF Transmitters

AMERICAN WATER

9/30/2015

1. CONFIDENTIALITY AND NON-DISCLOSURE

This Request for Proposal (RFP) and the information contained herein, and any other information, data, materials of or about American Water (AW) or its business operations in connection with this RFP, constitute highly sensitive and confidential information, and is the property of AW. Each potential proposer (Proposer) shall regard this RFP and all such information, data, and materials as strictly confidential. This RFP and all proposals submitted to AW, and all other information, data, materials, and communications relating to this RFP shall be subject to the terms of the Non-Disclosure Agreement (NDA) that has been executed between AW and Proposer. Each Proposer must recognize that AW operates in a highly competitive business environment and, for that reason, the Proposer must not disclose any portion or portions of this RFP, or of any such information, data, and materials, to any of its business partners, affiliates, or subcontractors, or to any other third party, unless each such business partner, affiliate, subcontractor, or other third party, as the case may be, first executes a confidentiality agreement no less restrictive than the NDA that has been signed by the Proposer and AW.

2. GENERAL COMPANY INFORMATION

With headquarters in Voorhees, NJ, AW employs approximately 6,900 dedicated professionals who provide drinking water, wastewater and other related services to approximately 16.2 million people in 32 states, Military bases, and Ontario, Canada. More information can be found by visiting www.amwater.com.

3. SCOPE OF PROJECT/WORK

3.1. Project Summary/Purpose of RFP

The overall objective of strategically sourcing Water Meters and related Reading Equipment for American Water Inc. is to obtain reliable and accurate water meters with consideration for the Total Cost of Ownership.

Water Meters under consideration for this RFP include the smaller set of meter sizes, typically 5/8” to 2”. Proposers may provide partial bids if their full range of meter sizes is less than 5/8” to 2”.

Expected results include:

- Reliable and accurate meters and meter reading solutions with expected lifespans of at least twenty years, for an annual procurement of approximately 275,000 meters (although no minimum quantity will be guaranteed).
- Identification of configurations of meters, registers and RF Transmitters to allow integration into the current lineup of American Water meter reading technologies and capabilities, including options with cross-vendor solutions
- Identification of potential configurations for meters, registers and RF Transmitters that will support an American Water long-term strategy for migration from Advanced Meter Reading (AMR) technologies to Advanced Metering Infrastructure (AMI) technologies
- Ability to integrate the meter reading technology to our Fathom 2.0 system or other MDM solutions to facilitate migration to advanced and increasingly interoperable technology
- Confirmation from meter vendors that their technologies and solutions align with the requirements and specifications of American Water and traditional AWWA standards
- Training provided to each AW district at no cost to include initial training and annual training by Manufacturer to ensure full understanding of all aspects of installation, operation and troubleshooting on all components.

3.2. AW Locations for Deliveries

The List of AW Locations and historical purchasing volume is included in Exhibit A.

3.3. Objectives/Requirements

This RFP is being issued to select supplier(s). This RFP is structured to ensure an approach that maximizes responsiveness, value delivered, and quality service levels while providing incentives for American Water and its suppliers. Please ensure that your responses to the RFP requirements are answered completely. Any proposal for additional service offerings should be presented in a separate document.

This RFP and the subsequent evaluation process are designed to ensure the achievement of the objectives listed above. Our goal is to complete this process with one or more contracts executed in December, 2015.

3.4. Technical Specifications

The Technical Specifications and Vendor Questions are included as Exhibit B.
These Technical Specifications list the requirements for meters and RF technology under consideration in this RFP.
Answers to the Vendor Questions must be provided in the Proposal in Microsoft WORD format.

3.5. Pricing

The Pricing Worksheet is included as Exhibit C.
Proposed pricing shall follow the format provided in Exhibit C.
Please attach Pricing Worksheet as a Microsoft EXCEL file to the proposal response.
Clarifications or explanations may be submitted with the completed Pricing Worksheet.

3.6. Contract Terms and Conditions

The Contract Terms and Conditions are included as Exhibit D.
Proposers may request changes to the terms and conditions of the draft Contract when submitting their Proposal.

AW requests Proposers to base their Proposals on the terms and conditions set forth in the draft Contract. Acceptance of the terms and conditions of the draft Contract will be a factor in the evaluation of Proposals. AW recognizes, however, that Proposals may be conditioned on the mutual resolution of particular issues.

To the extent that a Proposer intends to condition its Proposal on particular changes to the draft Contract, such changes shall be identified as set forth in section 5.1. In addition, to the extent that proposed changes to the terms and conditions substantially change the nature of the transaction or the scope of Work, AW may reject the Proposal in its sole discretion as non-responsive to the requirements of this RFP.

In evaluating proposed terms and conditions, AW will assume that the Proposer’s comments includes all suggested changes and that the Proposer accepts all terms and conditions that are not specifically addressed pursuant to section 5.1. AW does not intend to discuss or negotiate any issue, term or condition that is not specifically identified pursuant to section 5.1**.** If the Proposer(s) selected for negotiations raises any such issue, term or condition, AW reserves the right to suspend or terminate negotiations with the selected Proposer.

4. RFP INSTRUCTIONS AND EVENT CALENDAR

4.1. American Water Representation

All questions with regard to this RFP must be made by e-mail only through the designated AW representative. Discussion with other parties within or associated with AW may result in disqualification from the RFP process.

For the purposes of this RFP, the AW representative is:

Supply Chain: Michael Cline

Michael.Cline@amwater.com

4.2. RFP Instructions

Step 1. Prepare RFP Response

Please review the RFP and respond to all questions. There are no limits to length of response. If you are a attaching a document to answer these questions, please provide the specific name of each document next to the question.

Step 2. Submit Clarifying Questions Form

After thoroughly reviewing the RFP, if you have a need to clarify any of American Water's questions or requirements, please submit a Microsoft WORD file with your questions to the AW representative at the above email address on or before 10/7/2015. AW will collect all questions and distribute all questions and answers to all parties who elect to participate in this RFP. Some questions may be slightly altered so that the source of the questions will remain anonymous.

Step 3. Submit Final RFP Response

Proposers are required to submit their response via email to Michael.cline@amwater.com by 10/21/2015 no later than 5:00 pm EDT. Proposers must submit a proposal (complete) via electronic mail by that date and time.

4.3. Event Calendar

RFP EVENT CALENDAR

RFP Event	Date
Distribution of Intent to Respond / NDA	9/25/2015
Distribution of RFP; Response Period Begins	9/30/2015
Potential Proposers Submit Intent to Respond Form / NDA	9/29/2015 Before 5:00 PM EDT
Potential Proposers Submit Clarifying Questions to AW	10/8/2015 Before 5:00 PM EDT
AW Provides Answers to Questions	10/15/2015 Before 5:00 PM EDT
Response Period Ends; Responses Due	10/22/2015 Before 5:00 PM EDT
Select Vendor(s)	11/18/2015

4.4. Additional Terms

This RFP constitutes an invitation to the Pre-qualified Respondents to submit Proposals to AW. AW reserves, holds without limitation and may exercise, in its sole discretion, the rights as set forth below. Such rights are in addition to and shall not serve to limit any of the specific rights and conditions set forth in this RFP. By responding to this RFP, Proposers acknowledge and consent to the following AW rights:

1. Disclaimer - This RFP does not constitute an offer by AW to enter into a contract, nor does any response to this RFP constitute an acceptance of an offer. A response to this RFP by a Proposer does not bind AW in any way. In addition, any costs associated with preparing proposals in response to this RFP and for providing any additional information required by AW to facilitate the evaluation process are the sole responsibility of the Proposer and will not be reimbursed by AW or any of AW's affiliates or subsidiaries.

2. AW reserves the right to waive any defect, technicality or any other minor informality or irregularity in any Proposal.

3. AW reserves the right to eliminate any Proposer that submits an incomplete or inadequate response, or is not responsive to the requirements of this RFP, or is otherwise deemed to be unqualified during any stage of the procurement process.

4. AW reserves the right to prepare and issue such amendments and addenda to this RFP prior to the deadline for receipt of all Proposals, including any amendments or addenda that may expand or cancel any portion or all of the work described in this RFP.

5. AW reserves the right to receive questions concerning this RFP from Proposers and to provide such questions, and AW's responses, if any, to all Proposers.

6. AW reserves the right to request clarifications of information submitted in the Proposals.

7. AW reserves the right to modify or terminate the procurement process by written notice to the Proposers for any reason whatsoever.

8. AW reserves the right to change or alter the schedule for any events associated with this procurement process upon notice to the Proposers, including, without limitation, the date for receipt of Proposals or any other deadlines and dates set forth in this RFP.

9. AW reserves the right to issue subsequent RFPs.

10. AW reserves the right to conduct investigations with respect to the experience of any team member included in a Proposal and to request additional evidence to support any such information.

11. AW reserves the right to visit and examine any of the facilities referenced in the Proposals or SOQs and to observe and investigate the operations of such facilities.

12. AW reserves the right to interview one or more of the Proposers, in AW's sole discretion, in order to obtain clarification of information provided by the Proposer.

13. AW reserves the right to amend the Work described in the draft Contract, at any time, to omit Work therein or to include Work not currently contemplated therein.

14. AW reserves the right to determine the selected Proposer(s) with whom to negotiate the Contract.

15. AW reserves the right to discontinue negotiations with the selected Proposer(s) and commence negotiations with the next ranked Proposer(s).

16. AW reserves the right to enter into, or decline to enter into, the Contract with the selected Proposer(s) following negotiations. Price will not be the sole criteria during evaluations.

17. AW reserves the right, for any reason, to decide not to award a Contract as a result of this procurement process.

18. AW reserves the right to decide on the most appropriate method for Project implementation, which may include discontinuation of this procurement process and development of the Project via another process elected by AW.

19. All volumes and business profiles are projections only. Both volumes and business profiles may change due to changes in AW business strategy or external business conditions.

20. A person having legal authority to represent the Proposer must submit the response to this RFP.

21. Following submission of proposals and final evaluation, AW will have the right to retain the proposals for any unsuccessful responses, maintaining them in confidence.

22. AW requires that Proposer’s proposal remain valid for a period of at least (90) calendar days from the proposal due date.

4.5. Supplier Selection

AW reserves the right to make one or more awards based solely on the information provided, to conduct discussions, or to request proposal revisions, if deemed necessary by AW. The Proposer(s) selected for the award will be chosen on the basis of which Proposer(s) will provide the greatest overall benefit to AW.

Key considerations for the award(s) will include the following:

- Analysis of historical data on defects and failure rates for each meter model and/or component quoted
- Flow test accuracy data for each meter assembly as new and any data for meters removed from service and tested
- Demonstration of compatibility between meters/registers and MIU units of different vendors
- The offering of an AMI migratible MIU which does not require a repeat visit to the field to transition from AMR to AMI
- Training provided to each AW district at no cost to include initial training and annual training by Manufacturer to ensure full understanding of all aspects of installation, operation and troubleshooting on all components.
- Interviews with other Water Utilities on their experiences with each meter model

AW has no obligation to reveal how proposals were assessed. Therefore, proposals should contain your best terms within the proposed functional and technical approach.

5. RFP COMPLETION DOCUMENTS

5.1. Proposer Proposed Revisions

If your company is unable to comply with any terms contained within the Technical Specifications/Pricing Worksheet or Agreement Terms and Conditions exhibits, please complete the table below. All information requested in this table must be provided.

Document Name	Section Name & Number	Are Proposed Changes Negotiable, Mandatory, or Suggested?	Rationale For Proposed Changes

5.2 Proposal Summary and Certification Form

After a proposal has been completed, an authorized representative of each Proposer must sign the document attached below in order to verify that each Proposer's proposal is accurate. Once signed, return this document, along with the completed submission, via email to Michael.Cline@amwater.com by 10/22/2015 @ 5:00 pm EST. AW and the Proposer agree that a facsimile of a Proposer's signature is equal to an original signature for purposes of this RFP.

Save this page only as a separate PDF file before emailing.

The undersigned submits a proposal pursuant to the requirements and specifications defined in this RFP, without exception unless such exception is clearly noted on this proposal summary document. Third party proposals will not be accepted.

The Proposer declares that it has carefully examined the requirements and specifications, and that it proposes and agrees, if its proposal is accepted, that it will contract with AW to provide the indicated proposal response(s).

____

Proposer Name

____ ____________________

Name of Contact *(please print)* Title

6. EXHIBITS

6.1.	*Exhibit A*	-	*AW Locations for Deliveries and Historical Volume*
6.2.	*Exhibit B*	-	*Technical Specifications & Questions for Proposer*
6.3.	*Exhibit C*	-	*Pricing Worksheet*
6.4.	*Exhibit D*	-	*Agreement Terms and Conditions*
6.5.	*Exhibit E*	-	*Flat File Template*

Exhibit A: AW Locations for Deliveries and Volume (7/2014 – 6/2015)

State	City	Address	Plant	Purchased *
CA	Imperial Beach	1019 Cherry Ave	D401	672
CA	Newbury Park	2439 W Hillcrest Dr	D402	1,122
CA	Pacific Grove	836 Carmel Ave	D404	1,056
CA	Rosemead	8657 Grand Ave	D406	3,200
CA	Sacramento	4701 Beloit Dr	D403	786
CA	Santa Rosa	4787 Old Redwood Hwy	D405	30
IA	Clinton	2020 Manufacturing Dr	D501	1,118
IA	Davenport	5201 Grand Ave	D502	2,536
IL	Alton	4436 Industrial Dr	D308	4,061
IL	Belleville	100 N Water Works Dr	D314	10,430
IL	Cairo	4100 Ohio Street	D309	200
IL	Herod	RR Lat-37.59115938 Long-88.2	D315	550
IL	Lincoln	311 Limit Street	D307	266
IL	Pekin	328 Broadway St	D305	846
IL	Peoria	8400 N University St	D306	3,525
IL	Pontiac	401 W Howard St	D304	432
IL	Sterling	1202 Commerce Dr.	D303	240
IL	Streator	120 S Sterling St	D302	570
IL	Urbana	601 N Lincoln Ave	D301	5,517
IL	Woodridge	1000 Internationale Pkwy	D313	5,060
IN	Crawfordsville	809 Banjo Dr	D560	338
IN	Gary	1650 Michigan St	D569	5,020
IN	Greenwood	2501 Endress Place	D571	552
IN	Jeffersonville	2423 Middle Rd	D566	1,354
IN	Kokomo	1720 E Superior St	D551	5,668
IN	Mooresville	425 W Main St	D562	336

IN	Muncie	1420 S Burlington Dr	D552	2,799
IN	Newburgh	5622 W State Route 66	D567	845
IN	Noblesville	835 Wayne St	D570	3,900
IN	Richmond	1730 Sylvan Nook Dr	D553	341
IN	Seymour	7174 N 760 E	D568	431
IN	Shelbyville	1700 McCall Dr	D563	415
IN	Terre Haute	51 Locust St	D564	3,384
IN	Wabash	3929 S State Road 15	D556	120
IN	Warsaw	2420 Hidden Lake Rd	D557	270
IN	West Lafayette	1007 Happy Hollow Rd	D558	140
KY	Lexington	2340 Richmond Rd	D602	2,933
KY	Owenton	102 N Main St	D601	200
MD	Bel Air	1004 Baltimore Pike	D901	325
MI	Calumet	311 5th St	D851	76
MO	Branson	300 Terrace Drive	D371	804
MO	Brunswick	329 S Small St	D351	74
MO	Jefferson City	221 Brooks St	D352	846
MO	Joplin	2323 Davis Blvd	D353	2,404
MO	Mexico	506 S Western St	D354	1,022
MO	Parkville	101 E 1st St	D355	70
MO	Saint Charles	1290 Motherhead Rd	D356	3,695
MO	Saint Louis	1050 Research Blvd	D359	28,320
MO	Shell Knob	Hwy 39 North	D365	300
MO	St Joseph	602 Main St	D357	5,980
MO	Warrensburg	1705 Montserrat Park Rd	D363	825
NJ **	Lakewood	100 James St	D206	67,530
NY	Hewlett	25 Starfire Ct	D801	250
NY	North Bellmore	1285 Newbridge Rd	D802	435
NY	Sea Cliff	325 Prospect Ave	D803	307

PA	Bangor	1760 Valley View Dr	D102	40
PA	Berwick	306 W Front St	D108	154
PA	Bethel Park	560 Horning Rd	D132	13,016
PA	Birdsboro	660 Lincoln Rd	D114	214
PA	Brownsville	1701 17th Street	D128	110
PA	Bushkill	Winona Falls Road	D104	248
PA	Butler	203 Oneida Valley Rd	D126	3,807
PA	Clarion	425 Waterworks Rd	D119	1,206
PA	Clarks Summit	1 Zimmerman Street	D101	250
PA	Coatesville	100 Cheshire Ct, Ste 104	D136	353
PA	East Norriton	171 W Johnson Hwy	D115	1,570
PA	Elizabeth	101 Long St	D129	2,500
PA	Frackville	250 W Laurel St	D109	44
PA	Hummelstown	200 Canal St	D110	250
PA	Indiana	1909 Oakland Ave	D120	44
PA	Kane	66 Dwights Rd	D121	4
PA	McMurray	300 Galley Rd	D131	5,876
PA	Mechanicsburg	852 Wesley Dr	D111	2,071
PA	Milton	105 Sodom Rd	D112	440
PA	New Castle	2736 Ellwood Rd	D122	7,512
PA	Philipsburg	1912 Tyrone Pike	D113	10
PA	Punxsutawney	203 Sycamore St	D124	20
PA	Royersford	20 S Limerick Rd	D117	633
PA	Scranton	2699 Stafford Ave	D140	2,969
PA	Sinking Spring	920 Mountain Home Rd	D116	108
PA	Susquehanna	88 Willow Ave	D107	390
PA	Tobyhanna	446 Sterling Rd	D106	485
PA	Uniontown	72 Coolspring St	D130	574
PA	Warren	10 Willey St	D125	2,041

PA	Yardley	1145 Edgewood Rd	D118	500
TN	Chattanooga	1490 Riverside Dr	D701	5,348
TN	Whitwell	13026 Hwy.28	D704	30
VA	Alexandria	2225 Duke St	D751	810
VA	Bluefield	1970 Leatherwood Ln	D660	152
VA	Hopewell	900 Industrial Street	D752	123
VA	Warsaw	621 Oldhams Rd	D754	116
VA	Woodbridge	4504 Dale Blvd	D753	9,500
WV	Charleston	1600 Pennsylvania Ave	D662	11,643
WV	Hinton	95 Grace St	D655	562
WV	Huntington	4002 Ohio River Rd	D661	3,779
WV	Montgomery	148 6th Ave	D664	1,250
WV	Oak Hill	129 Highland Ave	D659	200
WV	Princeton	173 Twelvemile Rd	D653	722
WV	Racine	22885 Coal River Rd.	D667	8,400
WV	Salt Rock	31 Water Plant Road	D665	635
WV	Webster Springs	520 Orchard St	D651	100
WV	Weston	1243 US Highway 19 S	D652	750

***** Purchased volumes may not reflect actual demand due to changes in inventory levels.

** Due to state mandated testing requirements of New Jersey, meters are delivered to our testing center in Lakewood. After testing, meters are redistributed to the locations that will use them at American Water expense.

Meter Purchases July 2014 – June 2015 by Attribute

By Size

Row Labels	Sum of Qty
1	16,943
3/4	10,578
5/8	248,564
Grand Total	**276,085**

5/8 includes 5/8x1/2 and 5/8x3/4 meters

By Unit of Measure

Row Labels	Sum of Qty
CF	101,456
GL	174,629
Grand Total	**276,085**

Note: American Water is committed to convert to purchasing only meters registering in gallons over the course of this contract period (subject to regulatory approval)

Construction

Row Labels	Sum of Qty
	228
Bronze	60,102
Cast Iron	7,431
Composite	208,324
Grand Total	**276,085**

Configuration

Row Labels	Sum of Qty
	2,649
Inside Set	63,793
Outside Set	209,643
Grand Total	**276,085**

With MIU

Row Labels	Sum of Qty
FALSE	89,039
TRUE	187,046
Grand Total	**276,085**

Note: A significant number of MIU's were purchased separately. 82% of installed meters are AMR or AMI equipped

Integrated MIU

Row Labels	Sum of Qty
FALSE	149,658
TRUE	37,388
Grand Total	**187,046**

Integrated MIU's are directly attached to the meter body. Non-integrated MU's are attached via a wire of some length

Wire Length (Non-Integrated MIU)

Row Labels	Sum of Qty
2	120
3	148,143
5	38
(blank)	1,357
Grand Total	**149,658**

American Water has historically purchased a large number of different meter configurations. We expect to work with the successful proposer to reduce this to a small number of standard configurations.

Exhibit B – Technical Specifications and Requirements

Specifications: Cold Water Meters and RF Transmitters

1) **All Meters – 5/8” through 2”**
   a) Meters furnished under these specifications shall be the product of a manufacturer with at least ten (10) years of experience in meter manufacturing for the United States Market.
   b) Meters shall be new, first line quality, positive displacement type for cold water service.
   c) Meters shall comply with the latest revisions of AWWA Standard C700 and C710.
   d) Meters must be compliant with ANSI/NSF Standard 61 Annex G.
   e) Meters must be compliant with the Safe Drinking Water Act.
   f) They shall be designed for use with potable water below 120 degrees F.
   g) Meters shall be able to withstand 150 psi working pressure.
   h) Reliability testing for all AWWA standards related to Burst Pressure and Freezing Conditions shall be provided, for example AWWA C710-09.
   i) Reliability testing data on Packaging drop and vibration tests shall be provided.

2) Positive Displacement Meter Type - 5/8” through 2”
   a) Meters must be of the nutating disc type.
   b) Meters with stuffing boxes, spindles and packing glands will not be acceptable.
   c) The register and measuring element will be an integrated. This integrated unit will not be removable from the external housing. The meter body shall have the size and direction of water flow through the system imprinted on the external housing.

3) Static Meter Type - 5/8” through 2”
   a) The register shall not be removable from the measuring sensor.
   b) The register and measuring element will be an integrated unit. This integrated unit will not be removable from the external housing. The systems shall have the size and direction of water flow through the system imprinted on the external housing.

4) Registers
   a) The register must be an electronic device encapsulated in glass with 9 or more programmable digits with a resolution of at least 0.01 units, utilizing a liquid crystal display (LCD). It will have indicators for flow direction, flow rate in gallons per minute, battery life and unit of measurement. The register must be hermetically sealed with a heat tempered glass cover and be tamper resistant. Mechanical registers are not acceptable.
   b) Connections for AMR transmitters shall use a minimum 22 gauge copper vinyl clad wiring per AWG. Wiring convention shall employ a 3 wire connection with red, green and black with white as a spare. Wires shall be labelled R, B, G (and W) as are terminals on the meter and transmitter. Connectors shall be standard devices fully resilient to wet conditions per UL 486D.
   c) Registers must have a means of obtaining a final read if the register fails or the readout is not visible.

5) RF Transmitters

   a) Transmitter housing made of plastic shall be tested using Izod impact resistance standards and identify the level of strength of the material. Transmitter shall be provided in a waterproof casing rated IP8 or better (submersion up to 1 meter of depth) in accordance with the IP code, IEC standard 60529. Transmitter shall continue to function in a temperature range -22°F to + 149°F (-30°C to + 65°C). Transmitter units shall be provided with a unique bar code that enables the utility to readily link the installed transmitter with the address/meter.
   b) Connections for AMR transmitters shall use a minimum 22 gauge copper vinyl clad wiring per AWG. Wiring convention shall employ a 3 wire connections with red, green and black

with white as spare. Wires shall be labelled R, B, G (and W) as are terminals on the meter and transmitter. Connectors shall be standard devices fully resilient to wet conditions per UL 486D.

c) AMR transmitter battery life shall follow the warranty period of the transmitter (see warranty below). For systems using true two way communication (including migrating AMR to AMI systems), the data management system shall provide clear indication of estimated battery remaining life and provide a warning that battery failure can occur within 6 months. For two way systems (migrating AMI), the vendor shall provide clear examples of to what extent battery use can be shortened by possible uses including 1) extracting 5 minute reads for a one week period (as part of use study or evaluation of meter sizing) 2) extracting 4 special reads per read that may be requested (as in transient properties where responsibility for the bill changes hands).

d) If the vendor should indicate that the battery is replaceable in the transmitter, the vendor shall describe how water tightness can be maintained after the transmitter case has been opened.

e) Vendor shall be knowledgeable about the proposed locations of the transmitter including placement at meter which can be inside a building below grade or in exterior subsurface vaults and meter pits (metal lids) and shall provide sufficient information to the utility at the time of bid about what measures may be required to obtain readings (example external wall mounted transmitter, nonmetallic pit lids). Vendor shall provide brackets for a variety of transmitter mountings to include locations at the meter or in close proximity to the meter (interior settings), in pits and on walls. Brackets shall be rugged and meet impact standards (noted for transmitters). Bracket pricing shall be included in the proposed pricing.

f) Vendor shall identify issues regarding obstacles to effective transmission and reception of data to antenna on vehicle operating at normal speed including transmission problems with metal meter pit lids, metal lid vaults, building structures and transmitters set below grade. Remedies for such issues (e.g.., composite lids, use of wall mounted transmitters to outside of building) shall be identified in the vendor bid so the utility can examine possible options and additional costs. The vendor shall design the system to achieve a data retriever rate of 99% of reads and read related alarms. Vendors shall identify the interval, duration and strength of radio signals from radio transmitting AMI devices (including the nature of frequency hopping if employed). Vendors shall provide any documentation it possesses concerning health related concerns and the use of their devices to aid the utility in the effort to assuage concerned customers. For migrating systems, the ability to readily switch back and forth between AMI and AMR collection shall be described.

g) Vendor should convey all data available from meter or stored in transmitter to data management system using secure (encrypted) format that meets the Advanced Encryption Standard (AES) encryption standard (National Institute of Standards and Technology (NIST) for type 4 uses. Vendor shall describe any and all data that cannot be conveyed by its data collection system that exist at the meter or MIU level that is not encrypted.

h) Transmitters must be compatible with other meter manufacturers' encoder registers to include Sensus, Neptune, Badger, Mueller, Elster and Master Meter.

i) The System must be capable of migration from mobile to fixed base AMI/AMR (water meters) and shall allow data collection (manual, mobile RF, and/or fixed base) to operate together seamlessly in a mixed system that utilizes the same technology with a common interface to the American Water MDM (Fathom), or other MDM option as selected by AW.

j) The System shall provide a secondary means of reading meters equipped with a MIU via a handheld device equipped with an RF transceiver.

k) MIUs shall be compliant to all Federal and State Regulations governing RF transmissions. Vendors shall provide test data for measured signal strength at 3, 5 and 10 meters in various field conditions (pit, basement, and street level, etc.).

6) Serial Numbers and Labeling

a) Serial numbers must be unique across the entire inventory of meters installed at American Water including meters provided by competing manufacturers.
b) Meters must have unique serial numbers assigned, and permanently etched on the meter body. Serial numbers shall be easily readable when viewed from above in a pit set application.
c) Meter Interface Units (MIUs) must have a unique serial number etched on the body.
d) Changes to Serial Number format or convention must be pre-approved by AW Supply Chain.
e) Meters and MIUs must have distinct barcodes attached. Supplier shall provide background information and supporting documentation regarding their barcode characteristics upon request by American Water.
f) Vendors will work with AW to develop Labeling Specifications for durability, barcoding and readability.

7) Flat File for Meter Deliveries

a) Supplier must provide a Flat File with each shipment in accordance with an AW Template.
b) The Flat File provides information on serial numbers and factory flow test data.
c) Flat File's will be emailed at time of meter delivery in accordance with AW directions.

8) Flow Test Accuracy

a) Meters must meet the accuracy requirements of AWWA M6, Table 5.3
b) The meter must be warranted to perform to the accuracy levels set forth in Table 5.3 for twenty (20) years from the date of shipment.

9) Advanced Reporting

a) Vendor shall fully describe options (and any support costs) for securing data logged information from on-site collection system. This shall include how data interface operates and whether direct contact with the transmitter is required. MIUs shall be capable of datalogging at least 40 days of hourly data.
b) Vendors shall identify any third parties with which they have provided data formatting information to allow that party to provide meter data management. Vendor shall identify any distinctions in data information that are different between the third party and their own MDM system that would prevent entry into the Fathom system.
c) Vendor shall identify all third party monitors and actuators (valves) that can communicate with the data collection system and convey information to either the meter data management or the monitoring vendor software. This includes shutoff valves, acoustic monitors, temperature, pressure and water quality monitors. If data conveyance does not use the third party monitor software, any partial data not provided shall be identified.
d) Amongst vendor devices, different alarms (backflow, tamper, variations in use) can have different meanings. Vendor shall identify parameters provided such as duration/frequency (e.g., backflow alarm 35 days/every 15 minutes), exact nature of alarm (e.g., tamper means cut wires, continuous use can mean water consumption every hour for x days). The vendor shall be willing to provide sufficient information to facilitate conveyance of alarms with readers for incorporation into the meter data collection and management system currently operated by Fathom.
e) MDM error reporting shall include identification of locations with missing reads, metered accounts identified as unbilled with usage, accounts identified as active with zero use and accounts identified as active with usage at variance to past history (as available).
f) If applicable, vendor shall describe its ability to make data available to the water customers of the utility through selective access to account information provided by the manufacturer owned MDM. Vendor shall describe how the utility is able to control extent of access by customer and how data is secure.
g) The system must be capable of having at the minimum the following reporting capabilities:
   i) Programmable leak detection
   ii) Programmable reverse flow detection

    - iii) Tamper alarm
    - iv) No flow
    - v) Dry Barrel (for static meters)
    - vi) No Response (unable to communicate)
  - h) Programmable data logging capability must include:
    - i) Peak flows and volumes within intervals
    - ii) Minimum of 5,000 data points
    - iii) Intervals must be programmable from 15 minutes to daily
  - i) Alarms must be logged including date and time of event. Logs must be downloadable.
  - j) Historical data must be available for ≥ 90 days, with hourly data showing:
    - i) Readings
    - ii) Consumption
    - iii) Alarm/Error Codes

10) Supplier Quality Assurance / Corrective Action Program

  - a) Supplier must be certified through ISO 9000 Quality Management and must commit to transitioning to ISO 9000:2015
  - b) Supplier must have a Quality Assurance / Quality Control and Corrective Action Program.
  - c) Upon request by American Water, Supplier will provide American Water a copy of its quality assurance program and corrective action program, and any records with respect to those programs that relate to any Goods purchased under this Agreement. Upon reasonable notice, American Water shall have the right (at its own travel-related expense) to conduct quality audits, including reasonable on-site visits and interviews.
  - d) Supplier will supply American Water with summaries/reports of Root Cause evaluations (or similar evaluations) when defects or quality issues are identified within water meters in the range of serial numbers which have been purchased by American Water.
  - e) Supplier agrees to notify AW of any changes in meter materials, manufacturing process, software or firmware at least 90 days prior to implementation. Changes in firmware that diminish the acceptability of data coming into Fathom meter ready system will not be allowed without written approval from AW.
  - f) Program Management and Support – Supplier agrees to provide dedicated program management resources to support the day-to-day logistical and quality concerns of AW.
  - g) Supplier agrees to timely responses on AW requests for Root Cause Analyses (RCA). If applicable, RMAs from AW will designate the Severity Level:
    - i) Level 1: 3 working days
    - ii) Level 2: 7 working days
    - iii) Level 3: 10 working days

11) Warranty

  - a) Vendor shall provide a minimum 10 year warranty (replacement provided at no cost including shipping) on the meter and MIU with a 10 year diminishing reimbursement for the cost of the replacement unit.
  - b) An option for 15 years full warranty and 5 year diminishing warranty shall be included with any change in price clearly stated in the bid for utility analysis.
  - c) Vendor shall provide currently available options for the disposal of lithium batteries in the transmitters, describing removal procedure from transmitter and outlets for disposal.
  - d) Vendor shall indicate how their company currently disposes of lithium batteries and the transmitter casings.
  - e) Vendor shall provide an estimate of the unit cost for the disposal based on current costs.

12) Failures

  - a) A failed meter is one that is unable to accurately register the flow of water pursuant to the requirements of AWWA M6 Table 5.3 OR
  - b) A failed meter is one that is unable to transmit meter readings to a receiving device when equipped to do so OR
  - c) A failed meter is one that leaks when installed properly

d) Meter failure rate is defined as the percentage of meters that fail divided by the number of meters in service. Failure rates will be measured both annually and over the life of the meter.

e) When a failure rate of a specific meter model or family of meter models (sharing one or more characteristics, such as register type or RF transmitter) exceeds a certain value, the supplier will work with AW to remedy the situation, to include the following:
   i) Compensation for changing of the defective meter
   ii) Lost revenue per month from a stopped meter
   iii) Costs associated with testing in-stock faulty water meters
   iv) Costs associated with testing new replacement water meters to confirm meter issue has been resolved

f) Compensation can be approximated on a per-meter basis, with a cost of $XX per meter either experiencing a defect, or a cost of $xx for each meter in the population of meters potentially affected by the defect.

13) **Meter Reading File Standardization**

a) Vendors must be willing to standardize on the output format of meter reading data (for example: ARBN, MVRS). These formats would be transformed into one standard AW File Format, once one is developed.

**Questions: Please respond fully to the following questions.
A separate Microsoft WORD file may be used for responses.**

1. Describe the different failure modes that have occurred with your meter models and RF transmitters. What error codes or symptoms are observable in the event of each failure mode? What is the average failure rate for each of the products for which pricing has been provided? Please also provide failure rate information for the complete system (meter and MIU).
2. Describe the different failure modes of your registers, and how a final read can be obtained from the meter if the register fails.
3. Fully explain the process for how meters are tested prior to shipment to American Water, including a description of your testing bench and all applicable features. If fewer than 100% of meters are tested in accordance with AWWA standards, as a fully assembled meter, explain the statistical process used to validate the testing methodology. What other tests are performed on the meter, register or transmitter? What is the pressure rating for each meter model?
4. Explain all error codes generated by the register and/or RF Transmitter. Explain the logic and basis of the error codes, as well as the triggering conditions. Explain how error codes are reset, and how long the data is available for retrieval by AW. Explain when error codes are transmitted, such as with the periodic read transmissions, or if they are transmitted at the time the error code is generated.
5. Explain how much data is saved on the transmitter, as well as how long it is available, and if options exist to reprogram the register/transmitter to adjust these settings. What type of information is stored on the transmitter? What is the format of the data? Does your data transmission adhere to a standard protocol? If so, which one?
6. Describe the steps and equipment needed to datalog from an MIU. If there are multiple equipment configurations capable of datalogging, explain each fully. Describe what data and frequency of reads is available from an MIU.
7. For meter models other than your own, which have you confirmed are compatible with your standard MIU’s? Are there any special considerations or concerns when attaching your MIU to other vendors’ meters? Please provide a technical specification of your MIUs.
8. For MIU models other than your own, which have you confirmed are compatible with your different models of meters? Are there any special considerations or concerns when attaching your meter to other vendors’ MIUs?
9. American Water utilizes Fathom to process meter data and interface with our Customer Information and Billing System. Do you have a current agreement with Fathom? Is Fathom capable of receiving meter readings and error codes from your MIUs? If not, will you commit to working with Fathom to develop the necessary interfaces?
10. Do your meters have any unique installation requirements? What values of torque are recommended for installation? What process is required to clear any “empty tube” error codes? How are fluctuating readings accounted for when filling/venting the meter after installation?
11. What mounting options exist for your MIUs, both inside set and outside set? Are there any restrictions or special requirements for mounting MIUs? What types of connections are available for MIUs, such as direct wire (splice), cable, coax, Nicor or touch-coupling?
12. Describe any potential consequences or concerns with interference with other vendor’s RF transmitters.
13. How many MIUs can a single DCU recognize in an AMI implementation?
14. Describe how your equipment solution could be incorporated into an MDM solution with Fathom, including the options available for a streamlined data path from the DCU to

Fathom. Describe the security considerations in effect for the data being transmitted. What standards or protocols do you follow for data security?

15. Describe your current (and future) capabilities with remote disconnect meters and distribution system leak detection solutions.
16. List your company's operating locations (manufacturing, distribution, etc.) related to the scope of this RFP.
17. Does your company utilize manufacturing production plants from outside of The United States? If yes, where? Do you source any components from outside of the United States? If so, specify which components and from which countries. Are the meters assembled and tested in the United States?
18. Describe your quality program and any certifications you hold from recognized quality assurance organizations, such as ISO or QS. Specifically, what areas do your certifications address? What training programs are in place?
19. Explain how you manage continuous improvement and what programs (Six Sigma, Lean Manufacturing, SPC, etc.) your company has in place to improve quality and reduce costs. Provide a step-by-step description of how your RMA process functions, including how defective items are diagnosed and dispositioned. Will you provide American Water with results of Root Cause Evaluations or other Corrective Action documentation, such as 8D reports?
20. Please describe your performance in the last 2 years in the following areas and provide calculation methodology:
    a. On time delivery (as a percentage)
    b. Lead time (in business days)
    c. Order accuracy (as a percentage)
    d. Fill rate (as a percentage)
    e. Backlog fulfillment (in business days)
    f. Return rate (as a percentage of units shipped)
21. Do you anticipate any capacity constraints associated with your proposal? If so, please explain. What has been the capacity utilization rate for each of your facilities for the past three years?
22. American Water is committed to supplier diversity and requires its suppliers to report on spending with diverse suppliers. Do you track Diversity Spend with your suppliers? Would you provide quarterly reports if requested by AW? How much of your annual spend is with certified Diverse Suppliers?
23. What is the convention for generating and assigning Serial Numbers (such as first two digits signifying the year of manufacture)? Describe the typical number of digits of a serial number, and if there are any limitations on serial number length? Will you allow flexibility in special requests from American Water in customizing the Serial Number format?
24. Please provide names and contact information for at least three of your current non-American Water customers.
25. Are you a member of the Taulia Supplier Portal? In the near future, American Water will be transitioning Purchase-To-Pay functionality to the Taulia Supplier Portal. All invoices will need to be submitted via Taulia.

26. AW will require the selected Supplier(s) to work with AW to develop cost reduction/continuous improvement initiatives, over the term of the agreement, to uncover and control all costs associated with (electronic) requisitioning, designing, purchasing, distributing, warehousing, and (electronic invoicing) payment methodologies.

    Such activity should consider, but not be limited to, initiatives such as the following:

    - Proposals for creative solutions for reducing AW's procurement, operating, and disposition costs
    - Recommendations for alternative pricing models that would potentially create more incentive to lower AW's combined total costs
    - Standardizing opportunities
    - Consolidated billing
    - Sole-source incentives

    Please provide additional information or proposals in an attachment labeled Additional Continuous Improvement Opportunities. Please describe how youwill commit to reducing costs for AW over the term of the agreement. If sending an attachment, please provide the specific name of the attachment.

27. Is your transmitter signal available for other vendors to use to allow reading of multiple systems for a common receiver "Open Architecture Automatic Metering Reading System" including flags and alarms? Please explain.

28. AW would like to explore a Vendor Managed Inventory program for meters at some time in the future. Do you have the ability to operate such a program if provided with inventory levels and forecasts?

29. Describe if any of the meters in your proposal have additional certifications or meet additional standards, such as meeting Underwriters Laboratory (UL) or Factory Manual (FM) approvals.

30. If you state that your meters can achieve specific accuracy results at flow less than the AWWA Requirements of ¼ GPM, please provide supporting data and test results.

31. In a paragraph, explain why AW should select your products over the other manufacturers.

32. Are your MIUs programmable in the field? Describe what alarms or settings can be adjusted in the field. Describe what alarms or settings can be adjusted at the factory prior to shipping. Do the alarms and error codes from the MIU differ if it is attached to a meter from another vendor?

33. Describe the different modes of operation of the MIU (such as “Storage”, “Test”, “Smart”, …). Explain the purpose and functionality of each mode, and the set of features available in each mode. Explain how to transition between modes.

Exhibit C - Pricing Worksheet

Provide pricing for all significant combinations/options you offer (body material, bottom plate, register lens…). These prices can also be listed separately as "Adders".

Vendor	Meter Type	Size	Vendor Model #	Description	Body Material	Bottom Material	Thread Material	Register Type	MIU -Integral	MIU - Non-Integral	Price

Vendor	Hardware			Description							Price
	MIU (Inside)										
	MIU (Outside)										
	DCU										
	Handheld Unit										
	Mobile Unit										
	Antenna										
	Leak Detection										
	Remote Disconnect Meter										
	MIU Bracket(s)										
	Other										

Specify whether Register Lens is Glass or Plastic.

Specify the different connection options for connecting MIUs.

Provide a price list for all meter reading accessories and equipment.

Provide a price plan to list all "adders" for different MIU connection options, including wire/cable lengths.

Provide specific pricing for configurations with integrated Meters and MIUs.

Exhibit D – Contract Terms and Conditions

Exhibit E – Flat File Template

Accompanying each delivery of water meters must be a CSV file containing specific data fields. This file is referred to as a “Flat File”, and allows AW to perform batch upload of important data related to the procurement of water meters.

The required data fields include:

- Purchase Order #
- Quantity Shipped
- Cost
- Shipping/Receiving Date
- SAP Material Number
- Prefix (2 character abbreviation for the State)
- Manufacturer
- Construction Year
- Model Number
- Inspection
- Manufacturing Part Number
- Serial Numer
- Test Date
- High Flow Test
- Intermediate Flow Test
- Low Flow Test
- Certification Year
- Certification Number (Name of who completed the testing)
- Certification Type
- Initial Meter Reading Register 1
- Initial Meter Reading Register 2

American Water 2015 Residential Water Meter Bid

Objective: Develop residential meter supply relationships that minimize total cost of ownership for American Water:

1) Right meter for the task
2) Accurate, reliable, efficient

Vendors in Final Consideration:

1) Badger Meter
2) Mueller Systems
3) Neptune Technology Group
4) Sensus

Note: Flow test accuracy data was reviewed for water meters from numerous vendors. Review of the accuracy results allowed for a selection of vendors to include in the full RFP process.

Quantitative Considerations:

- Accuracy
- Reliability
  - Meter
  - Transmitter
  - Integration
- Read Efficiency
  - Speed
  - Missed Reads / Bad Reads
- Head Loss
- Throughput

Qualitative Considerations:

- Materials
- Register: Mechanical / Solid State
- Failure Modes
- Supplier Quality Management System
- Data Logging Ability
- Error Reporting
- Leak Detection
- Backflow Detection
- Compatibility with Fathom
- Lay Length / Meter Dimension
- Manufacturing Location

Timeline:

• Vendor Kick-Off Meetings:	
o Mueller	8/4/2015
o Badger	8/5/2015
o Sensus	8/5/2015
o Neptune	8/19/2015
• Discussion Meter Bid with Regional Presidents	8/11/2015
• Create Scope of Work / Meter Bid Specification	8/6/2015 – 8/26/2015
• Create Draft Contract Template and T’s & C’s	8/6/2015 – 8/26/2015
• Compile the RFP Package	8/6/2015 – 8/28/2015
• Meter Bid Team Review RFP Package	8/31/2015 – 9/4/2015
• Finalize RFP Package	9/7/2015 – 9/9/2015
• Release RFP	9/9/2015 – 9/25/2015
• Review RFP Responses	9/28/2015 – 10/2/2015
• RFP Clarifications to Vendors	10/5/2015 – 10/9/2015
• Perform Vendor Audit Visits	8/31/2015 – 10/2/2015
• Presentation to Meter Bid Committee	Week of 10/12/2015
• Selection of Vendor(s)	10/16/2015
• Contract Negotiations	10/19/2015 – 11/6/2015
• Contract Review / Approval	11/9/2015 – 11/13/2015
• Fully signed Contract goes in effect	2/1/2016

Contents of Contract Package:

1. Contract Signature Document
2. General Terms and Conditions
3. Scope of Work / Specifications
4. Pricing / Payment Terms
5. Quality Requirements
6. Diversity Clause
7. Other Attachments, if needed

AMERICAN WATER

2016 Meter Guidance

Meter Selection – Pricing – Warranty Returns – Best Practices

Mike Cline - Supply Chain 856-727-6227 Meters@amwater.com

Table of Contents

Overview

American Water went out to bid for Residential Meters (5/8" – 2") in the fall of 2015. Following the Request for Proposal, the responses were evaluated and contracts were negotiated. With a focus on Quality, and Total Cost of Ownership, vendors were selected to supply various equipment. To meet the needs and requests from each state of American Water, options are provided for each element of metering (meters and meter for reading technology).

- The two vendors selected for meter procurement in 2016 – 2018 are Badger and Neptune.
    - Badger supplies both Nutating Disc meters and Ultrasonic meters.
    - Neptune supplies Nutating Disc meters.
- Sensus is selected to provide iPERL Electromagnetic meters for specific situations (Residential Fire Service).
- Mueller is selected to provide Remote Disconnect Meters, and AMR/AMI meter reading technology.

Moving forward in 2016, all Meter Related Equipment will be assigned SAP Material Numbers. This includes Meter Interface Units (MIUs) and Handheld Reading Equipment.

All meter purchases must occur through the SAP-SRM Marketplace Shopping Cart Process, using SAP Material Numbers for each component. If a new configuration is desired, it must be submitted for evaluation through the Material Master team (Greg Baker / Tamika Wilson-Byrd / Mike Cline).

The following are the standard features on the new meter configurations:

- Solid State (LCD) Registers
- Unit of Measure: 100 Gallons
- Outside set / Waterproof Registers
- Nicor Connectors on both Meters and MIU's
    - 3 foot of wire from both the meter and the MIU
    - 10 foot extension available

Current Meter Contracts

Residential Meters:

- Badger Meters
    - Nutating Disc: 5/8” – 2”
    - E-Series (Ultrasonic): 5/8” – 2”
- Neptune
    - Nutating Disc: 5/8” – 2”
- Sensus
    - iPERL (Electromagnetic): 5/8” – 1”
- Mueller
    - Remote Disconnect Meters 5/8”

Commercial/Industrial Meters:

- Sensus
    - OMNI Meters
        - C2 – Compound: 1-1/2”, 2”, 3”, 4”, 6”, 8” and 10”
            - Includes strainer
        - F2 – Fire Service: 4”, 6”, 8” and 10”
            - UL and FM approved
            - Includes strainer

Note: For one-off purchases of large meters, price quotes should be obtained from HD Supply rather than directly from the Meter Manufacturer (such as Metron-Farnier or Master Meter).

AMR / AMI:

- Mueller
    - AMR – Hot Rod
    - AMI – Mi.Node
- Neptune
    - AMR/AMI – R900
- Itron ?
- Aclara ?

Pricing

Vendor	Component	Model	Size	Body	Bottom	Bolts	Register	Units	Inside/Outside	Connection	MIU	Vendor #	SAP #	Description	Price
Badger	Meter	Recordall M25	5/8"	Polymer	Polymer		HR-E LCD	Gallons		Nicor	No	PM25ADHRELCD9GN5			
Badger	Meter	Recordall M25	5/8"	Bronze	Cast Iron		HR-E LCD	Gallons		Nicor	No	LLM25ADHRELCD9GN5CI			
Badger	Meter	Recordall M25	5/8"	Bronze	Bronze		HR-E LCD	Gallons		Nicor	No	LLM25ADHRELCD9GN5BZ			
Badger	Meter	Recordall M35	3/4"	Bronze	Cast Iron		HR-E LCD	Gallons		Nicor	No	LLM35BDHRELCD9GN5CI			
Badger	Meter	Recordall M35	3/4"	Bronze	Bronze		HR-E LCD	Gallons		Nicor	No	LLM35BDHRELCD9GN5BZ			
Badger	Meter	Recordall M55	1"	Bronze	Cast Iron		HR-E LCD	Gallons		Nicor	No	LLM55CCHRELCD9GN5CI			
Badger	Meter	Recordall M55	1"	Bronze	Bronze		HR-E LCD	Gallons		Nicor	No	LLM55CCHRELCD9GN5BZ			
Badger	Meter	E-Series	5/8"	Polymer	Polymer		HR-E LCD	Gallons		Nicor	No	PME25HRELCD9GN5			
Badger	Meter	E-Series	3/4"	Polymer	Polymer		HR-E LCD	Gallons		Nicor	No	PME35HRELCD9GN5			
Badger	Meter	E-Series	1"	Polymer	Polymer		HR-E LCD	Gallons		Nicor	No	PME55HRELCD9GN5			
Badger	Meter	E-Series	5/8"	Stainless	Stainless		HR-E LCD	Gallons		Nicor	No				
Badger	Meter	E-Series	3/4"	Stainless	Stainless		HR-E LCD	Gallons		Nicor	No	SSE35HRELCD9GN5			
Badger	Meter	E-Series	1"	Stainless	Stainless		HR-E LCD	Gallons		Nicor	No	SSE55HRELCD9GN5			
Badger	Meter	E-Series - Fire Service (UL)	1"	Stainless	Stainless		HR-E LCD	Gallons		Nicor	No				
Badger	Meter	E-Series	1.5"	Stainless	Stainless		HR-E LCD	Gallons		Nicor	No	SSE120ELLHRELCD9GN5			
Badger	Meter	E-Series	2"	Stainless	Stainless		HR-E LCD	Gallons		Nicor	No	SSE170ELLHRELCD9GN5			
Badger	MIU	Orion Cellular - w/ 10 yrs data (Inside)								Nicor		OCFLIWBN8			
Badger	MIU	Orion Cellular - w/ 10 yrs data (Outside)								Nicor		OCFLOWBN8			

Configurations

The following combinations of Meters / MIUs have been tested and verified.

If Nicor connectors are installed on both the Meter and the MIU, the configuration will work with no splicing or concern for wire colors.

	Neptune R900 (8 digits)	**Mueller Hot Rod (6 digits)**	**Badger Endpoint**	**Sensus Endpoint**
Neptune Register (Ecoder/ProRead)	🟩	🟩	N/A	N/A
Mueller Register	🟩	🟩	N/A	N/A
Badger PD Register	🟩	🟩	N/A	N/A
Badger E-Series Register	🟩	🟥	N/A	N/A
Sensus Register	🟩	🟥	N/A	N/A

The following is a wiring diagram required if wire splicing is necessary.

Meter to MIU wiring patterns

Hersey Meter	to	Neptune R900
Red		Black
White		Red
Black		Green

Hersey Meter	to	Mueller Hot Rod
Red		Red
White		White
Black		Black

Sensus, Invensys or Badger Meter	to	Neptune R900
Red		Black
Green		Red
Black		Green

Sensus, Invensys or Badger Meter	to	Mueller Hot Rod
Red		Red
Green		White
Black		Black

Neptune Meter	to	Neptune R900
Red		Red
Green		Green
Black		Black

Neptune Meter	to	Mueller Hot Rod
Red		White
Green		Black
Black		Red

Serial Numbers

Starting in 2016, a new Serial Number convention will be enabled.

- Serial numbers will be 8 characters long, with all 8 characters etched on the Meter Body.
- Meter vendors will not duplicate any serial numbers.
- All 8 characters etched on the meter body will be entered into Click/SAP exactly as etched.
- Open Ranges of Serial Numbers (# of potential duplicates within this range)

15500000 – 15699999	200,000	(2)
16300000 – 16599999	300,000	(1)
24600000 – 24999999	400,000	(6)
26700000 – 26999999	300,000	(0)
28700000 – 28999999	300,000	(1)
53800000 – 54099999	300,000	(2)
56100000 – 56399999	300,000	(3)
61100000 – 61599999	500,000	(7)
62500000 – 63299999	500,000	(2)
63500000 – 63999999	500,000	(1)
64500000 – 65099999	600,000	(4)
65300000 – 66099999	800,000	(8)
97200000 – 97499999	300,000	(1)
97600000 – 97899999	300,000	(1)

- Largest Ranges with no conflicts

16400000 – 16599999	200,000	
26700000 – 26999999	300,000	
28700000 – 28899999	200,000	
62500000 – 62699999	200,000	
63500000 – 63799999	300,000	(63500000 – 63999999) 500,000 (1 conflict)
64900000 – 65099999	200,000	
65800000 – 65999999	200,000	
97700000 – 97899999	200,000	

Installation

Nicor Connectors

New meters and transmitters will be purchased with a Nicor connection. In situations where an already installed meter and transmitter is in place without Nicor connectors, but a replacement meter or transmitter is to be installed (with a Nicor connection), a Nicor "Splice Kit" must be used. This consists of a Male or Female Nicor connector on a 3 foot length of wire with exposed wires on the opposite end. The exposed wires must be spliced to the installed component wiring using Gel Caps.

- Male Nicor– attaches to the Register of the Meter (Male Nicor has three "holes")
- Female Nicor– attaches to the MIU (Female Nicor has three "pins")

At no time should a Nicor connector ever be cut off to perform a splice. A Nicor "Splice Kit" should always be used to "upgrade" the installed wiring.

Nicor "Splice Kits" can be purchased directly from Nicor (SAP Vendor #XXXXXXX) using the following SAP Part Numbers:

- 1XXXXX - 3 foot Male Nicor Connector (to be attached to the Meter Register)
- 1XXXXY - 3 foot Female Nicor Connector (to be attached to the MIU)
- 1XXXXZ - 10 foot Nicor Extension Cable (Male on one end, Female on the other)

General Installation Guidance (TBD)

Warranty Return Process

The following information is required for the return of Defective Meters to the appropriate Meter Vendor:

- Identify the suspected cause/symptom/problem details on a tag affixed to each defective meter
- Follow the Vendor's RMA process to receive an RMA # and Return Shipping Information
- Follow Meter End of Life Guidance at the following link to correctly process the Meter through the necessary SAP steps: Link - AW Meter End of Life Guidance

KAW_R_PSCDR2_NUM011_081823_ATTACHMENT 4_CONFIDENTIAL FILED UNDER SEAL PURSUANT TO THE PETITION FOR CONFIDENTIAL TREATMENT FILED ON AUGUST 18, 2023

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and David Hill

12. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 14. Explain in specific detail how Kentucky-American evaluated each of the proposed alternatives, a copy of all documents Kentucky-American relied upon in its evaluation of the proposed alternatives, and a copy of all written material explaining the reason that Kentucky-American selected the proposed AMI system.

Response:

Please see the direct testimony of Melissa Schwarzell, pages 3 through 9, for a detailed description of the methodology followed in developing the cost benefit analysis.

Additionally, please see three attachments which are confidential and provided pursuant to a Petition for Confidential Protection:

1. Confidential Attachment 1 - CBA: This is the Excel file which supports the calculations and charts found in the Cost Benefit Analysis section of Exhibit A. (Please note that the file includes a minor update with an immaterial impact of small differences of ~$0.2mm in the 20-year NPV charts (or ~$20k/year), relative to those filed.)

2. Confidential Attachment 2 – Propagation Study: This is the propagation study which supported the hybrid solution cost benefit analysis.

3. Confidential Attachment 3 – Ops Matrix: This is a matrix of considerations that were evaluated when determining the best metering equipment vendor from an operational perspective.

KAW_R_PSCDR2_NUM012_081823_ATTACHMENT 1_CONFIDENTIAL FILED UNDER SEAL PURSUANT TO THE PETITION FOR CONFIDENTIAL TREATMENT FILED ON AUGUST 18, 2023

R900 Propagation Analysis

KY American – Lexington, KY

September 2nd, 2021

[redacted]

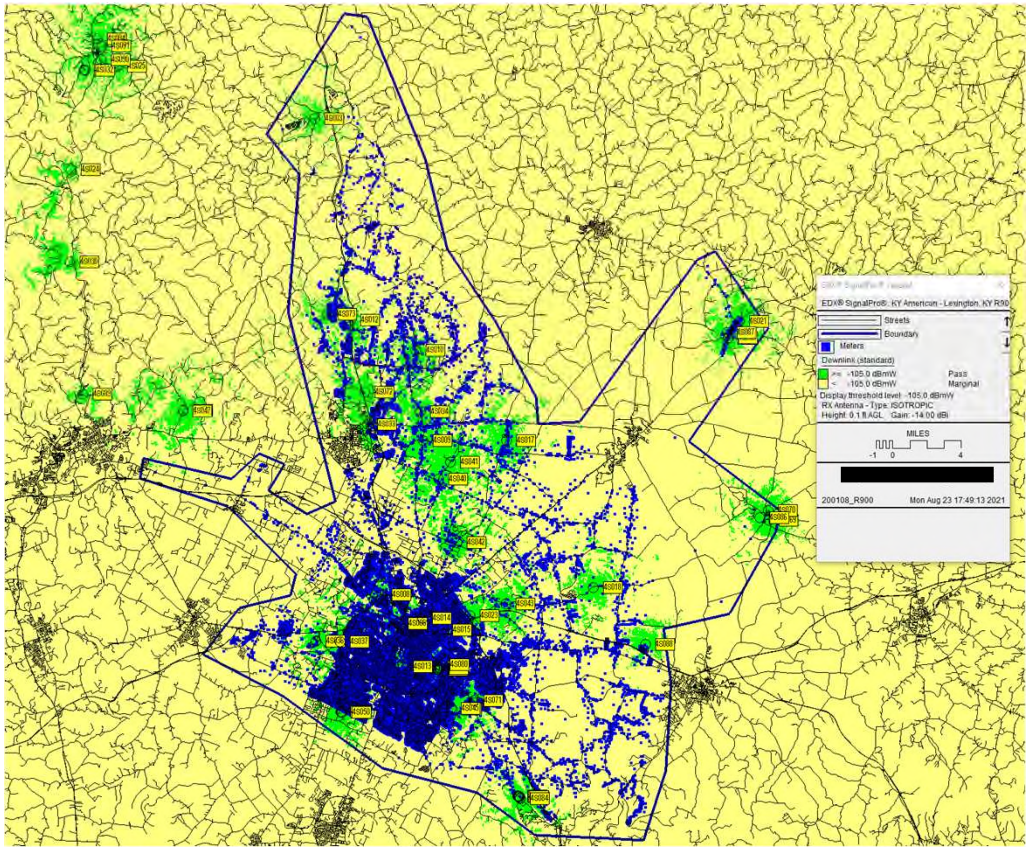
Predicted Coverage Results:

[redacted]

Map	Description	Provided Services		133,805	Geocoded Services	132,400	Area (sq Miles)	833.80
		#Coll	**MIU Type**	**Read Type**	**Pass**	**%Pass**	**Pass**	**%Pass**
1a	Provided	91	R900v4 Pit	Billing	41,644	31.45%	134.24	16.09%
1b	Provided	91	R900v4 Pit	Daily	31,825	24.03%	102.16	12.25%
2a	Best Provided	50	R900v4 Pit	Billing	40,679	30.72%	120.86	56.70%
2b	Best Provided	50	R900v4 Pit	Daily	31,205	23.56%	91.85	11.01%
3	~99%	278	R900v4 Pit	Billing	130,715	98.72%	472.78	56.70%
4	~99%	309	R900v4 Pit	Daily	130,551	98.60%	426.52	51.15%

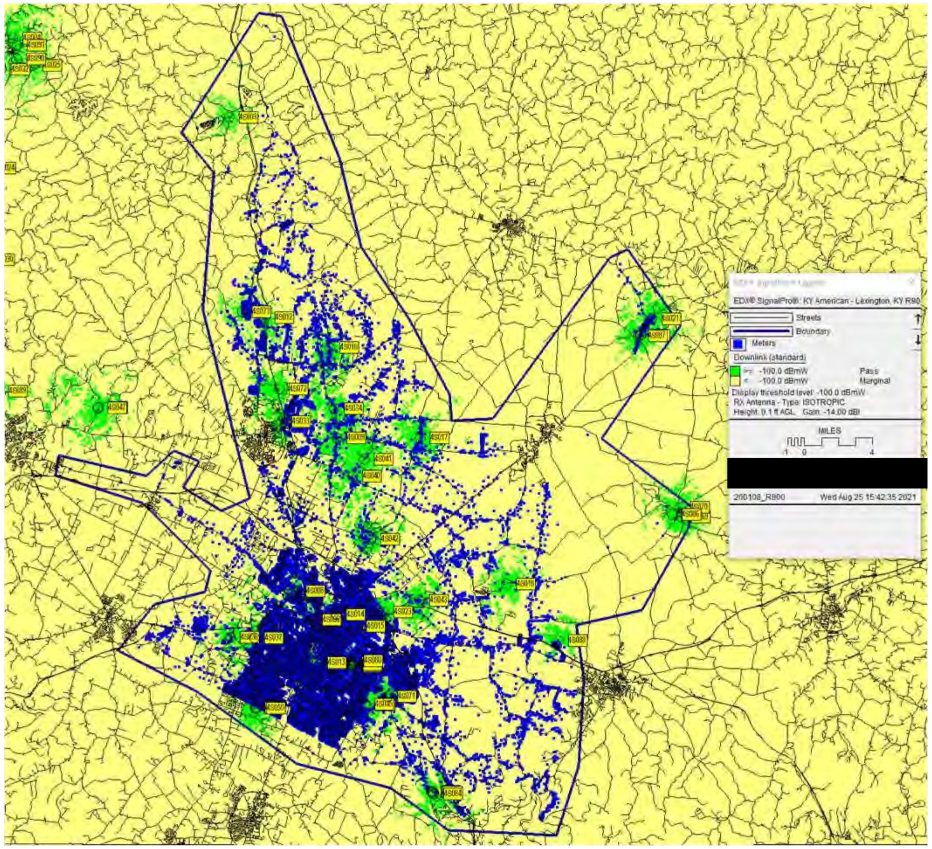
[redacted]

Map 1a: Provided Assets - Billing



[redacted]

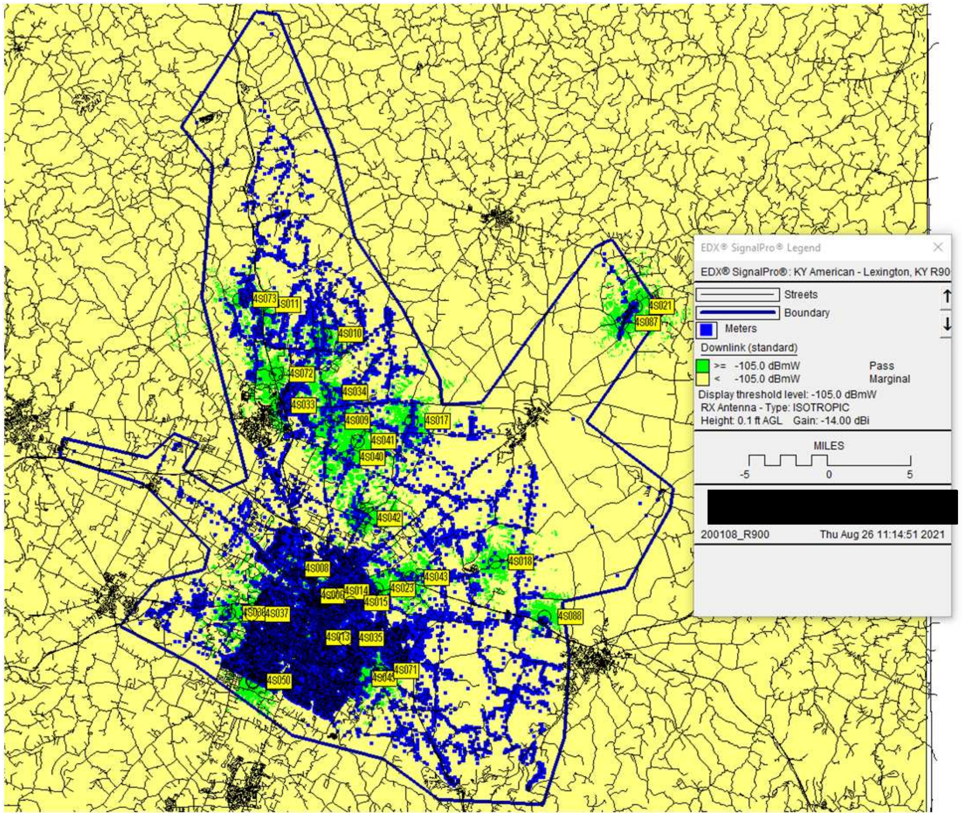
Map 1b: Provided Assets - Daily



[redacted]

Map 2a: Best Provided Assets - Billing

[redacted]



EDX® SignalPro® Legend

EDX® SignalPro®: KY American - Lexington, KY R90

Downlink (standard)

🟩 >= -105.0 dBmW Pass
🟨 < -105.0 dBmW Marginal

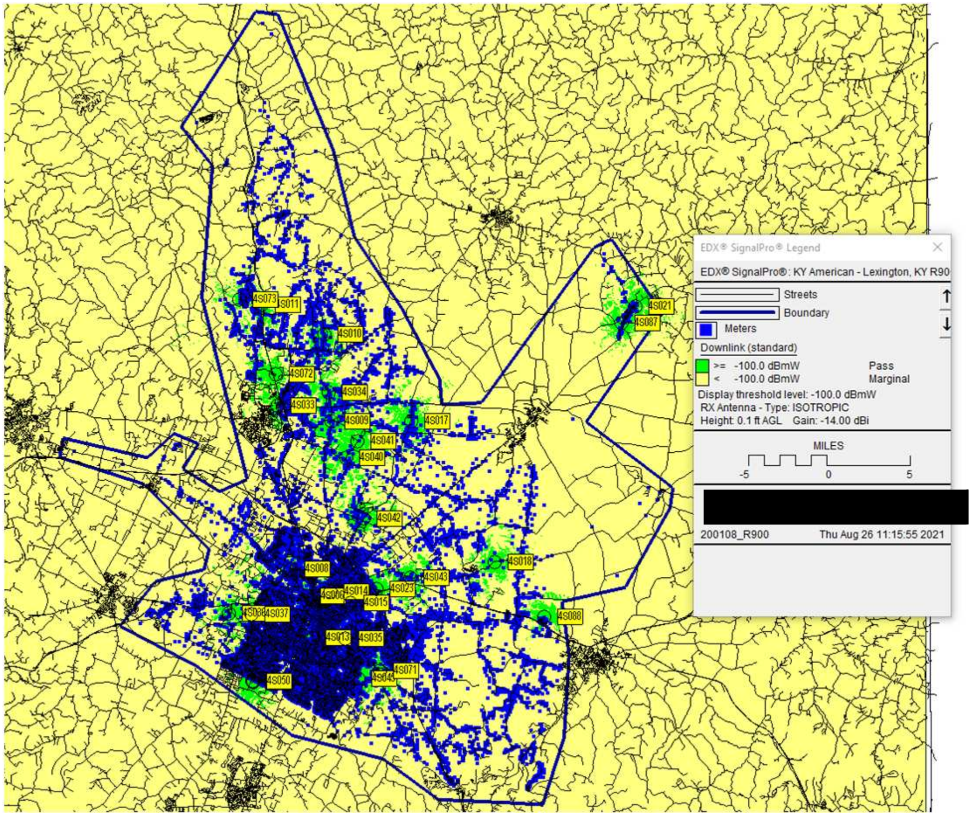
Display threshold level: -105.0 dBmW
RX Antenna - Type: ISOTROPIC
Height: 0.1 ft AGL Gain: -14.00 dBi

[redacted]

200108_R900 Thu Aug 26 11:14:51 2021

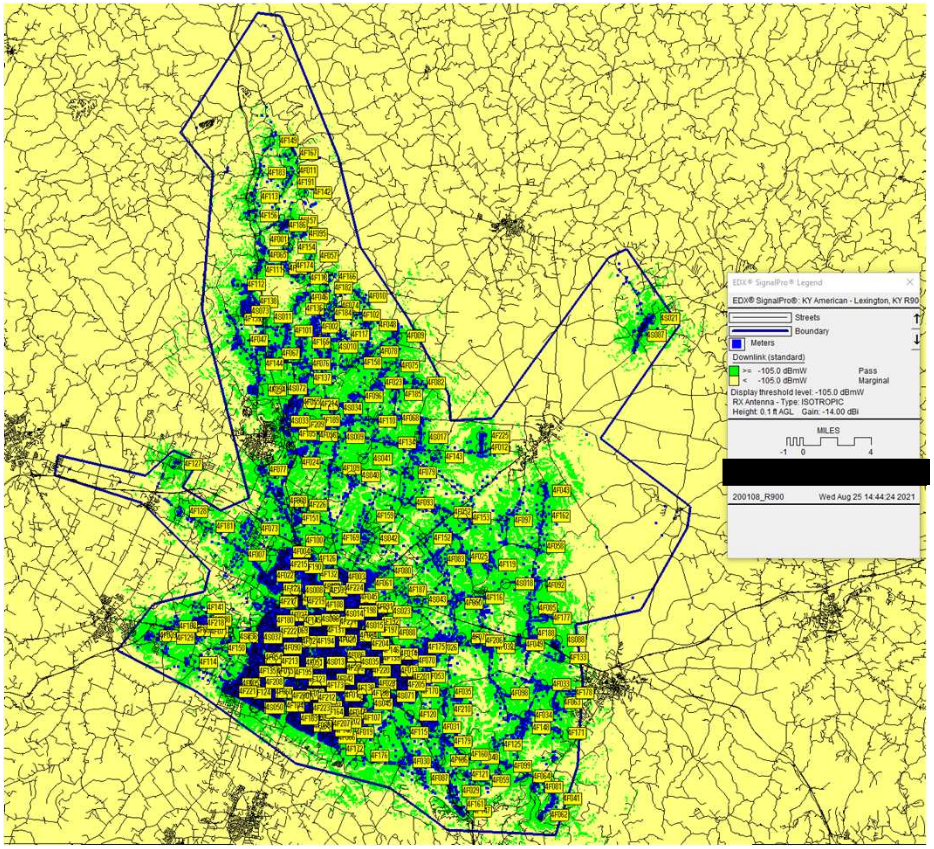
Map 2b: Best Provided Assets - Daily

[redacted]



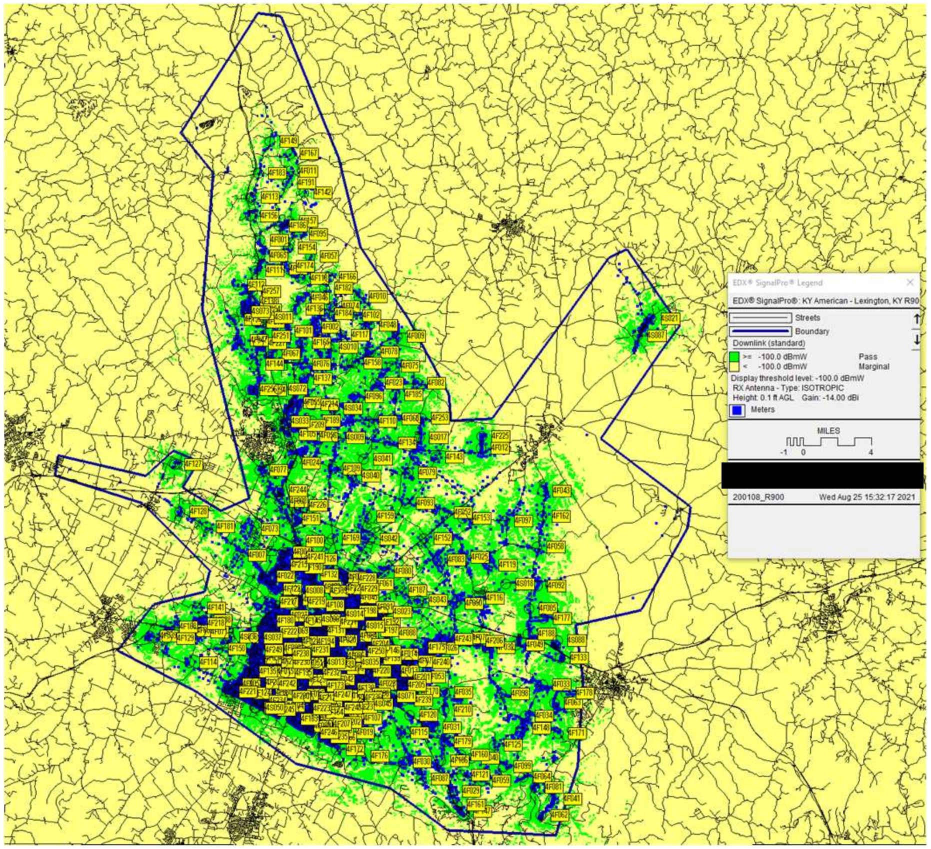
[redacted]

Map 3: ~99% predicted - Billing



Map 4: ~99% predicted - Daily

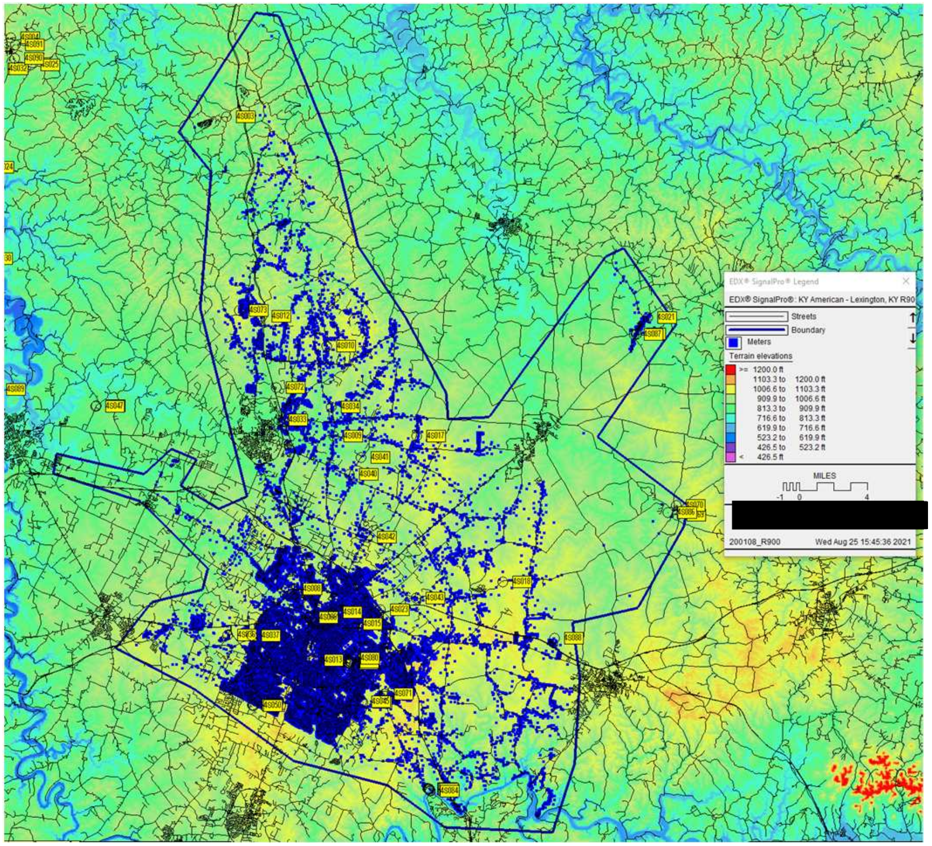
[redacted]



Elevation Map

(National Elevation Dataset available, courtesy of the U.S. Geological Survey)

[redacted]



[redacted]

Gateway Locations:

Map	Location	Latitude	Longitude	Collector	Elev(m)	AntHgt(m)	Elev(ft)	AntHgt(ft)	Coax(dB)	AntGain	Antenna
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Gateway Locations:

[redacted]

Map	Location	Latitude	Longitude	Collector	Elev(m)	AntHgt(m)	Elev(ft)	AntHgt(ft)	Coax(dB)	AntGain	Antenna

[redacted]

Gateway Locations:

[redacted]

Map	Location	Latitude	Longitude	Collector	Elev(m)	AntHgt(m)	Elev(ft)	AntHgt(ft)	Coax(dB)	AntGain	Antenna

[redacted]

Gateway Locations:

[redacted]

Map	Location	Latitude	Longitude	Collector	Elev(m)	AntHgt(m)	Elev(ft)	AntHgt(ft)	Coax(dB)	AntGain	Antenna
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

Assumptions:

- Spare gateway recommended for system maintenance.
- Revised propagation analysis required for Gateway location or height changes.
- FAA/ASR may be required for structures near airports or heights >200ft.
- AM Tower detuning evaluations for structures within 3km, check with LBA Group or Sitesafe.
- 10ft minimum vertical separation from other 900MHz system antennas on structure. Antenna requires 3ft-4ft standoff for side mounting on towers.
- Complies with FCC/IC Rules: May not cause harmful interference, and must accept any interference received, including interference that may cause undesired operation.
- MIUs mounted inside structures are not recommended for Fixed Network solutions. RF signal is affected differently by building materials used within structures and it is difficult to account for all types of construction. If the Scope states inside MIU used for study, an average loss value is applied to the model. In situations, where inside MIUs do not perform as necessary, an external wall MIU or additional Gateways may be required
- Propagation based on defined MIU (External Wall or Pit w/External Antenna) with specified gateway/collector. Older equipment should be replaced. Propagation is subject to change based on equipment specifications and performance. Performance cannot be confirmed until final system evaluation and analysis complete. Daily - 1 read in 24 hours (1 Day) expected; Billing - 1 read in 72 hours (3 Days) expected; Hourly - 1 read each hour expected. Propagation model is based on performance for >90% read success; backfill read redundancy included, and typical RF environment <-120dBm. Use of this propagation analysis done with this understanding and there is no guarantee of product or performance. Additional gateways could be required. Antenna heights are set to 75 feet as default unless heights provided. This affects Find (search ring) and asset locations.
- R900 IoT gateway (Tmega) with 2 antenna receiver diversity requires minimum of 6 feet horizontal and ideally 12-20 feet horizontal antenna separation.

			[redacted]	[redacted]	Additional Notes	
Pros and Cons	**Notes**					
Supply Chain - Lead times and availability	Can meet delivery deadlines?		Lead times are not a concern.	Lead times are not a concern.	Lead times are considerably shorter than anticipated.	
Supply Chain - return/cancellation policy	Which is flexible with commission not approving AMI?		Any unshipped orders can be canceled.	No confirmation yet but meter team believes they will be as flexible as [redacted]	We have contracts that allow us to stop orders for items that have not been shipped.	
Supply Chain - Ability to exchange with other states	Are states willing to take on delivered and unused endpoints?		States such as MO and PA have compatibility.	States such as NJ have compatitibility.	There is a method to transfer endpoints to others states.	
Costs - meter pit alterations	Costs		Plastic Lid is preferred for this specific manufacturer. Testing to confirm endpoints work with metal lids with the gasket/washer ring in 2023.Any cellular endpoint is preferred to have composit lids from AW's meter team's perspective.	[redacted] endpoints are compatible with metal lids but needs new antenna. Testing confirming new antenna. Any cellular endpoint is preferred to have compositE lids from AW's meter team's perspective.	Lid ring has nothing to do with performance of the endpoint and only deals with compaitbility of lid. Work with exisiting manufacturer to potentially create a composite lid with correct hole size. Composite lids are preferred for any AMI endpoint.	Trumble, Nicro, and VWF brand.
Costs - meters and endpoints	Costs		Pricing is more favorable.	Pricing is less favorable.		
MDMS maturity	Which manufaturer is further along with our MDMS?		[redacted] omatibility with AW's MDMS is more mature and established.	[redacted] s scheduled to be compatible between 2023.		
Customer service- Internal Facing	Which system can provide customer data today?		Portal that can be deployed today and used by employees. Superior and more mature than [redacted]	Portal that can be accessed by employees and not as much information. No single sign on. Not as user friendly.	This detail is critical for the commision. What additional information is will be available for customers who have high usage? How quickly will we inform customers and how will we inform customers? Will need to know what other states are doing?	
Customer service - External Facing	Which system can provide customer data today?		Portal that can be deployed today and used by customers. Scheduled to be compatible in 2023/2024 with AW's MyWater.	Portal cannot be accessed by customers. Customer data must be managed internally. Scheduled to be compatible in 2023/2024 with AW's MyWater.	Important but not critical. Better to wait for information to be compatible with MyWater for residential customers.	
Readability - Cellular Coverage	Percentage of cellular coverage		[redacted] ses the AT&T network and Verizon today.	[redacted] ses the Firstnet network. Will be transitioning to Verizon Q2 2023.	[redacted] Firstnet capable vs ready. They use the same bandwidth as [redacted] on the AT&T network which uses the 2,4, and 12 bands vs band 14. Currently Firstnet is still not letting LTE-M devices join on band 14(Firstnet)	
Meter and Endpoint Performance	Does technology operate as intended?		Yes	Yes		

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and David Hill

13. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 17, Figure 9.

    a. Explain why Kentucky-American is using the Consumer Price Index (CPI) to calculate inflation and how the CPI changes the cost of meter material.

    b. Explain whether Kentucky-American considered using a different depreciation rate when modeling the scenarios for the AMI. If so, then provide the depreciation rate with supporting evidence. If not, then explain why not.

Response:

a. The Consumer Price Index measures historical changes in the cost of goods. The index itself does not cause changes, but rather it provides a data-based indicator of past inflationary trends. This evidence-based metric was used in the Cost Benefit Analysis as a reasonable predictor of future trends in the change of metering material costs, absent more precise future information specific to those goods.

b. KAWC considered using other life depreciation rates, such as those currently authorized for various components of metering infrastructure (ranging from 2.41% to 3.66%) as well as those requested in this proceeding for various components of metering infrastructure (ranging from 1.50% to 51.63%). Neither provided a representation of the expected life of the 2" and smaller meter and endpoint investments being evaluated. However, because the cost benefit analysis presumed a replacement once every 10 years for meters 2" and smaller and their endpoints, these rates did not represent the expected life of the capital investments, and thus did not provide a good matching principle between costs and benefits. Using a 10% total depreciation rate resulted in the costs of metering capital expenditures being spread out over a 10-year period and thus provided a good matching principle for comparing the cost of the products to customers over time, relative to the benefits produced for customers over the same period.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and David Hill

14. Refer to the Application, Exhibit A, page 17, footnote 11. Explain what Kentucky-American means by "undue refinement."

Response:

"Undue refinement," in this context, refers to situations where the complexity of a calculation is not merited, given the minimal additional informational benefit it would provide.

"Avoiding undue refinement" is a phrase used occasionally in the NARUC Uniform System of Accounts, as adopted by the Kentucky Public Service Commission. For example, the phrase is used when describing ways to reduce complexity in accounting for plant additions and retirements, as well as materials and supplies.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and David Hill

15. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 17. Explain whether Kentucky-American's labor costs for meter readers will decrease if the Commission grants a Certificate of Public Convenience and Necessity (CPCN) for AMI.

Response:

As noted on page 12 of Exhibit A, if the CPCN is granted, KAW does not expect labor costs for meter reading to decrease substantially until the entire service territory is nearly completely converted to AMI, sometime between 2033 and 2034. At that time, the demand for meter reading labor is expected to be eliminated, and meter reading efforts would shift to exception management. Please also see the Company's response to PSC 2-9, which describes the redeployment of labor resources.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and David Hill

16. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 18.

    a. Explain why Kentucky-American is planning on a ten-year installation phase for the AMI if the useful life of the AMI is ten years.

    b. Explain whether Kentucky-American could complete AMI installation by 2027 if the CPCN was granted in this case. If not, explain why not.

Response:

a. The Company plans to deploy cellular AMI over the course of ten years as it completes normal, scheduled, periodic replacement of its meter and endpoint equipment. This is different than deploying a network at a single point in time with a fixed life. Instead, the endpoints throughout the system would each have their own life span and due to the ongoing nature of the meter replacement program, the assets would be continually renewed, sustaining AMI capabilities over the long term.

b. If the CPCN were granted, KAW expects that it would be theoretically possible to complete the installation of cellular AMI throughout its service territory by 2027, presuming adequate availability of labor and material resources and adequate allocation of capital.

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Melissa Schwarzell and David Hill

17. Refer to the Application, Exhibit A, Advanced Metering Infrastructure Development Plan, page 19.

    a. Explain why Kentucky-American used a 20-year net present value (NPV) for the AMI system if the useful life of AMI meters is 10 years.

    b. Provide the depreciable life Kentucky-American is using for the AMI meters.

    c. Provide a cost-benefit analysis with a ten-year NPV and ten-year useful life.

Response:

a) A twenty-year NPV was used for two reasons. First, the lids that must be purchased during the first replacement cycle are not planned for routine replacement within the measured period, meaning that they are expected to produce benefits throughout the 20-year period.

   Additionally, neither field service labor benefits, meter reading benefits, or vehicle benefits are fully reflected by year 10 for investments made in the first 10 years. In fact, meter reading benefits are not expected to fully begin until year 11, so ignoring these later years would materially understate the benefit to cost relationship. For example, meters replaced in years 2-10 would still be creating benefits in year 11, meters replaced in years 3-10 would still be creating benefits in year 12, and meters replaced in years 4-10 would still be creating benefits in year 13, etc.

   Due to both of these factors, twenty years was the minimum amount of time that seemed reasonable for the cost benefit analysis and associated NPVs in order to create a reasonable match between costs and benefits.

b) The depreciable life in the cost benefit analysis is ten years. Please see the Company's response to PSC 2-13 for further discussion of the depreciation rate used in the study.

c) A ten-year useful life is already reflected in the cost benefit analysis. A ten-year cost net of benefit NPV, which considerably understates benefits, is:

AMI [redacted]	$	19.2
Existing Tech [redacted]	$	15.5
AMI-[redacted]	$	24.8
Existing Tech [redacted]	$	18.4
AMI Hybrid [redacted]	$	26.4

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

18. Refer to the Application, paragraph 20. Explain how the $28 opt out fee for AMI meters was calculated. Provide documentary support for the $28 opt out fee in Excel spreadsheet format with all formulas, columns, and rows unprotected and fully accessible.

Response:

Kentucky-American's current New Account Set Up Activation Fee is $28, which is intended to cover the cost of meter reading when customers request a new account or a change in ownership of an existing account. The opt out fee for AMI meters is also intended to cover the cost of an exception based meter reading, so the Company proposed that the AMI opt out fee also be $28.

For further support, please see the attached file KAW_R_PSCDR2_NUM018_081823_Attachment.

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

19. Refer to the Application, Exhibit 11, Proposed Construction Expenditures. For each project listed, explain whether Kentucky-American expects to request a CPCN for that project or, if there is a pending case or the project was previously approved by the Commission, provide the case number for that project.

Response:

On July 26, 2023, KAW filed a request for a CPCN for the project identified as the Millersburg Transmission Main in Exhibit 11 of the Application. The case number assigned to the proceeding is Case No. 2023-00248. KAW does not expect to request a CPCN for any other project listed.

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

20. Refer to the Application, Exhibit 11, Proposed Construction Expenditures. Also refer to Case No. 2018-00358,[2] Exhibit 11, Proposed Construction Expenditures.

    a. Identify and provide a breakdown by category and dollars of the components of the Normal Recurring Construction projects that are projected for 2024 through 2026.

    b. Identify and provide a breakdown by category and dollars of the components of the Normal Recurring Construction projects that were constructed between 2019 and 2021.

    c. Explain any increases by category for the period 2024 through 2026 compared to the period 2019 through 2021 and state whether any of the increases are due to a change in project component definition.

Response:

a. Please see attachment KAW_R_PSCDR2_NUM020_081823_Attachment.

b. Please see attachment KAW_R_PSCDR1_NUM014A_071823_Attachment.

c. Line B has increased due to increased planned main replacement investments in KAW's water distribution system. Line F has a budget increase due to an initiative to replace vaults that are in poor condition and replacement of broken valves within the system. Line G – Services and Laterals New experienced an increase due to a change in project component definition incorporating the material and installation costs associated with the meter pit and setter into Line G, which was previously funded under Line I. Line J increased due to a transition from a 15-year meter replacement to a 10-year meter replacement plan, which has resulted in an increase during the transition period of 2024 to 2026. Line O – Vehicles has increased due to vehicle cost increases, vehicle availability, and replacement needs. Line Q has experienced increases due to project costs increases, contract labor increases and replacement needs.

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[2] Case. No. 2018-000358, *Electronic Application of Kentucky-American Water Company for an Adjustment of Rates* (filed on Nov. 28, 2018), KAW_APP_EX1_THRU_EX36_112818.pdf at 218.

Kentucky American Water
RP Lines
2024-2026

Business Unit	Project #	Project Title	2024	2025	2026
		RECURRING PROJECTS	**FORECAST**		
Kentucky	DV	Developer Mains	$ 2,500,000	$ 2,500,000	$ 2,500,000
Kentucky	R12-**A1	Mains - New	$ 765,000	$ 748,549	$ 1,112,000
Kentucky	R12-**B1	Mains - Replaced / Restored	$ 21,585,200	$ 42,478,470	$ 43,841,519
Kentucky	R12-**C1	Mains - Unscheduled	$ 1,659,999	$ 1,660,000	$ 1,660,000
Kentucky	R12-**D1	Mains - Relocated	$ 700,000	$ 1,416,000	$ 1,426,000
Kentucky	R12-**E1	Hydrants, Valves, and Manholes - New	$ 419,500	$ 419,500	$ 419,500
Kentucky	R12-**F1	Hydrants, Valves, and Manholes - Replaced	$ 2,266,799	$ 2,320,000	$ 2,308,000
Kentucky	R12-**G1	Services and Laterals - New	$ 3,247,500	$ 3,344,500	$ 3,458,000
Kentucky	R12-**H1	Services and Laterals - Replaced	$ 1,205,000	$ 1,205,000	$ 1,205,000
Kentucky	R12-**I1	Meters - New	$ 45,500	$ 45,500	$ 45,500
Kentucky	R12-**J1	Meters - Replaced	$ 13,352,672	$ 7,754,482	$ 8,545,126
Kentucky	R12-**K1	ITS Equipment and Systems (Local)	$ 401,589	$ 789,604	$ 408,285
Kentucky	R12-**L1	SCADA Equipment and Systems	$ 899,000	$ 683,000	$ 756,000
Kentucky	R12-**M1	Security Equipment and Systems	$ 625,000	$ 625,000	$ 625,000
Kentucky	R12-**N1	Offices and Operations Centers	$ 793,000	$ 550,000	$ 505,000
Kentucky	R12-**O1	Vehicles	$ 1,400,000	$ 1,000,000	$ 1,111,000
Kentucky	R12-**P1	Tools and Equipment	$ 2,041,100	$ 484,955	$ 708,855
Kentucky	R12-**Q1	Process Plant Facilities and Equipment	$ 3,209,499	$ 2,866,000	$ 2,977,000
Kentucky	R12-**S1	Engineering Studies	$ 75,000	$ 75,000	$ 75,000
Kentucky	R12-**T12	ITS Equipment and Systems - Enterprise Solutions	$ 2,996,000	$ 2,996,000	$ 2,450,728
		TOTAL RPs	**57,687,358**	**71,461,561**	**73,637,513**

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

21. Refer to the Application, Exhibit 11, Proposed Construction Expenditures, and Application, Exhibit 37, Schedule B-1. Provide a schedule that reconciles the change in Utility Plant in Service plus Construction Work in Progress totaling $954,105,317 in the Base Period to Utility Plant in Service plus Construction Work in Progress totaling $1,050,288,710 in Exhibit 37 compared to the Capital Budget in Exhibit 11.

Response:

Please refer to KAW_R_PSCDR2_NUM021_081823_Attachment.

Kentucky American Water Company
Case No. 2023-00191
KAW_R_PSCDR2_NUM021_081823

Item	Forecast Period Ending 1/31/25	Base Period Ending 9/30/23	Variance of Forecast Year to Base	Notes:
Exhibit 37				
Utility Plant in Service	$1,041,662,258	$939,850,668	$101,811,590	Retirements are included in UPIS
Construction Work in Process	8,626,452	14,254,649	(5,628,197)	
Total Utility Plant and CWIP	1,050,288,710	954,105,317	96,183,393	
Exhibit 11				
Construction Expenditures				
Oct 2023 - Dec 2023	15,609,970			
Jan 2024 - Dec 2024	88,096,903			
January 2025	3,412,031			
Total Construction Expenditures	107,118,904			
Retirements	(10,935,510)			Retirements are not included in Exhibit 11
Total Construction Expenditures, net of Retirements	96,183,393		96,183,393	
Difference			0	

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

22. Refer to the Application, Exhibit 37, Schedule B-1, Deferred Maintenance and Taxes W/P-1-10. Provide the case numbers where Kentucky-American was authorized to defer maintenance expense.

Response:

Please see pages 17-19 of the Commission's June 27, 2019 Order in Case No. 2018-00358, in which the Commission held "The Commission further finds that Kentucky-American's deferred maintenance, including the incremental increase from the Base Period Update, is reasonable, and therefore should be allowed for ratemaking purposes an increase in rate base of $1,586,270 and an increase to revenue requirement of $176,343.

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

23. Refer to the Application, Exhibit 37, Schedule B-4. Explain why allowance for funds used during construction (AFUDC) is included in the construction work in progress (CWIP) balance.

Response:

The National Association of Regulatory Utility Commissioners ("NARUC") allows for the capitalization of AFUDC during the construction of utility plant, and the Company has reflected it properly as a component of CWIP.

The 1996 version of the NARUC USoA for Water Utilities was modified and adopted by the Kentucky Public Service Commission in 2002.

"(17) "Allowance for funds used during construction" includes the net cost for the period of construction of borrowed funds used for construction purposes and a reasonable rate on other funds when so used. No allowance for funds used during construction shall be included in these accounts upon expenditures for construction projects which have been abandoned.

Note:--When only a part of a plant or project is placed in operation or is completed and ready for service but the construction work as a whole is incomplete, that part of the cost of the property placed in operation, or ready for service, shall be treated as "Utility Plant in Service" and allowance for funds used during construction thereon as a charge to construction shall cease. Allowance for funds used during construction on that part of the cost of the plant which is incomplete may be continued as a charge to construction until such time as it is placed in operation or is ready for service, except as limited in item 17, above."

https://psc.ky.gov/agencies/psc/forms/usoa/0600ab02.pdf

Please note that the Company is including $1,672,091 of AFUDC in its calculation of present rate revenues. By including this amount in present rate revenues, the Company is offsetting the inclusion of CWIP in rate base for projects that are accruing AFUDC until the project is placed into service. Refer to Exhibit 37, Schedule C-1.

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

24. Refer to the Application, Exhibit 37, Schedule C-1, line 18, support services expense. Provide a copy of the contract of the schedule used to determine the adjustment for forecasted at present Rates of $660,295.

Response:

Please see workpaper "KAWC 2023 Rate Case – Support Services Exhibit.xlsx", provided in the Company's response to data request KAW_R_PSCDR1_NUM001_071823, for the schedule used to determine the adjustment forecasted at present rates in the amount of $523,069 as stated in Exhibit 37, Schedule C-1, line 18. The amount of $660,295 referenced above corresponds with the adjustment for the Company's Regulatory Expense, as shown on line 31 of the same exhibit and schedule (please see workpaper "KAWC 2023 Rate Case - Regulatory Expense Exhibit" provided in the Company's response to data request KAW_R_PSCDR1_NUM001_071823).

KENTUCKY-AMERICAN WATER COMPANY
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Witness: Jeffrey Newcomb

25. Refer to the Application, Exhibit 37, Schedule D-2, lines 45, 46, and 49.

    a. Explain why Kentucky-American is using the CPI as an inflation factor for expenses. Include in the explanation whether Kentucky-American considers the Headline CPI a more reliable figure for ratemaking purposes than the Core CPI.

    b. Explain whether Kentucky-American considered using the Producer Pricing Index (PPI) or the Personal Consumption Expenditures (PCE) price index to calculate inflation. If not, explain why not.

    c. Provide a list of every expense category in this case for which Kentucky-American is using an inflation factor.

Response:

a. The Company used unique and specific inflation factors developed for each operating and maintenance ("O&M") category that aligns with the United States Bureau of Labor Statistics (the "BLS") by specific measure category and type of cost to recognize the impact of inflation on the Company's expenses through the future test year. Kentucky-American ("KAWC") considers "Headline CPI" more representative of inflation throughout the entire economy which is a consistent view on cost increases applicable to both businesses and customers while "Core CPI" removes or does not include all inputs and factors within its overall index.

b. No. The Company selected the consumer price index ("CPI") because it was the closest applicable index that captured relevant inflation impacts concerning the expense categories it was applied to. KAWC felt that the use of this index better represented the future inflationary impacts the Company will experience in the future test year rather than using a general CPI (i.e., blanket inflationary factor) or another index. The CPI updates are more current, the weights are updated annually while the PPI updates weights only every five (5) years. The PPI attempts to collect prices for a specific day of the month, while the CPI collects prices throughout the month. There are further differences between the CPI and PPI that are not taken into consideration (e.g., item level specificity) by the PPI which led KAWC to use CPI from the U.S. BLS as a more appropriate index to calculate and apply inflation on consistent and conservative basis.

c. Below is a list of the Company's O&M expenses that include an inflation factor:

- Building and Maintenance
- Contract Services
- Customer Accounting
- Employee Related
- Fuel and Power
- Maintenance and Supplies
- Miscellaneous
- Office Supplies
- Rents
- Support Services

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

26. Refer to the Application, Exhibit 37, Schedule F-6, page 9. Provide the exhibit in Excel spreadsheet format with all formulas, columns, and rows unprotected and fully accessible.

Response:

Please refer to KAW_R_PSCDR2_NUM026_081823_Attachment. When preparing this response, a clerical error was noted in cell K37. The amortization period being proposed in Case No. 2023-00191 should read 2 years and not 3 years. 2 years, or 24 months, is what is reflected in the revenue requirement at proposed rates in this case and supported in the Company's Direct Testimony of Jeffrey Newcomb.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

27. Refer to the Application, Exhibit 37, Schedule F-6, page 9.

    a. Provide cost justification for a forecasted $850,000 in legal expenses.

    b. Provide cost justification and an explanation for $0 in accounting expenses.

Response:

a. The forecasted $850,000 in legal expenses comes from the Regulatory Expense Workpaper which is based on discussions with outside counsel, a review of historic costs, and known engagement of outside counsel.

b. Kentucky-American does not seek recovery of its accounting expenses as a rate case expense.

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

28. Refer to the Application, Exhibit 37, Schedule F-6, page 9. Refer also to the Direct Testimony of Jeffrey Newcomb (Newcomb Direct Testimony), page 12, lines 13-17.

a. Explain whether Kentucky-American is requesting authorization to establish a regulatory asset or liability for any of the rate case expenses related to this case.

b. Reconcile the discrepancy that Kentucky-American is recovering the forecasted rate case expenses in this case or whether Kentucky-American is deferring them to their next base rate case.

c. Reconcile the discrepancy whether Kentucky-American is using a 3-year or 2-year amortization period for rate case expenses.

Response:

a. Kentucky-American is proposing to recover forecasted rate case expenses related to this case over a two-year amortization period. Kentucky-American will defer rate case expenses related to this case to a regulatory asset up to the amount ultimately authorized by the Commission. The resulting regulatory asset will be amortized over the period authorized by the Commission to appropriately match revenues with expense. Any rate case expenses related to this case in excess of the amount approved by the Commission will be expensed immediately.

b. Kentucky-American is proposing to recover forecasted rate case expenses related to this case over a two-year amortization period, starting at the beginning of the future test year, February 1, 2024. The proposed revenue requirement in this case includes forecasted rate case expenses related to this case being amortized over a two-year amortization period.

c. Kentucky-American is proposing to use a two-year amortization period for rate case expenses related to this case. As discussed above in subpart b, the proposed revenue requirement in this case includes forecasted rate case expenses related to this case being amortized over a two-year amortization period. The "3 Years" amortization period shown in the Application, Exhibit 37, Schedule F-6, page 9, is the result of a clerical error and should read "2 Years."

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

29. Refer to the Bulkley Direct Testimony, page 7.

    a. Provide a copy of the Moody's Investors Service (Moody's) industry outlook referenced in the second bullet.

    b. Explain how high natural gas prices affect rating agency outlooks for the regulated water utility industry.

Response:

a. Please see KAW_R_PSCDR2_NUM029_081823_Attachment 1_CONFIDENTIAL. The attachment is confidential and provided pursuant to a Petition for Confidential Protection.

b. Ms. Bulkley did not imply that high natural gas prices would affect the rating agency outlooks for regulated water utilities. Moody's changed its outlook for the utility sector from stable to negative in November 2022 based on the effect of three factors: (1) natural gas prices; (2) inflation; and (3) interest rates. While the regulated water utility industry rating agency outlook would not specifically be affected by natural gas prices, the industry is affected by both inflation and interest rates which, as Moody's noted, will put pressure on customer affordability and increase uncertainty regarding the timely recovery of costs.

KAW_R_PSCDR2_NUM029_081823_ATTACHMENT 1_CONFIDENTIAL FILED UNDER SEAL PURSUANT TO THE PETITION FOR CONFIDENTIAL TREATMENT FILED ON AUGUST 18, 2023

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

30. Refer to the Bulkley Direct Testimony, generally. Provide an electronic copy of the ROE workpapers in Excel spreadsheet format with all formulas, columns, and rows intact and fully accessible.

Response:

Please see KAW_R_PSCDR2_NUM030_081823_Attachment 1 through KAW_R_PSCDR2_NUM030_081823_Attachment 26. Attachments 13, 20 and 21 are confidential and provided pursuant to a Petition for Confidential Protection. An index is provided below.

Exhibit No./ Figure No.	**KAW_R_PSCDR2 _NUM030_081823 Attachment #**
Exhibit AEB-1 Summary	1
Exhibit AEB-2 Proxy Selection	2 through 12, 13_Confidential
Exhibit AEB-3 CGDCF	14, 15, 16
Exhibit AEB-4 CAPM	14, 17, 18
Exhibit AEB-5 Long Term Beta	1
Exhibit AEB-6 Market Return	1
Exhibit AEB-7 Flotation Cost	19
Exhibit AEB-8 Regulatory Risk	2 through 12, 20_Confidential
Exhibit AEB-9 Capital Structure	21 Confidential
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KAW_R_PSCDR2_NUM030_081823_ATTACHMENT 13_CONFIDENTIAL
KAW_R_PSCDR2_NUM030_081823_ATTACHMENT 20_CONFIDENTIAL
KAW_R_PSCDR2_NUM030_081823_ATTACHMENT 21_CONFIDENTIAL
FILED UNDER SEAL PURSUANT TO THE PETITION FOR CONFIDENTIAL TREATMENT FILED ON AUGUST 18, 2023

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

31. Refer to the Bulkley Direct Testimony, page 7, line 4. Provide a rating agency report explaining that regulated water utility stock prices are expected to decline.

Response:

Rating agencies assign credit ratings to companies based on an assessment of the likelihood a company could default on its debt and therefore, are unlikely to opine on expectations regarding the share prices of utility stocks.

As discussed on page 20, line 5 through page 21 line 10 of Ms. Bulkley's Direct Testimony, equity analysts expect the utility sector to underperform the broader market as a result of high inflation and the recent increase in interest rates. For example, Fidelity recommends underweighting the utility sector while Keybanc Capital Markets has a negative view of the utility sector in 2023 and expects a decline in the relative valuation of the utility sector as compared to the S&P 500.

The referenced Fidelity report has been provided as KAW_R_PSCDR2_NUM031_081823_Attachment 1.

The referenced Keybanc Capital Markets report has been provided as KAW_R_PSCDR2_NUM031_081823_Attachment 2.

Commentary | Second Quarter 2023

Investment Research Update

From the desk of

Denise Chisholm
*Director of Quantitative
Market Strategy*

Fidelity INVESTMENTS

Performance Summary: Technology Takes the Lead

Investors weighed a shifting outlook during the first quarter, as inflation fell but stayed high, the U.S. Federal Reserve raised interest rates more slowly, and a bank crisis unfolded. The information technology, communication services, and consumer discretionary sectors led the stock market during the quarter as investors turned their focus to cyclical stocks. Financials, energy, and health care were the bottom performers for the quarter.

Sector	Performance as of 3/31/23				Weight in S&P 500®
	Latest Quarter	1-Year	3-Year Annualized	Dividend Yield	
Communication Services	20.5%	-17.8%	9.4%	0.9%	8.1%
Consumer Discretionary	16.1%	-19.6%	14.5%	0.9%	10.1%
Consumer Staples	0.8%	1.2%	14.7%	2.5%	7.2%
Energy	-4.7%	13.6%	48.4%	3.7%	4.6%
Financials	-5.6%	-14.2%	18.1%	1.9%	12.9%
Health Care	-4.3%	-3.7%	15.4%	1.7%	14.2%
Industrials	3.5%	0.2%	21.7%	1.6%	8.7%
Information Technology	21.8%	-4.6%	24.3%	0.9%	26.1%
Materials	4.3%	-6.3%	23.9%	2.0%	2.6%
Real Estate	2.1%	-19.6%	10.1%	3.4%	2.6%
Utilities	-3.2%	-6.2%	10.3%	3.1%	2.9%
S&P 500®	7.5%	-7.7%	18.6%	1.6%	

Past performance is no guarantee of future results. Sectors defined by the Global Industry Classification Standard (GICS®); see Index Definitions for details. Performance metrics reflect S&P 500 sector indexes. Changes were made to the GICS framework on 9/24/18; historical S&P 500 communication services sector data prior to 9/24/18 reflect the legacy telecommunication services sector. The top three performing sectors over each period are shaded green; the bottom three are shaded red. It is not possible to invest directly in an index. All indexes are unmanaged. Percentages may not total 100% due to rounding.

Source: Haver Analytics, Morningstar, FactSet, Fidelity Investments, as of 3/31/23.

Scorecard: Several Cyclical Sectors Look More Attractive

The signals appear mixed overall. That said, there may be a higher margin of safety in several cyclically oriented sectors, mainly due to relative valuations. With core inflation continuing decline at the end of the quarter, and rates appearing nearer to the end of the tightening cycle, sectors including consumer discretionary, information technology, and industrials may offer opportunities.

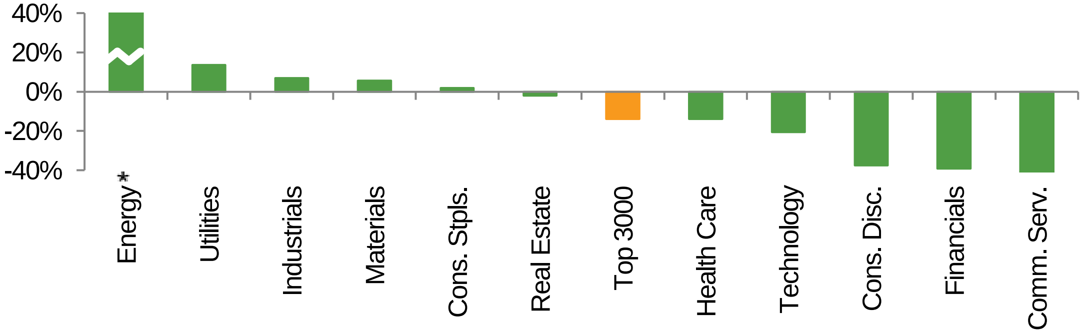
Sector	Strategist View	Longer	Time Horizon View	Shorter	Comments
	🟩 Overweight ⬜ Neutral 🟥 Underweight	Fundamentals	Valuations	Relative Strength	
Communication Services	🟥	–		+	Defensive characteristics may hinder performance
Consumer Discretionary	🟩		–		Increasingly constructive contrarian indicators, median valuation compelling
Consumer Staples	🟥		–		Valuation presents a headwind
Energy	🟥 New since Q4	+	+	–	Top-decile historical fundamentals appear unlikely to be sustained
Financials	🟩	–			Recovering fundamentals bolster the outlook
Health Care	🟩		+	–	Good combination of fundamentals and valuation
Industrials	🟩	+		+	Fundamentals and relative strength look attractive
Information Technology	🟩 New since Q4				Bottom-quarter fundamentals may offer a contrarian buy signal
Materials	🟩	+		+	Valuation and economic indicators look supportive
Real Estate	🟥	–	+		Elevated valuation likely to be a headwind
Utilities	🟥		–	–	Defensive characteristics may hinder performance

Past performance is no guarantee of future results. Strategist view, fundamentals, valuations, and relative strength are based on the top 3,000 U.S. stocks by market capitalization. Sectors defined by the GICS; see Index Definitions for details. Historical communication services data has been restated back to 1962 to account for changes to the GICS framework made on 9/24/18. **Strategist view** is as of the date indicated based on the information available at that time and may change based on market or other conditions. This is not necessarily the opinion of Fidelity Investments or its affiliates. Fidelity does not assume any duty to update any of the information. Overweight and underweight views represent opportunistic tilts in a hypothetical portfolio relative to broad market sector weights. Sector weights may vary depending on an individual's risk tolerance and goals. Time horizon view factors are based on historical analysis and are not a qualitative assessment by any individual investment professional. The top three sectors based on each time horizon view metric are shaded green; the bottom three are shaded red. See Glossary and Methodology for details. It is not possible to invest directly in an index. All indexes are unmanaged. Source: Haver Analytics, FactSet, Fidelity Investments, as of 3/31/23.

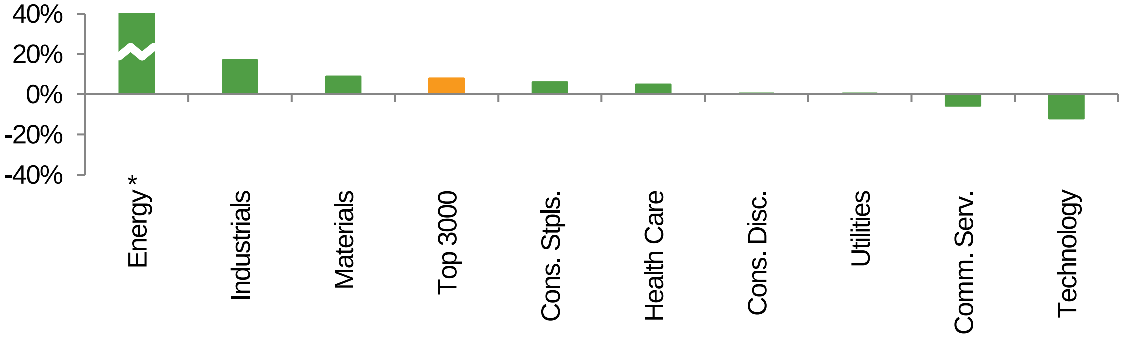
Fundamentals: Energy, Industrials, and Materials Led

Energy led the fundamentals rankings, coming in first in earnings per share (EPS) growth, EBITDA (earnings before interest, taxes, depreciation, and amortization) growth, and return on equity (ROE). The industrials and materials sectors also scored well. Financials was the worst performing sector, ranking 10th in EPS growth and ninth in ROE. Real estate and communications services also posted relatively poor fundamentals.

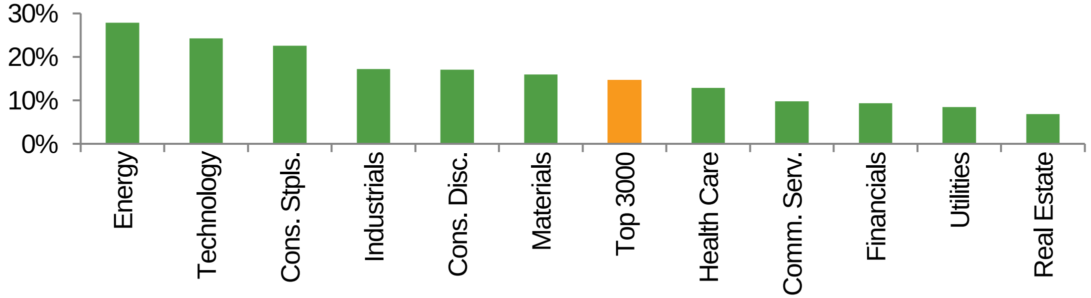
EPS Growth (Last 12 Months)



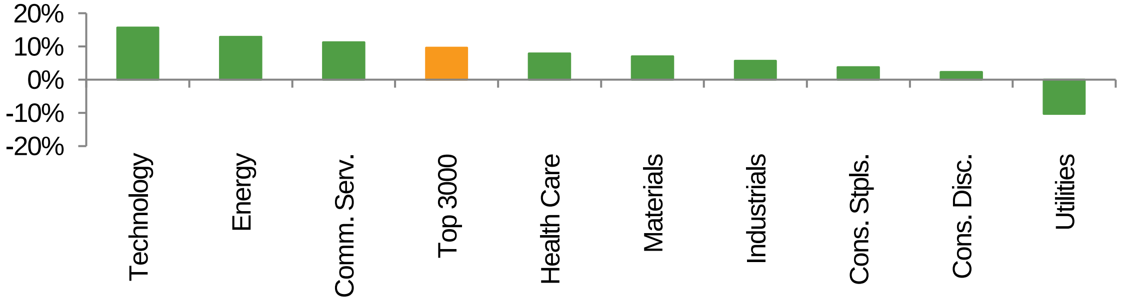
EBITDA Growth (Last 12 Months)



Return on Equity (Last 12 Months)



Free-Cash-Flow Margin (Last 12 Months)



Fundamentals: Strong and improving fundamentals historically have been an intermediate-term indicator of sector performance. Our analysis gives a view of how each sector has done in terms of growth and profitability.

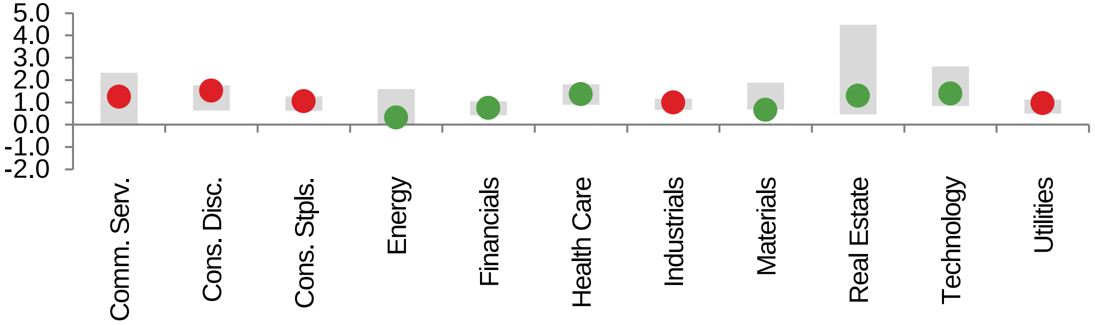
Past performance is no guarantee of future results. EPS = earnings per share. EBITDA = earnings before interest, taxes, depreciation, and amortization. * EPS growth value over the last 12 months for energy was 205%; EBITDA growth for energy over the same period was 83.7%. The financials and real estate sectors are not represented in the EBITDA growth or free-cash-flow margin charts because of differences in their business models and accounting standards. See Glossary and Methodology for further explanation. Sectors based on the top 3,000 U.S. stocks by market capitalization and defined by GICS. Communication services data restated back to 1962.

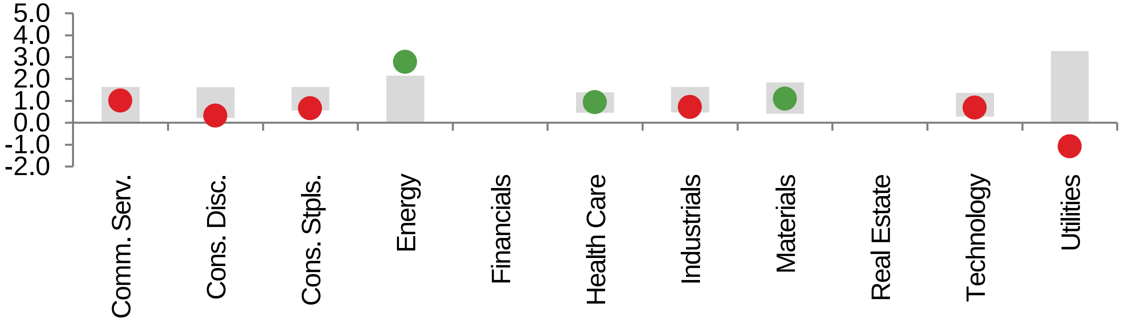
Source: Haver Analytics, Fidelity Investments, as of 3/31/23.

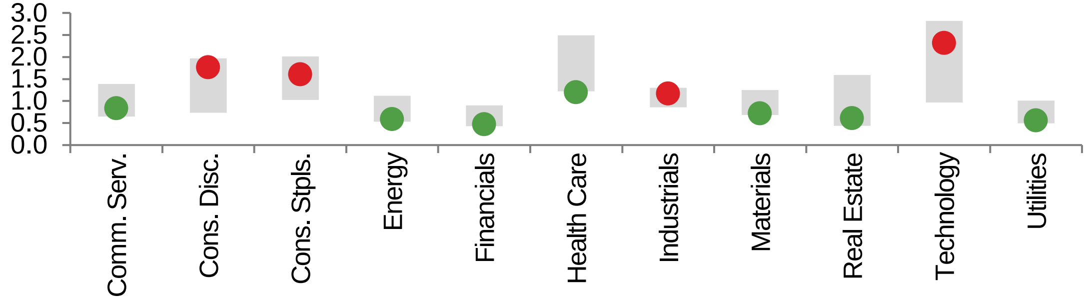
Valuations: Energy, Real Estate, and Health Care Looked Cheap

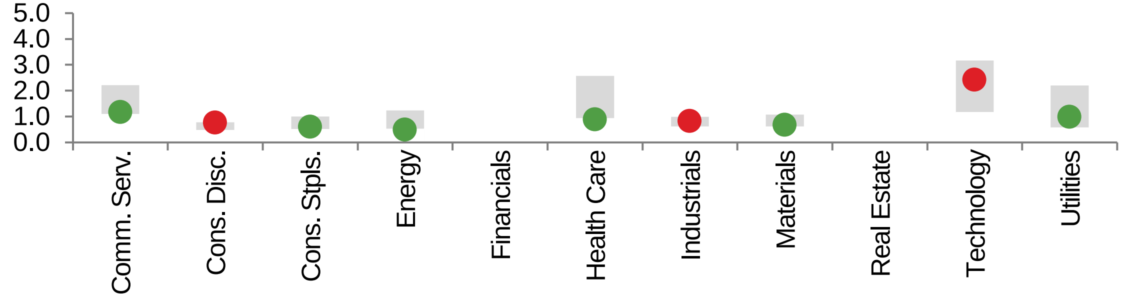
Energy had the cheapest quarter-end valuations, ranking least expensive in price-to-earnings and free-cash-flow yield. Real estate and health care also looked relatively inexpensive for the quarter. Consumer discretionary, utilities, and consumer staples had the highest aggregate valuations.

▨ Historical Range ● Current: Green/Red = Cheap/Expensive Relative to Historical Average


Price-to-Earnings Ratio; Forward Price/Earnings Ratio Relative to Top 3,000 Stocks


Free-Cash-Flow Yield; Free-Cash-Flow Yield Relative to Top 3,000 Stocks


Price-to-Book Ratio; Forward Price/Book Ratio Relative to Top 3,000 Stocks


Price-to-Sales Ratio; Forward Price/Sales Ratio Relative to Top 3,000 Stocks

Valuations: On their own, valuations are only a moderately effective indicator of future sector performance, but when combined with other factors, they can be a useful tool in determining the risk-and-reward profile.

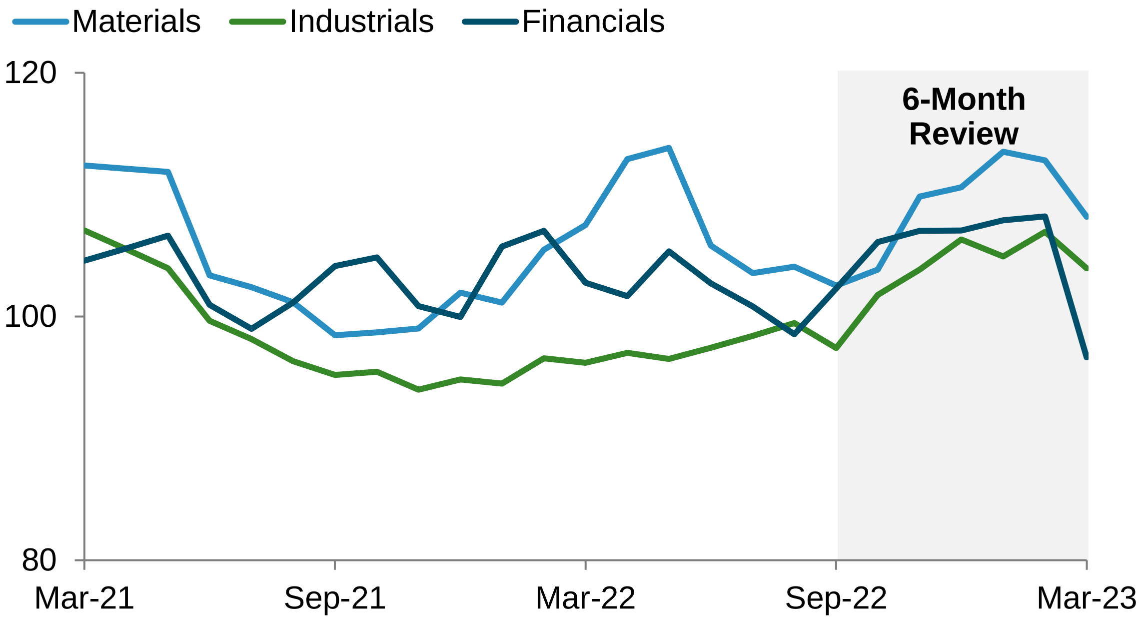
Past performance is no guarantee of future results. Free-cash-flow yield reflects free cash flow divided by market price per share; it is the inverse of the price-to-free-cash-flow ratio. Historical range excludes the top and bottom 5%. Green or red circles indicate if current levels are below or above the historical average, which excludes the top and bottom 5%.
The financials and real estate sectors are not represented in the free-cash-flow yield or price-to-sales charts because of differences in their business models and accounting standards. See the Glossary and Methodology for further explanation. Historical range since January 1962. Sectors based on the top 3,000 U.S. stocks by market capitalization and defined by GICS. Communication services data restated back to 1962. Source: Haver Analytics, Fidelity Investments, as of 3/31/23.

Relative Strength in Materials, Industrials, Financials

The materials, industrials, and financials sectors exhibited the greatest strength based on our relative price momentum score the past six months. Conversely, consumer discretionary, utilities, and consumer staples exhibited weakness based on relative price momentum.

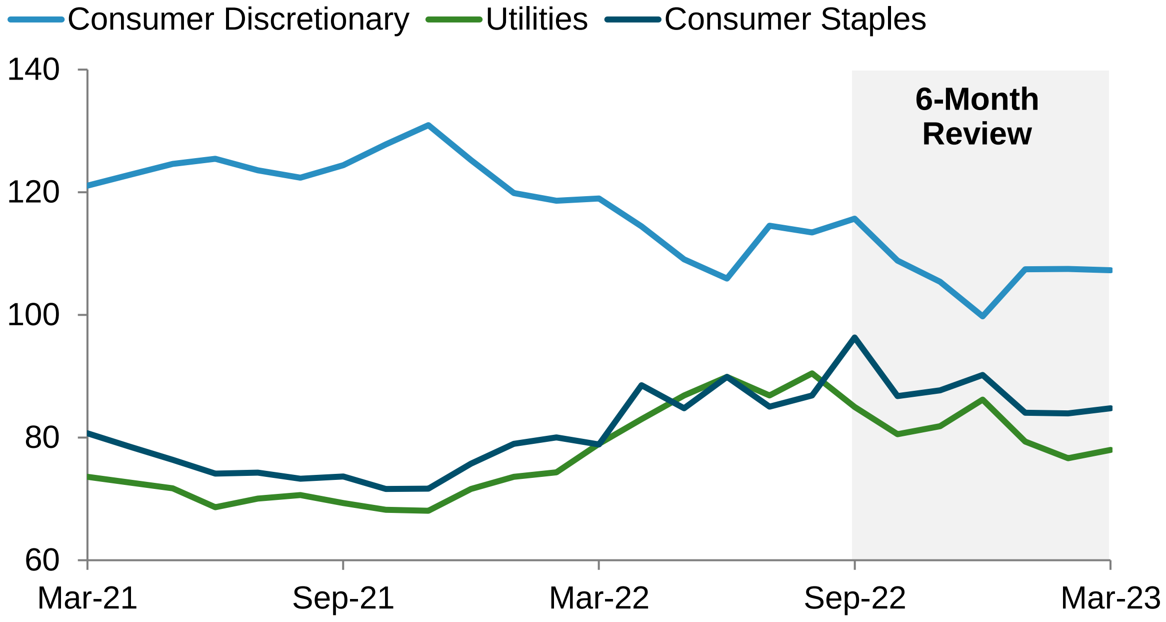
Sectors Exhibiting Relative Strength

Price Relative to the Russell 3000 Index



Sectors Exhibiting Relative Weakness

Price Relative to the Russell 3000 Index



Relative Strength: Stocks and sectors that have outperformed the broader market have tended to continue to do so.

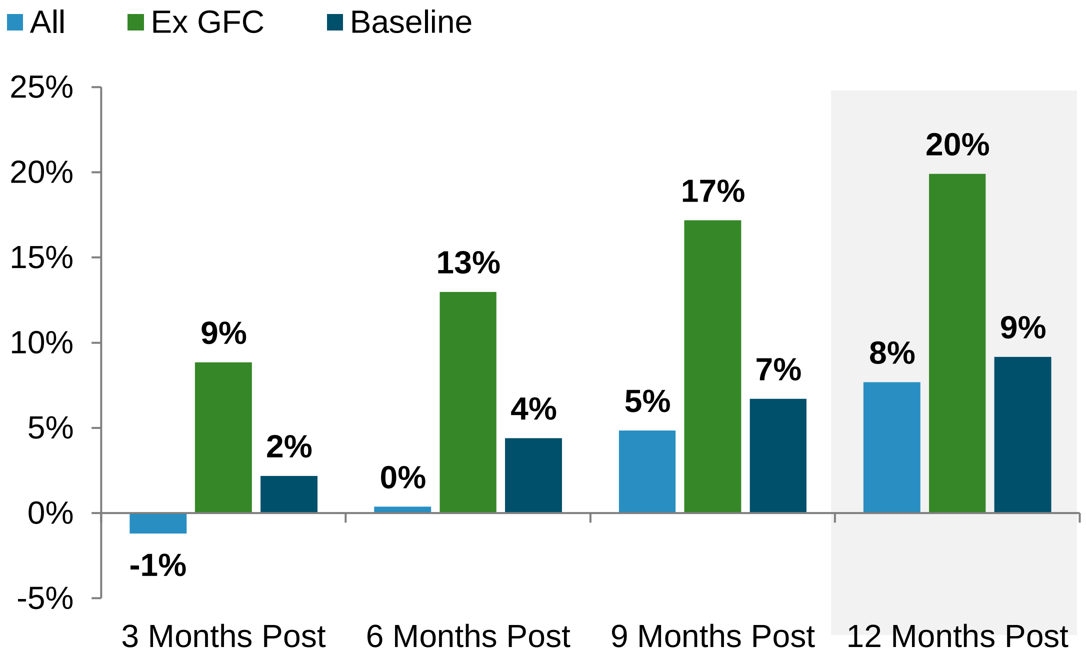
Past performance is no guarantee of future results. Relative strength compares the performance of each sector with the performance of the broad market, based on changes in the ratio of the securities' respective prices over time. See Glossary and Methodology for further explanation. Charts represent performance of sectors based on the top 3,000 stocks by market capitalization relative to the Russell 3000 Index. It is not possible to invest directly in an index. All indexes are unmanaged. Source: FactSet, Fidelity Investments, as of 3/31/23.

How Does the Banking Crisis Affect the Market Outlook?

History suggests the recent banking sector crisis may present an investment opportunity—although not for financials stocks. Financials in the S&P 500 dropped 4% on March 9. Financials sell-offs of this magnitude or more have happened just 1% of the time since 1989. Outside of 2007–2009, the S&P 500 index has returned an average of 20% over the next 12 months following a decline of 4% or greater for financial stocks (left). Notably, financial stocks trailed the market over the same time frame (right).

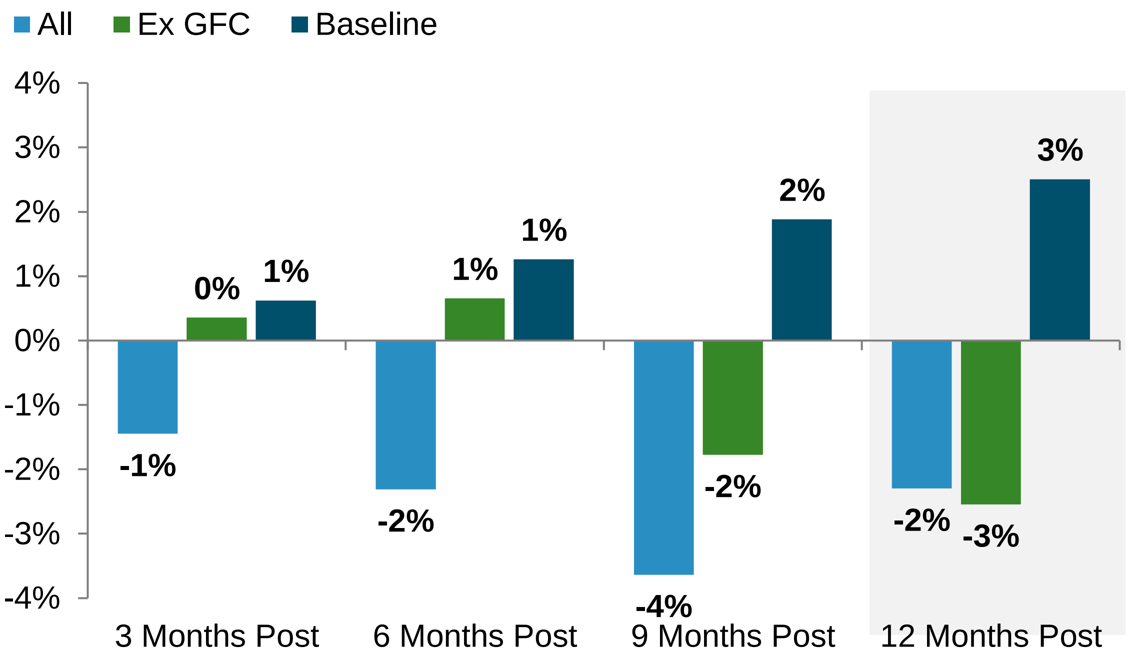
After Financial Sector Swoons, the Market Has Gained

Average S&P 500 Returns After One-Day Sell-Offs of 4% of More for the Financials Sector, 1989–Present



Financials Have Struggled After Big Sector Sell-offs

Average Financials Returns Relative to the S&P 500 After a One-Day Sell-off of 4% or More for the Financials Sector, 1989–Present



Past performance is no guarantee of future results. GFC = Global Financial Crisis of 2007–2009. Based on S&P 500 index data. Data analyzed daily since 1989. Financials measured as stocks in the S&P 500 Financials Index. One-day financials sell-offs of 4% or more occurred in 1% of instances observed in this time frame. Indexes are unmanaged. It is not possible to invest directly in an index. Sources: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. LEFT: Baseline refers to S&P 500 returns in all three, six, nine, and 12-month periods (not only post sell-off periods).

Equity Valuation Spreads Are Wide—A Good Sign in the Past

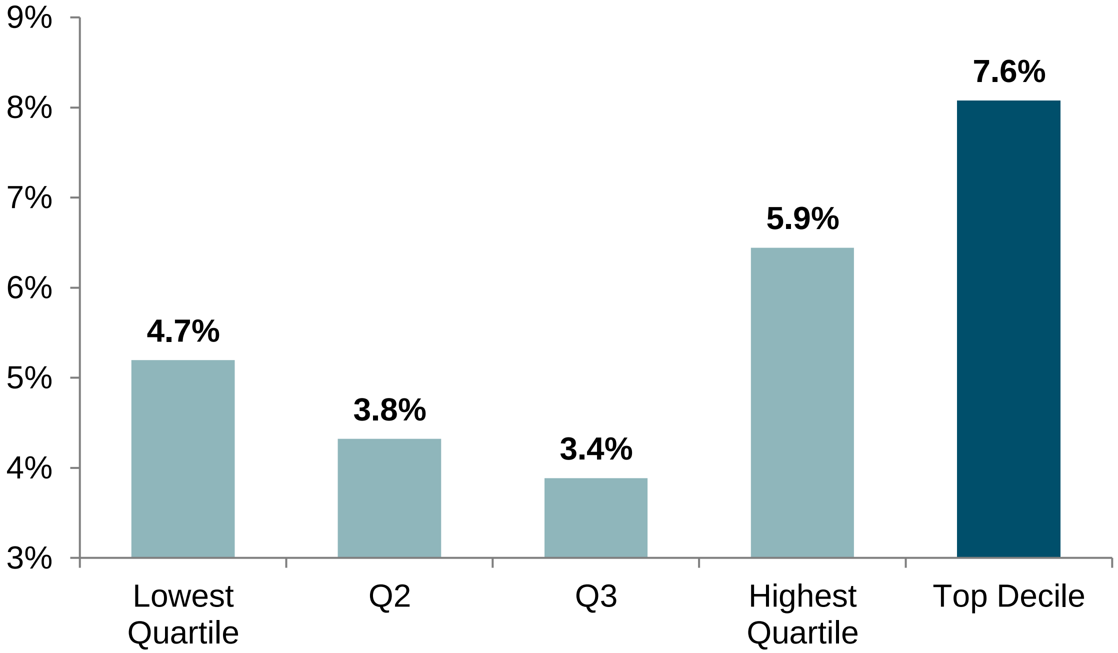
As of the end of February, valuation spreads—the difference in valuations between the market's cheapest and most expensive stocks—were in the top 10% of their historical range (left). Wide valuation spreads, which suggest investors are fearful, historically have been a contrarian bull signal. Since 1990, the S&P 500 has gained an average of 8% over six-month periods after stock valuations reached top-decile spreads (right).

Valuation Spreads Are in Their Top Decile

Valuation Spread Percentile Rank: S&P 500 vs. Forward EPS Yield

High Valuation Spreads Have Prefaced Strong Stock Returns

Rolling NSM S&P 500 Returns in Percentiles of Forward EPS Valuation Spread, 1990–Present



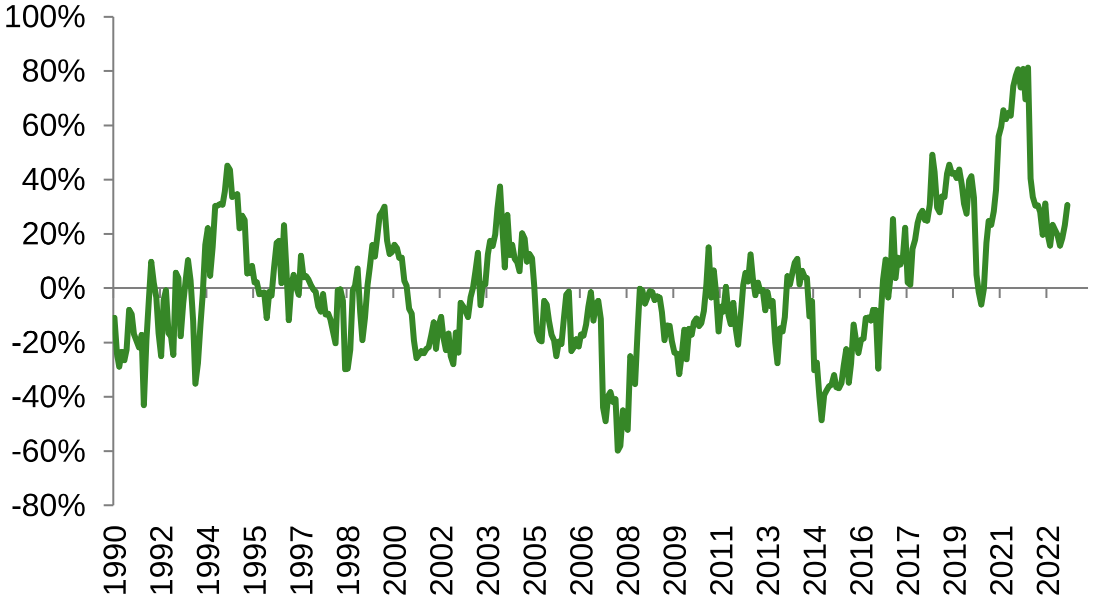
Past performance is no guarantee of future results. Based on the S&P 500 index data analyzed monthly since 1990. Forward EPS: Forward earnings per share. Equity valuation spreads calculated using the average forward price-to-earnings ratio of the most expensive quartile of stocks in the S&P 500 minus the average forward price-to-earnings ratio of the least expensive quartile of stocks in the S&P 500, based on an average of analysts' published earnings estimates for the next 12 months. Sources: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **RIGHT:** NSM is next six months.

The Historically Smarter Market Is Less Worried

Equity investors appeared more fearful than bond investors in the first quarter (left). While equity valuation spreads were in their top decile, spreads for high-yield bonds were just above the middle of their historical range. Since 1990, the bigger the differential between equity valuation spreads and high-yield bond spreads, the larger the S&P 500's six-month volatility-adjusted return (right).

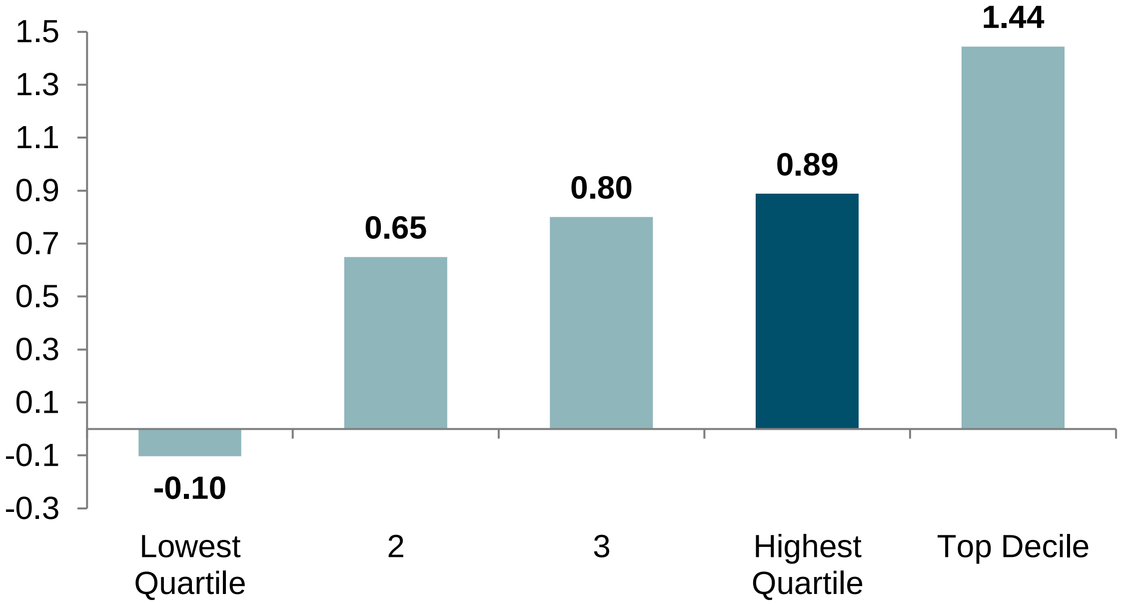
Equity Markets Are More Fearful Than Credit Markets

Percentile Rank Differential in Equity Valuation Spreads vs. High-Yield Spreads



More Fear in Stocks Than Bonds Has Been Good for Equity Investors

NSM S&P 500 Information Ratio in Percentiles of Equity Valuations vs. Percentiles of High Yield Spreads, 1990–Present



Past performance is no guarantee of future results. Data analyzed for the S&P 500 index monthly since 1990. High-yield spreads defined as the difference between the average yield-to-worst of the Bloomberg US Corporate High Yield Index and the yield on the 10-year Treasury note. Sources: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **LEFT:** EPS: Earnings per share. EPS yield is the average per-share earnings yield of the stocks analyzed. Equity valuation spreads calculated using the average forward price-to-earnings ratio of the most expensive quartile minus the average forward price-to-earnings ratio of the least expensive quartile, based on an average of analysts' published earnings estimates for the next 12 months.

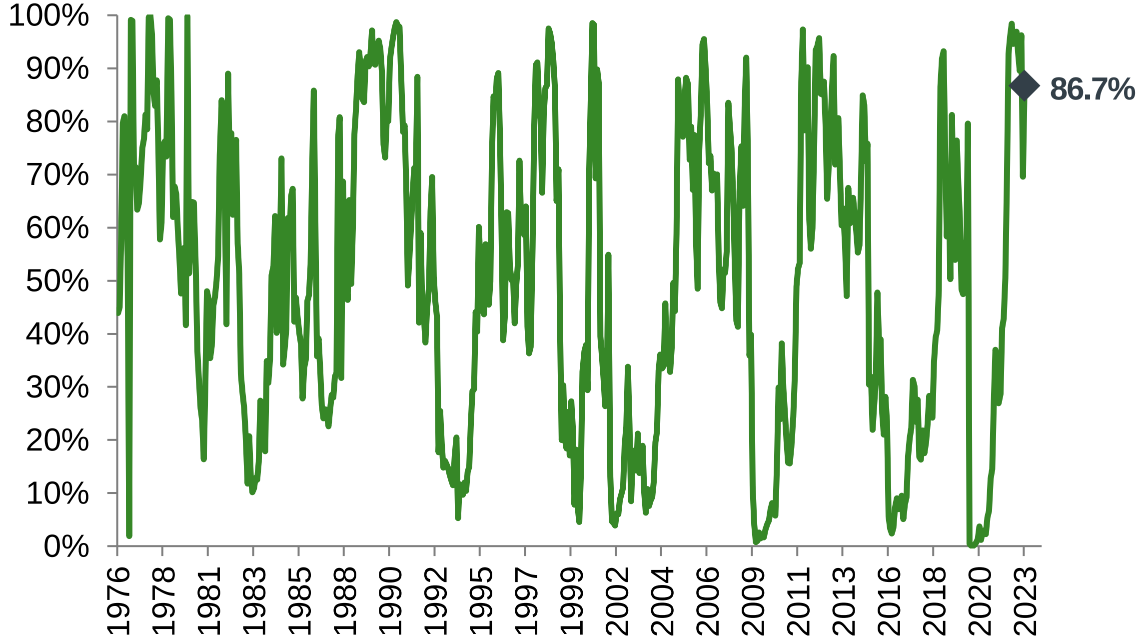
RIGHT: NSM is next six months. Equity valuation spreads calculated using the average forward price-to-earnings ratio of the most expensive quartile minus the average forward price-to-earnings ratio of the least expensive quartile, based on an average of analysts' published earnings estimates for the next 12 months. Information ratio is calculated as the excess return divided by the tracking error.

Stocks Tended to Advance When Defensive Sectors Were Expensive

Another potentially bullish signal: In the first quarter, defensives stocks traded at a big premium to cyclicals (left). Since 1976, when the valuation difference between defensive and cyclical sectors was in its top quartile based on price to forward earnings, the S&P 500 advanced over the next 12 months 90% of the time, with cyclicals typically outperforming (right).

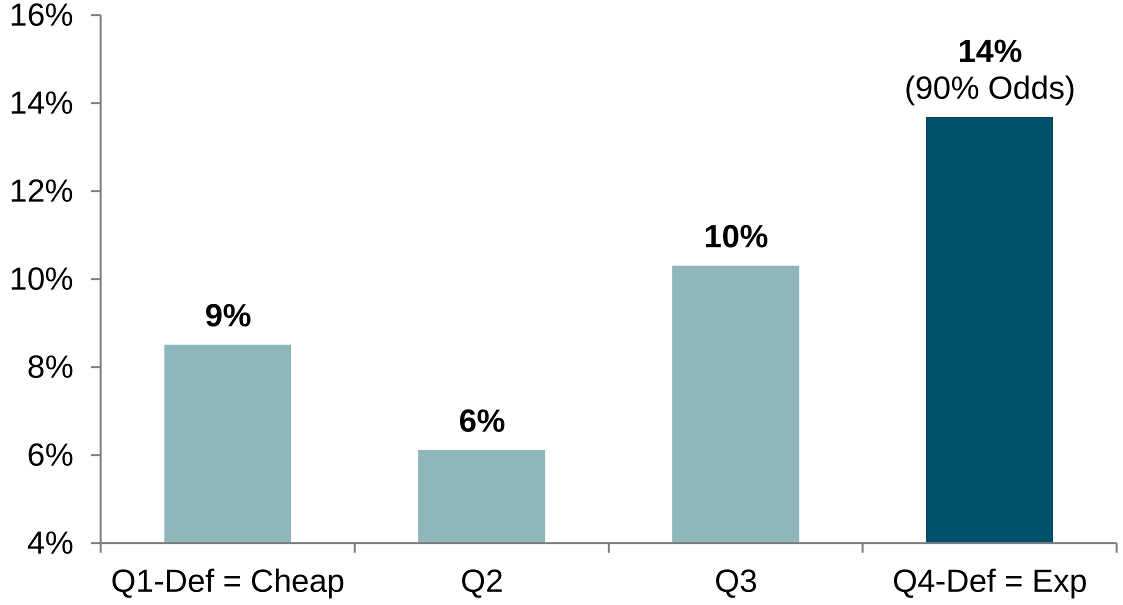
Defensive Sectors Are Expensive Relative to Cyclicals

Percentile Rank of Defensive Sectors' Relative Forward PE vs. Cyclical Sectors' (ex Energy)



The Market Has Tended to Advance After Defense Became Expensive

NTM Advance in Quartiles of Defensive Sector Relative Valuations



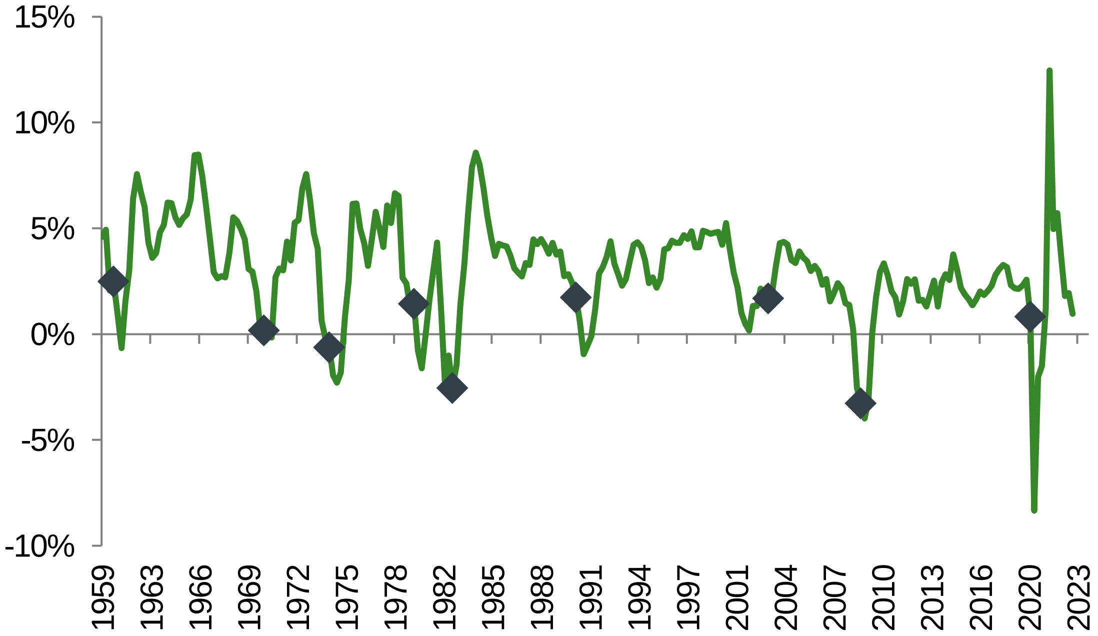
Past performance is no guarantee of future results. Analysis based on a Fidelity list of top 3,000 stocks by market capitalization using monthly data since 1976. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **LEFT:** Forward P/E: Forward price-to-earnings ratio. Cyclical sectors analyzed: materials, industrials, financials, consumer discretionary, information technology, communication services and real estate. Defensive sectors analyzed: utilities, health care, and consumer staples. Energy does not behave consistently like a defensive or cyclical sector, so it was excluded from this analysis. A forward P/E ratio typically uses an average of analysts' published earnings estimates for the next 12 months. **RIGHT:** NTM is next 12 months.

Stocks Can Recover ahead of Real GDP

Real (adjusted for inflation) U.S. gross domestic product (GDP) growth has fallen below 1%, a level consistent with previous recessions (left). Historically, the market has recovered before real GDP has—and this could be happening already. In the past, stocks have tended to advance over the 12 months after real GDP growth reached less than 1%. Cyclicals have led the way, and consumer discretionary has outperformed 74% of the time.

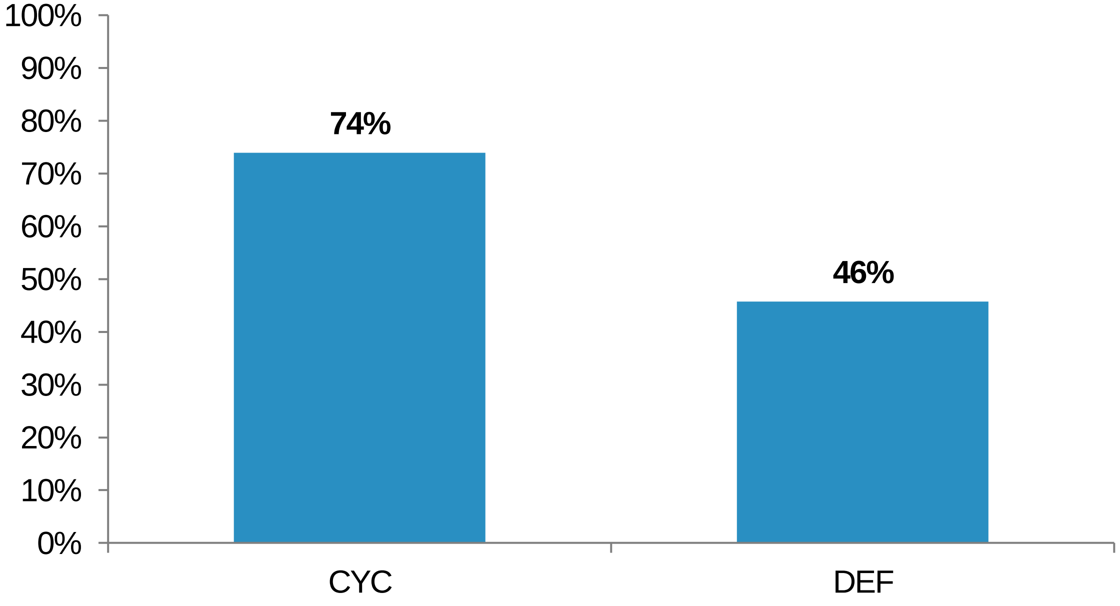
Watching the Decline of Real GDP

Year-Over-Year Percent Change in Real GDP



Cyclicals Have Led in Recessionary Market Recoveries

Sector Odds of Outperformance (ex Energy) One Year After Sub-1% GDP Growth



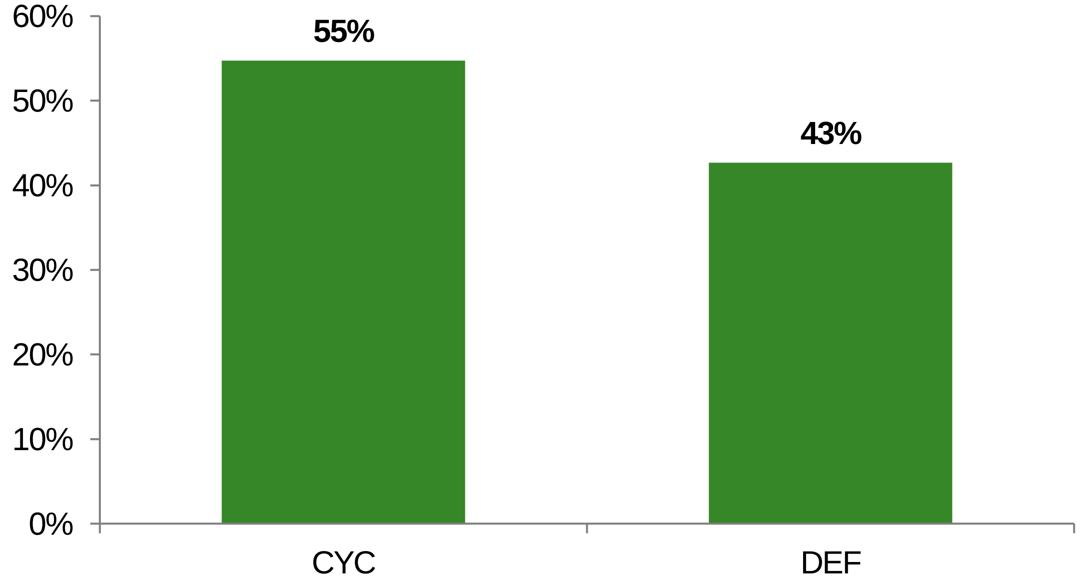
Past performance is no guarantee of future results. Analysis based on Fidelity top 3,000 stocks by market capitalization using monthly data since 1959. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **LEFT:** GDP: Gross domestic product. Real GDP is adjusted for inflation. Diamonds on the chart indicate past U.S. recessions, as defined by the National Bureau of Economic Research. **RIGHT:** CYC: Cyclical sectors. DEF: Defensive sectors. Cyclical sectors include communication services, consumer discretionary, financials, industrials, materials, real estate, and technology. Defensive sectors include consumer staples, health care, and utilities. Energy does not behave consistently like a defensive or cyclical sector, so it was excluded from this analysis.

Tech Has Stood Out After Yields Have Fallen

The banking crisis drove down yields on two-year Treasury notes in March. Equities historically have gotten a boost after top-quartile monthly declines in bond yields. Cyclical sectors have tended to outperform, particularly technology and consumer discretionary. Defensive sectors, especially utilities and consumer staples, have tended to lag.

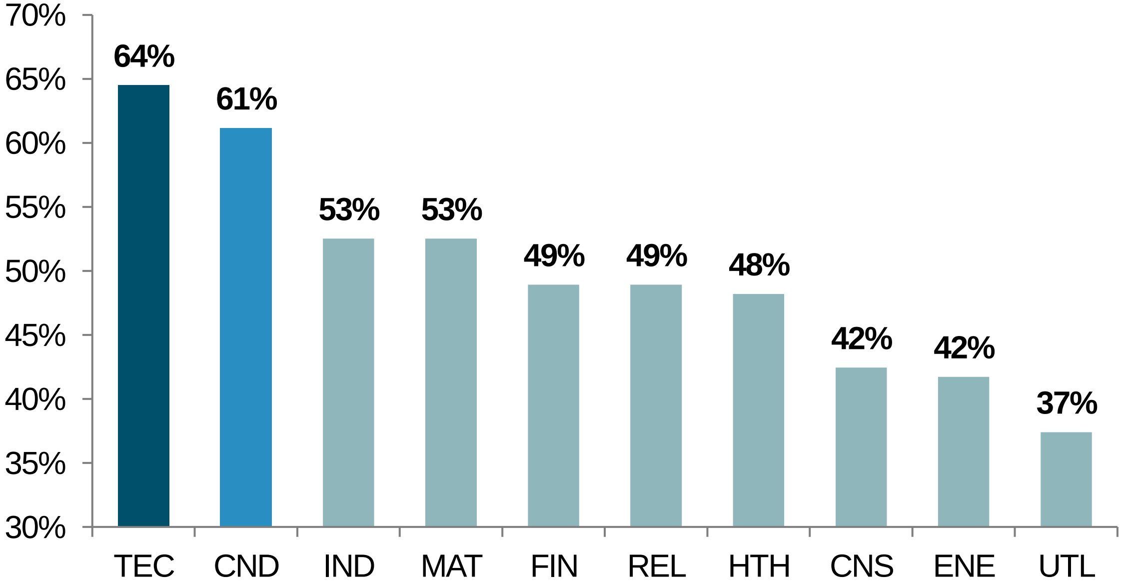
Cyclicals Have Led After Big Yield Declines

Cyclical vs. Defensive Sector Leadership (ex Energy) Six Months Following Top-Quartile One-Month Yield Declines, 1976–Present



Technology Stocks Have Led After Big Yield Declines

Next-Six-Month Odds of Sector Performance Following Top-Quartile One-Month Yield Declines, 1976–Present



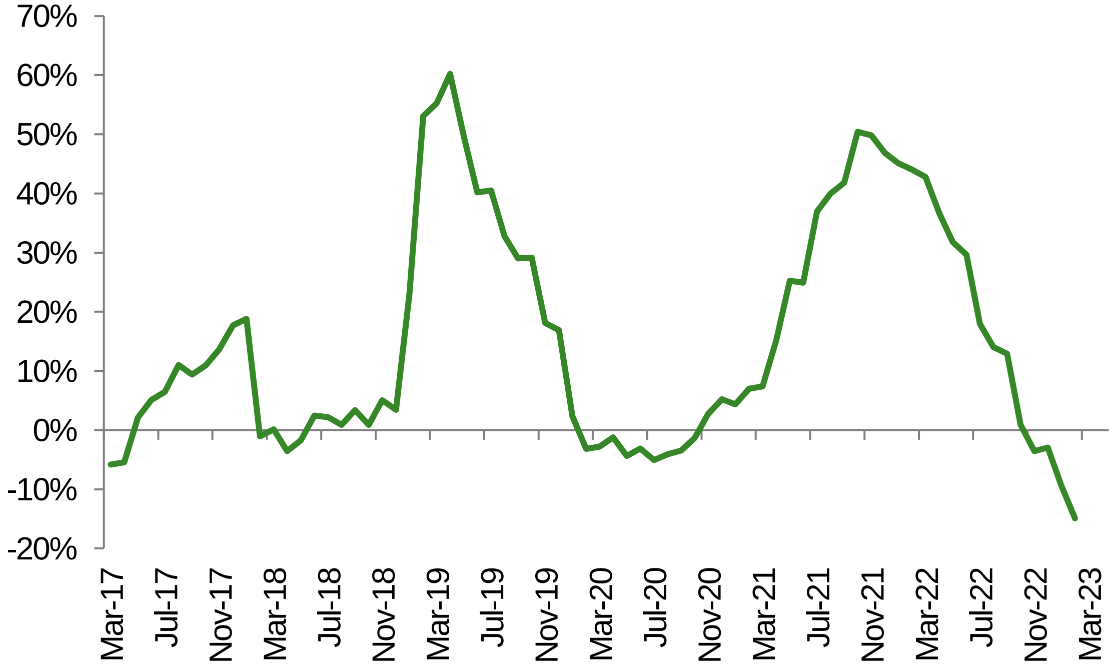
Past performance is no guarantee of future results. Analysis based on Fidelity list of the top 3,000 stocks by market capitalization. Data gathered monthly. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **LEFT:** Yield declines calculated for 2-Year U.S. Treasury yields. Cyclical sectors include communication services, consumer discretionary, financials, industrials, materials, real estate, and technology. Defensive sectors include consumer staples, health care, and utilities. Energy does not behave consistently like a defensive or cyclical sector, so it was excluded from this analysis. **RIGHT:** Sector breakdown defined by Fidelity Investments. TEC: Information technology. CND: Consumer discretionary. IND: Industrials. MAT: Materials. FIN: Financials. REL: Real estate. HTH: Health care. CNS: Consumer staples. ENE: Energy. UTL: Utilities.

Falling Earnings May Make Tech Stocks Appealing

Technology earnings have plummeted (left). This has pushed up the sector's average price-to-earnings ratio. Counterintuitively, technology stocks have outperformed, on average, during the 12 months after bottom-quartile year-over-year earnings growth, likely because their earnings outlooks subsequently improved (right). The sector performed even better when its valuations were high to start those periods.

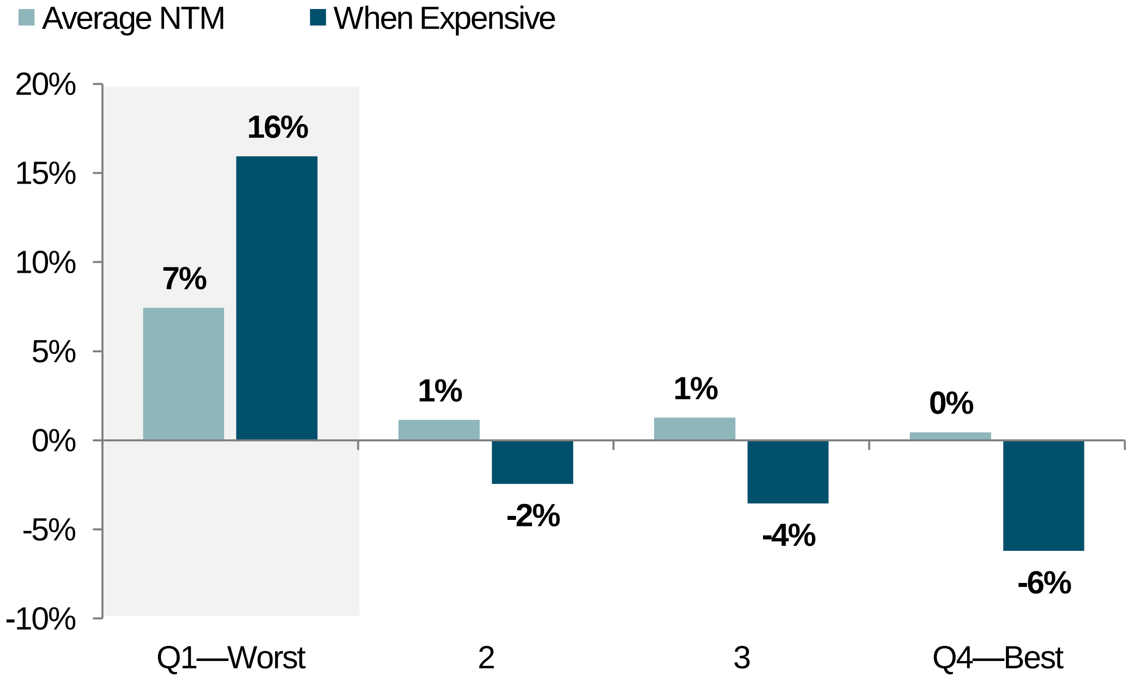
Tech Earnings Have Tanked

Percent Year-Over-Year Change in Information Technology Earnings



After Weak Earnings, Technology Performed Best When It Was Expensive

Relative Performance in Quartiles of Prior EPS Growth, 1962–Present



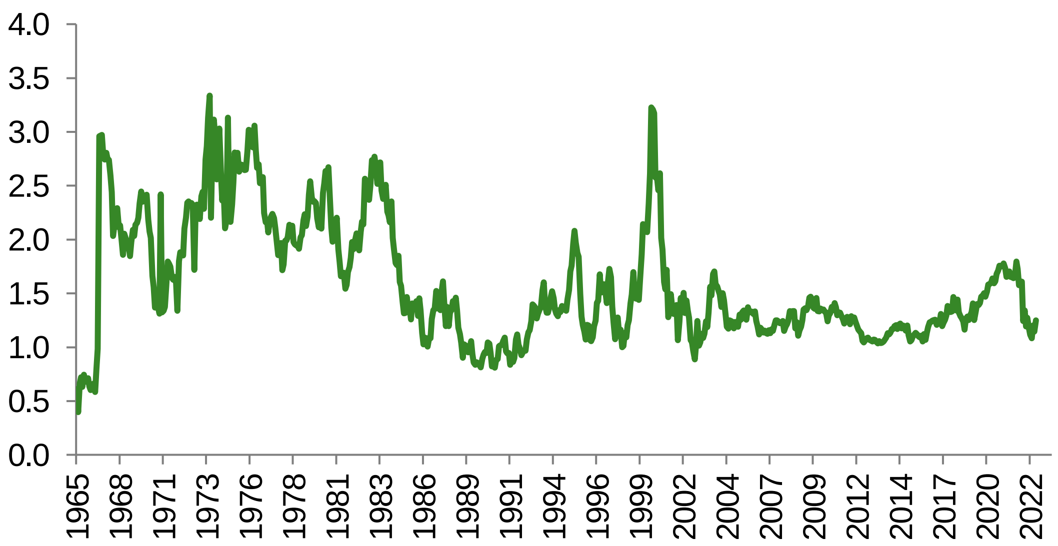
Past performance is no guarantee of future results. Analysis based on Fidelity top 3,000 stocks by market capitalization. Data gathered monthly. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **RIGHT:** EPS: Earnings per share. NTM: Next twelve months. "When expensive" signifies forward price-to-earnings ratios in the top half of the sector's historical range. A forward P/E ratio typically uses an average of analysts' published earnings estimates for the next 12 months.

Semiconductor Stocks Look Inexpensive

Although technology looked expensive on both trailing and forward earnings in the first quarter, certain sub-sectors looked historically cheap on book value. The standout was semiconductors, which reached bottom-quartile price-to-book ratios (left). From comparable levels in the past, semiconductor stocks have outperformed the market over the next 12 months, on average, even when earnings declined (right).

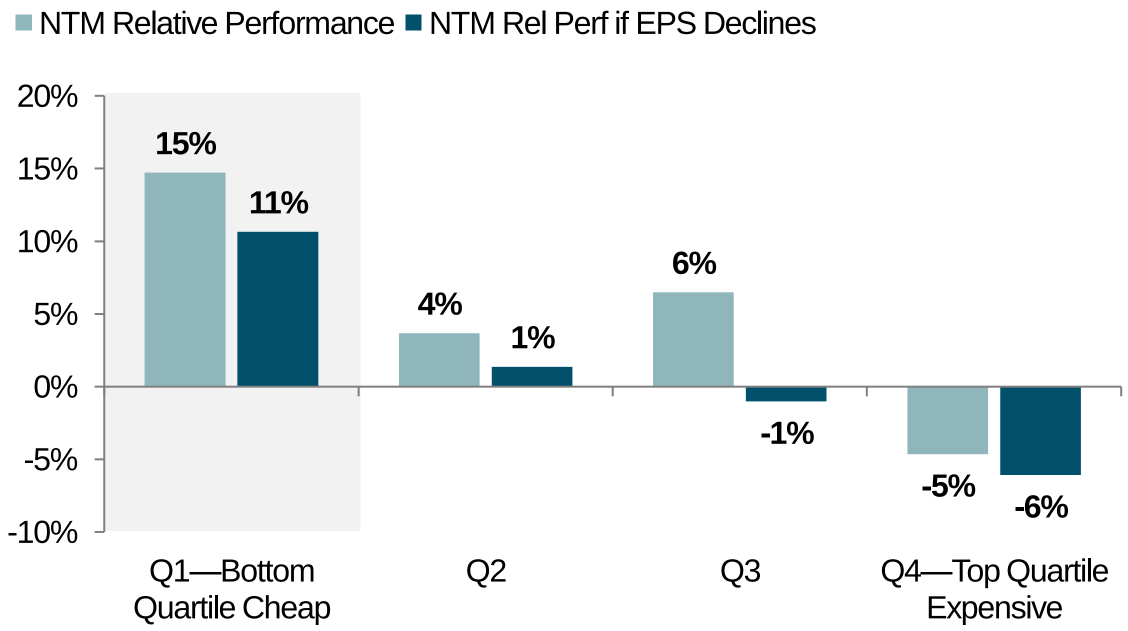
Semiconductor Stocks Look Cheap

Semiconductor Industry Relative Price-to-Book



Semiconductors Have Outperformed After Bottom-Quartile Price-to-Book Ratios

NTM Average Relative Performance in Quartiles of Relative P/Book, All Instances and When EPS Declines, 1965–Present



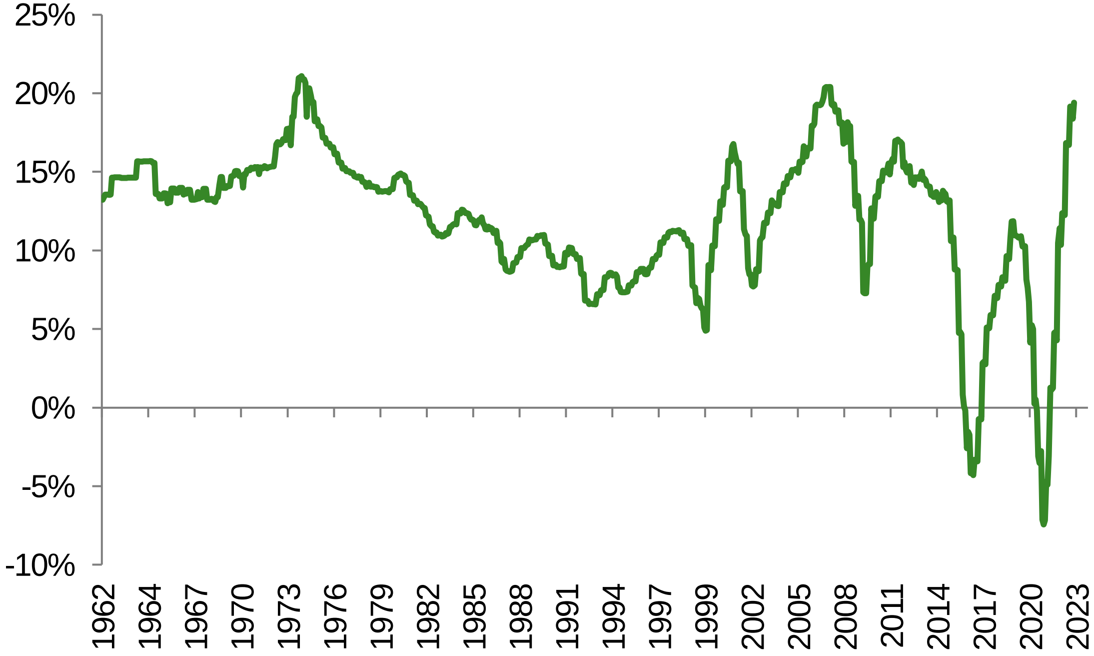
Past performance is no guarantee of future results. Analysis based on Fidelity top 3,000 stocks by market capitalization since 1965. Data gathered monthly. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **LEFT:** Price-to-Book is the aggregate stock price of semiconductor stocks among the 3,000 divided by the aggregate per-share book value. **RIGHT:** NTM is next twelve months. P/Book: Price-to-book. EPS: Earnings per share.

Energy Earnings Historically Have Struggled After High Margins

Energy-sector margins have reached the top decile of their historical range and could be peaking (left). Since 1962, the sector's earnings have tended to fall substantially after margins reached comparable levels: -10% overall over the next 12 months and -20% during periods when crude prices fell (right).

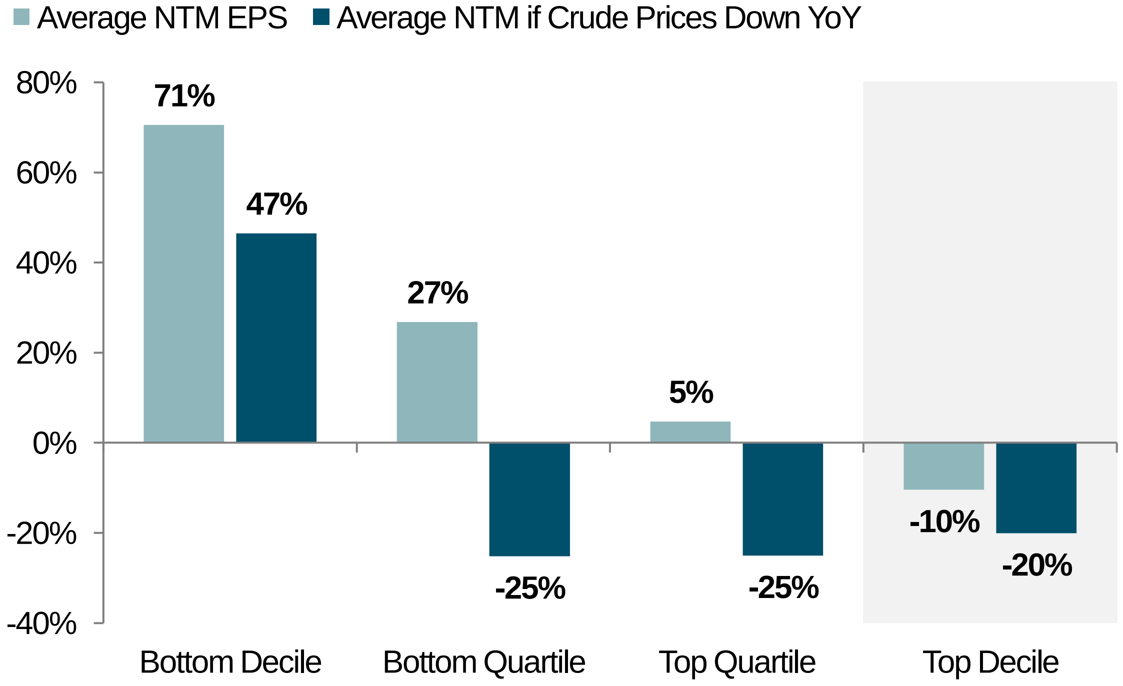
Energy Margins May Be Peaking

Energy EBIT/Sales



In Energy, High Margins Have Been Bad for Future Earnings Growth

Average NTM EPS Growth in Quartiles and Deciles of Operating Margin, 1962–Present



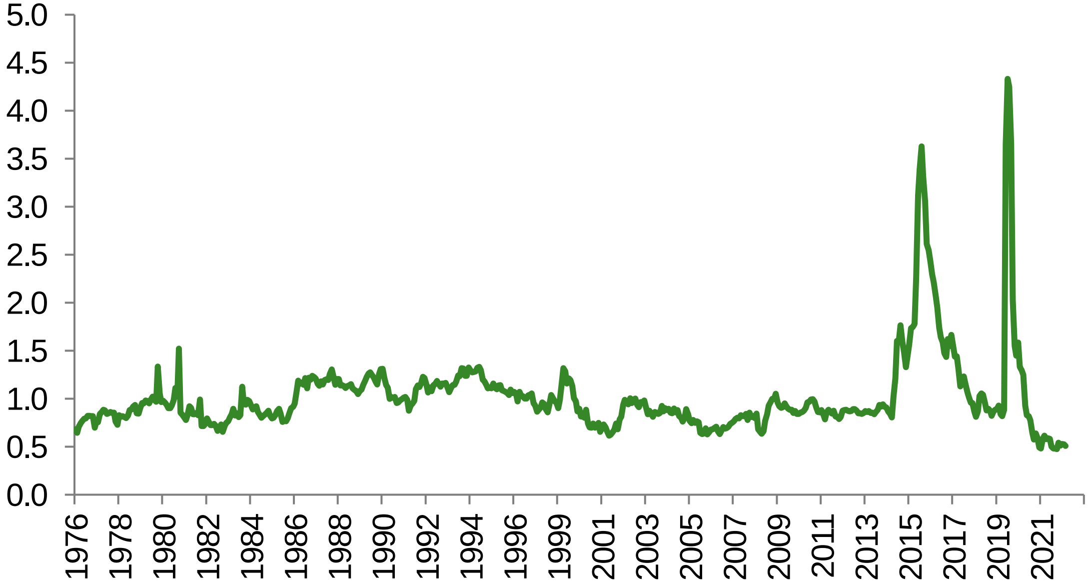
Past performance is no guarantee of future results. Analysis based on Fidelity top 3,000 stocks by market capitalization since 1962. Data gathered monthly. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. **LEFT:** EBIT: Earnings before interest and taxes. EBIT is compared relative to aggregate revenue for energy stocks within the 3,000 stocks analyzed. **RIGHT:** NTM: Next twelve months. EPS: Earnings per share. YoY: Year over year. Operating margin measures pre-tax profit relative to revenue after accounting for variable production costs, such as wages.

But Earnings and Crude Prices Pose Headwinds for Energy

Energy bulls may point to the sector's low price-to-earnings ratio (left). It's true that, all else being equal, energy stocks have outperformed following bottom-quartile P/Es. But that hasn't been the case when earnings have declined: In those instances, the sector posted negative average returns, even from cheap valuations (right).

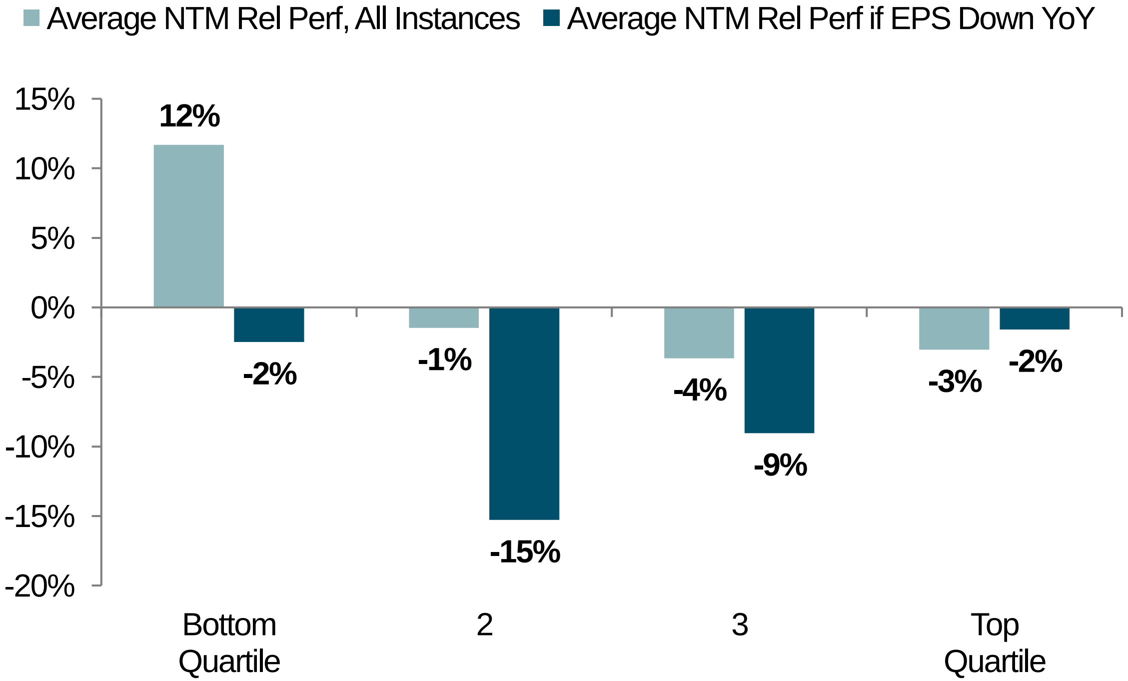
Energy Is Cheap

Energy Relative Fwd PE



But Low Energy Valuations Haven't Been Enough to Offset Weak Earnings

NTM Relative Performance from Fwd P/E Quartiles, 1976–February 2023



Past performance is no guarantee of future results. Analysis based on Fidelity top 3,000 stocks by market capitalization since 1976. Data gathered monthly. Source: Haver Analytics, FactSet, Fidelity Investments, as of 2/28/2023. LEFT: Fwd P/E: Forward price-to-earnings ratio. A forward P/E ratio typically uses an average of analysts' published earnings estimates for the next 12 months. RIGHT: NTM: Next twelve months. EPS: Earnings per share.

Glossary and Methodology

Glossary

Cycle Hit Rate: Calculates the frequency of a sector outperforming the broader equity market over each business cycle phase since 1962.

Dividend Yield: Annual dividends per share divided by share price.

Earnings before Interest, Taxes, Depreciation, and Amortization (EBITDA): A non-GAAP measure often used to compare profitability between companies and industries, because it eliminates the effects of financing and accounting decisions.

Earnings-per-Share Growth: Measures the growth in reported earnings per share over the specified past time period.

Earnings Yield: Earnings per share divided by share price. It is the inverse of the price-to-earnings (P/E) ratio.

Enterprise Value: A measure of a company's total value that includes its market capitalization as well as short- and long-term debt and cash on its balance sheet.

Free Cash Flow (FCF): The amount of cash a company has remaining after expenses, debt service, capital expenditures, and dividends. High free cash flow typically suggests stronger company value.

Free-Cash-Flow Margin: The amount of free cash flow as a percentage of revenue. High FCF margin often denotes strong profitability.

Free-Cash-Flow Yield: Free cash flow per share divided by share price. A high FCF yield often represents a good investment opportunity, because investors would be paying a reasonable price for healthy cash earnings.

Full-Phase Average Performance: Calculates the (geometric) average performance of a sector in a particular phase of the business cycle and subtracts the performance of the broader equity market.

Median Monthly Difference: Calculates the difference in the monthly performance of a sector compared with the broader market, and then takes the midpoint of those observations.

Price-to-Book (P/B) Ratio: The ratio of a company's share price to reported accumulated profits and capital.

Price-to-Earnings (P/E) Ratio: The ratio of a company's current share price to its reported earnings. A forward P/E ratio typically uses an average of analysts' published earnings estimates for the next 12 months.

Price-to-Sales (P/S) Ratio: The ratio of a company's current share price to reported sales.

Relative Strength: The comparison of a security's performance relative to a benchmark, typically a market index.

Return on Equity (ROE): The amount, expressed as a percentage, earned on a company's common stock investment for a given period.

Risk Decomposition: A mathematical analysis that estimates the relative contribution of various sources of volatility.

Methodology

Strategist View: Our sector strategist, Denise Chisholm, tracks key indicators that have influenced the historical likelihood of outperformance of each sector. This historical probability analysis informs the Strategist Views.

Fundamentals: Sector rankings are based on equally weighting the following four fundamental factors: EBITDA growth, earnings growth, ROE, and FCF margin. However, we evaluate the financials and real estate sectors only on earnings growth and ROE because of differences in their business models and accounting standards.

Relative Strength: Compares the strength of a sector versus the S&P 500 index over a six-month period, with a one-month reversal on the latest month; identifying relative strength patterns can be a useful indicator of short-term sector performance.

Relative Valuations: Valuation metrics for each sector are relative to the S&P 500. Ratios compute the current relative valuation divided by the 10-year historical average relative valuation, eliminating the top 5% and bottom 5% values to reduce the effect of potential outliers. Sectors are then ranked by their weighted average ratios, weighted as follows: P/E: 37%; P/B: 21%; P/S: 21%; and FCF yield: 21%. However, the financials and real estate sectors are weighted as follows: P/E: 65% and P/B: 35%.

Appendix

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Past performance is no guarantee of future results.

Investing involves risk, including risk of loss.

All indexes are unmanaged. You cannot invest directly in an index. Index or benchmark performance presented in this document does not reflect the deduction of advisory fees, transaction charges, and other expenses, which would reduce performance.

Stock markets are volatile and can decline significantly in response to adverse issuer, political, regulatory, market, or economic developments.

Because of its narrow focus, sector investing tends to be more volatile than investments that diversify across many sectors and companies. Sector investing is also subject to the additional risks associated with its particular industry. The Energy sector is defined as companies whose businesses are dominated by either of the following activities: the construction or provision of oil rigs, drilling equipment, or other energy-related services and equipment, including seismic data collection; or the exploration, production, marketing, refining, and/or transportation of oil and gas products, coal, and consumable fuels. Financials: companies involved in activities such as banking, consumer finance, investment banking and brokerage, asset management, and insurance and investments.

The energy industries can be significantly affected by fluctuations in energy prices and supply and demand of energy fuels, energy conservation, the success of exploration projects, and tax and other government regulations.
The technology industries can be significantly affected by obsolescence of existing technology, short product cycles, falling prices and profits, competition from new market entrants, and general economic condition.

Index Definitions: The Russell 3000® Index is a market capitalization-weighted index designed to measure the performance of the 3,000 largest companies in the U.S. equity market.

The S&P 500® index is a market capitalization-weighted index of 500 common stocks chosen for market size, liquidity, and industry group representation to represent U.S. equity performance. S&P 500 is a registered service mark of Standard & Poor's Financial Services LLC. Sectors and industries are defined by the Global Industry Classification Standard (GICS).

The S&P 500 sector indexes include the standard GICS sectors that make up the S&P 500 index. The market capitalization of all S&P 500 sector indexes together comprises the market capitalization of the parent S&P 500 index; each member of the S&P 500 index is assigned to one (and only one) sector.

The S&P CoreLogic Case-Shiller U.S. National Home Price Index is a composite of single-family home price indexes for the nine U.S. Census divisions and is calculated monthly. It is included in the S&P CoreLogic Case-Shiller Home Price Index Series, which seeks to measure changes in the total value of all existing single-family housing stock.

Appendix

Sectors are defined as follows: **Communication Services:** companies that facilitate communication or provide access to entertainment content and other information through various types of media. **Consumer Discretionary:** companies that provide goods and services that people want but don't necessarily need, such as televisions, cars, and sporting goods; these businesses tend to be the most sensitive to economic cycles. **Consumer Staples:** companies that provide goods and services that people use on a daily basis, like food, household products, and personal-care products; these businesses tend to be less sensitive to economic cycles. **Energy:** companies whose businesses are dominated by either of the following activities: the construction or provision of oil rigs, drilling equipment, or other energy-related services and equipment, including seismic data collection; or the exploration, production, marketing, refining, and/or transportation of oil and gas products, coal, and consumable fuels. **Financials:** companies involved in activities such as banking, consumer finance, investment banking and brokerage, asset management, and insurance and investments. **Health Care:** companies in two main industry groups: health care equipment suppliers and manufacturers, and providers of health care services; and companies involved in the research, development, production, and marketing of pharmaceuticals and biotechnology products. **Industrials:** companies whose businesses manufacture and distribute capital goods, provide commercial services and supplies, or provide transportation services. **Materials**: companies that are engaged in a wide range of commodity-related manufacturing. **Real Estate:** companies in two main industry groups—real estate investment trusts (REITs), and real estate management and development companies. **Technology:** companies in technology software and services and technology hardware and equipment. **Utilities:** companies considered to be electric, gas, or water utilities, or companies that operate as independent producers and/or distributors of power.

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After A 'Good Run' For Utilities In 2022, Analyst Says 'Trade Is Over — For Now,' But Retains Bullish Bias On These Stocks

Benzinga

Jan. 17, 2023, 09:22 AM

The utility sector is generally credited as an “all-weather” investment, given its defensive nature and the steady returns it generates in the form of dividends. Riding on these traits, utility stocks fared relatively better in a down year for equity markets.

The Dow Jones Utility Average was down merely 1.4% in 2022 compared to S&P 500's 19.4% slump. The **Utilities Select Sector SPDR Fund** (NYSE:XLU), an exchange-traded fund tracking the performance of utility stocks that are S&P 500 components, rose 1.4% last year.

An analyst at KeyBanc Capital Markets warned that the good times may not last.

The Utility Analyst: Analyst Sophie Karp downgraded both **Southern Company** (NYSE:SO) and **CenterPoint Energy, Inc.** (NYSE:CNP) from Overweight to Sector Weight.

The analyst sees Southern Company pressured by near-term headwinds and a not-so-attractive valuation, stemming from the shares trading above KeyBanc's price target.

CenterPoint's valuation is unattractive, and it is also at risk from the "Texas regulatory noise," she said.

The Utility Thesis: The utility sector's relative outperformance came on the back of the pre-recessionary environment in the U.S. in 2022, analyst Karp said. She noted that the sector now traded at a 2.8 times premium to the S&P 500 Index, which is relatively wide by historical standards.

She said the utility sector is relatively overvalued and will see a mean reversion in 2023, adding that the last time such a premium over the S&P 500 Index happened was in 2004.

“We are therefore negative on the sector overall going into 2023 and our OW picks grow fewer,” Karp said.

See also: Best Utility Stocks Right Now

There has been a surprising deterioration of the regulatory environment across multiple jurisdictions, including the historically stronger ones, she noted. Some regulatory developments, according to the analyst, are driven by the regulator’s desire to moderate the impact on customer bills. “Given that power and commodity prices remain elevated, we expect to continue seeing regulators getting 'creative' with assumptions and rate mechanisms to achieve that goal,” she added.

Karp said she would focus on rate affordability, as inflationary pressures will likely be a factor for the foreseeable future.

“As we turn to 2023, we believe that the sector will find it difficult to defend this relative valuation position, particularly as macro headwinds persist and begin to take a toll on utility earnings,” she added.

The analyst sees **Xcel Energy, Inc.** (NYSE:XEL) as standing out for having the most affordable and low-rate states in its territory.

KeyBanc’s few Overweight stocks in the sector are:

- **FirstEnergy Corp.** (NYSE:FE)
- **NorthWestern Corp.** (NASDAQ:NEW)
- **Constellation Energy Corp.** (NASDAQ:CEG)
- Xcel
- **Duke Energy Corp.** (NYSE:DUK)
- **WEC Energy Group, Inc.** (NYSE:WEC)

KeyBanc singled out **Dominion Energy, Inc.** (NYSE:D) as the most interesting story to watch in 2023, as its shares have underperformed the sector by a wide margin in the fourth quarter. The firm expects the company to start asset sales and balance sheet repair this year due to the prospectively lower return on equity in Virginia.

Utility Price Action: The XLU ended Friday's session down 0.36% at $71.33, according to Benzinga Pro data.

Read next: Southern Company Needs To Examine Its Portfolio: Why This Analyst Is Bullish

Photo: courtesy of Unsplash.

Southern News MORE (/NEWS/SO)

Southern Company (SO) Q1 Earnings on Deck: What to Expect (/news/stocks/southern-company-so-q1-earnings-on-deck--what-to-expect-12379587)
Zacks 3d

Southern Co. (SO) Gains As Market Dips: What You Should Know (/news/stocks/southern-co--so-gains-as-market-dips--what-you-should-know-12377000)
Zacks 4d

Southern raised to Buy at Mizuho with Vogtle 4 nearing completion (https://seekingalpha.com/news/3958407-southern-raised-to-buy-at-mizuho-with-vogtle-4-nearing-completion?utm_source=businessinsider&utm_medium=referral)
Seeking Alpha 4d

Benzinga's Top Ratings Upgrades, Downgrades For April 20, 2023 (/news/stocks/benzinga-s-top-ratings-upgrades-downgrades-for-april-20-2023-1032247500)
Benzinga 4d

Earnings Preview: Southern Co. (SO) Q1 Earnings Expected to Decline (/news/stocks/earnings-preview--southern-co--so-q1-earnings-expected-to-decline-12375616)
Zacks 4d

: Southern Co. upgraded to buy from neutral at Mizuho (/news/stocks/--southern-co--upgraded-to-buy-from-neutral-at-mizuho-12373877)
MarketWatch 4d

Southern Co (SO) was upgraded to a Buy Rating at Mizuho Securities (/news/stocks/southern-co-so-was-upgraded-to-a-buy-rating-at-mizuho-securities-1032246024)
TipRanks 4d

Great Southern Bancorp (GSBC) Surpasses Q1 Earnings and Revenue Estimates (/news/stocks/great-southern-bancorp-gsbc-surpasses-q1-earnings-and-revenue-estimates-12372218)
Zacks 5d

Your Market View

NAME	PRICE	+/-	%
◢ **TSLA (/stocks/tsla-stock)**	161.62	-0.93	-
◢ **AAPL (/stocks/aapl-stock)**	165.24	-0.10	-
◢ **MSFT (/stocks/msft-stock)**	281.16	-0.61	-
◢ **NFLX (/stocks/nflx-stock)**	328.81	-0.21	-
◢ **SPOT (/stocks/spot-stock)**	130.85	-0.58	-

[]

CNP (/stocks/cnp-stock)

30.77

0.24 (0.79%)

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KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witnesses: Ann Bulkley and Nick Furia

32. Refer to the Bulkley Direct Testimony, page 7, lines 23-26. Also refer to the Bulkley Direct Testimony, page 13, lines 6-19.

   a. Explain what Kentucky-American means by Kentucky-American's "relative risk."

   b. Explain the impact of market conditions, including increased inflation and high interest rates, on financing capital projects or going to the market for debt.

   c. State how often Kentucky-American goes to the market for debt or issues equity.

Response:

a. Please see the response to KAW_R_PSCDR2_NUM003.

b. In response to record high inflation in 2022, the Federal Reserve has steadily and significantly increased the federal funds rate and reduced its holdings of both Treasuries and mortgage-backed securities. These changes in market conditions resulted in a significant increase in interest rates, which has been reflected in the financing costs for utilities, most transparently noted in the cost of debt. Figure 3 of Ms. Bulkley's Direct Testimony demonstrates the changes in the yield on long-term government bonds increased significantly since the Federal Reserve's decision to accelerate the normalization of monetary policy as of the end of 2022. Further, the yields on the Moody's Baa utility bond indexes have increased from approximately 2.90 percent in January 2021 to 5.43 percent at the end of July 2023, which demonstrates that the cost of borrowing for companies has significantly increased.

c. Timing of debt and equity issuances are driven by, among other things, market conditions, availability and/or constraints on short-term debt limits.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

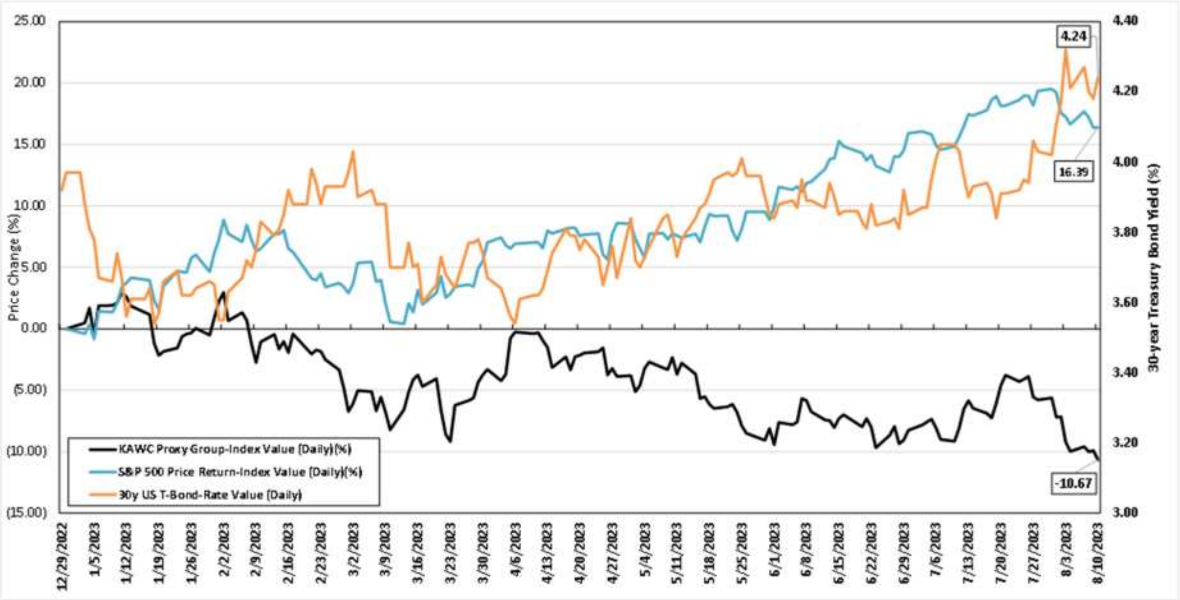
33. Refer to the Bulkley Direct Testimony, page 13, lines 6-8. Explain what recent changes from the Federal Reserve's monetary policy have increased market risk to Kentucky-American specifically.

Response:

In this proceeding, the cost of equity is being estimated for KAWC based on a proxy group of risk comparable companies using cost of equity estimation models such as the DCF and CAPM. The cost of equity estimation models require inputs based on market data for the companies in the proxy group such as share prices, dividends and growth rates in the DCF model and the risk-free rate, beta and the market risk premium in the CAPM. The inputs are directly affected by changes in market conditions which are in turn affected by changes in the Federal Reserve's monetary policy. For example, high levels of inflation and the Federal Reserve's normalization of monetary policy (i.e., increases in the federal funds rate and reduction in the holdings of Treasuries and mortgage-backed securities) have resulted in an increase in the yields on long-term government bonds.

The utility sector is a defensive section sector and thus a "bond proxy". This means that changes in the share prices of utilities are inversely correlated to changes in the yields on long-term government bonds. Therefore, as interest rates rise, the cost of equity for utilities is likely to increase. In the CAPM, this effect is directly observed through the estimate of the risk-free rate while in the DCF this is indirectly observed through a decline in the share price which increases the dividend yield. For example, as shown in Figure 1 below, since January 1, 2023, the share prices of the companies included in Ms. Bulkley's proxy group have significantly underperformed the broader market with the share prices of the proxy group companies declining 10.67 percent while the S&P 500 increased 16.39 percent. Therefore, the recent changes in market conditions which indicate increased market risk must be reflected in the cost of equity that is estimated for KAWC.

Figure 1: Relative Performance of KAWC's Proxy Group and the S&P 500, January 1, 2023 through August 10, 2023



Further, since the cost of equity is being determined for the forward-looking period when KAWC's rate will be in effect it is imperative that the cost of equity estimation models reflect the market conditions that investors expect during the rate period. This is achieved by relying on forward-looking inputs in the DCF and CAPM to the extent possible and additionally determining what effect the expected market conditions could have on the results produced by the cost of equity models.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

34. Refer to the Bulkley Direct Testimony, page 26, lines 5-20. Explain why natural gas utilities are included in the proxy group instead of just water utilities.

Response:

Please see page 28, line 1 through page 31, line 3 of Ms. Bulkley's Direct Testimony for a detailed discussion of why Ms. Bulkley included natural gas utilities in her proxy group including references to regulators that have also considered the inclusion of natural gas utilities in the proxy group to estimate the ROE for a water utility. Please also see the response to PSC 2-36.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

35. Refer to the Bulkley Direct Testimony, page 27, Figure 6. Provide the most recent awarded ROEs for each utility in the proxy group.

Response:

Ms. Bulkley's analysis relies on market data for the proxy group companies to estimate the investor-required return on equity, not the most recent awarded ROE for each of the utility operating companies within the proxy group. Therefore, Ms. Bulkley has not conducted the requested research.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

36. Refer to the Bulkley Direct Testimony, page 28, generally. For both the natural gas companies and the electric companies in the proxy group, explain how the operational risk, business risk, and the current and future environmental requirements specifically compare to the regulated water industry.

Response:

In developing the proxy group, it is essential to balance the relative risk of the companies included in the proxy group with the overall size of the group. Therefore, given the small number of water utilities that can be included in the proxy group, Ms. Bulkley considered the inclusion of electric and natural gas utilities. Ms. Bulkley required that each natural gas and electric utility included in the proxy group derive a majority of their operating income from regulated operations. Further, electric utilities were required to: (1) own water operations and (2) have operation that were primarily transmission and distribution only and thus own limited generation. Thus, Ms. Bulkley's screening criteria resulted in the inclusion of electric and natural gas utilities that were generally comparable to KAWC.

However, it is always the case that the proxy companies do not have exactly the same risk profile as the subject company, KAWC. This is true for not only the electric and natural gas utilities but also for the water utilities included in Ms. Bulkley's proxy group. Therefore, Ms. Bulkley did not compare the risks of the electric and natural gas utilities to the risks of the regulated water industry but instead more appropriately evaluated the relative risks of the proxy group companies and KAWC to determine how the Company's risk profile compares with the group to determine the appropriate placement of the ROE within the range of results established using the proxy group companies. Please see Section VIII (pages 44-57) of Ms. Bulkley's Direct Testimony for a discussion of the specific regulatory, business, and financial risks faced by KAWC as compared with the proxy group. Additionally, the analyses presented by Ms. Bulkley related to the relative business, financial and overall investment risk of KAWC as compared to the proxy group are presented in Exhibit AEB-7 and Exhibit AEB-8.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

37. Refer to the Bulkley Direct Testimony, page 40, lines 12-17.

a. Explain why the Bloomberg beta values are based on ten years of weekly S&P data as opposed to the five years of data used to calculate the Value Line beta values.

b. Provide the number of companies included in the Value Line beta calculations.

c. Explain why Kentucky-American did not use Value Lines' broader market (New York Stock Exchange Composite Index) proxy for the beta calculation that using, and instead used the S&P 500 index as the market proxy.

Response:

a. Bloomberg allows an analyst to calculate beta coefficients relative to the S&P 500 Index over various timeframes. For purposes of the CAPM and ECAPM analyses conducted by Ms. Bulkley, as stated in her direct testimony, "the beta coefficients reported by Bloomberg are calculated using ten years of weekly returns relative to the S&P 500 Index."

b. Ms. Bulkley relied on the beta coefficients calculated by Value Line and provided in the individual Value Line reports for each of the companies in her proxy group. As noted on page 31 of KAW_R_PSCDR2_NUM037_081823_Attachment 1, Value Line calculates the beta coefficient for a company based on "a regression analysis of the relationship between weekly percentage changes in the price of a stock and weekly percentage changes in the NYSE [New York Stock Exchange] Index over a period of five years".

c. Please see the response to part b above.

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CHAPTER

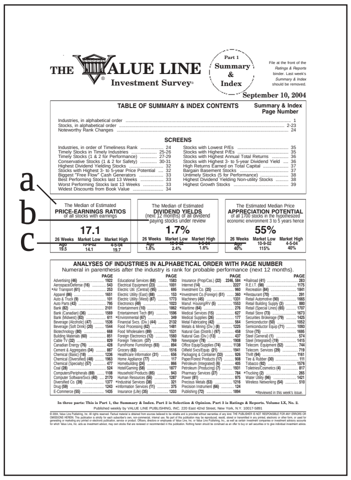
1

GETTING STARTED

How to use *The Value Line Investment Survey*

The Value Line Investment Survey is a unique source of financial information designed to help investors make informed investment decisions that fit their individual goals and levels of risk. It is: (1) a proven forecaster of stock price performance over the next six to 12 months; (2) a source of interpretative analysis of approximately 1,700 individual stocks and more than 90 industries; and (3) a source of historical information that helps investors spot trends.

If you come across any unfamiliar terms as you read through this guide, please refer to the *Glossary* which begins on page 30.



THE VALUE LINE Investment Survey®

Part 1 Summary & Index

File at the front of the *Ratings & Reports* binder. Last week's *Summary & Index* should be removed.

September 10, 2004

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SCREENS

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The Median of Estimated
PRICE-EARNINGS RATIOS
of all stocks with earnings

17.1

26 Weeks Ago	Market Low 10-9-02	Market High 4-5-04
19.5	14.1	19.7

The Median of Estimated
DIVIDEND YIELDS
(next 12 months) of all dividend paying stocks under review

1.7%

26 Weeks Ago	Market Low 10-9-02	Market High 4-5-04
1.6%	2.4%	1.6%

The Estimated Median Price
APPRECIATION POTENTIAL
of all 1700 stocks in the hypothesized economic environment 3 to 5 years hence

55%

26 Weeks Ago	Market Low 10-9-02	Market High 4-5-04
40%	115%	40%

ANALYSES OF INDUSTRIES IN ALPHABETICAL ORDER WITH PAGE NUMBER
Numeral in parenthesis after the industry is rank for probable performance (next 12 months).

	PAGE		PAGE		PAGE		PAGE
Advertising (46)	1922	Educational Services (68)	1583	Insurance (Prop/Cas.) (22)	2246, 584	*Railroad (41)	283
Aerospace/Defense (16)	543	Electrical Equipment (23)	1001	Internet (14)	2227	R.E.I.T. (98)	1175
*Air Transport (61)	253	Electric Util. (Central) (95)	695	Investment Co. (25)	960	Recreation (84)	1841
Apparel (86)	1651	Electric Utility (East) (88)	153	*Investment Co.(Foreign) (51)	360	*Restaurant (70)	291
Auto & Truck (9)	101	Electric Utility (West) (87)	1773	Machinery (45)	1331	Retail Automotive (90)	1665
Auto Parts (43)	795	Electronics (49)	1023	Manuf. Housing/RV (5)	1553	Retail Building Supply (3)	880
Bank (82)	2101	Entertainment (10)	1862	*Maritime (64)	276	Retail (Special Lines) (65)	1707
Bank (Canadian) (36)	1569	Entertainment Tech (91)	1596	Medical Services (15)	627	Retail Store (73)	1673
Bank (Midwest) (83)	611	*Environmental (67)	349	Medical Supplies (26)	177	Securities Brokerage (79)	1425
Beverage (Alcoholic) (47)	1536	Financial Svcs. (Div.) (44)	2132	Metal Fabricating (42)	564	Semiconductor (50)	1052
Beverage (Soft Drink) (20)	1544	Food Processing (62)	1481	Metals & Mining (Div.) (8)	1225	Semiconductor Equip (71)	1093
Biotechnology (80)	668	Food Wholesalers (89)	1531	Natural Gas (Distrib.) (97)	458	Shoe (75)	1695
Building Materials (60)	851	Foreign Electronics (12)	1560	Natural Gas (Div.) (13)	437	Steel (General) (1)	574
Cable TV (32)	829	Foreign Telecom. (37)	769	Newspaper (78)	1908	Steel (Integrated) (19)	1415
Canadian Energy (76)	428	Furn/Home Furnishings (93)	894	Office Equip/Supplies (74)	1138	Telecom. Equipment (52)	744
Cement & Aggregates (34)	887	Grocery (63)	1516	Oilfield Svcs/Equip. (21)	1941	Telecom. Services (29)	719
Chemical (Basic) (18)	1236	Healthcare Information (31)	656	Packaging & Container (33)	926	Thrift (94)	1161
Chemical (Diversified) (48)	1963	Home Appliance (77)	117	Paper/Forest Products (17)	908	Tire & Rubber (30)	111
Chemical (Specialty) (57)	477	Homebuilding (24)	866	Petroleum (Integrated) (6)	405	Tobacco (92)	1576
Coal (28)	524	Hotel/Gaming (58)	1877	Petroleum (Producing) (7)	1931	Toiletries/Cosmetics (4)	817
Computers/Peripherals (69)	1108	Household Products (85)	943	Pharmacy Services (27)	784	*Trucking (2)	265
Computer Software/Svcs (40)	2170	Human Resources (56)	1287	Power (81)	975	Water Utility (96)	1421
Diversified Co. (39)	1377	*Industrial Services (38)	321	Precious Metals (53)	1216	Wireless Networking (54)	510
Drug (59)	1243	*Information Services (11)	375	Precision Instrument (66)	124		
E-Commerce (55)	1435	Insurance (Life) (35)	1203	Publishing (72)	1894		

*Reviewed in this week's issue.

In three parts: This is Part 1, the Summary & Index. Part 2 is Selection & Opinion. Part 3 is Ratings & Reports. Volume LX, No. 2.
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Summary & Index

Part 1 - Summary & Index

Please start with the *Summary & Index*. The front cover contains a Table of Contents, three important market statistics, and a list of all the industries we follow in alphabetical order with the relative industry rank to the right of the industry name and the page number of the industry analysis in *Ratings & Reports* listed under PAGE. The market statistics are found in three boxes. The first box (a) has the median of estimated price/earnings ratios of all stocks with earnings in *The Value Line Investment Survey*. The second box (b) shows the median of estimated dividend yields (total dividends expected to be paid in the next 12 months divided by the recent price) of all dividend-paying stocks in *The Survey*. The third box (c) contains the estimated median price appreciation potential 3 to 5 years into the future for the approximately 1,700 stocks in *The Survey*. By studying these statistics, a fairly good picture emerges of how the universe of Value Line stocks is currently being evaluated. ***The Value Line universe of approximately 1,700 stocks has a market value of more than $14 trillion, and is quite representative of the whole stock market.***

Beginning on page 2, the *Summary & Index* also includes an alphabetical listing of all stocks in the publication with references to their location in Part 3, *Ratings & Reports*. If you are looking for a particular stock, look inside the *Summary & Index* section, which is updated each week to provide the most current data on all companies included in *The Value Line Investment Survey*.

To locate a report on an individual company, look for the page number just to the left of the company name. Then turn to that page in Part 3, *Ratings & Reports*, where the number appears in the upper right corner.

In the far left column of *Summary & Index* is a number that refers to recent Supplementary Reports, if any, which are included on the back pages of *Ratings & Reports*. If two asterisks (**) appear in this column, it means that there is a Supplementary Report in the current Issue.

There are many columns in the *Summary & Index* with more information on each of the approximately 1,700 stocks we cover, including from left to right:

- page numbers for the latest company report and any recent Supplementary Report (Supplementary Reports are published at the back of *Ratings & Reports*)
- the name of each stock and the exchange on which it is traded (the New York Stock Exchange, unless otherwise indicated).
- each company's stock exchange (ticker) symbol
- the recent stock price (see the top of page 2 in *Summary & Index* under *Index to Stocks* for the specific date)
- Value Line's proprietary *Timeliness*™, *Safety*™ and *Technical*™ ranks (See Chapter 3 and the Glossary for definitions)
- Beta (a measure of volatility)
- each stock's 3- to 5-year Target Price Range and the % appreciation potential
- each stock's current P/E ratio
- each stock's % estimated dividend yield
- each stock's estimated earnings (approximately 6 months historical, 6 months estimated)
- each stock's estimated dividends for the next 12 months
- each stock's Value Line *Industry*™ rank (see Chapter 6)
- latest earnings and dividend declarations
- options trade indicator

There is also a wealth of information in the form of stock screens toward the back of the *Summary & Index*. The stock screens are a good place to start for anyone looking for investment ideas or help in forming a strategy. They are also useful for investors who want a list of stocks relevant to specific strategies they may have in mind.

Some examples of our useful screens are:

- Industries in Order of *Timeliness*
- Stocks Moving Up or Down in *Timeliness* Rank
- Timely Stocks in Timely Industries
- Conservative Stocks
- Highest Dividend Yielding Stocks
- Stocks with the Highest Estimated 3- To 5-Year Price Appreciation Potential
- Best/Worst Performing Stocks in the Past 13 Weeks
- Stocks With the Lowest and Highest P/E Ratios
- Stocks with the Highest Estimated Annual Total Returns (Next 3 To 5 Years)
- Stocks with the Highest Projected 3- To 5-year Dividend Yield
- Highest Growth Stocks (Definition Under The Title)

Part 2 - Selection & Opinion

THE VALUE LINE
Investment Survey®

PAGES 2119-2130
File in page order in the *Selection & Opinion* binder.

PART 2 **Selection & Opinion** SEPTEMBER 10, 2004

The Value Line View

In This Issue

The *Selection & Opinion* Index appears on page 2134 (September 3, 2004).

In Three Parts: Part 1 is the Summary & Index. This is Part 2, Selection & Opinion. Part 3 is Ratings & Reports. Volume LX, Number 2.

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ECONOMIC AND STOCK MARKET COMMENTARY

The U.S. economy clearly has lost some of its earlier edge as the fall approaches. This moderation in growth is observable along several fronts. For example, recent surveys show that manufacturing activity is slowing; consumer confidence is off; home sales are easing (although they remain high historically); and job growth—while better in August than in July—is not as strong as during the spring. On the other hand, personal spending is up as are orders for durable goods. This mixed pattern is consistent with the recently revised 2.8% rate of second-quarter gross domestic product growth.

We are probably in a soft spot, rather than on the threshold of an economic reversal. We believe the data are too uneven to suggest that we are approaching a recession or even a marked slowdown in growth. The current soft patch, which evolved in recent months following the spring and summer surge in oil prices, could well run its course once energy costs ease back, as we expect they will over the course of the next few quarters.

On balance, we think growth will average 3%, or slightly more, over the next 12 to 18 months. That is not a vigorous enough pace, in our opinion, to keep corporate earnings rising at their recent 20% plus rate. Nevertheless, it should be sufficient to allow earnings to move forward in a moderate, yet sustainable, fashion. Our economic forecast, it should be kept in mind, incorporates the view that oil prices will fall back somewhat.

We also believe that the Federal Reserve will maintain a moderately tighter monetary policy. Here, as well, GDP growth probably will be healthy enough for the Fed to raise the Federal Funds Rate—the rate that the lead bank controls directly and which is now just 1.5%—back up to perhaps 3.0% by the latter stages of 2005. With the GDP growth that we foresee, the Fed is unlikely to tighten monetary policy more aggressively.

This would seem to be a benign, but rather unexciting, backdrop for investors. At this juncture, however, the stock market is focusing more on the risks than the potential rewards.

Conclusion: Equity valuations, as a result, seem attractive enough for the market to stage a meaningful and perhaps sustainable rally at some point over the next several months. Please refer to the inside back cover of *Selection & Opinion* for our Asset Allocation Model's current reading.

CLOSING STOCK MARKET AVERAGES AS OF PRESS TIME

	8/26/2004	9/2/2004	%Change 1 week	%Change 12 months
Dow Jones Industrial Average	10173.41	10290.28	+1.1%	+8.1%
Standard & Poor's 500	1105.09	1118.31	+1.2%	+9.4%
N.Y. Stock Exchange Composite	6439.79	6535.05	+1.5%	+14.0%
NASDAQ Composite	1852.92	1873.43	+1.1%	+1.7%
NASDAQ 100	1383.98	1398.34	+1.0%	+2.7%
American Stock Exchange Index	1221.73	1243.10	+1.7%	+27.1%
Value Line (Geometric)	349.44	355.19	+1.6%	+7.8%
Value Line (Arithmetic)	1527.07	1553.38	+1.7%	+13.7%
London (FT-SE 100)	4453.9	4518.6	+1.5%	+7.5%
Tokyo (Nikkei)	11129.33	11152.75	+0.2%	+4.3%
Russell 2000	547.25	559.78	+2.3%	+10.3%

Selection & Opinion

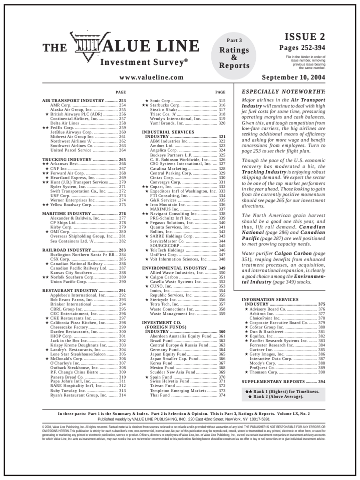
Selection & Opinion (S&O) contains Value Line's latest economic and stock market commentary and advice, along with one or more pages of research on interesting stocks or industries, and a variety of pertinent economic and stock market statistics. It also includes three model stock portfolios

(Stocks with Above-Average Year-Ahead Price Potential, Stocks for Income and Potential Price Appreciation, and Stocks with Long-Term Price Growth Potential). For more information on the portfolios, see page 26 in this Guide. If you spend time with *Selection & Opinion* each week, you should be able to get some valuable investment ideas.

Part 3 - Ratings & Reports

Ratings & Reports is the core of *The Value Line Investment Survey* with one-page reports on approximately 1,700 companies and one- or two-page reports on more than 90 industries. The company reports contain *Timeliness*, *Safety* and *Technical* ranks, our 3- to 5-year forecasts for stock prices, income and balance sheet data, as much as 17 years of historical data, and our analysts' commentaries. They also contain stock price charts; quarterly sales, earnings, and dividend information; and a variety of other very useful material. Each page in this section is updated every 13 weeks. When unexpected important news occurs during these 13 week intervals, a Supplementary Report (appearing in the back section of *Ratings & Reports)* is published. If there is a Supplementary Report, its page number will be shown in the far left hand column of the *Summary & Index*, near the company name.

Two asterisks — ** — indicate that a Supplementary Report is in this week's Edition.



Ratings & Reports

Every week subscribers receive a new Issue of *Ratings & Reports* containing approximately 135 company reports grouped by industry and a smaller number of one- or two-page industry reports. The industry reports precede the reports on the companies in that industry. Over the course of three months, new reports are issued on all of the approximately 1,700 companies and more than 90 industries.

CHAPTER

2

PLANNING AN INVESTMENT STRATEGY

Diversification

Most investors believe in owning a diversified portfolio of stocks, a strategy that Value Line strongly recommends. A diversified portfolio usually fluctuates less in its entirety than does an individual stock because the price variations of individual stocks tend to cancel each other out, with some moving up while others move down. It is also important to diversify not only among stocks, but also across industries.

For most individual investors, a practical rule for diversifying is to hold a total of at least ten stocks in approximately equal dollar amounts in at least ten or more different industries.

Creating a Diversified Portfolio

A good way to start is to turn to the screen called *Timely Stocks In Timely Industries*, usually found on page 25 of the *Summary & Index*.

This screen not only lists the industries that Value Line currently ranks highest (based on our *Timeliness Ranking System*, discussed in Chapter 3), but also the stocks that have the highest *Timeliness* ranks in those timely industries.

Select ten or more industries you think might be attractive from among those with the highest industry ranks. At this point, you may want to read the pages on specific industries to help you make a decision. The industry reports precede the reports on the companies in their industry. Then select one or two of the stocks ranked highest for *Timeliness* within each industry. The pages in *Ratings & Reports* examine these stocks in great detail.

Many of the stock screens in the back pages of the *Summary & Index* can be useful in creating a diversified portfolio. For instance, if you are interested in stocks of companies with growing sales, cash flow, earnings, dividends, and book value, study the Highest Growth Stocks screen. To be included in this list, a company's annual growth of sales, cash flow, earnings, dividends and book value must together have averaged 11% or more over the past 10 years and be expected to average at least 11% in the coming 3-5 years. There are many screens of stocks in the back section of the *Summary & Index* which will help you form a diversified portfolio. As mentioned elsewhere in this guide, *Selection & Opinion* also contains model portfolios which can be used to obtain ideas for any investor's portfolio.

CHAPTER

3

VALUE LINE'S RANKING SYSTEMS

The Value Line Investment Survey has a number of unique features that distinguish it from other advisory services and make it easier for you to have accurate, timely information so that you may keep up to date on all developments affecting your investments.

Probably the most famous are Value Line's time-honored ranking systems for *Timeliness* and *Safety*, which rank approximately 1,700 stocks relative to each other for price performance during the next six to 12 months. The newer Value Line *Technical Ranking System* is designed to predict short-term stock price movements. In each case, stocks are ranked from 1 to 5, with 1 being the highest ranking.

Note: Any one Value Line stock rank is always relative to the ranks of all other stocks in the Value Line universe of approximately 1,700 stocks.

Timeliness

The *Value Line* **Timeliness** rank measures relative probable price performance of all of the approximately 1,700 stocks during the next six to 12 months on an easy-to-understand scale from 1 (Highest) to 5 (Lowest). The components of the *Timeliness Ranking System* are the 10-year trend of relative earnings and prices, recent earnings and price changes, and earnings surprises. All data are actual and known. A computer program combines these elements into a forecast of the price change of each stock, relative to all other approximately 1,700 stocks for the six to 12 months ahead.

Rank 1 (Highest): These stocks, as a group, are expected to be the best performers relative to the Value Line universe during the next six to 12 months (100 stocks).

Rank 2 (Above Average): These stocks, as a group, are expected to have better-than-average relative price performance (300 stocks).

Rank 3 (Average): These stocks, as a group, are expected to have relative price performance in line with the Value Line universe (approximately 900 stocks).

Rank 4 (Below Average): These stocks, as a group, are expected to have below-average relative price performance (300 stocks).

Rank 5 (Lowest): These stocks, as a group, are expected to have the poorest relative price performance (100 stocks).

Changes in the *Timeliness* ranks can be caused by:

1. New earnings reports
2. Changes in the price movement of one stock relative to the approximately 1,700 other stocks in the publication
3. Shifts in the relative positions of other stocks

TIMELINESS **2** Raised 5/28/04
SAFETY **1** New 7/27/90
TECHNICAL 3 Lowered 8/6/04
BETA .65 (1.00 = Market)

Ranks Box
(Also see item 1, on page 21)

Value Line's Timeliness Rank Record

The *Value Line Timeliness Ranking System* has been operating essentially in its present form since 1965. Its exemplary record has attracted the attention of academicians and has been the subject of numerous articles in scientific and financial journals.

Our performance record is discussed here and shown in the graphs on pages 9 and 10. The first shows that through December 2004 our 1-ranked stocks appreciated 49,441% (before commission costs and before dividends) since 1965. That compares with a gain of 1,082% for the Dow Jones Industrial Average. That is, if you consistently owned the one hundred stocks ranked number one out of the total of approximately 1,700, the portfolio, as a whole, would have appreciated more than 49,000%. The second graph shows that if you bought all our 1-ranked stocks at the beginning of January of each year, held them until the end of December, and then set up a new portfolio of 1-ranked stocks at the beginning of each subsequent year, the portfolio would have risen 19,715% since 1965. These are records we believe nobody else has ever matched.

Making Changes Weekly

Value Line has been calculating changes in the *Timeliness Ranking System* on a weekly basis for more than 37 years and has been publishing the results of those changes in *Selection & Opinion*. The record of weekly performance is outstanding and is shown in the chart and table on page 9. There you can see just how stocks ranked 1, 2, 3, 4, and 5 have done, assuming that all rank changes were implemented each week.

What you can clearly see is that there have been spectacular results not only for stocks in Groups 1 and 2, but also, in reverse, for those in Groups 4 and 5. You can see that our evaluations for *Timeliness* are equally effective in showing both good stocks to seek and poor ones to avoid.

Stocks ranked 1 and 2 for *Timeliness* cannot be expected to outperform the market in every single week or month. But over a longer period, the expectation that they will do so as a group is warranted, as our actual results demonstrate.

Making Annual (Once a Year) Changes

Most investors do not buy and sell stocks every week. Frequent "trading" may result in large commission costs. For these reasons, we have also regularly published a record of the results of annual changes in the *Timeliness Ranking System*. In what we call the "Frozen Record," we assume that investors buy stocks on the first business day of each year and hold them until the last day of the same year. Here, too, the top groups have consistently surpassed the growth of the other groups, as can be seen on page 10.

Safety

A second investment criterion is the *Safety* rank assigned by Value Line to each of the approximately 1,700 stocks. The *Value Line Safety* rank measures the total risk of a stock relative to the approximately 1,700 other stocks. It is derived from a stock's Price Stability rank and from the Financial Strength rating of a company, both shown in the lower right hand corner of each page in *Ratings & Reports*. Safety ranks are also given on a scale from 1 (safest) to 5 (riskiest) as follows:

Rank 1 (Highest): These stocks, as a group, are the safest, most stable, and least risky investments relative to the Value Line universe, which accounts for about 95% of the market volume of all stocks in the U.S.

Rank 2 (Above Average): These stocks, as a group, are safer and less risky than most.

Rank 3 (Average): These stocks, as a group, are of average risk and safety.

Rank 4 (Below Average): These stocks, as a group, are riskier and less safe than most.

Rank 5 (Lowest): These stocks, as a group, are the riskiest and least safe.

Stocks with high *Safety* ranks are often associated with large, financially sound companies; these same companies also often have somewhat less than average growth prospects because their primary markets tend to be growing slowly or not at all. Stocks with low *Safety* ranks are often associated with companies which are smaller and/or have weaker than average finances; on the other hand, these smaller companies sometimes have above-average growth prospects because they start with a lower revenue and earnings base.

Value Line's Safety Rank Record

Safety becomes particularly important in periods of stock market downswings, when many investors want to try to limit their losses. As with *Timeliness*, the record of *Safety* over the years is impressive. When you study the data (shown in the table below), you will find that stocks with high *Safety* ranks generally fall less than the market as a whole when stock prices drop. The table shows how *Safety* ranks worked out in all major market declines between 1966 and the present.

The lesson is clear. If you think the market is headed lower, but prefer to maintain a fully invested position in stocks, concentrate on stocks ranked 1 or 2 for *Safety*. Also, at the same time, try to keep your portfolio ranked as high as possible for *Timeliness*. You may not be able to find stocks ranked high on both counts. You then must decide which is more important—price performance over the next six to 12 months, or *Safety*. A compromise of picking stocks ranked 1 or 2 for Timeliness and 1 or 2 for Safety may be necessary.

The Penalty and Reward of Risk

A risky stock is one which has low price stability and whose price fluctuates widely around its own long-term trend. It may also be a stock of a company with a low Financial Strength rating. One may reasonably assume that the price of a risky stock will go up more than that of a safe stock in a generally strong market. Yet, if in the interim it went down more sharply and you had to sell at an inopportune time, you could suffer a heavier penalty for having bought the high-risk stock instead of the safer one.

High Value Line *Timeliness* ranks give some protection against a general market decline, but only over a period of six to 12 months. They cannot be relied upon to help protect against a sharp drop in the stock market in every week or month, as a high *Safety* rank may often do.

Technical

The Value Line *Technical* rank uses a proprietary formula to predict short-term (three to six month) future price returns relative to the Value Line universe. It is the result of an analysis which relates 10 price trends of different duration for a stock during the past year to the relative price changes of the same stock expected over the succeeding three to six months. The *Technical* rank is best used as a secondary investment criterion. We do not recommend that it replace the *Timeliness* rank. As with the other ranks, the *Technical* rank goes from 1 (Highest) to 5 (Lowest.)

RESULTS OF SAFETY RANKS IN MAJOR MARKET DECLINES

Safety Rank	**2/11/66– 10/7/66–**	**12/13/68– 7/2/70–**	**4/14/72– 9/11/74–**	**6/17/81– 8/11/82–**	**8/26/87– 12/4/87–**	**7/13/90– 11/2/90–**	**4/22/98– 10/08/98–**	**5/22/01– 9/21/01**	**4/16/02– 10/9/02**
Group 1	–15.6%	–28.6%	–40.5%	–10.5%	–24.7%	–19.0%	–6.1%	–11.5%	–20.8%
Group 2	–18.2	–29.6	–39.9	–16.2	–28.7	–15.5	–14.0	–14.0	–23.8
Group 3	–24.0	–41.1	–47.2	–25.2	–36.0	–24.9	–29.7	–23.4	–33.1
Group 4	–26.5	–57.0	–53.3	–33.6	–40.7	–33.2	–41.7	–41.7	–55.2
Group 5	–29.2	–64.8	–70.0	–31.4	–46.9	–33.1	–37.8	–34.3	–51.7

The results of the *Technical* ranks since the beginning of 1984, are shown below. From that data, we can calculate that from December 31, 1983, through December 2002, the stocks with a *Technical* ranks of 1 rose 1105%. Those ranked 5 rose just 17%. By way of comparison, the Standard & Poor's 500 Stock Index, a recognized measure of broad stock market performance, was up 433% in the same period.

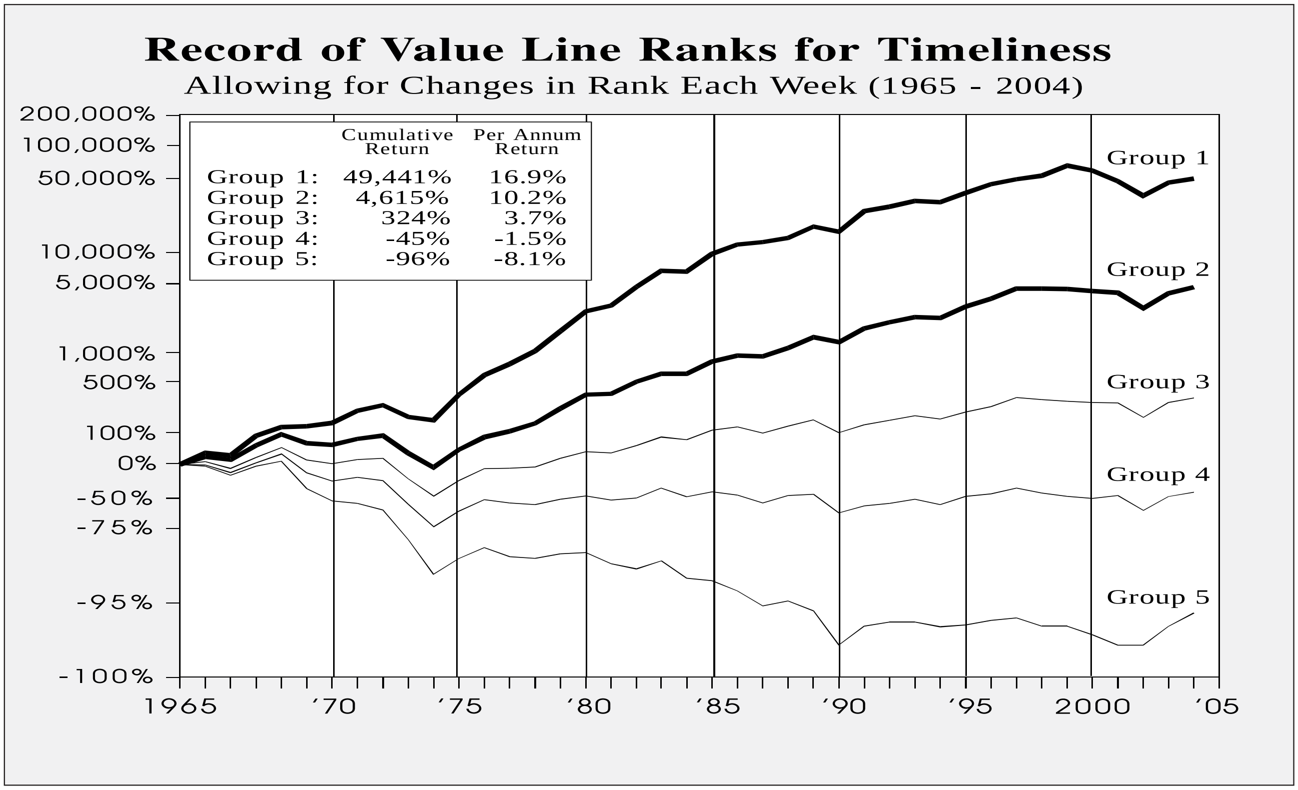
Industry

Value Line also publishes *Industry* ranks which show the *Timeliness* of each industry. These ranks are updated weekly and published on the front and inside pages of the *Summary & Index*. They also appear at the top of each Industry Report. The *Industry* Rank is calculated by averaging the *Timeliness* ranks of each of the stocks which have been assigned a *Timeliness* rank in a particular industry. For more information, see page 22.

RECORD OF TECHNICAL RANKS (*QUARTERLY REBALANCING*)

	1	**2**	**3**	**4**	**5**
1984	-14.9%	-8.8%	-6.0%	-5.5%	0.0%
1985	42.5	32.3	28.1	19.7	4.5
1986	36.6	25.0	18.4	4.5	-11.7
1987	-7.7	-6.2	-6.7	-5.8	-18.2
1988	11.2	13.3	16.0	22.2	10.1
1989	27.6	25.0	19.9	9.0	-15.6
1990	-15.2	-11.2	-14.6	-28.5	-45.6
1991	61.9	32.1	31.7	44.5	43.5
1992	19.7	12.1	11.4	9.9	12.4
1993	41.5	21.7	12.3	14.7	19.2
1994	-1.4	-3.1	-2.3	-3.4	-7.6
1995	31.1	27.2	24.6	16.7	11.0
1996	21.5	22.6	16.6	15.0	19.3
1997	40.4	31.6	24.9	22.5	8.7
1998	26.5	16.9	2.5	-6.9	-8.8
1999	70.0	17.6	1.1	-0.5	8.7
2000	-7.0	10.1	12.9	12.2	-7.3
2001	-5.3	7.6	9.8	22.9	34.6
2002	-42.9	-25.8	-14.2	-8.3	-3.4
2003	57.2	39.2	38.4	55.3	122.9
2004	21.8	15.3	15.6	16.4	19.5
TOTAL	**2207**	**1133**	**712**	**550**	**211**
S&P:	**635**				

BUYING AND SELLING STOCKS EACH WEEK



Record of Value Line Ranks for Timeliness

Allowing for Changes in Rank Each Week (1965 - 2004)

RECORD OF VALUE LINE RANKINGS FOR TIMELINESS (ALLOWING FOR CHANGES IN RANK EACH WEEK)†

April 16, 1965 to December 31, 2004

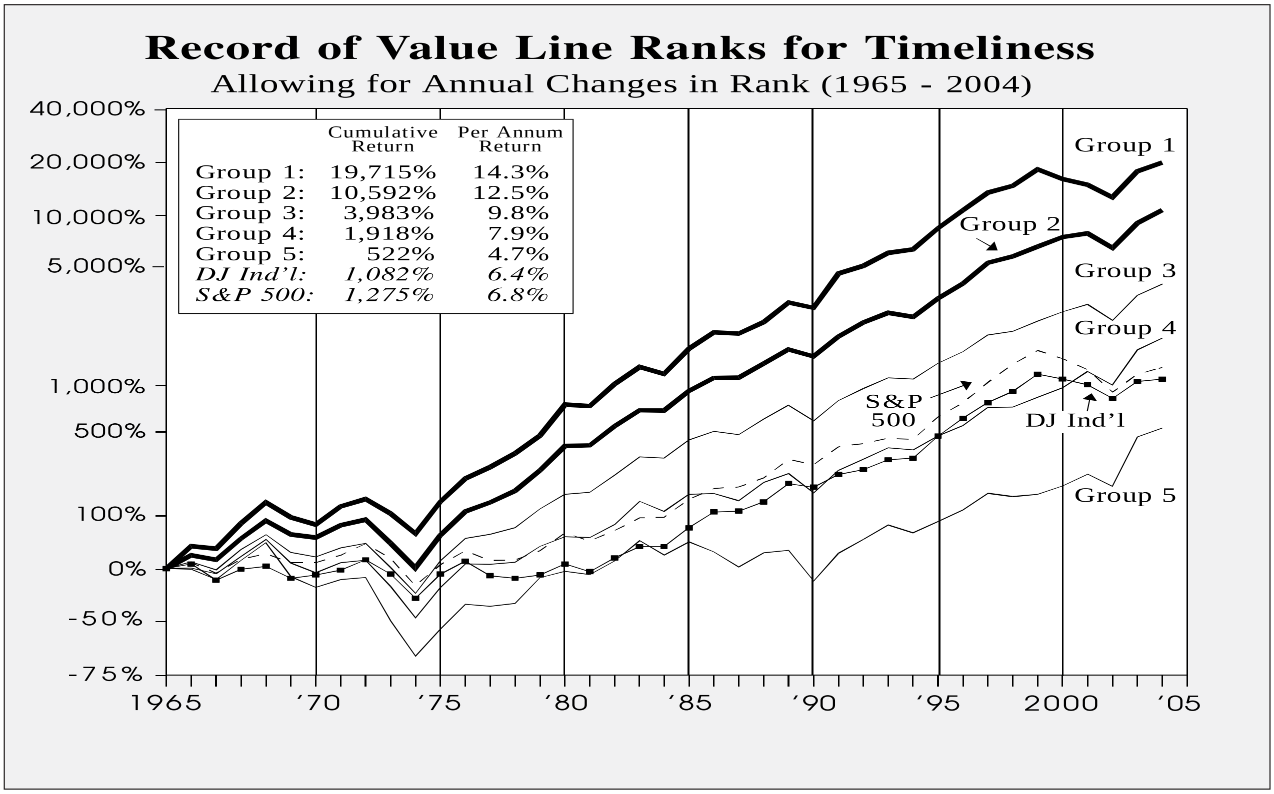
Group	’65*	‘66	‘67	‘68	‘69	‘70	‘71	‘72	‘73	‘74	‘75	‘76	‘77	‘78	‘79	‘80	‘81	‘82	‘83	‘84	‘85
1	28.8%	-5.5%	53.4%	37.1%	-10.4%	7.3%	30.6%	12.6%	-19.1%	-11.1%	75.6%	54.0%	26.6%	32.6%	54.7%	52.6%	13.6%	50.6%	40.9%	-2.1%	47.0%
2	18.5	-6.2	36.1	26.9	-17.5	-3.2	13.7	7.4	-28.9	-29.5	47.4	31.2	13.4	18.3	38.0	35.7	1.8	31.0	19.1	-0.8	30.7
3	6.7	-13.9	27.1	24.0	-23.8	-8.0	9.3	3.5	-33.6	-34.1	40.7	29.0	1.3	3.0	20.7	15.4	-3.3	17.9	20.2	-5.6	22.8
4	-0.4	-15.7	23.8	20.9	-33.3	-16.3	8.4	-7.1	-37.9	-40.6	39.3	28.8	-6.9	-3.8	12.8	7.4	-8.7	5.1	25.0	-17.4	11.4
5	-3.2	-18.2	21.5	11.8	-44.9	-23.3	-5.5	-13.4	-43.8	-55.7	40.9	26.7	-17.6	-3.2	10.4	2.9	-21.4	-10.9	19.0	-31.0	-5.6

Group	‘86	‘87	‘88	‘89	‘90	‘91	‘92	‘93	‘94	‘95	‘96	‘97	‘98	‘99	‘00	‘01	‘02	‘03	‘04	’65* to 2004
1	22.9%	5.4%	9.5%	27.9%	-10.4%	55.4%	10.0%	13.4%	-2.6%	22.8%	20.4%	11.3%	8.2%	24.1%	-10.4%	-20.3%	-27.2%	33.8%	8.4%	49,441%
2	14.4	-2.4	20.4	26.5	-10.2	34.1	14.3	12.4	-2.2	28.1	19.0	24.0	0.1	-0.5	-4.4	-3.8	-28.8	38.2	14.5	4,615
3	7.7	-12.6	16.1	13.7	-24.4	18.9	11.0	9.8	-6.9	16.6	12.3	21.5	-3.9	-3.3	-3.2	-0.8	-27.1	38.2	10.5	324
4	-6.8	-15.8	17.6	2.6	-33.7	16.7	6.2	8.5	-9.9	17.1	7.1	14.5	-11.0	-7.5	-3.7	5.9	-26.7	34.2	9.4	-45
5	-19.6	-28.0	11.4	-19.2	-45.5	25.5	15.4	0.3	-15.2	5.2	7.5	16.6	-11.5	-1.3	-19.7	-7.2	-15.7	52.2	15.2	-96

* *April through December*

† *Geometric Averaging*

BUYING STOCKS AT THE BEGINNING OF EACH YEAR



RECORD OF VALUE LINE RANKINGS FOR TIMELINESS (WITHOUT ALLOWING FOR CHANGES IN RANK EACH WEEK)†

April 16, 1965 to December 31, 2004

Group	'65*	'66	'67	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85
1	33.6%	-3.1%	39.2%	31.2%	-17.7%	-8.9%	26.5%	10.1%	-17.1%	-23.1%	51.6%	35.3%	15.8%	19.8%	25.6%	50.2%	-1.9%	33.7%	25.2%	-8.6%	38.6%
2	18.9	-6.0	31.9	26.3	-16.3	-4.0	17.4	7.5	-26.2	-27.8	53.0	36.3	12.7	16.1	30.8	37.4	0.7	29.0	22.2	-0.1	29.5
3	8.9	-9.7	30.1	21.4	-20.7	-5.5	12.2	6.2	-27.0	-28.5	52.9	33.8	5.2	9.2	27.6	20.8	2.7	25.5	26.7	-1.6	26.6
4	0.8	-7.2	25.1	25.1	-26.8	-11.7	14.2	3.2	-29.1	-33.6	48.4	36.1	-0.2	2.4	23.1	13.2	-0.9	18.1	35.2	-12.3	24.6
5	-1.2	-12.4	28.4	25.9	-35.7	-13.1	10.5	2.9	-43.1	-36.8	42.1	38.2	-2.8	4.0	39.9	8.4	-4.2	19.9	30.0	-17.1	18.7
Avg.	10.1	-7.9	29.9	24.6	-22.1	-7.5	14.9	5.5	-27.7	-29.6	51.2	35.1	5.8	9.6	28.0	23.4	0.9	25.0	27.5	-4.7	27.0

Group	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'65* to 2004
1	23.5%	-1.2%	16.0%	28.7%	-6.6%	56.7%	10.1%	18.5%	4.6%	31.3%	27.0%	25.8%	9.3%	23.7%	-11.7%	-7.4%	-15.0%	40.1%	12.2%	19,715%
2	18.7	0.4	19.7	20.3	-8.7	29.8	19.9	13.6	-5.3	27.1	21.4	31.3	8.5	13.9	13.2	4.8	-17.3	37.9	18.8	10,592
3	11.5	-4.1	23.2	19.6	-18.6	30.0	17.5	15.3	-1.6	22.8	16.1	24.1	4.8	14.5	13.0	10.2	-18.8	38.6	15.8	3,983
4	1.5	-9.1	27.2	12.4	-22.8	34.1	15.6	16.5	-2.9	20.2	14.3	26.6	0.6	13.5	14.0	23.3	-16.2	58.2	16.5	1,918
5	-12.1	-17.9	20.0	3.3	-33.0	43.8	19.9	20.3	-9.3	15.7	15.8	24.4	-4.0	2.8	11.6	16.4	-14.5	90.1	12.3	522
Avg.	10.2	-4.9	22.6	17.8	-17.6	33.4	17.3	15.7	-2.6	23.2	17.4	26.1	4.4	14.0	11.4	11.0	-17.5	45.4	16.0	4,264

Dow Jones Industrials	1,082%
S&P 500	1,275%

* *April through December*

† *Arithmetic Averaging*

CHAPTER

4

UNDERSTANDING THE VALUE LINE PAGE

To start studying a stock, we suggest that you concentrate on four features found on every *Ratings & Reports* page (*see sample on page 21 of this guide*). First, we recommend that you look at the *Timeliness*, *Safety*, and *Technical* ranks (*see item 1*) shown in the upper left corner of each page. Then, read the Analyst's Commentary (*item 17*) in the bottom half of each report. Next, we suggest you look at our forecasts for various financial data including the stock price (*items 11, 15, 22, 23, and 29*). These forecasts are explained in more detail later in this Chapter. Finally, we think you should study the historical financial data appearing in the Statistical Array in the center of the report (*item 26*). Illustrations and more detail follow. There is also a lot of other useful information on each page, but the four features mentioned above provide the best place to begin.

TIMELINESS	**2**	Raised 5/28/04
SAFETY	**1**	New 7/27/90
TECHNICAL	3	Lowered 8/6/04
BETA	.65	(1.00 = Market)

Ranks Box
(Also see item 1, on page 21)

Value Line Ranks

(See 1 *in the example on page 21)*

A synopsis of the *Value Line Ranking System* follows. For a more detailed description, please refer to Chapter 3.

Timeliness

The *Timeliness* rank is Value Line's measure of the expected price performance of a stock for the coming six to 12 months relative to our approximately 1,700 stock universe. Stocks ranked 1 (Highest) and 2 (Above Average) are likely to perform best relative to the others. Stocks ranked 3 are likely to be average performers relative to the Value Line universe. Stocks ranked 4 (Below Average) and 5 (Lowest) are likely to underperform stocks ranked 1 through 3 in Value Line's stock universe.

Just one word of caution. Stocks ranked 1 are often volatile and tend to have smaller market capitalizations (the total value of a company's outstanding shares, calculated by multiplying the number of shares outstanding by the stock's market price per share). Conservative investors may want to select stocks that also have high *Safety* ranks because they are usually more stable issues.

Safety

The *Safety* rank is a measure of the total risk of a stock compared to others in our approximately 1,700 stock universe. As with *Timeliness*, Value Line ranks each stock from 1 (Highest) to 5 (Lowest). However, unlike *Timeliness*, the number of stocks in each category from 1 to 5 is not fixed. The *Safety* rank is derived from two measurements (weighted equally) found in the lower right hand corner of each page:

a company's Financial Strength and a Stock's Price Stability. Financial Strength is a measure of the company's financial condition, and is reported on a scale of A++ (Highest) to C (Lowest). The largest companies with the strongest balance sheets get the highest scores. A Stock's Price Stability score is based on a ranking of the standard deviation (a measure of volatility) of weekly percent changes in the price of a stock over the last five years, and is reported on a scale of 100 (Highest) to 5 (Lowest) in increments of 5.

Technical

The *Technical* rank is primarily a predictor of short term (three to six months) relative price change. It is based on a proprietary model which examines 10 short-term price trends for a particular stock over different periods in the past year. The *Technical* ranks also range from 1 (Highest) to 5 (Lowest). At any one time, approximately 100 stocks are ranked 1; 300 ranked 2; 900 ranked 3; 300 ranked 4; and 100 ranked 5.

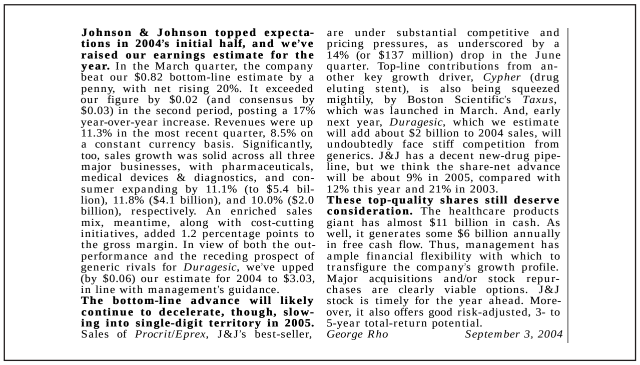
Beta

This is a measure of volatility, as calculated by Value Line. While it is not a rank, we do consider it important. See the *Glossary* for more detail.

Analyst's Commentary

(17 in the example on page 21)

Next, look at the analyst's written commentary in the lower half of the page. Many readers think this is the most important section of the page. In the commentary, the analyst discusses his/her expectations for the future. There are times when the raw numbers don't tell the full story.



Johnson & Johnson topped expectations in 2004's initial half, and we've raised our earnings estimate for the year. In the March quarter, the company beat our $0.82 bottom-line estimate by a penny, with net rising 20%. It exceeded our figure by $0.02 (and consensus by $0.03) in the second period, posting a 17% year-over-year increase. Revenues were up 11.3% in the most recent quarter, 8.5% on a constant currency basis. Significantly, too, sales growth was solid across all three major businesses, with pharmaceuticals, medical devices & diagnostics, and consumer expanding by 11.1% (to $5.4 billion), 11.8% ($4.1 billion), and 10.0% ($2.0 billion), respectively. An enriched sales mix, meantime, along with cost-cutting initiatives, added 1.2 percentage points to the gross margin. In view of both the outperformance and the receding prospect of generic rivals for *Duragesic*, we've upped (by $0.06) our estimate for 2004 to $3.03, in line with management's guidance.

The bottom-line advance will likely continue to decelerate, though, slowing into single-digit territory in 2005. Sales of *Procrit/Eprex*, J&J's best-seller, are under substantial competitive and pricing pressures, as underscored by a 14% (or $137 million) drop in the June quarter. Top-line contributions from another key growth driver, *Cypher* (drug eluting stent), is also being squeezed mightily, by Boston Scientific's *Taxus*, which was launched in March. And, early next year, *Duragesic*, which we estimate will add about $2 billion to 2004 sales, will undoubtedly face stiff competition from generics. J&J has a decent new-drug pipeline, but we think the share-net advance will be about 9% in 2005, compared with 12% this year and 21% in 2003.

These top-quality shares still deserve consideration. The healthcare products giant has almost $11 billion in cash. As well, it generates some $6 billion annually in free cash flow. Thus, management has ample financial flexibility with which to transfigure the company's growth profile. Major acquisitions and/or stock repurchases are clearly viable options. J&J stock is timely for the year ahead. Moreover, it also offers good risk-adjusted, 3- to 5-year total-return potential.

George Rho *September 3, 2004*

Analyst's Commentary

(Also see item 17, on page 21)

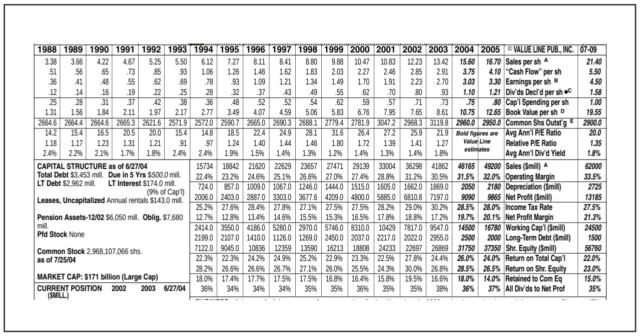
The analyst uses the commentary to explain why the forecast is what it is. The commentary is also particularly useful when a change in trend is occurring or about to occur. As an example, a stock may have a poor *Timeliness* rank but the analyst thinks earnings could turn around in the future. In this case, the analyst may use the commentary to explain why he/she thinks conditions are likely to get better, thus giving the subscriber insight into what is happening, and why.

Financial and Stock Price Projections

Value Line's security analysts make a variety of financial and stock price projections in most reports we publish. They make ***Estimates*** for 23 different numbers and ratios going out 3 to 5 years into the future in the Statistical Array (*item 15*). They also forecast a ***Target Price Range*** (*item 11*) for each stock, going out 3 to 5 years. And finally they show the ***2007-09 Projections*** (*item 29*) for the price of the stock, along with the expected percentage appreciation (depreciation) and the expected annual total return (including dividends). These projections are discussed below.

Financial Estimates

(15 in the example on page 21)



1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	© VALUE LINE PUB., INC.	07-09
3.38	3.66	4.22	4.67	5.25	5.50	6.12	7.27	8.11	8.41	8.80	9.88	10.47	10.83	12.23	13.42	***15.60***	***16.70***	Sales per sh [A]	***21.40***
.51	.56	.65	.73	.85	.93	1.06	1.26	1.46	1.62	1.83	2.03	2.27	2.46	2.85	2.91	***3.75***	***4.10***	"Cash Flow" per sh	***5.50***
.36	.41	.48	.55	.62	.69	.78	.93	1.09	1.21	1.34	1.49	1.70	1.91	2.23	2.70	***3.03***	***3.30***	Earnings per sh [B]	***4.50***
.12	.14	.16	.19	.22	.25	.28	.32	.37	.43	.49	.55	.62	.70	.80	.93	***1.10***	***1.21***	Div'ds Decl'd per sh ■[C]	***1.58***
.25	.28	.31	.37	.42	.38	.36	.48	.52	.52	.54	.62	.59	.57	.71	.73	***.75***	***.80***	Cap'l Spending per sh	***1.00***
1.31	1.56	1.84	2.11	1.97	2.17	2.77	3.49	4.07	4.59	5.06	5.83	6.76	7.95	7.65	8.61	***10.75***	***12.65***	Book Value per sh [D]	***19.55***
2664.6	2664.4	2664.6	2665.3	2621.6	2571.9	2572.0	2590.7	2665.0	2690.3	2688.1	2779.4	2781.9	3047.2	2968.3	3119.8	***2960.0***	***2950.0***	Common Shs Outst'g [E]	***2900.0***
14.2	15.4	16.5	20.5	20.0	15.4	14.8	18.5	22.4	24.9	28.1	31.6	26.4	27.2	25.9	21.9	***Bold figures are Value Line estimates***		Avg Ann'l P/E Ratio	***20.0***
1.18	1.17	1.23	1.31	1.21	.91	.97	1.24	1.40	1.44	1.46	1.80	1.72	1.39	1.41	1.27			Relative P/E Ratio	***1.35***
2.4%	2.2%	2.1%	1.7%	1.8%	2.4%	2.4%	1.9%	1.5%	1.4%	1.3%	1.2%	1.4%	1.3%	1.4%	1.8%			Avg Ann'l Div'd Yield	***1.8%***
						15734	18842	21620	22629	23657	27471	29139	33004	36298	41862	***46165***	***49200***	Sales ($mill) [A]	***62000***
						22.4%	23.2%	24.6%	25.1%	26.6%	27.0%	27.4%	28.8%	31.2%	30.5%	***31.5%***	***32.0%***	Operating Margin	***33.5%***
						724.0	857.0	1009.0	1067.0	1246.0	1444.0	1515.0	1605.0	1662.0	1869.0	***2050***	***2180***	Depreciation ($mill)	***2725***
						2006.0	2403.0	2887.0	3303.0	3677.6	4209.0	4800.0	5885.0	6810.8	7197.0	***9090***	***9865***	Net Profit ($mill)	***13185***
						25.2%	27.6%	28.4%	27.8%	27.1%	27.5%	27.5%	28.2%	29.0%	30.2%	***28.5%***	***28.0%***	Income Tax Rate	***27.5%***
						12.7%	12.8%	13.4%	14.6%	15.5%	15.3%	16.5%	17.8%	18.8%	17.2%	***19.7%***	***20.1%***	Net Profit Margin	***21.3%***
						2414.0	3550.0	4186.0	5280.0	2970.0	5746.0	8310.0	10429	7817.0	9547.0	***14500***	***16780***	Working Cap'l ($mill)	***24500***
						2199.0	2107.0	1410.0	1126.0	1269.0	2450.0	2037.0	2217.0	2022.0	2955.0	***2500***	***2000***	Long-Term Debt ($mill)	***1500***
						7122.0	9045.0	10836	12359	13590	16213	18808	24233	22697	26869	***31750***	***37350***	Shr. Equity ($mill)	***56760***
						22.3%	22.3%	24.2%	24.9%	25.2%	22.9%	23.3%	22.5%	27.8%	24.4%	***26.0%***	***24.0%***	Return on Total Cap'l	***22.0%***
						28.2%	26.6%	26.6%	26.7%	27.1%	26.0%	25.5%	24.3%	30.0%	26.8%	***28.5%***	***26.5%***	Return on Shr. Equity	***23.0%***
						18.0%	17.4%	17.7%	17.5%	17.5%	16.8%	16.4%	15.8%	19.5%	16.6%	***18.0%***	***14.0%***	Retained to Com Eq	***15.0%***
						36%	34%	34%	34%	35%	35%	36%	35%	35%	38%	***36%***	***37%***	All Div'ds to Net Prof	***35%***

CAPITAL STRUCTURE as of 6/27/04
Total Debt $3,453 mill. **Due in 5 Yrs** $*500.0* mill.
LT Debt $2,962 mill. **LT Interest** $174.0 mill.
(9% of Cap'l)
Leases, Uncapitalized Annual rentals $143.0 mill.

Pension Assets-12/02 $6,050 mill. **Oblig.** $7,680 mill.
Pfd Stock None

Common Stock 2,968,107,066 shs.
as of 7/25/04

MARKET CAP: $171 billion (Large Cap)

CURRENT POSITION **2002** **2003** **6/27/04**
($MILL.)

Statistical Array

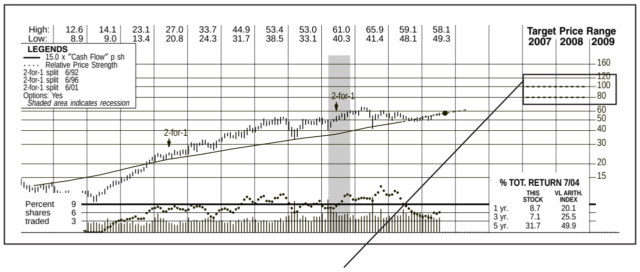
(Also see items 15 and 26, on page 21)

In the Statistical Array in the center of the report (where most of the numbers are), Value Line provides both historical data and financial projections. All projections are printed in ***bold italics.***

The estimates of sales, earnings, net profit margins, income tax rates, and so forth are all derived from spread sheets maintained on every company. Our analysts try to review their projections with a company's management whenever they think they should, but at least once a quarter. Afterward, they make whatever adjustments they believe are warranted by unusual developments that may not be revealed in the numbers, i.e., the outcome of pending lawsuits affecting the company's finances, the success of new products, etc.

Target Price Range

In the upper right-hand section of each report is a *Target Price Range*. The *Target Price Range* represents the band in which the expected average price is likely to fall.



Target Price Range (3 to 5 years)
(Also see item 11, on page 21)

This is the projected annual stock price range for the period out 3 to 5 years. The prices are based on the analyst's projections in the period out 3-5 years for earnings multiplied by the average annual price/earnings ratio in the Statistical Array for the same period. The width of the high-low range depends on the stock's *Safety* rank. (A stock with a high *Safety* rank has a narrower range, one with a low rank, a wider band.)

3- to 5- Year Projections
(Item 29, on page 21)

In the left hand column of each report, there is also a box which contains 2007-2009 *Projections* for a stock price. There you can see the potential average high and low prices we forecast, the % price changes we project, and the expected compound annual total returns (price appreciation plus dividends). To make these calculations, analysts compare the expected prices out 3 to 5 years into the future (as shown in the *Target Price Range* and *Projections* box) with the recent price (shown on the top of the report).

2007-09 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	100	(+75%)	*16%*
Low	80	(+40%)	*10%*

2006-08 Projections
(Also see item 29, on page 21)

Investors whose primary goal is long-term price appreciation should study the 3- to 5-year *Projections* carefully and choose stocks with above-average price appreciation potential. For comparative purposes, you can find the weekly Estimated Median Price Appreciation Potential for all approximately 1,700 stocks on the front page of the *Summary & Index.*

The *Target Price Range* and 3-to 5-year *Projections* are necessarily based upon an estimate of future earnings. They are, therefore, very subjective. These should not be confused with the *Timeliness* rank for 12-month performance, which is independent of estimates and based solely on historical data.

Annual Rates Of Change
(Item 23, *on page 21)*

At this point, it may be helpful to look at the *Annual Rates* box in the left-hand column. This box shows the compound annual per share growth percentages for sales, "cash flow," earnings, dividends and book value for the past 5 and 10 years and also Value Line's projections of growth for each item for the coming 3 to 5 years. All rates

ANNUAL RATES of change (per sh)	**Past 10 Yrs.**	**Past 5 Yrs.**	**Est'd '01-'03 to '07-'09**
Sales	9.0%	7.5%	*10.0%*
"Cash Flow"	12.5%	11.0%	*12.5%*
Earnings	13.5%	12.5%	*12.0%*
Dividends	13.5%	13.5%	*12.0%*
Book Value	14.5%	12.0%	*16.0%*

Annual Rates Box
(Also see item 23, on page 21)

of change are computed from the average number for a past 3-year period to an average number for a future period. For details, see below.

Trends are important here. Check whether growth has been increasing or slowing and see if Value Line's analyst thinks it will pick up or fall off in the future. Specific estimates for various data items for 3 to 5 years out can be found in ***bold italics*** print in the far right hand column of the Statistical Array (item 15).

Historical Financial Data
(26 in the example on page 21)

Many investors like to use the Statistical Array to do their own analysis. They, in particular, use the historical data in the center of each report to see how a company has been doing over a long time frame. It is worth pointing out that while all of the data are important, different readers find different data items to be most useful.

The numbers are probably most helpful in identifying trends. For example, look at sales per share to see if they have been rising for an extended period of time. Look at operating margins and net profit margins to see if they have been expanding, narrowing or staying flat. And examine some of the percentages near the bottom, such as the Return on Shareholders' Equity, to see if they have been rising, falling, or remaining about the same.

Calculating Annual Rates of Change

(Growth Rates)

In an attempt to eliminate short-term fluctuations that may distort results, Value Line uses a three-year base period and a three-year ending period when calculating growth rates.

Example: To calculate the compound annual sales growth from 2001-2003 (the latest years for which reported actual financial results were available when our Johnson & Johnson report on page 21 went to press) to 2007-2009, we take sales per share for each of the years 2001, 2002, and 2003 and average them. Then we take the sales per share for the years 2007-2009, as shown in the far right column of the large statistical section of our report.

In the case of Johnson & Johnson, the three-year base period average is $12.16. The three-year ending period average is $21.40. The compound annual growth rate over the seven years from 2002 (the middle year) to 2008 (again, the middle year) is 10.0%, rounded.

Investors often try to calculate a growth rate from one starting year to one ending year, and then can't understand why the number they get is not the same as the one published by Value Line. If they used a three-year base period and three-year ending period, they would get the same results we do.

CHAPTER

5

EXAMINING A VALUE LINE PAGE IN MORE DETAIL

In the following section, we are going to examine an actual Value Line page, with the objectives of interpreting the array of statistical data presented and weighing the data and the accompanying comment against your needs. We have chosen for examination a report on Johnson & Johnson, a large and well known manufacturer of health care products.

Putting Data in Perspective

Looking at the top of the page, we can see that Johnson & Johnson's stock price in September 2004 was $57.66 a share (item 5 on page 21). By itself, the stock price means very little. In the line below the price, annual high and low prices for each year from 1993 through late 2004 are indicated. Below the high and low annual prices is a price chart (graph) that shows monthly price ranges for essentially the same period, along with other useful information that we will discuss below. We note here, though, that while Johnson & Johnson stock has traded in a relatively narrow range for nearly four years, it has still climbed more than sixfold from its low of 8.9 in 1993 (adjusted for stock splits in 1996 and 2001).

Is the fact that the stock has moved up so much cause for concern? Has it become overvalued? Not necessarily—as we will see. Sales per share, cash flow per share, earnings per share, and book value per share are all at historical highs, as can be seen in the Statistical Array (items 15 and 26 on page 21).

Price Earnings Ratio—This is probably the most widely used measure of stock valuation. Value Line shows a variety of P/E ratios on every company page, as discussed below:

The *P/E ratio* on the very top of the Value Line page (item 6 on page 21). This is calculated by dividing the recent price of the stock by the total of the last six months of earnings and the next six months of estimated earnings.

The *Relative P/E ratio* (item 8). This compares the P/E of one stock with the median of estimated P/E ratios of all stocks under Value Line review. A relative P/E of more than 1 indicates that a stock's P/E ratio is currently higher than that of the Value Line universe; a P/E of less than 1 indicates that this stock's P/E is less than the Value Line average.

The *Trailing P/E ratio* (item 7). This is calculated by dividing the recent price of the stock by the past 12 months of actual (reported) earnings. This is the figure shown in most newspapers.

The *Median P/E ratio* (item 7). This is the average annual P/E ratio of a stock over the past 10 years, with certain statistical adjustments made for unusually low or high ratios.

The *Average Annual P/E ratio* (items 15 and 26). This figure is calculated by dividing the average price for each year by the actual reported earnings for the same year and is shown in the Statistical Array.

The *Relative (Annual) P/E ratio* (items 15 and 26). This figure is calculated by dividing the *Average Annual P/E* of a stock with the *Average Annual P/E* of all stocks under Value Line review in the same year.

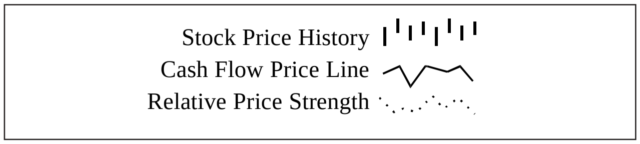
To gauge the significance of the recent price of a stock, the reader must look at the price in relation to a variety of data. As far as P/Es are concerned, the current P/E ratio and relative P/E ratio for Johnson & Johnson's stock, while above those of most stocks in the Value Line universe, are still quite close to the Value Line median P/E. These slightly above-average valuations underscore investors' long standing favor for this equity.

High P/E ratios may mean that the stock is overpriced, unless there are factors indicating that there will be a significant improvement in the company's fundamentals. Is this the case with Johnson & Johnson? Perhaps, since management has been very vigilant in its efforts to maximize returns from its businesses, and the Value Line analyst is expecting continued strong profit growth over the next three to five years. High growth rates often result in above-average price/earnings ratios. Johnson & Johnson's relative P/E ratio of 1.09 (item 8), a slightly richer valuation than found in the average stock followed by Value Line, also likely reflects the company's track record and growth expectations.

The *Dividend Yield* (item 10 in the right top corner of the page) shows the expected return from cash dividends on the stock over the next 12 months, as a percentage of the recent price. Johnson & Johnson's yield of 2.0% is above the median of all dividend paying stocks in the Value Line Universe. (The median is shown each week on the cover of the *Summary & Index* section.) We also see that the company has increased the dividend in every year since 1988, as shown in line four of the Statistical Array in the center of our report, and Value Line's analyst thinks additional increases are forthcoming. Many investors view regular increases in a dividend very positively.

The Price Chart

Next, look at Johnson & Johnson's price chart (or graph) at the top of the report. The first thing to look at is the price history, shown by the small vertical bars in the center of the graph. Those bars show the high and low monthly prices for the stock (adjusted for any subsequent stock splits or dividends). Looking at the bars, you can see that the stock price was in a strong uptrend from 1994 through 1999. Since then, it has traded in a broad range, generally between 40 and 60.



Now look at the "cash flow" line, the solid line running from 1992 through the middle of 2003, which is more fully described below. The dashed line from mid-2003 to mid-2005, which is an extension of the "cash flow" line, is Value Line's projection of the line for those years. For most of the past nine years, Johnson & Johnson's stock has traded above the "cash flow" line. More recently, the stock has moved back down to the line.

Finally, look at the *Relative Strength Price* line, the faint small dotted line, usually toward the bottom of the chart. This shows the relative performance of Johnson & Johnson stock versus the entire universe of Value Line stocks; when the *Relative Strength Price* line is rising, it means a stock is acting better than the universe. When it is falling, a stock is doing worse than the Value Line universe.

At the very bottom of the chart, we show volume of trading each month (item 14) as a percent of total shares outstanding. The *Legends* box (item 2) in the upper left of the price chart contains, among other things, information on the "cash flow" multiple, a record of stock splits, and whether or not there are options traded.

The *Target Price Range* (item 11) in the upper right corner of the price chart indicates where Value Line's analyst believes the stock is most likely to be selling in the 2007-09 period. This box should be viewed in conjunction with the *Projections* box (item 29) near the top left-hand corner of the page, which also gives our 3- to 5-year projections. For Johnson & Johnson, we expect the average price to hover between 80 and 100, which would be moderately above the current level.

Just above the 2007-09 PROJECTIONS box is a section containing the Value Line *Timeliness*, *Safety*, and *Technical* ranks, plus a Beta calculation. Johnson & Johnson's Beta of .65 reveals that this stock is likely to move up and down much more slowly than the typical stock on the New York Stock Exchange. If you think that the stock market will go up, you want to invest in stocks with high Betas. If you think the market will go down or are looking for stability, a stock like Johnson & Johnson, with a low Beta is the place to be.

The "Cash Flow" Line

The price chart at the top of the Johnson & Johnson page contains, among other things, a monthly price history for the stock (the vertical bars) overlaid by a solid line that we call the "cash flow" line (sometimes also called the "Value Line"). To plot the line, we multiply cash flow per share (net income plus depreciation and amortization divided by the number of shares outstanding at the end of the year) by a number (multiple) determined by our analyst. The goal is to create a "line" that most closely matches a company's stock price history and also "fits" the projected 3- to 5-year *Target Price Range*. In the case of Johnson & Johnson, the "cash flow" multiple is now 15. (The multiple can, and often does, change over time.)

The concept of a "cash flow" multiple is not too different from that for a Price/Earnings multiple (or ratio). The difference here is that instead of dividing the recent price of a stock by 12 months of earnings to create a P/E multiple, we divide the recent price by the total of 12 months of earnings plus 12 months of depreciation (and amortization, if there is any).

There is evidence that some stocks will generally trade at a price close to the "cash flow" line. In those cases when a stock is trading above the "cash flow" line, it will often move back down toward the "cash flow" line. When it is trading below, it will often do the opposite. In some cases, a stock may trade above or below the "cash flow" line for considerable periods of time.

Historical Results and Estimates

For each of the approximately 1,700 companies Value Line follows, we usually present per-share data going back 17 years in the Statistical Array in the center of each report. The historical data (item 26) appear on the left side and are presented in regular type. We also project statistical data (item 15) for the next fiscal year, as well as three to five years into the future. ***These projections are presented in bold italics.***

Now look at a list of items in the Statistical Array (items 15 and 26).

Sales per share, in the top line, is an important series. When earnings per share are depressed because of poor net profit margins, a high level of sales per share can suggest the potential for an earnings recovery. It would be disconcerting, however, if sales per share declined in tandem with earnings per share.

''Cash flow'' per share (second line), as commonly used by analysts, is the sum of reported earnings plus depreciation, less any preferred dividends, calculated on a per-share basis. It is an indicator of a company's internal cash-generating ability—the amount of cash it earns to expand or replace plant and equipment, to provide working capital, to pay dividends, or to repurchase stock. Johnson & Johnson's ''cash flow'' per share has expanded significantly since 1988.

Earnings per share (third line) are shown by Value Line as they were reported to stockholders, excluding nonrecurring items and adjusted for any subsequent stock splits or stock dividends. According to current accounting guidelines, companies now report earnings two ways. The first is basic earnings per share, which is the earnings available to common shareholders divided by the weighted average number of shares outstanding for the period. The second is diluted earnings per share, which reflects the potential dilution that could occur if securities or other contracts to issue common stock (like options and warrants) were exercised or converted into common stock. Value Line shows only one earnings figure in our statistical presentation; that figure is clearly identified in the footnotes (item 20), and much more often than not, it is the diluted earnings figure.

For Johnson & Johnson, earnings per share have expanded consistently over the past decade and a half. As indicated in footnote (B) (*item 20*) near the bottom edge of the report page, its earnings per share are now based on diluted shares outstanding.

Dividends Declared per share (fourth line) are usually the highest, in proportion to earnings, at older and larger companies, which tend to have slower-than-average growth. Directors of growth-oriented companies more often than not prefer to pay small or "token" dividends, or none at all, so they can reinvest earnings in the business. Johnson & Johnson has regularly paid out 34% to 38% of its earnings in dividends and invested the remainder in the business. A payout of about 25% is generally typical of larger capitalization companies followed by Value Line.

Capital Spending per share (fifth line) is the amount that a company spends on new plant and equipment. It doesn't include funds used for acquisitions of other companies.

Book Value per share (sixth line) is common shareholder's equity determined on a per-share basis. It includes both tangible assets, like plant and receivables and inventories, as well as intangibles, like the value of patents or brand names, known as ''goodwill.'' Any significant intangibles will normally be indicated in a footnote. If all assets could be liquidated at the value stated on the company's books, all liabilities such as accounts payable, taxes, and long-term debt paid, and all preferred stockholders compensated, the book value is what would be left for the common stockholders.

The number of C*ommon Shares Outstanding* (seventh line) is also listed in the Statistical Array. Sometimes net income rises, but earnings per share do not, because the number of shares outstanding has increased. This may happen because a company is issuing stock to pay for acquisitions or to fund internal growth. As a result, sales and profits may soar, while per-share sales and earnings lag. On the other hand, when cash-rich companies buy their own shares, earnings per share can rise even if net income is stable. Johnson & Johnson's share base has grown slightly in the past ten years.

The A*verage Annual P/E Ratio* (eighth line) shows what multiple of earnings investors have been willing to pay for a stock in the past and the P/E ratio the analyst expects out 3 to 5 years. Johnson & Johnson's average annual P/E has frequently been very high in recent years, and Value Line's analyst projects that it will be above average in the years through 2007-09.

The R*elative P/E Ratio* (ninth line) shows how the stock's price-earnings ratio relates to those of all stocks in the Value Line universe. Johnson & Johnson's relative P/E of 1.09 is 9% higher than that of the typical stock. However, its relative PE has often been even higher, and the Value Line analyst thinks it will be high again in the period to 2007-09.

The A*verage Annual Dividend Yield* (tenth line) is of special interest to conservative investors, many of whom are more concerned with income than with a stock's appreciation potential. Income-oriented investors should look for stocks with yields that are higher than the average shown each week in the center box of the front cover of the *Summary & Index*, but they should also look at the trend of dividends over time. Johnson & Johnson's dividend has been increased in each year shown on our page, and the analyst thinks it will continue to rise. Steady increases are very attractive for many investors. Investors should also look carefully at a company's Financial Strength to make certain that the company will be able to continue to pay the dividend. A good rule of thumb for conservative investors is to invest only in companies with Financial Strength ratings of at least B+.

Company Financial Data

The S*ales* figure (eleventh line) is the most common measure given when referring to a company's size. Johnson & Johnson's sales in 2004 are expected to be more than 2.9 times the amount recorded in 1994, a very strong performance.

The O*perating Margin* (twelfth line) indicates what percentage of sales is being converted into operating income. (Operating income is total sales minus the cost of goods sold and selling, general and administrative expenses. It is also referred to as EBITDA, or earnings before interest, taxes, depreciation, and amortization.) At Johnson & Johnson, the past decade has seen a rise in this figure, and the figure is expected to widen slightly more in the next 3 to 5 years.

*Depreciation (*thirteenth line) shows the amount charged against operating profits to reflect the aging of a company's plant and equipment . That number has risen quite steadily and is expected to continue to rise through 2007-09.

Net Profit (fourteenth line) is the amount the company earned after all expenses including taxes, but excluding nonrecurring gains or losses and the results of discontinued operations. Usually, the higher the net, the higher the per-share earnings. Johnson & Johnson's net profit has grown considerably since 1994, and has risen in every year.

Johnson & Johnson's *Income Tax Rate* (fifteenth line) has been in the 27% to 30% range for many years, and Value Line's analyst thinks it will stay there in the future. Income tax rates will normally remain steady unless the federal tax rate changes in the U.S. or unless a company increases or decreases the percentage of business it does overseas, where tax rates are different.

Net Profit Margin (sixteenth line) shows net income after taxes as a percentage of sales (or revenues). Here, the trend is the most important thing, with rising margins usually being favorable. It is often worthwhile to compare the net margin with the operating margin. Usually the two series move together, though not always. Depreciation charges, interest expense, income taxes, and other costs are deducted from (and other income added to) operating income in the determination of net profit. Where there is a disparity in the trends of the net and operating margins, it may be worth taking a second look. (If depreciation, interest charges, or tax rates move sharply in any direction, there will be an impact on net profits, and it would be worthwhile to try to determine why the change occurred.)

Johnson & Johnson's *Net Profit Margin* has been at record levels in recent years, and we expect the current high level to hold over the next 3 to 5 years.

Working Capital (seventeenth line), the company's current assets less current liabilities, indicates the liquid assets available for running the business on a day-to-day basis. The higher a company's sales, the more working capital it typically has and needs. But we caution that a number of large companies with steady revenue streams no longer believe large amounts of working capital are necessary. In those cases, a negative working capital may be perfectly acceptable because a company can meet normal operating expenses from consistent cash receipts.

Long-term Debt (eighteenth line) is the total debt due more than one year in the future. In the case of Johnson & Johnson, the amount is quite low relative to shareholder's equity.

Shareholders' Equity (nineteenth line), also known as net worth, is the total stockholders' interest (preferred and common) in the company after all liabilities have been deducted from the company's total assets. All intangible assets such as goodwill, patents, and, sometimes, deferred charges are included in shareholders' equity. Johnson & Johnson's equity has grown appreciably over the years, primarily from retained earnings.

Return on Total Capital (twentieth line) measures the percentage a company earns on its shareholders' equity and long-term debt obligations. When a company's return on total capital goes up, there should also be an increase in the return on shareholders' equity (see below). If not, it simply means that the company is borrowing more and paying interest, but not earning more for the stockholders on their equity in the company's assets. Unless a company can earn more than the interest cost of its debt over time, the risk of borrowing is not worthwhile.

Return on Shareholders' Equity (twenty-first line) reveals how much has been earned (in percentage terms) every year for the stockholders (common and preferred). Higher figures are usually desirable, often indicating greater productivity and efficiency. Johnson & Johnson's percent earned on net worth has been relatively high in recent years, and while it may slip in coming years, it is likely to remain above average.

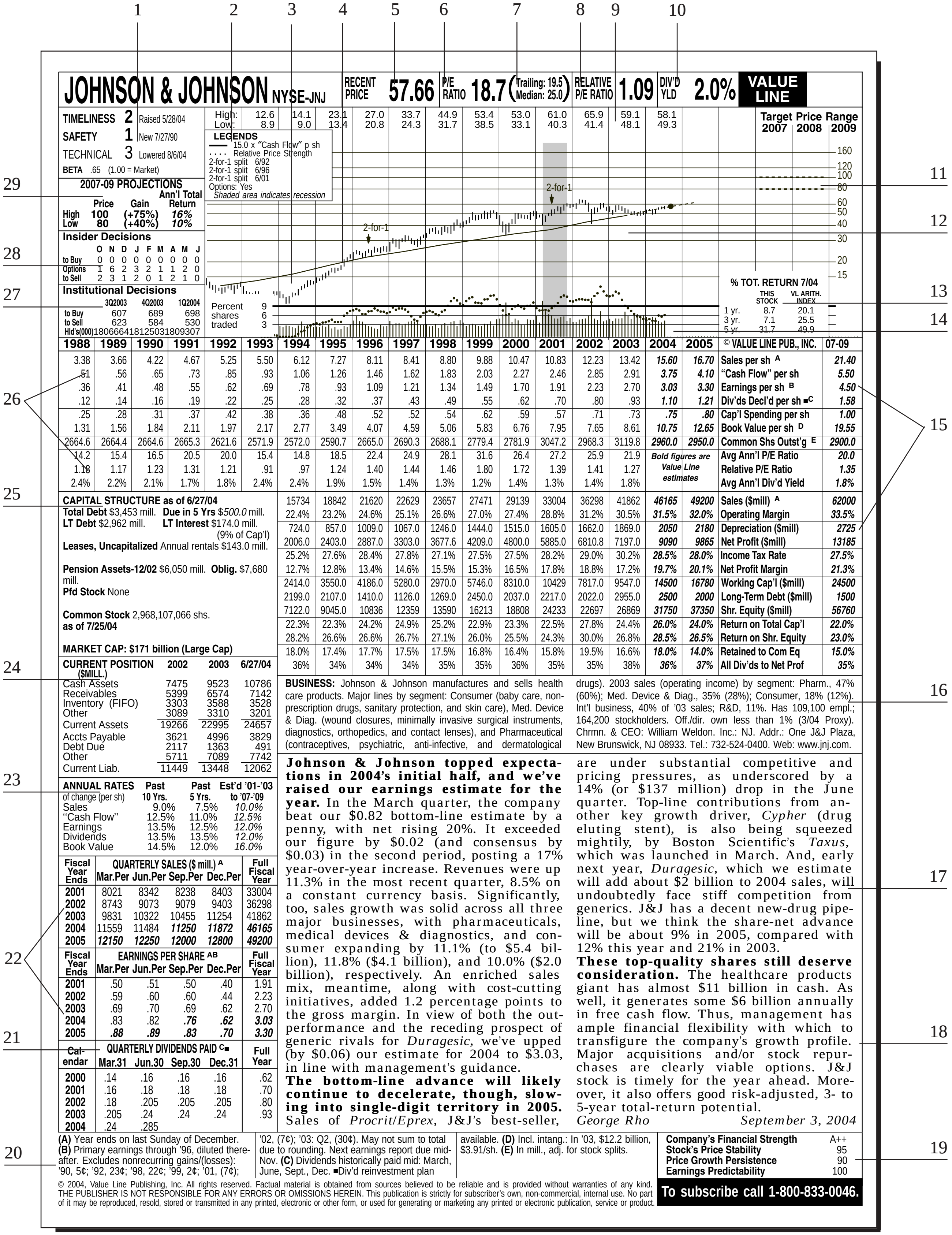
Trends in both this ratio and the return on total capital—two key gauges of corporate performance—say a great deal about the skill of management.

Retained to Common Equity (twenty-second line) also known as the ''plowback ratio,'' is net income less all dividends (common and preferred), divided by common shareholders' equity and is expressed as a percentage. It measures the extent to which a company has internally generated resources to invest for future growth. A high plowback ratio and rapidly growing book value are positive investment characteristics.

All Dividends to Net Profit, or ''payout ratio,'' (twenty-third line) measures the proportion of a company's profits that is distributed as dividends to all shareholders—both common and preferred. Young, fast-growing firms reinvest most of their profits internally. Mature firms are better able to pay out a large share of earnings. Johnson & Johnson has been paying out 34% to 38% of its profits in the form of cash dividends. By way of comparison, the typical large company in the Value Line universe usually pays out about 25% of its profits in dividends.

1. **Value Line's Ranks**—the rank for Timeliness; the rank for Safety; the Technical rank. Beta, the stock's sensitivity to fluctuations of the market as a whole, is included in this box but is not a rank. (*See Glossary for Industry rank*.)
2. **The Legends box** contains the "cash flow" multiple, the amounts and dates of recent stock splits and an indication if options on the stock are traded.
3. **Monthly price ranges of the stock**—plotted on a ratio (logarithmic) grid to show percentage changes in true proportion. For example, a ratio chart equalizes the move of a $10 stock that rises to $11 with that of a $100 stock that rises to $110. Both have advanced 10% and over the same space on a ratio grid.
4. **The "cash flow" line**—reported earnings plus depreciation ("cash flow") multiplied by a number selected to correlate the stock's 3- to 5-year projected target price, with "cash flow" projected out to 2005.
5. **Recent price**—see page 2 of the *Summary & Index* for the date, just under "Index to Stocks."
6. **P/E ratio**—the recent price divided by the latest six months' earnings per share plus earnings estimated for the next six months.
7. **Trailing and median P/E**—the first is the recent price divided by the sum of reported earnings for the past 4 quarters; the second is an average of the price/ earnings ratios over the past 10 years.
8. **Relative P/E ratio**—the stock's current P/E divided by the median P/E for all stocks under Value Line review.
9. **The stock's highest and lowest price of the year.**
10. **Dividend yield**—cash dividends estimated to be declared in the next 12 months divided by the recent price.
11. **Target Price Range**—the range in which a stock price is likely to trade in the years 2007-09. Also shown in the "Projections" box on the left.
12. **Relative Price Strength** describes the stock's past price performance relative to the Value Line Arithmetic Composite Average of approximately 1,700 stocks. (A rising line indicates the stock price has been rising more than the Value Line universe.)
13. **The % Total Return** shows the price appreciation and dividends of a stock and the Value Line Arithmetic Composite Index for the past 1, 3, and 5 years.
14. **The percent of shares traded monthly**—the number of shares traded each month as a % of the total outstanding.
15. **Statistical Array**—Value Line estimates appearing in the area on the right side are in *bold italics*.
16. **Business Data**—a brief description of the company's business and major products along, with other important data.
17. **Analyst's Commentary**—an approximately 350-word report on recent developments and prospects—issued every three months on a preset schedule.
18. **The expected date of receipt by subscribers.** *The Survey* is mailed on a schedule that aims for delivery to every subscriber on Friday afternoon.
19. **Value Line's Indexes** of Financial Strength, Stock's Price Stability, Price Growth Persistence, and Earnings Predictability. *(See Glossary for definitions.)*
20. **Footnotes** explain a number of things, such as the way earnings are reported, whether basic or diluted.
21. **Quarterly dividends paid** are actual payments. The total of dividends paid in four quarters may not equal the figure shown in the annual series on dividends declared in the Statistical Array. (Sometimes a dividend declared at the end of the year will be paid in the first quarter of the following year.)
22. **Quarterly sales** are shown on a gross basis. Quarterly earnings on a per-share basis (estimates in bold type).
23. **Annual rates of change** (on a compound per-share basis). Actual for each of the past 5 and 10 years, estimated for the next 3 to 5 years.
24. **Current position**—total current assets and total current liabilities, and their detail.
25. **The capital structure** as of the indicated recent date showing, among other things, the $ amount and % of capital in long-term debt and preferred stock. We also show the number of times that interest charges were earned.
26. **Statistical Array**—historical financial data appears in regular type.
27. **Stock purchases/sales by institutions**—the number of times institutions with more than $100 million of assets under management bought or sold stock during the past three quarters and the total number of shares held by those institutions at the end of each quarter.
28. **The record of insider decisions**—the number of times officers and directors bought or sold stock or exercised options during the past nine months.
29. **The projected stock price** in 2007-09. Also, the total expected % gain/loss before dividends and the Annual Total Return (% including dividends).

Sample Value Line Stock Page



JOHNSON & JOHNSON NYSE-JNJ

RECENT PRICE	P/E RATIO		RELATIVE P/E RATIO	DIV'D YLD	
57.66	18.7	(Trailing: 19.5 Median: 25.0)	1.09	2.0%	VALUE LINE

TIMELINESS 2 Raised 5/28/04

SAFETY 1 New 7/27/90

TECHNICAL 3 Lowered 8/6/04

BETA .65 (1.00 = Market)

2007-09 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	100	(+75%)	*16%*
Low	80	(+40%)	*10%*

Insider Decisions

	O	N	D	J	F	M	A	M	J
to Buy	0	0	0	0	0	0	0	0	0
Options	1	6	2	3	2	1	1	2	0
to Sell	2	3	1	2	0	1	2	1	0

Institutional Decisions

	3Q2003	4Q2003	1Q2004
to Buy	607	689	698
to Sell	623	584	530
Hld's(000)	1806664	1812503	1809307

LEGENDS
— 15.0 x "Cash Flow" p sh
. . . . Relative Price Strength
2-for-1 split 6/92
2-for-1 split 6/96
2-for-1 split 6/01
Options: Yes
Shaded area indicates recession

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
High:	12.6	14.1	23.1	27.0	33.7	44.9	53.4	53.0	61.0	65.9	59.1	58.1
Low:	8.9	9.0	13.4	20.8	24.3	31.7	38.5	33.1	40.3	41.4	48.1	49.3

Target Price Range

2007	2008	2009

% TOT. RETURN 7/04

	THIS STOCK	VL ARITH. INDEX
1 yr.	8.7	20.1
3 yr.	7.1	25.5
5 yr.	31.7	49.9

1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	© VALUE LINE PUB., INC.	07-09
3.38	3.66	4.22	4.67	5.25	5.50	6.12	7.27	8.11	8.41	8.80	9.88	10.47	10.83	12.23	13.42	***15.60***	***16.70***	**Sales per sh** A	***21.40***
.51	.56	.65	.73	.85	.93	1.06	1.26	1.46	1.62	1.83	2.03	2.27	2.46	2.85	2.91	***3.75***	***4.10***	**"Cash Flow" per sh**	***5.50***
.36	.41	.48	.55	.62	.69	.78	.93	1.09	1.21	1.34	1.49	1.70	1.91	2.23	2.70	***3.03***	***3.30***	**Earnings per sh** B	***4.50***
.12	.14	.16	.19	.22	.25	.28	.32	.37	.43	.49	.55	.62	.70	.80	.93	***1.10***	***1.21***	**Div'ds Decl'd per sh** ■C	***1.58***
.25	.28	.31	.37	.42	.38	.36	.48	.52	.52	.54	.62	.59	.57	.71	.73	***.75***	***.80***	**Cap'l Spending per sh**	***1.00***
1.31	1.56	1.84	2.11	1.97	2.17	2.77	3.49	4.07	4.59	5.06	5.83	6.76	7.95	7.65	8.61	***10.75***	***12.65***	**Book Value per sh** D	***19.55***
2664.6	2664.4	2664.6	2665.3	2621.6	2571.9	2572.0	2590.7	2665.0	2690.3	2688.1	2779.4	2781.9	3047.2	2968.3	3119.8	***2960.0***	***2950.0***	**Common Shs Outst'g** E	***2900.0***
14.2	15.4	16.5	20.5	20.0	15.4	14.8	18.5	22.4	24.9	28.1	31.6	26.4	27.2	25.9	21.9	***Bold figures are Value Line estimates***		**Avg Ann'l P/E Ratio**	***20.0***
1.18	1.17	1.23	1.31	1.21	.91	.97	1.24	1.40	1.44	1.46	1.80	1.72	1.39	1.41	1.27			**Relative P/E Ratio**	***1.35***
2.4%	2.2%	2.1%	1.7%	1.8%	2.4%	2.4%	1.9%	1.5%	1.4%	1.3%	1.2%	1.4%	1.3%	1.4%	1.8%			**Avg Ann'l Div'd Yield**	***1.8%***
						15734	18842	21620	22629	23657	27471	29139	33004	36298	41862	***46165***	***49200***	**Sales ($mill)** A	***62000***
						22.4%	23.2%	24.6%	25.1%	26.6%	27.0%	27.4%	28.8%	31.2%	30.5%	***31.5%***	***32.0%***	**Operating Margin**	***33.5%***
						724.0	857.0	1009.0	1067.0	1246.0	1444.0	1515.0	1605.0	1662.0	1869.0	***2050***	***2180***	**Depreciation ($mill)**	***2725***
						2006.0	2403.0	2887.0	3303.0	3677.6	4209.0	4800.0	5885.0	6810.8	7197.0	***9090***	***9865***	**Net Profit ($mill)**	***13185***
						25.2%	27.6%	28.4%	27.8%	27.1%	27.5%	27.5%	28.2%	29.0%	30.2%	***28.5%***	***28.0%***	**Income Tax Rate**	***27.5%***
						12.7%	12.8%	13.4%	14.6%	15.5%	15.3%	16.5%	17.8%	18.8%	17.2%	***19.7%***	***20.1%***	**Net Profit Margin**	***21.3%***
						2414.0	3550.0	4186.0	5280.0	2970.0	5746.0	8310.0	10429	7817.0	9547.0	***14500***	***16780***	**Working Cap'l ($mill)**	***24500***
						2199.0	2107.0	1410.0	1126.0	1269.0	2450.0	2037.0	2217.0	2022.0	2955.0	***2500***	***2000***	**Long-Term Debt ($mill)**	***1500***
						7122.0	9045.0	10836	12359	13590	16213	18808	24233	22697	26869	***31750***	***37350***	**Shr. Equity ($mill)**	***56760***
						22.3%	22.3%	24.2%	24.9%	25.2%	22.9%	23.3%	22.5%	27.8%	24.4%	***26.0%***	***24.0%***	**Return on Total Cap'l**	***22.0%***
						28.2%	26.6%	26.6%	26.7%	27.1%	26.0%	25.5%	24.3%	30.0%	26.8%	***28.5%***	***26.5%***	**Return on Shr. Equity**	***23.0%***
						18.0%	17.4%	17.7%	17.5%	17.5%	16.8%	16.4%	15.8%	19.5%	16.6%	***18.0%***	***14.0%***	**Retained to Com Eq**	***15.0%***
						36%	34%	34%	34%	35%	35%	36%	35%	35%	38%	***36%***	***37%***	**All Div'ds to Net Prof**	***35%***

CAPITAL STRUCTURE as of 6/27/04
Total Debt $3,453 mill. **Due in 5 Yrs** $*500.0* mill.
LT Debt $2,962 mill. **LT Interest** $174.0 mill.
(9% of Cap'l)

Leases, Uncapitalized Annual rentals $143.0 mill.

Pension Assets-12/02 $6,050 mill. **Oblig.** $7,680 mill.
Pfd Stock None

Common Stock 2,968,107,066 shs.
as of 7/25/04

MARKET CAP: $171 billion (Large Cap)

CURRENT POSITION ($MILL.)	2002	2003	6/27/04
Cash Assets	7475	9523	10786
Receivables	5399	6574	7142
Inventory (FIFO)	3303	3588	3528
Other	3089	3310	3201
Current Assets	19266	22995	24657
Accts Payable	3621	4996	3829
Debt Due	2117	1363	491
Other	5711	7089	7742
Current Liab.	11449	13448	12062

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '01-'03 to '07-'09
Sales	9.0%	7.5%	*10.0%*
"Cash Flow"	12.5%	11.0%	*12.5%*
Earnings	13.5%	12.5%	*12.0%*
Dividends	13.5%	13.5%	*12.0%*
Book Value	14.5%	12.0%	*16.0%*

Fiscal Year Ends	QUARTERLY SALES ($ mill.) A Mar.Per	Jun.Per	Sep.Per	Dec.Per	Full Fiscal Year
2001	8021	8342	8238	8403	33004
2002	8743	9073	9079	9403	36298
2003	9831	10322	10455	11254	41862
2004	11559	11484	***11250***	***11872***	***46165***
2005	***12150***	***12250***	***12000***	***12800***	***49200***

Fiscal Year Ends	EARNINGS PER SHARE AB Mar.Per	Jun.Per	Sep.Per	Dec.Per	Full Fiscal Year
2001	.50	.51	.50	.40	1.91
2002	.59	.60	.60	.44	2.23
2003	.69	.70	.69	.62	2.70
2004	.83	.82	***.76***	***.62***	***3.03***
2005	***.88***	***.89***	***.83***	***.70***	***3.30***

Cal-endar	QUARTERLY DIVIDENDS PAID C■ Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2000	.14	.16	.16	.16	.62
2001	.16	.18	.18	.18	.70
2002	.18	.205	.205	.205	.80
2003	.205	.24	.24	.24	.93
2004	.24	.285			

BUSINESS: Johnson & Johnson manufactures and sells health care products. Major lines by segment: Consumer (baby care, non-prescription drugs, sanitary protection, and skin care), Med. Device & Diag. (wound closures, minimally invasive surgical instruments, diagnostics, orthopedics, and contact lenses), and Pharmaceutical (contraceptives, psychiatric, anti-infective, and dermatological drugs). 2003 sales (operating income) by segment: Pharm., 47% (60%); Med. Device & Diag., 35% (28%); Consumer, 18% (12%). Int'l business, 40% of '03 sales; R&D, 11%. Has 109,100 empl.; 164,200 stockholders. Off./dir. own less than 1% (3/04 Proxy). Chrmn. & CEO: William Weldon. Inc.: NJ. Addr.: One J&J Plaza, New Brunswick, NJ 08933. Tel.: 732-524-0400. Web: www.jnj.com.

Johnson & Johnson topped expectations in 2004's initial half, and we've raised our earnings estimate for the year. In the March quarter, the company beat our $0.82 bottom-line estimate by a penny, with net rising 20%. It exceeded our figure by $0.02 (and consensus by $0.03) in the second period, posting a 17% year-over-year increase. Revenues were up 11.3% in the most recent quarter, 8.5% on a constant currency basis. Significantly, too, sales growth was solid across all three major businesses, with pharmaceuticals, medical devices & diagnostics, and consumer expanding by 11.1% (to $5.4 billion), 11.8% ($4.1 billion), and 10.0% ($2.0 billion), respectively. An enriched sales mix, meantime, along with cost-cutting initiatives, added 1.2 percentage points to the gross margin. In view of both the outperformance and the receding prospect of generic rivals for *Duragesic*, we've upped (by $0.06) our estimate for 2004 to $3.03, in line with management's guidance.

The bottom-line advance will likely continue to decelerate, though, slowing into single-digit territory in 2005. Sales of *Procrit*/*Eprex*, J&J's best-seller, are under substantial competitive and pricing pressures, as underscored by a 14% (or $137 million) drop in the June quarter. Top-line contributions from another key growth driver, *Cypher* (drug eluting stent), is also being squeezed mightily, by Boston Scientific's *Taxus*, which was launched in March. And, early next year, *Duragesic*, which we estimate will add about $2 billion to 2004 sales, will undoubtedly face stiff competition from generics. J&J has a decent new-drug pipeline, but we think the share-net advance will be about 9% in 2005, compared with 12% this year and 21% in 2003.

These top-quality shares still deserve consideration. The healthcare products giant has almost $11 billion in cash. As well, it generates some $6 billion annually in free cash flow. Thus, management has ample financial flexibility with which to transfigure the company's growth profile. Major acquisitions and/or stock repurchases are clearly viable options. J&J stock is timely for the year ahead. Moreover, it also offers good risk-adjusted, 3- to 5-year total-return potential.

George Rho *September 3, 2004*

(A) Year ends on last Sunday of December. **(B)** Primary earnings through '96, diluted thereafter. Excludes nonrecurring gains/(losses): '90, 5¢; '92, 23¢; '98, 22¢; '99, 2¢; '01, (7¢); '02, (7¢); '03: Q2, (30¢). May not sum to total due to rounding. Next earnings report due mid-Nov. **(C)** Dividends historically paid mid: March, June, Sept., Dec. ■Div'd reinvestment plan available. **(D)** Incl. intang.: In '03, $12.2 billion, $3.91/sh. **(E)** In mill., adj. for stock splits.

Company's Financial Strength	A++
Stock's Price Stability	95
Price Growth Persistence	90
Earnings Predictability	100

CHAPTER

6

THE VALUE LINE INDUSTRY REPORT

All the company reports in *The Value Line Investment Survey* are grouped by industry, and at the front of each industry group is a one- or two-page Industry Report.

The information contained in each Industry Report may differ considerably from one industry to another, but there is a general format we follow.

The number of industries followed in *The Value Line Investment Survey* is constantly changing. As companies drop out, usually because of mergers or acquisitions, we may discontinue an industry. On the other hand, as new industries develop, we add them. Some we have added in the past two years are Biotechnology, Human Resources, Entertainment Technology, and Coal.

Analytical Commentary

Much of each page contains analytical commentary. The text in each report is written by a Value Line security analyst, who normally also follows a number (sometimes as many as 10 or 12) of the companies in the industry.

The text normally includes comments about important developments in the industry and the impact those developments have been having on the companies. It also usually includes the analyst's projections about the immediate and longer-term prospects for the industry. We always recommend that you read this report to get an idea of just what an analyst thinks about an industry.

Composite Statistics

In the lower left corner of most reports is a table of Composite Statistics for an industry. The statistics are compiled from the data on the individual companies; the individual data headings are the same as those on the company pages.

Composite Statistics: Medical Supplies Industry

2000	2001	2002	2003	2004	2005		07-09
164858	201055	248344	268645	***290135***	***312500***	**Sales ($mill)**	***382700***
16.1%	15.1%	14.5%	15.2%	***15.5%***	***15.5%***	**Operating Margin**	***15.5%***
5577.5	6350.1	6330.5	6621	***6940***	***7175***	**Depreciation ($mill)**	***8150***
14415	16869	20095	22627	***25295***	***28200***	**Net Profit ($mill)**	***36355***
29.6%	27.8%	29.4%	29.5%	***29.5%***	***29.5%***	**Income Tax Rate**	***29.5%***
8.7%	8.4%	8.1%	8.4%	***8.7%***	***9.0%***	**Net Profit Margin**	***9.5%***
30578	32333	38233	37624	***39275***	***42000***	**Working Cap'l ($mill)**	***48750***
18597	25586	28450	27065	***26000***	***25000***	**Long-Term Debt ($mill)**	***22000***
63058	79376	86741	95895	***106480***	***118285***	**Shr. Equity ($mill)**	***154700***
18.5%	16.8%	18.1%	17.8%	***19.0%***	***19.5%***	**Return on Total Cap'l**	***19.0%***
22.9%	21.3%	23.2%	22.9%	***24.0%***	***24.0%***	**Return on Shr. Equity**	***23.5%***
17.1%	15.7%	17.5%	16.8%	***17.0%***	***17.0%***	**Retained to Com Eq**	***16.5%***
25%	26%	25%	25%	***28%***	***28%***	**All Div'ds to Net Prof**	***30%***
27.6	28.4	24.4	20.8	***Bold figures are Value Line estimates***		**Avg Ann'l P/E Ratio**	***19.0***
1.79	1.46	1.33	1.15			**Relative P/E Ratio**	***1.25***
.9%	.9%	1.0%	1.2%			**Avg Ann'l Div'd Yield**	***1.6%***

These statistics have two primary uses. First, they help an investor to examine trends in an industry. Second, they provide a benchmark for comparisons. An investor can look at the statistics on an individual company page and compare them with those of the industry to see how a company stacks up with its industry. He/she can also compare one industry with another.

Industry Trends

When purchasing a stock in a company, an investor should also know something about the industry in which a company is operating. Some important questions are:

- Is the industry growing?
- Are the industry's operating and profit margins growing or at least remaining steady?
- Are the industry's returns on total capital and shareholders' equity growing or at least remaining steady?

The answer to these questions can be found in the Composite Statistics table. In most cases, if an industry's trends are favorable, the operating conditions for the companies in that industry will also be favorable. If the industry trends are negative, the opposite may be true.

Company/Industry Comparisons

When you are investing in a company, you should also know how that company is performing relative to its industry. A company's size and operating performance are both very important, and you should study them by looking at our individual company pages. However, you should also know if a company is well run. Some questions an investor should ask are:

- How do a company's operating margins compare with the industry's operating margins?
- How do a company's net profit margins compare with the industry's margins?
- Are a company's returns on total capital and on shareholders' equity greater or smaller than those of the industry?

If a company's margins and returns are above average, the company is probably efficiently run. If the margins and returns are lower than most firms in the industry, the company is probably not being run as well as it could be.

WARNING! Many industries are dominated by one or two companies. When that is the case, company/industry comparisons may not be very useful. Examples here are Anheuser-Busch, which accounts for more than half the sales in our Alcoholic Beverage Industry, and Dow Chemical and Dupont, which together have more 80% of the sales of our Basic Chemical Industry. *Be careful when making company/industry comparisons to make certain the comparisons are meaningful.*

Industry Timeliness

At the top right of each report, we publish an INDUSTRY TIMELINESS rank. These go from 1 (highest) to 98 (lowest).

The Industry Timeliness ranks are calculated by averaging the Timeliness ranks of each of the stocks in a particular industry. If an industry has a large number of stocks ranked 1, the Industry Timeliness rank is likely to be high. If an industry has a large number of stocks ranked 5, the Industry rank is likely to be low.

The Industry ranks are updated weekly and published on the front and inside pages of the *Summary & Index*. You should always look in the *Summary & Index* to make certain you have the most recent numbers.

Relative Strength Chart

In the lower right corner of most reports is a relative strength chart going back for as many as seven years. Relative strength compares the price of a stock over time with the price of the stock market over the same time. (In this case, we use the Value Line Composite Index of approximately 1,700 stocks to represent the market.) When the relative strength line is rising, it means that the stocks in an industry are stronger than the broad market. When the line is falling, the stocks in an industry are weaker than the broad market.

CHAPTER

7

ANSWERS TO FREQUENTLY ASKED QUESTIONS

Long-term subscribers to The Value Line Investment Survey *are often well aware of the basic tenets of investing and the many ways information can be used in* The Value Line Investment Survey*. However, they and many newer readers often have questions about material in the publication. Below are answers to those questions we receive most frequently.*

TIMELINESS RANKS

How do you determine the *Timeliness* rank, and what makes it change?

TIMELINESS **2** Raised 5/28/04
SAFETY **1** New 7/27/90
TECHNICAL 3 Lowered 8/6/04
BETA .65 (1.00 = Market)

Ranks Box
(Also see item 1, on page 21)

Value Line's *Timeliness Ranking System* ranks all of the approximately 1,700 stocks in our universe for relative price performance in the coming six to 12 months. At any one time, 100 stocks are ranked 1; 300 are ranked 2; approximately 900 are ranked 3; 300 are ranked 4; and 100 are ranked 5. In simple terms, *Timeliness* ranks [which go from 1 (Highest) to 5 (Lowest)] are determined by a company's earnings growth and its stock's price performance over a 10 year period. A rank may change under three circumstances. The first is the release of a company's earnings report. A company that reports earnings that are good relative to those of other companies and good relative to the numbers we had expected may have its stock move up in rank, while a company reporting poor earnings could see its stock's rank drop.

A change in the price of a stock can also cause a stock's rank to change. A change in price carries less weight than a change in earnings, but it is still an important determinant. Generally speaking, strong relative price performance is a plus, while negative relative price performance (relative to all other approximately 1,700 stocks) is a minus.

And finally, there is the "Dynamism of the Ranking System." This phrase means that a stock's rank can change even if a company's earnings and stock price remain the same. That's because a fixed number of stocks is always ranked 1, 2, etc. Every time one stock's *Timeliness* rank moves up or down, another's must also change. As an example, let's suppose one company reports unusually good earnings, causing its stock's *Timeliness* rank to rise from 2 to 1. Since there can be only 100 stocks ranked 1, some other stock must fall to a rank of 2, even though there has been no change in its earnings or price.

Can you tell me where a particular stock ranks within its class (a high 1, a low 1, etc.)?

We do not disclose this information. However, we do list the date when a rank last changed and what the direction of the change was. Next to the *Timeliness* rank on each company page you can see when the last change occurred and whether it was raised or lowered. Changes are also indicated each week in the *Summary & Index* by an arrow next to *Timeliness* ranks.

I think that *Value Line* should change a certain stock's rank. Will you do it?

We appreciate your interest, but all ranks are generated by computer driven criteria and historical data. Value Line methodology keeps our System objective and unbiased, because the same criteria apply to all stocks.

Would you tell me the formula you use to calculate ranks?

The details of the formula are proprietary. The components of the *Timeliness Ranking System*, as mentioned earlier, include the long-term trend of earnings and stock prices, recent company earnings and stock price performance, and a comparison of the latest quarterly earnings with those that had been expected. (Better than expected earnings are normally positive, less than expected earnings, negative.) We cannot be more specific than that.

Why do stocks with *Timeliness* ranks of 1 or 2 sometimes have below-average, long-term appreciation potential, and vice versa?

Probably the most important thing for all readers to know is that the time horizons for *Timeliness* ranks and for 3- to 5-year *Projections* are very different. Our *Timeliness* ranks are for the relative performance of stocks over the coming six to 12 months. Our forecast for long-term price potential is for 3 to 5 years. Because of the very different time periods, our forecasts for the two periods can be very different.

To provide a more specific answer, stocks ranked 1 or 2 for *Timeliness* often have been moving higher and often sell at high price/earnings ratios. While we think these stocks will continue to outperform other stocks in the Value Line universe during the next six to 12 months, it is unrealistic to think a stock's price will keep moving up forever. At some point, earnings growth is likely to slow, at least somewhat, and our analysts try to be as realistic as possible in calculating the 3- to 5-year projections. If earnings growth slows in the future, a stock's price/earnings ratio is likely to narrow, limiting the potential for appreciation in the stock's price.

Why do some stocks not have a *Timeliness* rank?

Our computer-generated *Timeliness* ranks require at least two years of income statement and stock price history. If a stock has been trading for less than two years, possibly because a company is relatively new or because there was a major spinoff or acquisition, we are unable to assign a rank to it. We also suspend Timeliness ranks for unusual developments such as a merger offer or a bankruptcy filing.

TECHNICAL RANK

What exactly is the Technical rank?

The Technical rank uses a stock's price performance over the past year to attempt to predict short-term (three to six month) future returns. Each stock in our 1,700-company universe is ranked in relation to all others on a scale of 1 (Highest) to 5 (Lowest). There are no other factors incorporated into the model. While our Technical rank does contribute to investment decisions, we would like to stress that our primary investment advice is based on our successful time-proven *Timeliness Ranking System*. The Technical rank is best used as a secondary investment criterion.

EARNINGS

Why does *Value Line* sometimes show different share earnings than those in a company's annual report, or in The Wall Street Journal, or in a brokerage house report?

We each calculate earnings differently. In particular, *Value Line* excludes what we consider to be unusual or one-time gains or charges in order to show what we consider to be "normal" earnings.

Company earnings often contain one-time non-recurring or unusual items, such as expenses related to the early retirement of debt, a change in accounting principles, restructuring charges, or a gain or loss on the sale of assets. In order to make a reasonable comparison of core operating results from one year to the next—or from one company to another—it is necessary to exclude these items from reported earnings. Some items are relatively easy to take out because they are explicitly shown in the company's income statement and footnotes. Others, however, must be estimated by our analysts. Any unusual adjustments to reported earnings will be disclosed in the footnotes of each Value Line report.

OPERATING MARGIN

What is an operating margin?

The operating margin shows operating income (earnings before the deduction of depreciation, amortization, interest, and income taxes) as a percentage of sales or revenues. Operating income is sometimes referred to as EBITDA.

PRICE/EARNINGS RATIO

Why does the Value Line price/earnings ratio often differ from that in The Wall Street Journal or brokerage reports?

All price/earnings ratios are calculated by dividing the recent stock price by 12 months of earnings. The different ratios occur because we each use different 12-months earnings figures. Newspapers use 12-months trailing (i.e., reported) earnings. *Value Line* uses a total of the past six months of trailing earnings and the next six months of estimated earnings. (In our view, this is the best method since it incorporates both recent history and a near-term forecast.) Your broker is likely to use a calendar year's earnings. While we think our method is best, none is wrong. Just be sure that when you are comparing two companies' P/E ratios, you are using the same methods.

For additional information on P/E ratios, please turn to page 15.

ABBREVIATIONS

I have trouble understanding some of your abbreviations. Can you help me?

Yes. Most of the frequently used abbreviations are included in the Glossary at the end of this guide.

SELECTION & OPINION MODEL PORTFOLIOS

How are stocks chosen for the Model Portfolios I, II and III in *Selection & Opinion*?

Each portfolio is dedicated to a different investment objective. To guard against near-term underperformance, none of the portfolios can hold a stock that is ranked below 3 (Average) for *Timeliness*. *Timeliness* ranks range from 1 (Highest) to 5 (Lowest). To make it more attractive and useful to conservative investors, Portfolio II must hold stocks that are ranked at least 3 (Average) for *Safety*.

Portfolio I, Stocks with Above-Average Year-Ahead Price Potential, is built on Value Line's well-respected *Timeliness* Ranking System. It is primarily suitable for investors who wish to take more risk in hopes of greater returns than might be afforded in Portfolios II or III. To qualify for purchase, stocks have to be ranked 1 (Highest) for *Timeliness*. To reduce portfolio turnover (and recognizing the fact that many good growth stocks go up and down in price along the way), a stock that drops a rank in *Timeliness* to 2 (Above Average) may remain in the portfolio, assuming that the company's longer-term fundamentals remain sound. A stock that drops to 3 (Average) for *Timeliness* must be sold. We attempt to diversify the holdings as much as possible, but note that the *Timeliness Ranking System* tends to favor high earnings growth and more volatile issues that may cluster in a few industries.

Portfolio II, Stocks for Income and Potential Price Appreciation, attempts to combine our *Timeliness Ranking System* with an investment objective for above-average income. This portfolio is primarily suitable for more conservative investors. To qualify for purchase, a stock's yield (the estimated annual dividend for the next 12 months divided by the recent stock price) must be higher than the median yield for all approximately 1,700 stocks Value Line follows. The median is shown on the cover of the *Summary & Index* each week. The stock must also have a *Timeliness* rank of at least 3. The higher-than-average yields provide support to the shares in down markets. This portfolio tends to be less volatile because the companies, as a whole, are more likely to be mature and predictable.

Portfolio III, Stocks with Long-Term Price Growth Potential, is based on the fundamental research of our staff of research analysts. This portfolio is suitable for investors with a 3- to 5-year horizon; in terms of risk, it falls somewhere between Portfolios I and II. This portfolio tends to be the most flexible, allowing purchases of a broader array of companies. It is constructed under the principles of modern portfolio theory, which state that the risk of a portfolio should be viewed within the context of a portfolio as a whole, rather than judging the portfolio according to the average rankings of individual securities it holds. To that end, this portfolio is generally well diversified, comprising stocks in a variety of different non-related industries.

The Selected Investments section of *Selection & Opinion* has three portfolios. Why isn't there a "Conservative" portfolio?

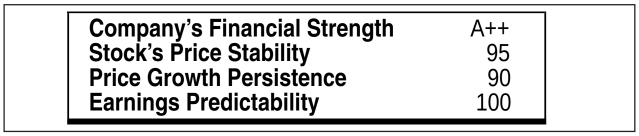
Portfolio II, Stocks for Income and Potential Price Appreciation, is the one we would recommend for "conservative" investors. A key criterion for this portfolio is that the stocks have above-average dividend yields. These attractive yields lend support to stock prices when the market is declining. This portfolio usually also has slightly lower-than-market risk (volatility) as measured by the average beta of the portfolios.

How have the Model Portfolios done?

We publish the record quarterly in *Selection & Opinion*, usually three or four weeks after the end of a quarter. We also publish them on our Web site in the section called "About Value Line."

FINANCIAL STRENGTH

What goes into the Financial Strength rating for each individual company?



Company's Financial Strength	A++
Stock's Price Stability	95
Price Growth Persistence	90
Earnings Predictability	100

Financial/Stock Price Data

(Also see item 19, on page 21)

Our Financial Strength ratings take into account a lot of the same information used by the major credit rating agencies. Our analysis focuses on net income, cash flow, the amount of debt outstanding, and the outlook for profits. Other factors also enter into the equation. For example, a company that faces the loss of patent protection on a key product might face a downgrade. The ratings range from A++ (Highest) to C (Lowest), in nine steps, based on the judgment of our senior staff members.

A STOCK'S 3- TO 5-YEAR PRICE PROJECTIONS

How are a stock's 3- to 5-year share-price projections derived?

Our analysts have developed comprehensive spreadsheet models that take into account the current economic climate and a company's operating fundamentals, including recent management initiatives, the actions of the competition, and many other relevant factors for each company. These models are used to develop our earnings and other financial projections for the coming 3 to 5 years.

The *Target Price Range* is calculated by multiplying a company's estimated earnings per share for the period out 3 to 5 years (in the far right hand column of the statistical array) by the stock's projected average annual price/earnings ratio for the same period and then developing a range showing the likely high and low price. The width of the band of the share-price projections varies, depending on the *Safety* rank of the company. Riskier stocks have a wider band, safer stocks a narrow band.

STOCK DECLINES

I bought a stock based on your advice, but it went down. What happened?

As you undoubtedly know, our *Timeliness Ranking System* has worked extremely well over time. Not all stocks do as we forecast, though, and we have never suggested that they will. What we have strongly recommended is that you diversify your portfolio by purchasing at least six stocks in at least six or more industries. That way, you will protect yourself from unexpected changes in the price of any one stock or any one industry. Also keep in mind that the *Value Line Ranking System* is relative. In declining markets, group 1 and 2 stocks have historically declined less than the general market. On the other hand, stocks ranked 1 and 2 have outperformed the market during periods when stock prices were rising.

SPEAKING TO ANALYSTS

I would like to speak to the Analyst who wrote a report.

Unfortunately, this isn't practical. Our staff of approximately 70 analysts has been hired and trained to analyze stocks and write commentaries for *The Value Line Investment Survey* and, to be fair to all subscribers, they do not have time to provide personalized advice or information.

PRETAX INCOME

Where can I find pretax income on a Value Line page?

You can't. We do, however, show net profit after taxes (usually line 14 in the Statistical Array) and the effective tax rate (usually line 15). You can calculate pretax income by dividing net profit by: 1 minus the tax rate. Example: If net profit was $100 million and the tax rate was 36%, pretax profit would be $156.25 million.

$$\frac{\$100{,}000{,}000}{1.00 - .36} = \$156{,}250{,}000$$

ERRORS IN REPORTS

What should I do if I find an error in a report?

If you think you have found an error in any of our publications, we would very much like to hear from you so that we can correct the mistake. Please write or call us. If you call, let the operator know that you want to report an apparent error, and he/she will connect you with an administrative assistant in the Research Department. Please address your written comments to the office of the Research Director, or e-mail us at VLIS@valueline.com.

If you believe you have found an error in an historical price or per share data item, please read on:

We actually receive very few complaints about our data. Most of those that we do get relate to historical prices and per share data, and the fact is that our stock prices, earnings, and other data are usually correct. When there appears to be a difference in stock prices or earnings per share, it is usually because of a stock split or a stock dividend. Value Line (and everyone else) retroactively adjusts historical stock prices and share data for stock splits and dividends. Splits and dividends of 10% or more are shown in the *Legends* box in the upper left hand corner of the price chart. Splits of less than 10% are shown in the footnotes.

INTERNET (WEB) SITE

Does Value Line have a Web site?

Yes, we do. Our address is *www.valueline.com*. The Web site includes useful features for today's informed investor.

The Web site is designed to help keep you informed about the stock market and the stocks you are interested in. There is a section where you can get recent stock prices and news on companies you are interested in, and another where you can set up your own portfolios. Three times each day we provide both written and video commentary from our economist and senior portfolio managers. Each afternoon we provide the latest analysis from our security analysts about selective stocks in the news that day. We also archive all issues of *The Value Line Investment Survey* published in the past three months.

To access some of this data, you must be a subscriber. To enter the "subscriber-only" section, you must enter your user code (your subscriber number on the label of your weekly envelopes) and password ("stocks").

COMPANY COVERAGE

Does a company pay to be included in *The Value Line Investment Survey*?

No. Value Line is not compensated by the companies under our review. This allows us to be totally objective when we analyze companies in *The Value Line Investment Survey*.

Does the roster of stocks covered by *Value Line* change?

Yes. Vacancies constantly occur within our approximately 1,700 stock universe. Sometimes a company's earnings will deteriorate to such a degree that we believe investors have lost interest. If that happens, we will discontinue coverage. More frequently, companies leave our universe when they are acquired by or merged with another firm. Acquired or merged companies will be replaced by others. In choosing replacements, we try to select actively traded stocks with broad investor interest.

Why isn't ABC, Inc., a large well known company, included?

We do try to include companies with actively traded stocks, which have broad public interest. If ABC fits in this category, we will, in all likelihood, provide coverage in the future.

GROWTH RATES

How are the growth rates calculated in the Annual Rates of change box?

We use a compound annual rate that reflects the annual change for various items over the entire period being computed. All rates of change are computed from the average figure for a past 3-year period to an average for a future 3-year period. For more details, see page 14.

ANNUAL RATES of change (per sh)	**Past 10 Yrs.**	**Past 5 Yrs.**	**Est'd '01-'03 to '07-'09**
Sales	9.0%	7.5%	*10.0%*
"Cash Flow"	12.5%	11.0%	*12.5%*
Earnings	13.5%	12.5%	*12.0%*
Dividends	13.5%	13.5%	*12.0%*
Book Value	14.5%	12.0%	*16.0%*

Annual Rates Box

(Also see item 23, on page 21)

GLOSSARY

Aaa Corporate Bond Rate—the average yield on corporate bonds rated Aaa by Moody's Investors Service. Bonds that are rated Aaa are judged to be of the best quality compared to all other corporate bonds.

After-Tax Corporate Profits—*see Corporate Profits.*

AFUDC—*see Allowance for Funds Used During Construction.*

Allowance for Funds Used During Construction (Electric Utility Industries)—a non cash credit to income consisting of equity and debt components. This non cash income results from construction work in progress and is expected to be converted into cash income at a future date.

American Depositary Receipts (ADRs)—since most other nations do not allow stock certificates to leave the country, a foreign company will arrange for a trustee (typically a large bank) to issue ADRs (sometimes called American Depositary Shares, or ADSs) representing the actual, or underlying, shares. Each ADR is equivalent to a specified number of shares (the ratio is shown in a footnote on the Value Line page).

American Stock Exchange Composite—a market-capitalization weighted index of the prices of the stocks traded on the American Stock Exchange.

Amortization—an accounting method that reduces the value of an asset on a regular basis over time.

Analyst's Commentary—an approximate 350-word report on each company page in *Ratings & Reports* on recent developments and prospects—issued every three months on a preset schedule.

Annual Change D-J Industrials (Investment Companies)—the yearly change from year end to year end in the Dow Jones Industrial Average, expressed as a percentage.

Annual Change in Net Asset Value (Investment Companies)—the change in percentage terms of the net asset value per share at the end of any given year from what it was at the end of the preceding year, adjusted for any capital gains distributions made during the year.

Annual Rates of Change (Per Share)—compound yearly rates of change of per-share sales, cash flow, earnings, dividends, and book value, or other industry-specific, per-share figures, over the past 10 years and five years and estimated for the coming three to five years. Historical rates of change are computed from the average figures for a past three-year period to the most recent actual three-year period. Forecasted rates of change are computed from the average figure for the most recent three-year period to an average for a future three-year period. If data for a three-year period are not available, a two- or one-year base may be used.

Annual Total Return—a compound yearly return to shareholders that includes both stock price appreciation and dividend returns.

Annuity—a form of contract sold by life insurance companies that guarantees a fixed or variable payment at some future time.

Arithmetic Average—a simple mean. Items to be averaged are added and their sum is divided by the number of items. The result is an arithmetic, or simple, average (or mean).

Asset Quality (Bank and Thrift Industries)—an indicator of problem loans and other assets relative to total assets. A bank with good asset quality, for example, has a lower percentage of problem loans than the average bank.

Asset Value Per Share Year End (Investment Companies)—total common equity at year end, with securities valued at market rather than cost, divided by the number of shares outstanding at year end.

Assets—for a corporation, the total of current assets (normally cash and short-term investments, inventories, and receivables) and long-term assets (normally including property and equipment and good will).

Assets Year End (Investment Companies)—total investment company assets at market value, including stocks, bonds, government securities, and cash, at year end.

Available Seat Miles (ASM) (Air Transport Industry)—a measure of the airline seating capacity available for sale. Each ASM is one seat flown one mile.

Average Annual Dividend Yield—dividends declared per share for a year divided by the average annual price of the stock in the same year, expressed as a percentage.

Average Annual P/E ratio— is calculated by dividing the average price for a year with the actual reported earnings for that year and is shown in the Statistical Array.

Average Annual Price Earnings (P/E) Ratio—the average price of the stock for the year divided by earnings per share (excluding nonrecurring items, as determined by Value Line) reported by the company for the year. In the case of fiscal-year companies, all data are for the fiscal year. (*See also Price/Earnings ratio.)*

Average Interest Rate Paid (Financial Services Industries)—the interest paid during the year divided by the average debt outstanding.

Average Price for the Year—the sum of the 52 Wednesday closing prices for a stock for the year divided by 52.

Backlog—orders for goods and services that have been received but not yet delivered or rendered.

Balance Sheet—financial statement that lists the assets, debts, and owner's investment as of a specific date.

Basic Earnings Per Share—net income divided by the weighted average number of common shares outstanding during a period. (This calculation is required by the Financial Accounting Standards Board for all years ending after December 15, 1997.)

Basis Point—in the context of discussions on interest rates, one basis point equals one-hundredth of one percentage point.

Beta—a relative measure of the historical sensitivity of the stock's price to overall fluctuations in the New York Stock Exchange Composite Index. A Beta of 1.50 indicates a stock tends to rise (or fall) 50% more than the New York Stock Exchange Composite Index. The ‘‘Beta coefficient’’ is derived from a regression analysis of the relationship between weekly percentage changes in the price of a stock and weekly percentage changes in the NYSE Index over a period of five years. In the case of shorter price histories, a smaller time period is used, but two years is the minimum. The Betas are adjusted for their long-term tendency to converge toward 1.00.

Bond—a long-term debt instrument, characterized typically by fixed, semiannual interest payments and a specified maturity date.

Book Value Per Share—net worth (including intangible assets), less preferred stock at liquidating or redemption value, divided by common shares outstanding.

Business Data—a section on a Value Line company report that describes the company's most important products, lists large shareholders, and includes the company's address, telephone number, and Internet address.

Capacity at Peak (Electric Utility Industry)—a utility's generating capability plus purchases from other utilities less sales to other utilities.

Capacity Utilization—the ratio of actual production levels to maximum possible production levels, expressed as a percentage. The Federal Reserve Board publishes capacity utilization figures monthly for both the overall economy and individual industries.

Capital Funds (REIT Industry)—stockholders' equity (net worth) plus subordinated debt.

Capital Gains Per Share After Tax (Real Estate Industry)—profits derived net of income taxes on the sale of property (either land or buildings) during the year, expressed in terms of the number of common shares outstanding at yearend.

Capital Spending Per Share—the outlays for plant and equipment for the year expressed on a per-share basis. Excludes funds spent for acquisitions.

Capital Structure—a balance sheet item defined by Value Line as the total of a company's long-term debt, preferred stock at liquidation or redemption value, and its shareholders' equity.

Capitalization — see **Market Capitalization.**

Cash Assets—the sum of cash on hand plus short-term securities, such as Treasury bills, that can readily be converted into cash.

"Cash Flow"—the total of net income plus non-cash charges (depreciation, amortization, and depletion) minus preferred dividends (if any). See Free Cash Flow.

"Cash Flow" Line—also known as the “Value Line.” See page 17 for more information.

"Cash Flow" Per Share—net profit plus non cash charges (depreciation, depletion, and amortization), less preferred dividends (if any), divided by common shares outstanding at year end.

CD—abbreviation for Certificate of Deposit. See also Time Deposits.

Certificate of Deposit—*see Time Deposits.*

Closed-End Investment Company (or Fund)—a company or fund that has a relatively fixed number of shares (hence the term ‘‘closed-end’’) that are bought or sold through broker/dealers on the stock exchange. In contrast, an open-end (or mutual) fund stands ready (continually) to redeem shares for cash or issue new shares for cash and, hence, deals directly with its investors.

Combined Ratio (Insurance [Property/Casualty] Industry)—the percentage of losses to premiums earned plus the percentage of expenses to premiums written. The break-even point is 100%; in other words, a combined ratio of less than 100% represents an underwriting profit and a combined ratio of more than 100% represents an underwriting loss.

Common Equity Ratio—shareholder's equity divided by total capital (i.e., long-term debt, preferred equity, and common equity).

Common Shares Outstanding—the number of shares of common stock actually outstanding at the end of a company's accounting year. This total excludes any shares held in the company's treasury. The figures for common shares outstanding in previous years are fully adjusted for all subsequent stock splits and stock dividends.

Common Stock to Surplus (Insurance Industries)—the market value of the common stock held in the insurance company's investment portfolio divided by statutory net worth.

Compound Growth—the annual rate of growth of an investment when dividends or interest are reinvested.

Consumer Price Index—a Labor Department index, published monthly, designed to reflect changes in the cost of living. Housing, food, beverage, and transportation costs account for about 80% of the value of the index, which is a measure of inflation at the consumer level.

Conversion Price—the effective price paid for common stock when the stock is obtained by converting either convertible preferred stock or convertible bonds or debentures. For example, if a $1,000 bond is convertible into 20 shares of stock, the conversion price is $50, that is, $1,000 divided by 20.

Convertible Debentures—long-term debt instruments, not secured with collateral, that may be converted into a specified number of shares of common stock.

Convertible Preferred Stock—preferred stock that may be converted into a specified number of shares of common stock.

Corporate Profits—the aggregate of all profits for U.S. corporations reported by the Commerce Department as part of the domestic income and product (GDP) accounts. Reported both on a pretax and aftertax basis. They are somewhat different from profits reported to shareholders and profits reported for tax purposes.

Current Assets—assets that may reasonably be expected to be converted into cash, sold, or consumed during the normal operating cycle of a business, usually 12 months or less. Current assets usually include cash, receivables, and inventories.

Current Liabilities—financial obligations that will have to be satisfied within the next 12 months. Current liabilities include accounts payable, taxes, wage accruals, and total short-term debt, or Debt Due (the sum of notes payable and the portion of long-term debt maturing in the operating year).

Current Position—the components of a company's working capital are presented in this table in Value Line reports on industrial companies. The difference between current assets and current liabilities is known as Working Capital.

Current Ratio—the sum of current assets divided by the sum of current liabilities.

Cyclical Stock—stocks of companies whose earnings tend to fluctuate with the economy (the opposite of a growth stock, which is defined below).

d—a deficit, or a loss.

Debenture—a long-term debt instrument that is usually not secured by collateral.

Debt—see Total Debt, Long-Term Debt, Debt Due, and Total Debt Due in 5 Years.

Debt Due—the sum of bank notes and other notes payable in 12 months (or less) and that portion of long-term debt due within 12 months. See also Total Debt Due in 5 Years.

Demand Deposits (Bank Industries)—deposits that a depositor may withdraw from his account at any time.

Depletion—an accounting method that allows companies extracting oil, gas, coal, or other minerals to gradually reduce the value of these natural resources.

Deposits (Bank Industries)—total savings (time and demand deposits) entrusted to a bank.

Deposits (Thrift Industry)—funds that have been entrusted to a thrift.

Depreciation—an amount charged against operating profits to reflect the aging of plant and equipment owned by a company.

Diluted Earnings Per Share—net income (with certain possible adjustments) divided by the weighted average number of shares outstanding during a period, assuming any securities or other contracts to issue common stock (including options and warrants) were exercised or converted into common stock. (This calculation is required by the Financial Accounting Standards Board for all years ending after December 15, 1997.)

Dilution—the reduction in earnings associated with the hypothetical conversion of convertible securities into common stock. Also, in the context of a discussion of a merger or acquisition, the reduction in share earnings estimated to occur as a result of the merger or acquisition.

Discount From or Premium Over Net Asset Value (Investment Companies)—the difference between the net asset value and market price, expressed as a percentage of net asset value. If the price exceeds the net asset value, the percentage of the excess or premium is shown with a plus sign.

Disposable Income—a Commerce Department figure published monthly that reflects personal income less income taxes and other taxes. Conceptually, the statistic is designed to reflect funds available for consumers to spend or save.

Dividend—a payout to shareholders determined by a Board of Directors.

Dividend Yield—the year-ahead estimated dividend yield (shown in the top right-hand corner of the Value Line page) is the estimated total of cash dividends to be declared over the next 12 months, divided by the recent price of the stock.

Dividends Declared Per Share—the common dividends per share declared (but not necessarily paid) during the company's operating, fiscal year (displayed within the Statistical Array of the Value Line page). See also Dividends Paid Per Share.

Dividends Paid Per Share—the common dividends per share paid (but not necessarily declared) during the calendar year (indicated in the quarterly dividend box in the bottom left corner of the Value Line page). See also Dividends Declared Per Share.

Dow Jones Industrial Average—a price-weighted average of 30 of the largest U.S. industrial companies, published by Dow Jones & Co.

Dow Jones Transportation Average—a price-weighted average of 20 of the largest U.S. transportation companies, published by Dow Jones & Co.

Dow Jones Utility Average—a price-weighted average of 15 of the largest U.S. utility companies, published by Dow Jones & Co.

Downstream (Petroleum [Integrated] Industry)—the refining and marketing operations of an integrated oil company, as opposed to exploration and production activities (which are referred to as upstream operations).

Durable Goods—products used by consumers or businesses that are expected to last three or more years. These goods tend to be big-ticket items (for example, automobiles and washing machines). Durable goods sales are generally interest rate sensitive and correlate with the overall level of economic activity.

Dynamism—*see page 24.*

Earned Surplus—*see Retained Earnings.*

Earnings—see also Net Profit. A company's total profit before nonrecurring gains or losses, but after all other expenses.

Earnings Per Share—net profits attributable to each common share as originally reported by the company, but adjusted for all subsequent stock splits and stock dividends; may be based on weighted average shares outstanding (Basic EPS) or weighted average shares including all shares reserved for conversion of convertible securities (Diluted EPS). Annual and quarterly earnings per share figures on the Value Line page exclude nonrecurring or one-time gains and losses, which are noted in the footnotes.

Earnings Per Share (Bank Industries)—net profit after taxes, expressed on a per-share basis as reported by the company. Includes investment securities gains and losses after 1982.

Earnings Per Share Sensitivity to Change in Loss Ratio (Insurance [Property/Casualty] Industry)—the degree to which earnings per share will be affected by a one percentage point change in the insurance company's loss ratio.

Earnings Predictability—a measure of the reliability of an earnings forecast. Predictability is based upon the stability of year-to-year comparisons, with recent years being weighted more heavily that earlier ones. The most reliable forecasts tend to be those with the highest rating (100); the least reliable, the lowest (5). The earnings stability is derived from the standard deviation of percentage changes in quarterly earnings over an eight-year period. Special adjustments are made for comparisons around zero and from plus to minus.

Earnings Surprise—company earnings reports that are significantly better or worse than were forecast.

Equally Weighted Average—a stock price index that gives equal weight to each stock regardless of its price or market capitalization. The Value Line indexes are equally weighted averages.

Equity—ownership interest held by shareholders in a corporation (essentially the same as stock).

Equity Offering—the selling of stock by a corporation.

Ex-Dividend Date—the date by which an investor must have purchased a stock in order to receive announced dividends or stock distributions.

Expense Ratio (Insurance [Property/Casualty]Industry)—see Percent Expense to Premiums Written.

Expense Ratio (REIT Industry)—expenses other than interest, expressed as a percentage of the average assets.

Expenses/Assets (Investment Companies)—operating expenses expressed as a percentage of the investment company's total assets at yearend.

Exports—the sale of goods and services from one country to another. U.S. exports of goods and services are reported by the Commerce Department in its Gross Domestic Product (GDP) reports.

Federal Funds—a market among commercial banks in which banks that need a short-term loan in order to meet regulatory reserve requirements are able to borrow from banks with excess funds. The Federal Funds rate is the interest rate charged on such loans.

Federal Reserve Board—the governing body of the Federal Reserve System, which regulates certain banks and is charged with setting national monetary policy.

FHLB Advances (Thrift Industry)—funds borrowed from the regional Federal Home Loan Bank.

Financial Strength Rating—a relative measure of financial strength of the companies reviewed by Value Line. The relative ratings range from A++ (strongest) down to C (weakest), in nine steps.

Financial Times-Stock Exchange 100 (FT-SE 100)—a stock price index made up of 100 of the largest stocks traded on the London Stock Exchange. The index is published by The Financial Times, a London-based financial newspaper.

Finding Cost (Natural Gas [Diversified] and Petroleum Industries)—the amount of money spent per barrel to increase proved reserves through acquisitions, discovery, or enhanced recovery.

Fixed-charge Coverage (Electric Utility Industry)—pretax operating income after depreciation but before other income, interest charges, and Allowance for Funds Used During Construction (AFUDC), divided by long-term plus short-term interest plus twice the preferred dividend. Used as a measure of financial strength for an electric utility. A fixed charge coverage of 100 means that the operating income equals fixed expenses. A figure above 100 means that operating income exceeds fixed expenses, and vice versa.

Free Cash Flow—net income plus depreciation minus the total of dividends, capital expenditures, required debt repayments, and any other scheduled cash outlays.

Full Cost Accounting (Canadian Energy, Natural Gas Diversified, and Petroleum Industries)—a method of accounting under which all costs related to the exploration and development of oil and gas reserves are immediately expensed (a less conservative method than Successful Efforts Accounting).

Fully Diluted Earnings Per Share—earnings per share assuming conversion of all convertible securities plus the exercise of all warrants and options. Similar to Diluted Earnings, which replaced Fully Diluted EPS for all years after December 15, 1997.

Funds Borrowed (Bank Industries)—Federal Funds (free reserves borrowed from other banks), securities sold under Repurchase Agreements (‘‘repos’’), commercial paper sold by bank holding companies and non bank subsidiaries, and any other non deposit sources of short-term funds.

GAAP—abbreviation for the Generally Accepted Accounting Principles used by U.S. companies and determined by the Financial Accounting Standards Board (FASB), a private, industry-sponsored organization.

General and Administrative Expenses—expenses such as salaries, rents, advertising, and public relations.

Geometric Average—a geometric average is the nth root of the product of n terms. If n = 3, the geometric average of the three numbers would be the cube (or third) root of the product of the three numbers.

Goodwill—see intangibles.

Government Securities (Bank Industries)—fixed-income debt obligations of the U.S. Government and federal agencies.

Gross Billings (Advertising Industry)—the aggregate outlays for advertising paid by clients to the media. Billings generally serve as a basis for agency commissions.

Gross Dividend Declared per ADR (American Depositary Receipts)—dividends per ADR declared (but not necessarily paid) during the company’s fiscal year before any withholding taxes. For companies based in the United Kingdom, dividends declared are net of the Advance Corporation Tax.

Gross Equipment (Air Transport Industry)—the total of all flight equipment, ground stations, and other property, and all equipment (including property under capital lease) at original cost as reported by the airline company. Does not include advance payments for new equipment.

Gross Income (Financial Services Industry)—the total of interest on receivables, discounts, commissions, service charges, and other revenues.

Gross Income (REIT and Thrift Industries)—all income earned in normal operations excluding nonrecurring items such as gains from property sales.

Gross Income to Interest Ratio (Financial Services Industry)—gross income divided by total interest paid.

Gross Loans (Bank Industries)—total loans outstanding before deductions for loan-loss reserves and unearned income.

Gross Margin – Gross Profit as a % of Sales.

Gross Portfolio Yield (Investment Companies)—gross annual income (before any expenses) divided by total assets at yearend, expressed as a percentage.

Gross Profit (Industrial and Retail Industries) – The income remaining after subtracting the cost of the goods sold. Gross Profit is income before other expenses such as general, selling, and administrative costs, interest, depreciation, and taxes.

Growth Stock—stocks of companies whose earnings grow consistently over time reflecting the fact that such companies have limited sensitivity to the country's economy as it moves up and down (the opposite of a cyclical stock, which is defined above).

Holding Company—a business that confines its activities to owning stock in and supervising the management of other companies.

Housing Starts—the number of single- and multi-family units for which construction has begun. Published by the Commerce Department.

Imports—a country's purchases of goods or services from other countries. U.S. imports of goods and services are reported by the Commerce Department when it releases the Gross Domestic Product (GDP) report.

Income Dividends Per Share (Investment Companies)—dividends declared from net investment income on a per-share basis.

Income Statement—a financial report that lists revenues, expenses, and net income throughout a given period.

Income Stocks—stocks with higher-than-average dividend yields. (Often, but not always, stocks with dividends that are considered likely to be maintained or raised.)

Income Taxes—the total of all foreign and domestic (federal, state and city) taxes charged against income.

Income Tax Rate—total income taxes as a % of pretax income.

Industrial Production—a Federal Reserve index, published monthly, of the output of the nation's factories, mines, and utilities.

Industry Timeliness Rank—the relative *Timeliness* rank of an industry, updated weekly in the *Summary & Index* and calculated by averaging the *Timeliness* ranks of each of the stocks assigned a *Timeliness* rank in the industry. Industries with high *Timeliness* ranks are those with large percentages of stocks that also have high *Timeliness* ranks. The rank of each industry is listed on the front cover of *Summary & Index*, next to the name of the industry.

Initial Public Offering—a corporation's first equity offering to the public.

Initial Unemployment Insurance Claims—a weekly Labor Department compilation of new unemployment claims based on data from each of the States in the Union and Washington, D.C.

Insider Decisions—the number of decisions to buy or sell a company's shares made by officers and directors and shown by month for a nine-month period. This table is shown on the left side of the price chart on the *Ratings & Reports* page. (The source of this information is Vickers Stock Research Corp.)

Institutional Decisions—the number of decisions reported by investment managers having equity assets under management of $100 million or more to buy or sell a company's shares. This table appears on the left side of the price chart on the Value Line page. (The source of this information is Vickers Stock Research Corp.)

Insurance in Force (Insurance Industries)—the aggregate face amount of all life insurance policies outstanding.

Intangibles—assets such as goodwill (the excess of cost over net assets of companies acquired by purchase), patents, trademarks, unamortized debt discounts, and deferred charges. This figure, if it is material, is footnoted on the Value Line page.

Intangibles Per Share—intangible assets divided by the number of common shares at year end.

Interest—payment for the use of borrowed money. Many companies have both interest charges (for long- and short-term funds they have borrowed) and interest income (for money they have invested, usually in short-term, interest-bearing investments).

Interest Cost to Gross Income (Thrift Industry)—interest expenses for the year, expressed as a percentage of gross income.

Inventories—raw materials, work in progress, and finished products. LIFO (last-in, first-out) accounting minimizes illusory, but taxable, inventory profits in periods of rising prices because high-cost materials are expensed against income first. Under FIFO (first-in, first-out) accounting, the reverse is true. Average cost (middle-in, middle-out) is a compromise between LIFO and FIFO.

Inventory Investment—the change in inventories valued at average prices for the period, as published by the Commerce Department in its periodic Gross Domestic Product reports.

Inventory-to-Sales-Ratio—a ratio of inventories to sales, expressed as a percentage. An excessively high ratio may indicate that businesses have too much inventory on hand and are about to cut back production in order to reduce inventories. A decline in production would slow economic growth.

Inventory Turnover—sales divided by year-end inventory. A measure of the efficiency of inventory management.

Investment Company (or Fund)—a company or fund that invests in other companies (usually through the purchase of equity or debt securities) or invests in commodities or real property, etc., or any combination of the above.

Investment Income (Insurance Industry)—dividends, interest, and rents received on investments and any other investment income less the expenses of the investment department.

Investment Income Per Share (Insurance Industry)—dividends, interest, and rents received on investments less the expenses of the investment department, divided by the number of common shares outstanding at year end.

Large Cap — a market capitalization (stock price times shares outstanding) of more than $5 billion.

Leading Economic Indicators—a monthly Commerce Department index designed to gauge future economic activity.

Leases—contractual rentals of plant and equipment. Must be ''capitalized'' when most of the benefits and obligations of ownership are transferred to the lessee. Capitalizing leases increases long-term debt and gross plant, and depreciation and interest are charged to profits. Uncapitalized-lease accounting enhances the balance sheet, since the financial obligation is not shown.

Legends Box—the box at the top of the Price Chart in each full-page report in *The Value Line Investment Survey*. This box is labeled LEGENDS and includes the specific “Cash Flow” per share multiple that will be plotted on the Price Chart and lists stock splits. It also identifies the “Cash Flow” and Relative Price Strength lines that are plotted on the Price Chart

Leveraged Buyout—a corporate takeover, often led by members of management, in which funds are borrowed against company assets in order to pay off existing shareholders. As a result, a publicly held company becomes a highly leveraged, privately held company.

Life Premium Income (Insurance Industries)—funds received from policyholders in exchange for promises to make future payments upon (1) death or at a specific date or dates under various forms of life insurance and annuity contracts and/or (2) disability under accident and health contracts.

Load Factor (Air Transport Industry)—the percentage of total airline seating capacity that is actually sold and utilized. It is computed by dividing revenue passenger miles flown by available seat miles flown in scheduled service.

Load Factor (Electric Utility Industry)—the ratio of the average output in kilowatts supplied during a designated period to the maximum output occurring in that period.

Loan Loss Experience (Bank and Thrift Industries)—net loan charge-offs divided by average loans outstanding in a given period.

Loan Loss Provision (Bank and Thrift Industries)—funds set aside each quarter in order to cover future possible losses on loans that are not repaid. This figure appears on the bank’s income statement.

Loan Loss Reserve (Bank Industries)—reserves set aside at a point in time in order to cover future possible loan losses. This figure appears on the bank’s balance sheet.

Long-Term Debt—the portion of borrowings (including bank notes, debentures, and capitalized leases) that will be due not in the current 12 months, but in future operating years.

Long-Term Interest Earned—pretax income plus long-term interest expense (including capitalized interest) divided by long-term interest. *See Total Interest Coverage.*

Market Capitalization (Market Cap)—the market value of all common shares outstanding for a company, calculated by multiplying the recent price of a stock by the number of common shares outstanding. Large Cap stocks have market values of more than $5 billion. Mid Cap stocks have market values of from $1 billion to $5 billion. Small Cap stocks have market values of less than $1 billion. (When there are multiple classes of common stock, which often sell at different prices, the number of shares of each class is multiplied by the applicable price.)

Market-Capitalization Weighted Average—a stock price index weighted by the value of all shares outstanding for each stock. In such an index, large market capitalization stocks get proportionately more weight than small stocks.

Median—the middle value in an ordered series of numbers. As an example, if you ranked a number of stocks in order based on stock price from high to low, the stock price in the middle would be the median.

Median Price Earnings (P/E) Ratio (as shown on the top of a Value Line company report)—is the average annual P/E ratio of a stock over the past 10 years, with certain statistical adjustments made for unusually low or high ratios.

Merchandise Trade Balance—the difference between U.S. exports of goods and U.S. imports of goods. Published monthly by the Commerce Department.

Mid Cap — a market capitalization (stock price times shares outstanding) of from $1 billion to $5 billion.

Money Supply—Federal Reserve measures of money outstanding. The Federal Reserve is able to influence increases or decreases in the size of the money supply. If money supply grows significantly faster than overall economic growth for an extended period of time, higher rates of inflation often follow. If money supply grows too slowly, economic growth is inhibited.

NA—not available; information that was not available when the report went to press.

NASDAQ Composite—a market-capitalization weighted average of approximately 5,000 stocks traded electronically in the NASDAQ market.

Net Asset Value (Investment Companies)—the market value of a company's assets less any liabilities divided by the number of shares outstanding.

Net Income—see Net Profit.

Net Interest Income (Bank and Thrift Industries)—the dollar amount of interest received on loans and other investments, less the dollar amount of interest paid on deposits and other borrowings.

Net Interest Margin (Bank Industries)—the difference between interest rates earned (on loans and other earning assets) and interest rates paid (on deposits and other sources of funds) divided by total value of earning assets.

Net Loan Losses (Bank Industries)—loans written off during a period net of recoveries on loans previously written off. Also referred to as net loan charge-offs and net loan write-offs.

Net Profit (or Income)—a company's total profit before nonrecurring gains or losses, but after all other expenses.

Net Profit Margin—net income before nonrecurring gains and losses as a percentage of sales or revenues.

Net Revenues (Advertising Industry)—total commissions and fees received by the agency.

Net Sales—gross volume less returns, discounts, and allowances.

Net Working Capital—working capital less long-term debt, preferred stock at liquidating value, deferred taxes, minority interests, other long-term liabilities, and intangible assets. Occasionally the phrase is used in a less strict sense to mean working capital less long-term debt. See Working Capital.

Net Worth—all the assets shown on the balance sheet, including any intangible assets (i.e., goodwill, debt discount, deferred charges) less current liabilities, long-term debt, and all other noncurrent liabilities. In other words, the sum of common plus preferred stockholders' equity. Generally referred to as shareholders' equity.

New Loan Volume (Thrift Industry)—the total of loans originated plus loans purchased in a given period by a thrift.

New York Stock Exchange Composite—a market-capitalization weighted average of all the common stocks traded on the New York Stock Exchange.

Nikkei Stock Average—an index of 225 Japanese stocks. A barometer of the Japanese stock market.

NMF—not meaningful. Used when a number or ratio is so large or small that it is not meaningful. For example, a price/earnings ratio of 100 would probably not be meaningful because earnings in a particular period were unusually depressed.

Non-Financial Domestic Debt—the sum of U.S. consumer, business, and government borrowings outstanding.

Non-interest Expense (Bank Industries)—expenses other than interest and loan loss provisions, such as wages and overhead.

Non-interest Income (Bank Industries)—income other than interest income, such as trust fees, other fee income, and gains on securities transactions.

Non-performing Assets (Bank and Thrift Industries)—generally includes loans that are not providing, or are not expected to provide, interest income at the contractual rate. Also includes foreclosed properties.

Nonrecurring Items—various unusual gains or losses excluded from reported earnings by Value Line analysts in order to reflect income from ongoing operations. Nonrecurring items are footnoted by year on the Value Line page.

$100 DJI Grew To (Investment Companies)—the amount to which a $100 investment (divided equally) in each of the 30 Dow Jones Industrial Stocks would have grown from year end 1960 (or year in which the company began operations).

$100 Net Assets Grew To (Investment Companies)—the amount to which $100 invested in the net assets of a closed-end fund would have grown from year-end 1960 (or after the first year of the company's operation), assuming all capital gains distributions had been reinvested in additional shares.

Operating Earnings—earnings (profits) left after subtracting the cost of goods sold and marketing, general, and administrative costs from sales. Sometimes referred to as EBITDA (earnings before interest, taxes, depreciation, and amortization).

Operating Income—see Operating Earnings.

Operating Margin—operating earnings as a percentage of sales.

Operating Profit—see Operating Earnings.

Option—a contract that gives a buyer the right to buy or sell 100 shares of stock within a certain period of time and at a pre-established price. A call option gives an investor the right to buy 100 shares of stock at a specified price, while a put option allows him to sell 100 shares.

Output Per Hour (Nonfarm)—a Labor Department index of what U.S. non-agricultural workers produce, on average, in an hour. An increase in this index over time is an indicator of productivity gains.

Par Value—the nominal or face value of a stock or bond.

Passenger Yield (Air Transport Industry)—the average revenue per mile paid by each passenger, computed by dividing passenger revenues by revenue passenger miles.

Payout Ratio—see Percent All Dividends to Net-Profit.

P/E Ratio—the price of the stock divided by earnings for a 12-month period. See Average Annual Price-Earnings (P/E) Ratio, Current Price-Earnings (P/E) Ratio, Trailing Price-Earnings (P/E) Ratio, and Median Price-Earnings (P/E) Ratio.

Peak Load (Electric Utility Industries)—the greatest demand for power during a specified period of time.

Pension Liability—the total of all unfunded, vested pension benefits that have been accrued.

Percent All Dividends to Net Profit—the sum of all cash dividends (common and preferred) declared, but not necessarily yet paid, for a company's operating or fiscal year, divided by net profit for that year, expressed as a percentage. Also known as the payout ratio.

Percent Commissions (Securities Brokerage Industry)—income received for execution of trades in commodities, listed securities, NASDAQ transactions, and sales for mutual fund shares as a percentage of total revenues.

Percent Common Stocks (Investment Companies)—the value of common stocks held as a percentage of total assets at year end.

Percent Earned Common Equity—net profit less preferred dividends divided by common equity (i.e., net worth less preferred equity at liquidation or redemption value), expressed as a percentage. See Percent Earned Total Capital.

Percent Earned Shareholders' Equity—net profit divided by net worth, expressed as a percentage. See Percent Earned Total Capital.

Percent Earned Net Worth (REIT Industry)—net profit divided by average net worth for the year, expressed as a percentage.

Percent Earned Total Assets (Bank and Thrift Industries)—net profit divided by total reported assets, expressed as a percentage.

Percent Earned Total Capital—net profit plus one half the interest charges on long-term debt divided by total capital (i.e., long-term debt plus net worth), expressed as a percentage.

Percent Earned Total Capital (REIT Industry)—net profit plus total interest expense (i.e., the sum of short- and long-term interest outlays) divided by the average total capital (i.e., average total debt plus average net worth), expressed as a percentage. Should be compared to Percent Earned Net Worth to determine the impact of leverage (i.e., use of borrowed capital) to enhance the return to stockholders.

Percent Expense to Premiums Written (Insurance [Property/Casualty] Industry)—underwriting expense (commissions and general and administrative costs) divided by net premiums written less dividends to policyholders, expressed as a percentage. Also called the Expense Ratio.

Percent General & Administrative Expense to Gross Income (Thrift Industry)—expenses such as salaries, rents, and advertising and public relations costs divided by gross income for the year, expressed as a percentage.

Percent Interest Cost to Gross Income (Thrift Industry)—interest expenses for the year divided by gross income for the year expressed as a percentage.

Percent Interest Income (Securities Brokerage)—interest derived from funds loaned to customers' margin accounts plus interest on government and corporate securities held in the company's account, expressed as a percentage of total revenues.

Percent Investment Banking (Securities Brokerage Industry)—fees received for private placements, venture capital financing, real estate activity, mergers and acquisitions, exchange and tender offers, consulting, underwriting, and syndication participation, expressed as a percentage of total revenues.

Percent Investment Income to Total Investments (Insurance [Property/Casualty] Industry)—investment income less associated expense divided by total investments, expressed as a percentage.

Percent Losses to Premiums Earned (Insurance [Property/Casualty] Industry)—losses and loss expenses divided by premiums earned, expressed as a percentage. Also called the Loss Ratio.

Percent Price to Book Value (Insurance Industries)—the average price for the year divided by book value per share, expressed as a percentage.

Percent Principal Transactions (Securities Brokerage Industry)—trading and securities transactions for the firm's own account (e.g., block positioning, market making, and government, municipal, and corporate bond trading out of the company's inventory), expressed as a percentage of total revenues.

Percent Problem Assets to Mortgage Loans—total assets at year end that are problems.

Percent Short-Term Debt to Total Debt (Financial Services Industry)—all debt due in the next 12 months divided by total short-and long-term debt at year-end, expressed as a percentage.

Per Share Basis—total Sales, "Cash Flow," Earnings, or Dividends, and other data divided by the number of shares outstanding. Earnings and dividends are almost always described on a per share basis for ease of understanding.

Personal Consumption Expenditures—consumer spending reported monthly by the Commerce Department. Also included in the Gross Domestic Product (GDP) reports.

Personal Income—consumer income reported monthly by the Commerce Department. Also included in the Gross Domestic Product (GDP) reports.

Plant Age—an estimate derived by dividing accumulated depreciation at the most recent year end by the depreciation allowance in the most recent year.

Plowback Ratio—*see Retained to Common Equity.*

Policyholders' Dividends (Life Insurance Industries)—refunds to the policyholder of part of the premium paid on participation life insurance policies, reflecting the difference between the premium charged and actual mortality experience.

Policyholders' Surplus (Life Insurance Industries)—book value as determined using statutory accounting techniques. Statutory accounting, unlike generally accepted accounting principles (GAAP), does not permit deferral of policy acquisition costs.

Preference Stock—see Preferred Stock.

Preferred Stock—a security that represents an ownership interest in a corporation and gives its owner a prior claim over common stockholders with regard to dividend payments and any distribution of assets should the firm be liquidated. Preferred stock normally is entitled to dividend payments at a specified rate. These dividends must be paid in full before the payment of a common stock dividend. May or may not have seniority over preference stock (which is akin to preferred stock), depending on state regulations.

Preferred Stock Ratio—preferred stock at liquidation or redemption value divided by total capital (i.e., the sum of long-term debt, preferred equity, and common equity), expressed as a percentage.

Premium Income Per Share (Insurance Industries)—income to the insurance company consisting of payments made by life, accident and health, disability, and property/casualty insurance policyholders as provided for under the terms of their insurance contracts, divided by the number of common shares outstanding.

Premium Over Book (REIT Industry)—the percentage by which the average annual stock price exceeds the average annual book value per share. If the stock sells at a discount from book value, the percentage of that year is preceded by a minus sign.

Premium Over Net Asset Value (Investment Companies)—*see Discount From Net Asset Value.*

Premium Written to Surplus (Insurance [Property Casualty] Industry)—the total premium received for policies sold during the year divided by legally defined net worth.

Premiums Earned (Insurance Industry)—premiums received in advance for insurance protection that will remain in force for a year or more. Premiums accrue to revenues (i.e., are earned) only in proportion to the actual time elapsed under the policy relative to the entire policy term.

Premiums Written Per Share (Insurance [Property/Casualty] Industry)—the total premiums received from property/casualty insurance policyholders for policies sold during the year divided by the number of common shares outstanding.

Present Value—the amount that, if paid today, would be the equivalent of a future payment, or series of future payments, under specified investment assumptions. If, for example, funds can be invested today to yield 10% annually, a payment of $100 to be made one year hence has a present value of $90.91; that is, $100 divided by 1.10.

Pretax Corporate Profits—*see Corporate Profits.*

Pretax Margin—profits before federal, state, and foreign income taxes as a percentage of sales or revenues.

Price Chart—a graphic historical presentation of the movement of a stock and, often, additional information. The price chart that appears on each Value Line page includes monthly stock price ranges (small vertical lines), a cash flow line (a solid line with projections shown as dashes), and a relative-strength price line (a series of dots).

Price Earnings Ratio—Probably the most widely used measure of stock valuation. Value Line shows a variety of P/E ratios on every company page, as discussed below:

The P/E ratio on the very top of the Value Line page (item 6 on page 21). This is calculated by dividing the recent price of the stock by the total of the last six months earnings and the next six months of estimated earnings.

The *Relative P/E ratio*. This compares the P/E of one stock with the median of estimated P/E ratios of all stocks under Value Line review. A relative P/E of more than 1 indicates that a stock's P/E ratio is currently higher than that of the Value Line universe; a P/E of less than 1 indicates that this stock's P/E is less than the Value Line average.

A *Trailing P/E ratio*. This is calculated by dividing the recent price of the stock by the past 12 months of actual (reported) earnings. This is the figure shown in most newspapers.

A *Median P/E ratio*. This is the average annual P/E ratio of a stock over the past 10 years, with certain statistical adjustments made for unusually low or high ratios.

The *Average Annual P/E ratio*. This is calculated by dividing the average price for a year with the actual reported earnings for that year and is shown in the Statistical Array.

The *Average Relative Annual P/E ratio*. This is calculated by dividing the average annual P/E of a stock with the average annual P/E of all stocks under Value Line review.

Price Growth Persistence—a measurement of the historic tendency of a stock to show persistent price growth compared to the average stock. Value Line Persistence ratings range from 100 (highest) to 5 (lowest).

Price-Weighted Average—a stock price average that gives proportionately more weight to stocks with high share prices than it does to stocks with low prices. The Dow Jones Averages are price-weighted.

Primary Earnings Per Share—earnings per share calculated on the assumption of the conversion of certain senior securities (those of the company deemed, according to an accounting formula, to be common stock equivalents—that is, likely to trade like common shares) into common stock. This calculation has not been used since 1997.

Prime Rate—the base lending rate reported by the largest commercial banks in the nation.

Problem Assets (Thrift Industry)—delinquent loans, loans past due 90 days or more, and foreclosed real estate.

Producer Price Index (PPI)—Labor Department price indexes of goods categorized by industry and by stage of processing. Widely watched among them are the raw materials, intermediate goods, and finished goods indexes. A measure of inflation.

Projections Box—a box appearing in the upper left corner of a Value Line stock page. It includes the absolute price gain expected for the next 3 to 5 years as well as the compound annual return (appreciation plus dividends) during the same period.

Proved Reserves (Petroleum and Natural Gas /Diversified Industries)—quantities of natural resources that engineering estimates indicate with reasonable certainty are economically recoverable using present technology.

Quarterly Earnings—box appearing at the lower left hand corner of *The Value Line Investment Survey* page (directly below the quarterly sales box) in which five years of actual and estimated earnings are listed for each of the four quarters of each listed year.

Quarterly Sales—box appearing at the lower left hand corner of *The Value Line Investment Survey* page in which five years of actual and estimated sales are listed for each of the four quarters of each listed year.

Rate Base (Electric Utility Industry)—usually the net original cost of plant and equipment; in some instances including an allowance for cash, working capital, materials, and supplies.

Real—in the context of economic activity, a measure that excludes the effects of inflation. Real Gross National Product, for example, is a measure of the nation's output of goods and services, adjusted for inflation.

Real Estate Investment Trust (REIT)—a financial intermediary that invests its equity capital and debt in income-producing real estate and mortgages. Under legislation passed in 1961, REITs were granted conduit tax treatment (the same as that permitted mutual funds) under which the part of earnings which flows through to shareholders in the form of dividends is exempt from Federal income taxes at the trust (or corporate) level, provided several conditions are met. Among the conditions for qualification as a REIT under the Internal Revenue Code: At least 95% of otherwise taxable income must be distributed to shareholders in the calendar year earned, and specified percentages of both investments and gross income must be related to real estate.

Realized Gain or Loss—profit or loss on the sale of an asset.

Receivables—the value of goods and services sold and shipped to customers, for which the company has yet to be paid.

Receivables (Financial Services Industry)—the amount of money owed to finance companies by customers at year-end, net of unearned discount (the charges to the borrower) and loss reserves.

Relative Price-Earnings (P/E) Ratio—the stock's current P/E divided by the median P/E for all stocks under Value Line review. (*See also Price Earnings Ratio.*)

Relative Strength Price Line—a representation shown in the price chart on each Value Line page as a series of dots. The line compares the price of a stock with the price of an index (in this case the Value Line Arithmetic Composite) over time. When the line is rising, the stock is acting better than the broad index. When it is falling, the stock is acting worse than the index.

Reserve Life (Natural Gas [Diversified] and Petroleum Industries)—a company's reserves of oil, gas, or other natural resources divided by annual production.

Reserve Replacement Ratio (Natural Gas and Petroleum Industries)—the ratio of reserve additions to production. Reserve replacement is calculated by summing the total reserves added over a five-year period. The ratio is calculated by dividing replacement by production over the same period.

Retail Sales—a monthly measure of all U.S. retail activity, published by the Commerce Department.

Retained Earnings—net profit for the year, less all common and preferred dividends, when relating to the income account. With respect to the balance sheet or common equity, it is the sum of net profit in all years of the company's existence less all dividends (common and preferred) ever paid. In this case, also known as earnings retained or earned surplus.

Retained to Common Equity—net profit less all common and preferred dividends divided by common equity including intangible assets, expressed as a percentage. Also known as the Plowback Ratio.

Return on Shareholders' Equity—annual net profit divided by year-end shareholders' equity

Return on Total Capital—annual net profit plus 1/2 of annual long-term interest divided by the total of shareholders' equity and long-term debt

Revenue—see Sales.

Revenue Passenger Miles (Air Transport Industry)—a measure of airline traffic. Each revenue passenger mile represents one revenue-paying passenger flown one mile.

Revenues (Banks)—this figure has not been used by most banks in the past. However, the combination of net interest income and non-interest income will provide investors with a close approximation.

Revenues (Electric Utility, Natural Gas [Distribution], Telecommunications Industries)—the amounts billed for services rendered.

Revenues (Real Estate Industry)—the total of rental, construction, and interest income and property sales.

Revenues Per Share—gross revenues for the year divided by the number of common shares outstanding at year end.

Safety Rank—a measurement of potential risk associated with individual common stocks. The Safety Rank is computed by averaging two other Value Line indexes—the Price Stability Index and the Financial Strength Rating. Safety Ranks range from 1 (Highest) to 5 (Lowest). Conservative investors should try to limit their purchases to equities ranked 1 (Highest) and 2 (Above Average) for Safety.

Sales—gross volume less returns, discounts, and allowances; net sales.

Sales Per Share—net sales divided by the number of common shares outstanding at year-end.

Savings Deposits Per Share (Thrift Industry)—total savings deposits at year-end divided by the number of common shares outstanding at yearend.

Savings Rate—the personal savings rate, expressed as a percentage of consumer income, published monthly by the Commerce Department.

Seasonally Adjusted—a statistical method of adjusting economic data for seasonal differences in economic activity. For example, monthly retail sales are adjusted for the surge of buying that takes place during the end-of-year holiday season.

Shareholders' Equity—a balance sheet item showing a company's net worth. Represents the sum of common and preferred equity including redeemable preferred. Also includes intangibles.

Short-Term Debt—all debt due in the next 12 months and, therefore, considered a current liability. Same as Debt Due. See Total Debt.

Small Cap—a market capitalization (stock price times shares outstanding) of less than $1 billion.

Spot Market—a market in which commodities are purchased or sold and delivered quickly, that is, on the spot.

Standard Deviation—a statistical measure of volatility.

Standard & Poor's 500—a market-capitalization weighted index of 500 large U.S. common stocks.

Statistical Array—the large statistical section in the center of each Value Line company report in *Ratings & Reports*. The section contains up to 17 columns of historical information and three columns of estimates on 23 different data items.

Statutory Insurance Accounting (Insurance Industries)—the accounting method required for insurance companies reporting to state insurance regulatory authorities. It is a cash bookkeeping technique, rather than the usual method used in business.

Stock (Common)—units of ownership of a public corporation.

Stock Dividend—the issuance of additional common shares to common stockholders, with no change in total common equity. From an accounting standpoint, retained earnings (i.e., the earned surplus) are reduced and the value of the reported common stock component of common equity (usually called the ‘‘par value’’ account) is increased. (The reduced level of retained earnings is important since bond indentures limit dividend payouts by stipulating minimum levels of retained earnings.) See Stock Split.

Stock (Preferred)—a class of stock that generally has preference over common stock in the payment of dividends and the liquidation of assets and normally pays dividends at a specified rate.

Stock's Price Stability—a relative ranking of the standard deviation of weekly percent changes in the price of a stock over the past five years. The ranks go from 100 for the most stable to 5 for the least stable.

Stock Split—an increase in the number of common shares outstanding by a fixed ratio, say 2-to-1 or 3-to-1, with proportionate allocation of underlying common equity (i.e., the sum of common stock, capital surplus, and retained earnings) and earnings to the increased number of shares outstanding. Total common equity remains the same. From an accounting standpoint, the mix of retained earnings, capital surplus, and common stock remains unchanged. See Stock Dividend. When there is a stock split or dividend, **all historical per-share numbers (including past share prices) are adjusted to reflect the new shares outstanding.** If, for example, a company's stock traded in a range of 40 to 60 last year and it reported earnings of $2.00 per share, after adjustment for a 2-for-1 stock split, the price range for last year would be 20 to 30 and earnings would be $1.00 a share.

Successful Efforts Accounting (Canadian Energy, Natural Gas [Diversified], and Petroleum Industries)—a method of accounting under which exploratory wells found to be dry are expensed as incurred. See Full Cost Accounting.

Supplementary Report—an update of a regular full-page Value Line company report published in the back of the *Ratings & Reports* section when there is a significant development relating to a company. Among the most likely reasons for a Supplementary Report are a major corporate development, such as a merger or acquisition, an unexpectedly good or poor earnings announcement, a change in the sales or earnings outlook, an increase or decrease in the *Timeliness* rank.

Surplus (Insurance Industries)—the amount by which assets exceed liabilities on a legally defined accounting basis.

Target Price Range—the projected average annual price range three to five years hence, based on Value Line earnings and P/E Ratio forecasts. The midpoint of the range is our estimate of the average annual price three to five years from now. The percentage appreciation potential and the estimated annual total return are computed from the projected low and high prices three to five years hence.

Technical Rank—Value Line's proprietary ranking of estimated stock price performance relative to the overall market in the next three to six months, based on a complex analysis of the stock's relative price performance during the previous 52 weeks. Unlike the Timeliness Rank, earnings are not a factor in the Technical Rank. Stocks ranked 1 (Highest) and 2 (Above Average) are likely to outpace the market during the next quarter or two. Those ranked 4 (Below Average) and 5 (Lowest) are expected to underperform most stocks. Stocks ranked 3 (Average) will probably advance or decline with the market. The Technical Rank is purely a function of relative price action and is primarily a predictor of relative short-term price movements. (It may thus be particularly useful in trading short-term instruments such as stock options.) Investors should try to limit purchases to stocks with Technical Ranks of 1 (Highest) and 2 (Average). Under no circumstances, however, should the Technical Rank replace the Timeliness Rank as the primary tool in making an investment decision. Over the years, the Timeliness Rank has had a superior record.

Tender Offer—a way of taking over a company by offering shareholders a fixed (or variable) price for all outstanding stock. If enough shareholders decide to sell, the company can be taken over.

3- to 5-Year Projections—a potential average high and low stock prices Value Line forecasts for a period 3 to 5 years in the future.

Thrift—a financial institution deriving its funds primarily from consumer savings accounts.

Ticker Symbol—the abbreviation of the company's name by which a security is identified for purposes of trading. Also called *Stock Symbol*.

Time Deposits—interest-bearing deposits that a financial institution may require to remain on deposit for a specified period of time. Also called certificates of deposit.

Timeliness Rank—the rank of a stock's probable relative market performance in the year ahead. It is derived via a computer program using as input the long-term price and earnings history, recent price and earnings momentum, and earnings surprise. All data are known and actual. Stocks ranked 1 (Highest) and 2 (Above Average) are likely to outpace the year-ahead market. Those ranked 4 (Below Average) and 5 (Lowest) are expected to underperform most stocks over the next 12 months. Stocks ranked 3 (Average) will probably advance or decline with the market in the year ahead.

Investors should try to limit purchases to stocks ranked 1 (Highest) and 2 (Above Average) for Timeliness.

Timely Industries—see *Industry Timeliness*.

Timely Stocks—those ranked 1 or 2 for *Timeliness*. These are the stocks Value Line thinks will perform better than the Value Line universe as a whole in the coming six to 12 months.

Top Line—a reference to sales, which are usually shown on the top line of an income statement.

Total Capital—the sum of long-term debt, preferred stock at liquidation or redemption value, and common equity including intangibles.

Total Debt—the sum of long-term debt shown in the Capital Structure box and debt due displayed in the Current Position box.

Total Debt Due in 5 Years—the sum of bank notes due in 12 months (or less) and all long-term debt maturing within the next five years (including that portion of long-term debt due in the current operating year). See also Debt Due.

Total Distributions (Investment Companies)—total payments (capital gains plus dividends) made to shareholders of a fund.

Total Interest Coverage—pretax income plus total interest expense (including capitalized interest) divided by total interest expense.

Total Return (%)—the sum of the total appreciation (or depreciation) of a stock over a given period plus any cash dividends received during the same period divided by the price of the stock at the beginning of the period. Each Value Line page shows the total cumulative returns (if available) for the past 1, 3, and 5 years. Each page also denotes the total returns for the Value Line Arithmetic Index for the same periods for comparative purposes. (For more, see Value Line Arithmetic Composite Index)

Total Revenues (Securities Brokerage Industry)—gross revenue from all sources, including commissions, investment banking fees, principal transactions, and interest income (generally without deduction for interest expense) derived from funds loaned to customers' margin accounts plus interest on securities held in the company's account.

Trailing Price Earnings (P/E) Ratio—the recent price of the stock divided by the sum of earnings per share reported during the last 12 months.

Translation Rate (Foreign Stocks)—the exchange rate at which financial data are converted into dollars. Historical data are translated at the exchange rate on the last day of the fiscal year. In the case of quarterly data for the current fiscal year and all estimates, the translation rate is the estimated exchange rate at fiscal year end.

Treasury Stock—common stock issued and then reacquired by the issuing firm. Such reacquisitions result in a reduction of stockholders' equity.

Unconsolidated Income—aftertax earnings of partially or wholly owned subsidiaries whose financial results are not included in the pretax financial results or income taxes reported.

Underwriting Income Per Share (Insurance [Property/Casualty] Industry)—underwriting profit divided by the number of common shares outstanding at year-end.

Underwriting Margin (Insurance Industries)—the difference between 100% and the sum of the loss and expense ratios in property/casualty underwriting. It may be either positive (indicating an underwriting profit) or negative (indicating an underwriting loss).

Unemployment Rate—a Labor Department measure of the ratio of the number of unemployed in the labor force, expressed as a percentage. The Civilian Unemployment Rate is based on a work force that excludes U.S.-stationed members of the armed forces. The National (or Total) Unemployment Rate is based on a work force that includes U.S.-stationed members of the armed forces.

Unit Labor Costs (Nonfarm)—a Labor Department index based on the ratio of the Compensation Per Hour Index (Nonfarm) and the Output Per Hour Index (Nonfarm). Unit labor costs are useful because they illustrate how productivity gains offset rising wages, or how wage increases outstrip productivity gains.

Unrealized Appreciation (or Depreciation)—the dollar amount by which the market value of a holding exceeds (or falls below) its cost.

Untimely Stocks—those ranked 4 or 5 for *Timeliness*. These are stocks Value Line thinks will perform less well than the market in the coming six to 12 months.

Upstream—see Downstream.

Value Line Arithmetic Composite Index—an equally weighted price index of all stocks covered in *The Value Line Investment Survey*. Arithmetic refers to the averaging technique used to compute the average. See Arithmetic Average.

Value Line Geometric Composite Index—an equally weighted price index of all stocks covered in *The Value Line Investment Survey*. Geometric refers to the averaging technique used to compute the average. See Geometric Average.

Value Line Geometric Industrial Index—an equally weighted price index of all stocks in *The Value Line Investment Survey*, except for utilities and rails. Geometric refers to the averaging technique used to compute the average. See Geometric Average.

Value Line Geometric Rails Index—an equally weighted price index of railroad stocks reviewed in *The Value Line Investment Survey*. Geometric refers to the averaging technique used to compute the average. See Geometric Average.

Value Line Geometric Utilities Index—an equally weighted price index of utility stocks reviewed in *The Value Line Investment Survey*. Geometric refers to the averaging technique used to compute the average. See Geometric Average.

Warrant—an option to buy a security, usually a common stock, at a set price (exercise price) over an established number of years. A warrant has no claim on either the equity or the profits of a company.

Working Capital—current assets less current liabilities. See also Current Assets, Current Liabilities, and Net Working Capital.

Writedown—a company's recognition of a reduction in value of an asset. The decline in value is charged against income in the period that the writedown is taken.

Yield (for stocks)—the estimated dividends for the next 12 months divided by the current price, expressed as a percentage.

Yield-Cost Margin (Thrift Industry)—the difference between interest rates earned (on loans and other earning assets) and interest rates paid (on deposits and other sources of funds).

Yield Curve—a measure of the relationship between short-and long-term interest rates. Often the yields on three-month Treasury bills and 30-year Treasury bonds are compared. The yield curve is said to be positive when long-term rates are higher than short-term rates. When short-term and long-term rates are about equal, the yield curve is said to be flat. The yield curve is said to be inverted when short-term rates are higher than long-term rates.

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KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

38. Refer to the Bulkley Direct Testimony, page 41, lines 1-3. Explain how the average of the Value Line beta coefficients for the proxy group companies from 2013-2022 were calculated. Include in the response a description of the data.

Response:

Exhibit AEB-5 provides the Value Line beta coefficients for each company in Ms. Bulkley's proxy group as of the end of the year for the period of 2013 through 2022 as downloaded from Value Line. Please see the response to PSC 2-37 part b for a description of the methodology relied on by Value Line to estimate the beta coefficient for a company. Ms. Bulkley's long-term average beta coefficient for each of the companies in her proxy group was calculated as an average of the Value Line beta coefficients for the period of 2013 through 2022.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Ann Bulkley

39. Refer to the Bulkley Direct Testimony, Exhibit AEB-2, page 1.

    a. Provide each of the Value Line Investment Survey company profile sheets supporting the return on equity analyses.

    b. Explain whether any of the natural gas utilities have water operations.

    c. Confirm that there were no other regulated electric utilities that satisfied the proxy group selection criteria. Include in the response the importance of Eversource Energy having a water operation subsidiary.

Response:

a. Please see KAW_R_PSCDR2_NUM030_081823_Attachment 14.

b. Northwest Natural Gas Company ("NWN") owns water operations in Arizona, Idaho, Oregon, Texas, and Washington.

c. Eversource Energy was the only electric utility to meet Ms. Bulkley's proxy group selection criteria. As discussed in the response to PSC 2-36, Ms. Bulkley applied a set of screening criteria to develop a proxy group that balanced the relative risk of the companies included in the proxy group with the overall size of the group. The application of the selected screening criteria resulted in a group of water, natural gas and electric utilities that are comparable in risk to KAWC.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Nicholas Furia

40. Refer to the Direct Testimony of Nicolas Furia (Furia Direct Testimony), page 4, lines 15-17.

    a. Explain why Kentucky-American does not include preferred stock in their total debt.

    b. Explain how Kentucky-American issues its preferred stock.

    c. Explain a scenario when Kentucky-American would issue preferred stock over debt, either long-term or short-term.

Response:

a. Preferred Stock or Preference Shares are neither common equity nor debt. It is a hybrid of the two and as with past filings the Company has presented it as a separate item.

b. Kentucky-American issued the outstanding preferred stock in December 1991 and has not issued preferred stock since that time.

c. Kentucky-American does not currently plan to issue preferred stock.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Nicholas Furia

41. Refer to the Furia Direct Testimony, page 4. Explain what major changes, in regard to the capital structure, have occurred since Kentucky-American's 2018 rate case.[3]

Response:

Although the Company is unsure as to the definition of major changes, the Company provides the following information relating to activity in long-term debt, short-term debt, and equity since the 2018 rate case.

Issue Date	Long-Term Issuances
5/22/2019	16,000,000
5/24/2021	13,000,000
5/18/2022	10,000,000

Year	Short-Term Debt Activity *
2019	3,446,964
2020	9,431,784
2021	(10,997,967)
2022	(6,428,818)
JulYTD 2023	6,900,439

** Excludes the 364-day term loan executed by American Water to provide additional liquidity during the COVID-19 emergency (March 2020 through March 2021).*

Issue Date	Equity Infusions
12/9/2019	31,274,396
7/31/2020	30,069,791
10/31/2022	28,703,793
3/15/2023	29,968,307

Year	Retained Earnings *
2019	5,686,074
2020	4,152,591
2021	6,140,764
2022	14,216,507
JulYTD 2023	4,770,659

** Retained Earnings are net of Dividends.*

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[3] Case No. 2018-00358, *Electronic Application of Kentucky-American Water Company for an Adjustment of Rates* (Ky. PSC Nov. 28, 2018).

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Nicholas Furia

42. Refer to the Furia Direct Testimony, page 4, lines 20-21. Explain what debt requirements, long-term and short-term, Kentucky-American currently has. Include in the response if Kentucky-American has fulfilled these requirements.

Response:

Refer to the Furia Direct Testimony, page 5, lines15-18 for explanation of forecasted long-term debt requirements and page 6, lines 14-22 continued on page 7, lines 1-2 for details on currently modeled assumptions for long-term debt issuances. For short-term debt refer to page 6, lines 3-12 for explanation of Kentucky-American's short-term debt requirements.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Nicholas Furia

43. Refer to the Furia Direct Testimony, page 6. Explain whether when Kentucky-American issues debt, either long-term or short-term, that it also issues equity.

Response:

Kentucky-American evaluates its capital structure holistically, balancing debt and equity needs to provide cost-effective financing to support the Company's rate base and capital investment. Timing of debt and equity issuances are driven by market conditions, availability and/or constraints on short-term debt limits.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Nicholas Furia and Ann Bulkley

44. Refer to the Furia Direct Testimony, page 6, line 21. Refer also to the Bulkley Direct Testimony, page 38, lines 6-8. Explain whether the 4.95 percent and 5.56 percent debt interest rates are forecasted to show the current market conditions or Kentucky-American is anticipating a decline in interest rates.

Response:

Kentucky-American does not attempt to independently forecast interest rates. The Company utilizes Bloomberg's Forward Swap Curves to estimate future interest rates for modeling purposes. The underlying 10-year and 30-year treasury rates included the interest rates noted above are 3.57 percent and 3.88 percent, respectively. The 10 year historical average for the 10 year and 30 year treasury rates are 2.24 percent and 2.79 percent, respectively. The forecasted 10-year and 30-year treasury rates remain elevated to historical levels by 133 and 109 basis points, respectively.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Nicholas Furia

45. Refer to the Furia Direct Testimony, page 7, lines 1-2. Provide support for the projected 1 percent issuance costs for new bonds.

Response:

Please refer to KAW_R_PSCDR2_NUM045_081823_Attachment for 2019, 2021 and 2022 Actual Debt issuance costs which supported the projected 1 percent issuance costs for the new bonds. Please note: There was no bond issuance in 2020.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Larry Kennedy

46. Refer to the Direct Testimony of Larry E. Kennedy (Kennedy Direct Testimony), pages 3-4.

   a. Explain why Kentucky-American changed the depreciation method from the Retirement Rate Analysis to the Straight-Line Method.

   b. Explain the major differences between the two methods and include in the explanation which method is more commonly used by public service commission's across the United States.

Response:

a. There has been no change to the method used in the selection of depreciation parameters nor in the method of allocation used in the current depreciation study.

   The retirement rate method of analysis (sometimes referred to as the "actuarial analysis") is used to select the average service life and Iowa curve dispersion pattern using the historical retirement transactions. This step of analysis was conducted in both the current study and in the previously completed depreciation study. The retirement rate analysis is commonly used throughout the United States and Canada and has a long history of acceptance by regulatory commissions.

   The straight-line method allocates the depreciation expense to customers on an equal and systematic basis. This is in contrast to accelerated or decelerated methods of allocation, which favor the recovery of investment either earlier or later in the life of an asset. The straight-line method is the most commonly accepted method of allocation for regulated utilities throughout North America.

   Both the previous depreciation study and the current depreciation study were conducted using the Average Life Group procedure, the Straight-Line method, and Remaining Life Cradle to Grave technique. The retirement rate analysis was used by both Concentric, and previously by Gannett Fleming, to select the appropriate depreciation parameters for each account. There has been no change in the procedure, method, nor technique for this study. Furthermore, there has not been any change to the method used in the selection of average service life and Iowa curve dispersion pattern.

b. Please see the response to a above.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Larry Kennedy

47. Refer to the Kennedy Direct Testimony, pages 7-8. Provide the impact on depreciation expense for each account that's average service life was changed.

Response:

Please refer to the attachment "KAW_R_PSCDR2_NUM047_Attachment 1" for a table that contains the comparisons and impact of the proposed depreciation rates against the previous annual accrual rates on an account-by-account level. The accounts whose lives were changed from the previous study have been noted in the table.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Larry Kennedy

48. Refer to the Kennedy Direct Testimony, page 14. Considering the difference of the remaining life between the Retirement Rate Analysis and the Straight-Line Method, explain why Kentucky-American changed depreciation methods.

Response:

Please see the response to KAW_R_PSCDR2_NUM046 for a discussion of the retirement rate method of analysis and the straight-line method of allocation. There has been no change in depreciation procedures, methods, nor techniques in this depreciation study.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Larry Kennedy and Shelley Porter

49. Refer to the Kennedy Direct Testimony, 2022 Depreciation Study. Confirm that the Qualified Infrastructure Project (QIP) is not included in any part of the depreciation study.

Response:

All assets placed into service and posted to Continuing Property Records (CPRs) on or before December 31, 2022, are captured in the 2022 Depreciation study. This would include pipeline projects funded through the QIP mechanism.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Larry Kennedy

50. Refer to the Kennedy Direct Testimony, 2022 Depreciation Study, Section 3.1.2, page 3-3. Concentric recommends changing the minimum remaining life to three years of each vintage with each account to avoid any over recovery in the oldest vintages. Provide the impact this methodology change has on the depreciation rate. Include in the response any other impacts this methodology has on the depreciation study generally.

Response:

Please refer to Attachment "KAW_R_PSCDR2_NUM050 Attachment 1" for the detailed calculations that include the minimum remaining life of three years for each vintage. Please refer to "KAW_R_PSCDR2_NUM050 Attachment 2" for the detailed calculations that do not include the minimum remaining life.

When comparing the two sets of detailed calculation pages, the impact this methodology change has on the depreciation rate can be seen. Depreciation rates calculated using the minimum remaining life of three years may be significantly lower than those calculated with a minimum remaining life of 1 year, as was done in the previous depreciation study. This is due to the impact of depreciating older vintages over three years instead of one year. For example, on p.28 of both Attachments, in Account 320.200 – Water Treatment Equipment – Filter Media, there are three vintages impacted by this change. In Attachment 1, the vintages 2009, 2010 and 2011 each have remaining lives of 3.00 years, resulting in a total depreciation expense of $78,760. In Attachment 2, the vintages 2009, 2010, and 2011 all have the original remaining lives of 1.04, 1.26, and 1.51, respectively, resulting in a total depreciation expense of $144,344. This change results in a total depreciation expense decrease of 45 percent for Account 320.200. Similar reductions are seen in other accounts throughout the study.

Kentucky - American Water Company

Account #: 304.100 - Structures & Improvements - Supply

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2.5
ASL: 45
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1984	6.36	5	4	0.5360	3	14.14	0	38.5
1991	39.99	27	21	0.4584	25	18.58	1	31.5
2002	199,476.16	92,676	72,336	0.3153	157,062	26.82	5,856	20.5
2003	404,298.72	179,443	140,061	0.3012	324,883	27.63	11,757	19.5
2004	42,189.32	17,840	13,924	0.2870	34,593	28.45	1,216	18.5
2006	1,656,048.41	629,557	491,386	0.2580	1,413,069	30.12	46,908	16.5
2008	58,979.41	19,852	15,495	0.2285	52,331	31.83	1,644	14.5
2010	14,388,408.94	4,204,460	3,281,696	0.1983	13,264,974	33.57	395,195	12.5
2012	706,370.32	174,521	136,219	0.1677	676,107	35.33	19,136	10.5
2013	163,104.43	36,573	28,547	0.1522	159,024	36.23	4,390	9.5
2014	1,545,881.13	311,075	242,802	0.1366	1,534,961	37.13	41,345	8.5
2015	93,662.22	16,678	13,017	0.1209	94,694	38.03	2,490	7.5
2016	285,010.40	44,104	34,425	0.1050	293,337	38.94	7,532	6.5
2017	122,713.51	16,111	12,575	0.0891	128,546	39.86	3,225	5.5
2018	266,533.69	28,704	22,404	0.0731	284,109	40.79	6,966	4.5
2019	434,429.72	36,477	28,472	0.0570	471,123	41.71	11,294	3.5
2020	3,060,348.65	183,979	143,600	0.0408	3,375,801	42.65	79,156	2.5
2021	1,108,464.33	40,076	31,280	0.0245	1,243,454	43.59	28,529	1.5
2022	931,778.07	11,260	8,788	0.0082	1,062,756	44.53	23,868	0.5
TOTAL	25,467,743.78	6,043,418	4,717,053		24,570,852		690,508	

COMPOSITE ANNUAL ACCRUAL RATE	2.71%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	10.16
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	35.71

Kentucky - American Water Company

Account #: 304.200 - Structures & Improvements - Pumping

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	10,283.77	9,667	11,826	1.0000	0	11.87	0	88.5
1948	2,166.09	1,848	2,455	0.9855	36	16.78	2	74.5
1951	8,700.53	7,234	9,611	0.9606	394	18.00	22	71.5
1955	5,281.79	4,230	5,619	0.9251	455	19.74	23	67.5
1957	24,208.77	18,994	25,235	0.9064	2,605	20.65	126	65.5
1958	23,751.19	18,438	24,495	0.8968	2,818	21.12	133	64.5
1959	51,381.05	39,452	52,414	0.8870	6,674	21.60	309	63.5
1962	4,217.13	3,128	4,155	0.8568	695	23.08	30	60.5
1966	8,053.51	5,675	7,540	0.8141	1,722	25.17	68	56.5
1967	65,756.77	45,707	60,724	0.8030	14,897	25.71	579	55.5
1970	69,922.36	46,535	61,824	0.7688	18,587	27.38	679	52.5
1971	23,550.63	15,435	20,506	0.7572	6,577	27.96	235	51.5
1972	55,567.95	35,849	47,627	0.7453	16,276	28.54	570	50.5
1973	3,602.44	2,287	3,038	0.7333	1,105	29.12	38	49.5
1974	2,872.93	1,793	2,383	0.7212	921	29.72	31	48.5
1975	12,121.04	7,438	9,881	0.7089	4,058	30.32	134	47.5
1978	6,162.43	3,580	4,756	0.6711	2,331	32.16	72	44.5
1987	264,561.62	126,136	167,577	0.5508	136,669	38.05	3,592	35.5
1988	14,014.08	6,512	8,652	0.5368	7,465	38.74	193	34.5
1989	416,036.69	188,246	250,093	0.5227	228,350	39.43	5,792	33.5
1991	26,254.00	11,231	14,921	0.4942	15,271	40.82	374	31.5
1992	1,875,689.30	779,021	1,034,963	0.4798	1,122,080	41.53	27,022	30.5
1993	21,577.08	8,690	11,545	0.4653	13,268	42.24	314	29.5
1997	802.79	282	375	0.4063	548	45.12	12	25.5
1998	21,873.51	7,409	9,843	0.3913	15,312	45.86	334	24.5
1999	778,890.09	253,655	336,992	0.3762	558,732	46.59	11,992	23.5
2006	9,354.00	2,174	2,888	0.2685	7,869	51.86	152	16.5
2007	170,042.12	37,211	49,436	0.2528	146,112	52.63	2,776	15.5

Kentucky - American Water Company

Account #: 304.200 - Structures & Improvements - Pumping

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	100,990.47	20,721	27,529	0.2370	88,610	53.40	1,659	14.5
2010	4,552,377.38	808,906	1,074,667	0.2053	4,160,567	54.96	75,706	12.5
2011	18,733.60	3,069	4,078	0.1893	17,466	55.74	313	11.5
2013	52,732.79	7,170	9,525	0.1571	51,117	57.32	892	9.5
2014	699,722.81	85,319	113,350	0.1409	691,331	58.11	11,897	8.5
2015	7,528.64	812	1,079	0.1246	7,579	58.91	129	7.5
2016	39,193.67	3,671	4,878	0.1082	40,195	59.71	673	6.5
2017	39,418.03	3,131	4,160	0.0918	41,170	60.51	680	5.5
2018	50,059.81	3,262	4,333	0.0753	53,235	61.32	868	4.5
2019	21,742.09	1,105	1,467	0.0587	23,536	62.13	379	3.5
2021	96,254.67	2,109	2,802	0.0253	107,891	63.76	1,692	1.5
2022	40,418.66	298	396	0.0085	46,085	64.58	714	0.5
TOTAL	9,695,868.28	2,627,430	3,489,639		7,660,610		151,206	

COMPOSITE ANNUAL ACCRUAL RATE	1.56%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.36
COMPOSITE AVERAGE AGE (YEARS)	19.78
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	49.68

Kentucky - American Water Company

Account #: 304.300 - Structures & Improvements - Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1925	232.33	229	255	0.9531	13	9.18	1	97.5
1938	876.34	804	892	0.8852	116	13.16	9	84.5
1941	369.39	332	369	0.8678	56	14.18	4	81.5
1959	6,925.11	5,317	5,902	0.7411	2,062	21.60	95	63.5
1970	13,665.34	9,095	10,094	0.6423	5,621	27.38	205	52.5
1971	54,239.73	35,549	39,457	0.6326	22,919	27.96	820	51.5
1972	3,371.98	2,175	2,415	0.6227	1,463	28.54	51	50.5
1973	66.17	42	47	0.6127	29	29.12	1	49.5
1974	4,654.28	2,905	3,225	0.6025	2,128	29.72	72	48.5
1975	723.00	444	492	0.5922	339	30.32	11	47.5
1976	1,114.00	672	745	0.5818	536	30.93	17	46.5
1977	2,634.51	1,560	1,731	0.5713	1,299	31.54	41	45.5
1982	152,885.57	81,907	90,912	0.5171	84,906	34.72	2,446	40.5
1983	1,276.58	669	743	0.5059	725	35.37	21	39.5
1984	7,500.00	3,844	4,266	0.4946	4,359	36.03	121	38.5
1987	20,385.23	9,719	10,788	0.4602	12,655	38.05	333	35.5
1988	1,492,186.09	693,386	769,617	0.4485	946,397	38.74	24,432	34.5
1989	26,178.51	11,845	13,147	0.4367	16,958	39.43	430	33.5
1990	28,515.04	12,552	13,932	0.4249	18,860	40.12	470	32.5
1991	1,925.00	824	914	0.4129	1,300	40.82	32	31.5
1992	8,000.00	3,323	3,688	0.4009	5,512	41.53	133	30.5
1993	161,534.80	65,059	72,212	0.3887	113,553	42.24	2,689	29.5
1994	10,388.09	4,053	4,498	0.3765	7,448	42.95	173	28.5
1995	42,170.57	15,914	17,664	0.3642	30,832	43.67	706	27.5
1996	2,309,207.01	841,854	934,408	0.3519	1,721,180	44.39	38,770	26.5
1997	546,573.87	192,215	213,347	0.3394	415,213	45.12	9,202	25.5
1999	138,649.18	45,153	50,117	0.3143	109,330	46.59	2,346	23.5
2000	168,478.81	52,657	58,446	0.3017	135,304	47.33	2,858	22.5

Kentucky - American Water Company

Account #: 304.300 - Structures & Improvements - Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2001	99,872.41	29,898	33,185	0.2889	81,668	48.08	1,699	21.5
2002	11,650.51	3,333	3,700	0.2761	9,698	48.83	199	20.5
2003	7,407.94	2,021	2,243	0.2633	6,276	49.58	127	19.5
2005	31,219.61	7,678	8,522	0.2374	27,380	51.10	536	17.5
2006	121,065.14	28,138	31,231	0.2243	107,994	51.86	2,082	16.5
2007	260,339.27	56,971	63,234	0.2112	236,156	52.63	4,487	15.5
2008	57,998.81	11,900	13,209	0.1980	53,490	53.40	1,002	14.5
2009	33,441.24	6,403	7,107	0.1848	31,351	54.18	579	13.5
2010	23,046,363.26	4,095,078	4,545,293	0.1715	21,958,025	54.96	399,551	12.5
2011	57,455.23	9,414	10,449	0.1581	55,625	55.74	998	11.5
2012	24,932.42	3,738	4,149	0.1447	24,523	56.53	434	10.5
2013	1,983.30	270	299	0.1312	1,981	57.32	35	9.5
2014	5,009,806.59	610,860	678,018	0.1177	5,083,259	58.11	87,479	8.5
2015	27,430.21	2,958	3,283	0.1041	28,262	58.91	480	7.5
2016	3,343,842.71	313,228	347,665	0.0904	3,497,754	59.71	58,584	6.5
2017	496,170.25	39,417	43,751	0.0767	526,845	60.51	8,707	5.5
2018	446,584.92	29,098	32,298	0.0629	481,275	61.32	7,849	4.5
2019	7,227,236.46	367,164	407,530	0.0490	7,903,792	62.13	127,217	3.5
2020	9,318,068.75	339,094	376,374	0.0351	10,339,405	62.94	164,266	2.5
2021	2,908.98	64	71	0.0211	3,275	63.76	51	1.5
2022	13,484.73	99	110	0.0071	15,397	64.58	238	0.5

Kentucky - American Water Company

Account #: 304.300 - Structures & Improvements - Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	54,843,989.27	8,050,921	8,936,044		54,134,544		953,089	

COMPOSITE ANNUAL ACCRUAL RATE	1.74%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.16
COMPOSITE AVERAGE AGE (YEARS)	10.42
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	56.70

Kentucky - American Water Company

Account #: 304.400 - Structures & Improvements - T&D

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 40
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1991	28,804.37	20,494	-6,071	-0.2007	36,316	12.90	2,816	31.5
1992	3,241.57	2,250	-666	-0.1958	4,070	13.56	300	30.5
1996	4,311.28	2,671	-791	-0.1748	5,318	16.40	324	26.5
1997	26.54	16	-5	-0.1694	33	17.15	2	25.5
1998	139,105.41	80,647	-23,892	-0.1636	169,953	17.91	9,487	24.5
1999	28,241.70	15,797	-4,680	-0.1578	34,334	18.69	1,837	23.5
2000	6,176.47	3,327	-986	-0.1520	7,471	19.48	383	22.5
2006	73,847.79	30,057	-8,905	-0.1148	86,445	24.49	3,529	16.5
2008	25,387.15	9,158	-2,713	-0.1018	29,370	26.26	1,119	14.5
2009	92,187.89	31,085	-9,209	-0.0951	106,007	27.15	3,904	13.5
2010	25,516.58	7,997	-2,369	-0.0884	29,161	28.06	1,039	12.5
2011	4,504.67	1,303	-386	-0.0816	5,116	28.98	177	11.5
2014	352,752.28	76,162	-22,564	-0.0609	392,953	31.77	12,367	8.5
2015	22,892.11	4,373	-1,296	-0.0539	25,332	32.72	774	7.5
2016	4,367.21	725	-215	-0.0468	4,800	33.68	143	6.5
2017	49,625.80	6,987	-2,070	-0.0397	54,177	34.64	1,564	5.5
2018	253,438.83	29,259	-8,668	-0.0326	274,779	35.60	7,718	4.5
2021	4,364,849.75	168,916	-50,043	-0.0109	4,633,135	38.53	120,261	1.5
TOTAL	5,479,277.40	491,223	-145,529		5,898,770		167,744	

COMPOSITE ANNUAL ACCRUAL RATE	3.06%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.03
COMPOSITE AVERAGE AGE (YEARS)	3.59
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	36.58

Kentucky - American Water Company

Account #: 304.500 - Structures & Improvements - General

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 25
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2005	0.52	0	0	0.3663	0	11.14	0	17.5
2007	31,349.70	16,493	10,740	0.3263	22,177	12.47	1,778	15.5
2008	109,721.69	54,520	35,504	0.3082	79,704	13.17	6,052	14.5
2009	21,407.09	9,995	6,509	0.2896	15,968	13.88	1,150	13.5
2010	2,731,392.26	1,191,433	775,879	0.2705	2,092,083	14.61	143,153	12.5
2011	643,595.11	260,506	169,645	0.2510	506,129	15.36	32,945	11.5
2012	57,151.00	21,297	13,869	0.2311	46,140	16.13	2,861	10.5
2013	167,718.84	57,001	37,120	0.2108	138,985	16.91	8,220	9.5
2014	590,365.20	180,910	117,811	0.1901	502,072	17.70	28,359	8.5
2015	138,512.01	37,731	24,571	0.1689	120,867	18.51	6,528	7.5
2016	2,841,016.36	675,526	439,913	0.1475	2,543,155	19.34	131,506	6.5
2017	746,046.06	151,138	98,423	0.1256	684,925	20.18	33,947	5.5
2018	337,773.15	56,358	36,701	0.1035	317,961	21.03	15,121	4.5
2019	416,398.11	54,382	35,414	0.0810	401,804	21.89	18,355	3.5
2020	98,849.33	9,277	6,042	0.0582	97,750	22.77	4,294	2.5
2021	51,716.66	2,929	1,908	0.0351	52,395	23.65	2,215	1.5
2022	587,754.37	11,154	7,264	0.0118	609,878	24.55	24,844	0.5
TOTAL	9,570,767.46	2,790,651	1,817,313		8,231,993		461,328	

COMPOSITE ANNUAL ACCRUAL RATE	4.82%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	8.18
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	18.06

Kentucky - American Water Company

Account #: 304.600 - Structures & Improvements - Offices

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1970	637,016.69	482,927	514,342	0.7021	218,227	20.45	10,673	52.5
1971	756.95	566	603	0.6923	268	21.00	13	51.5
1972	19,510.13	14,372	15,307	0.6823	7,129	21.57	331	50.5
1977	4,946.00	3,363	3,582	0.6297	2,106	24.53	86	45.5
1979	5,098.00	3,344	3,562	0.6075	2,301	25.78	89	43.5
1982	72,800.40	45,049	47,979	0.5731	35,741	27.71	1,290	40.5
1984	1,886.00	1,119	1,192	0.5494	977	29.05	34	38.5
1986	24,125.00	13,679	14,569	0.5251	13,175	30.42	433	36.5
1987	135,815.04	75,200	80,091	0.5128	76,096	31.11	2,446	35.5
1988	45,634.12	24,652	26,256	0.5003	26,224	31.82	824	34.5
1989	44,800.88	23,592	25,126	0.4877	26,395	32.53	812	33.5
1990	18,070.07	9,267	9,870	0.4749	10,911	33.24	328	32.5
1991	1,100.00	549	585	0.4621	681	33.97	20	31.5
1992	16,106.41	7,809	8,317	0.4490	10,205	34.70	294	30.5
1994	7,768.27	3,545	3,776	0.4226	5,158	36.19	143	28.5
1995	26,046.75	11,510	12,259	0.4093	17,695	36.94	479	27.5
1996	7,455.45	3,186	3,393	0.3958	5,181	37.70	137	26.5
1997	2,091,767.73	863,076	919,221	0.3821	1,486,312	38.47	38,633	25.5
1998	226,122.80	89,945	95,796	0.3684	164,245	39.25	4,185	24.5
2005	23,878.25	6,937	7,388	0.2691	20,072	44.84	448	17.5
2006	57,796.03	15,879	16,912	0.2544	49,554	45.67	1,085	16.5
2008	1,698,053.43	412,376	439,201	0.2249	1,513,560	47.33	31,979	14.5
2013	6,248.83	1,008	1,074	0.1494	6,113	51.58	118	9.5
2014	194,379.25	28,130	29,960	0.1340	193,576	52.45	3,691	8.5
2015	30,859.52	3,951	4,208	0.1186	31,281	53.32	587	7.5
2016	15,059.54	1,675	1,784	0.1030	15,534	54.20	287	6.5
2020	165,020.59	7,128	7,592	0.0400	182,182	57.75	3,155	2.5
2021	10,008.14	260	277	0.0241	11,233	58.64	192	1.5

Kentucky - American Water Company

Account #: 304.600 - Structures & Improvements - Offices

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2022	6,565.18	57	61	0.0080	7,489	59.55	126	0.5
TOTAL	5,594,695.45	2,154,150	2,294,281		4,139,619		102,918	

COMPOSITE ANNUAL ACCRUAL RATE	1.84%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.41
COMPOSITE AVERAGE AGE (YEARS)	24.36
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.91

Kentucky - American Water Company

Account #: 304.700 - Structures & Improvements - Stores, Shop & Garage

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 55
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	41,614.47	23,449	21,633	0.5198	19,982	24.01	832	34.5
1990	17,912.83	9,590	8,848	0.4939	9,065	25.55	355	32.5
1993	546,102.20	268,631	247,822	0.4538	298,281	27.95	10,674	29.5
1996	147,253.93	65,808	60,710	0.4123	86,544	30.42	2,845	26.5
1999	70,632.43	28,285	26,094	0.3694	44,539	32.98	1,351	23.5
2002	4,796.09	1,691	1,560	0.3253	3,236	35.60	91	20.5
2009	799,355.85	189,111	174,462	0.2183	624,894	41.99	14,883	13.5
2011	7,549.73	1,528	1,410	0.1867	6,140	43.87	140	11.5
2014	3,312.34	498	460	0.1388	2,853	46.72	61	8.5
2015	9,065.45	1,206	1,112	0.1227	7,953	47.69	167	7.5
2016	24,525.08	2,831	2,612	0.1065	21,913	48.65	450	6.5
2017	2,984.03	292	269	0.0903	2,715	49.62	55	5.5
2022	6,577.32	59	54	0.0083	6,523	54.51	120	0.5
TOTAL	1,681,681.75	592,979	547,045		1,134,637		32,024	

COMPOSITE ANNUAL ACCRUAL RATE	1.90%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.33
COMPOSITE AVERAGE AGE (YEARS)	20.78
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	35.61

Kentucky - American Water Company

Account #: 304.800 - Structures & Improvements - Miscellaneous

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 25
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1985	20,864.76	17,295	11,808	0.5659	9,057	4.28	2,117	37.5
1987	23,786.05	19,056	13,010	0.5470	10,776	4.97	2,168	35.5
1989	65,469.45	50,589	34,539	0.5276	30,931	5.68	5,443	33.5
1990	13,875.00	10,520	7,182	0.5176	6,693	6.05	1,107	32.5
1991	6,522.00	4,849	3,310	0.5076	3,212	6.41	501	31.5
1992	5,113.58	3,725	2,543	0.4973	2,571	6.79	379	30.5
1994	3,145.91	2,194	1,498	0.4762	1,648	7.56	218	28.5
1997	532.14	345	236	0.4430	296	8.78	34	25.5
1998	34,995.42	22,116	15,099	0.4315	19,896	9.20	2,162	24.5
2000	9,043.98	5,398	3,685	0.4075	5,359	10.08	532	22.5
2001	19,040.39	11,017	7,521	0.3950	11,519	10.54	1,093	21.5
2002	21,530.03	12,054	8,230	0.3822	13,300	11.00	1,209	20.5
2003	314,782.79	170,178	116,186	0.3691	198,597	11.48	17,293	19.5
2005	130,702.15	65,408	44,656	0.3417	86,046	12.49	6,890	17.5
2006	180,858.20	86,708	59,198	0.3273	121,660	13.01	9,348	16.5
2007	78,551.61	35,957	24,549	0.3125	54,003	13.56	3,984	15.5
2011	1,875.00	682	465	0.2482	1,410	15.91	89	11.5
2012	124,046.63	41,913	28,616	0.2307	95,431	16.55	5,765	10.5
2019	14,472.01	1,861	1,271	0.0878	13,201	21.79	606	3.5
2020	113,275.01	10,621	7,251	0.0640	106,024	22.66	4,680	2.5
TOTAL	1,182,482.11	572,484	390,853		791,629		65,618	

COMPOSITE ANNUAL ACCRUAL RATE	5.55%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.33
COMPOSITE AVERAGE AGE (YEARS)	17.70
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	12.90

Kentucky - American Water Company

Account #: 305.000 - Collecting & Impounding Reservoirs

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 75
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	24,854.61	19,873	20,357	0.8191	4,497	15.03	299	88.5
1972	3,956.11	2,124	2,176	0.5501	1,780	34.73	51	50.5
1988	756,540.13	291,674	298,780	0.3949	457,760	46.08	9,933	34.5
1989	2,284.00	857	878	0.3845	1,406	46.84	30	33.5
1991	14,013.00	4,974	5,095	0.3636	8,918	48.38	184	31.5
1992	9,151.62	3,154	3,230	0.3530	5,921	49.16	120	30.5
1993	3,586.34	1,198	1,228	0.3423	2,359	49.94	47	29.5
1996	1,591.87	482	493	0.3099	1,099	52.31	21	26.5
2005	3,282.30	670	687	0.2092	2,596	59.69	43	17.5
TOTAL	819,259.98	325,006	332,925		486,335		10,728	

COMPOSITE ANNUAL ACCRUAL RATE	1.31%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.41
COMPOSITE AVERAGE AGE (YEARS)	36.01
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	45.25

Kentucky - American Water Company

Account #: 306.000 - Lake, River & Other Intakes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S1.5
ASL: 55
Net Salvage: -10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1961	449.15	374	470	0.9523	24	13.38	2	61.5
1966	19,532.24	15,542	19,556	0.9102	1,929	15.22	127	56.5
1970	31,574.52	24,111	30,339	0.8735	4,393	16.82	261	52.5
1971	23,098.06	17,443	21,949	0.8639	3,459	17.24	201	51.5
1991	164,120.57	89,014	112,008	0.6204	68,525	27.88	2,458	31.5
1992	6,000.00	3,175	3,995	0.6053	2,605	28.54	91	30.5
1993	6,985.00	3,601	4,532	0.5898	3,152	29.22	108	29.5
1994	169.67	85	107	0.5740	80	29.91	3	28.5
1997	3,365.94	1,544	1,942	0.5246	1,760	32.07	55	25.5
2002	245,293.78	93,417	117,548	0.4356	152,275	35.96	4,235	20.5
2007	2,378.59	704	886	0.3387	1,730	40.19	43	15.5
2010	820,061.67	198,621	249,927	0.2771	652,141	42.89	15,205	12.5
2012	257,591.23	52,840	66,490	0.2347	216,861	44.74	4,847	10.5
2013	49,161.46	9,158	11,524	0.2131	42,554	45.69	931	9.5
2016	50,743.32	6,530	8,216	0.1472	47,602	48.57	980	6.5
TOTAL	1,680,525.20	516,159	649,489		1,199,088		29,547	

COMPOSITE ANNUAL ACCRUAL RATE	1.76%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	16.93
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.64

Kentucky - American Water Company

Account #: 309.000 - Supply Mains

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 80
Net Salvage: -10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	222,234.89	206,040	244,458	1.0000	0	12.57	0	88.5
1940	503.19	450	554	1.0000	0	15.01	0	82.5
1941	433.53	385	477	1.0000	0	15.45	0	81.5
1944	41.85	36	45	0.9875	1	16.86	0	78.5
1951	218.11	178	223	0.9296	17	20.56	1	71.5
1953	1,629.41	1,306	1,634	0.9115	159	21.72	7	69.5
1956	59,882.73	46,484	58,162	0.8830	7,709	23.55	327	66.5
1959	109,730.59	82,289	102,962	0.8530	17,741	25.46	697	63.5
1964	16,403.53	11,539	14,438	0.8002	3,606	28.84	125	58.5
1965	440,490.69	305,616	382,398	0.7892	102,142	29.54	3,458	57.5
1967	2,613.29	1,762	2,204	0.7668	670	30.97	22	55.5
1968	5,722.03	3,800	4,755	0.7555	1,539	31.70	49	54.5
1970	3,226.09	2,077	2,599	0.7324	950	33.17	29	52.5
1972	10,673.26	6,651	8,322	0.7089	3,418	34.68	99	50.5
1976	127,784.70	74,192	92,831	0.6604	47,732	37.77	1,264	46.5
1980	3,498.25	1,877	2,348	0.6103	1,500	40.98	37	42.5
1981	2,370.70	1,245	1,558	0.5975	1,050	41.80	25	41.5
1982	53,151.82	27,318	34,182	0.5846	24,285	42.62	570	40.5
1983	358.65	180	226	0.5717	169	43.45	4	39.5
1984	14,163.31	6,955	8,703	0.5586	6,877	44.29	155	38.5
1987	96,069.30	43,816	54,825	0.5188	50,852	46.83	1,086	35.5
1988	100,191.76	44,513	55,696	0.5054	54,515	47.69	1,143	34.5
1989	1,976,228.33	854,488	1,069,166	0.4918	1,104,685	48.55	22,752	33.5
1991	9,330.23	3,810	4,767	0.4645	5,496	50.30	109	31.5
1992	1,765,551.22	699,586	875,347	0.4507	1,066,760	51.18	20,842	30.5
1993	5,475.01	2,103	2,631	0.4368	3,392	52.07	65	29.5
1994	29,331.77	10,905	13,645	0.4229	18,620	52.96	352	28.5
2000	25,261.98	7,498	9,381	0.3376	18,407	58.41	315	22.5

Kentucky - American Water Company

Account #: 309.000 - Supply Mains

ALG - Remaining Life
Survivor Curve: R3
ASL: 80
Net Salvage: -10%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	42,178.70	8,717	10,907	0.2351	35,490	64.97	546	15.5
2008	5,454.04	1,056	1,321	0.2202	4,678	65.92	71	14.5
2010	13,377,790.18	2,238,265	2,800,595	0.1903	11,914,974	67.83	175,655	12.5
2012	2,585.07	364	456	0.1602	2,388	69.75	34	10.5
2013	49,211.71	6,279	7,857	0.1451	46,276	70.72	654	9.5
2019	7,444.15	352	440	0.0538	7,748	76.56	101	3.5
TOTAL	18,567,234.07	4,702,134	5,870,114		14,553,843		230,594	

COMPOSITE ANNUAL ACCRUAL RATE	1.24%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.32
COMPOSITE AVERAGE AGE (YEARS)	19.63
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	61.58

Kentucky - American Water Company

Account #: 310.000 - Power Generation Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 35
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	141,116.13	125,443	109,641	0.7400	38,531	5.37	7,177	34.5
1989	45,199.86	39,487	34,513	0.7272	12,947	5.88	2,202	33.5
1996	209,151.84	154,001	134,601	0.6129	85,009	10.46	8,130	26.5
2007	170,728.73	78,000	68,174	0.3803	111,091	19.77	5,619	15.5
2008	133,198.85	57,086	49,895	0.3567	89,964	20.71	4,343	14.5
2009	32,060.10	12,823	11,208	0.3329	22,455	21.67	1,036	13.5
2010	1,755,075.06	651,357	569,305	0.3089	1,273,524	22.63	56,278	12.5
2011	36,789.08	12,584	10,998	0.2847	27,630	23.60	1,171	11.5
2012	20,101.38	6,287	5,495	0.2604	15,611	24.57	635	10.5
2013	69,396.79	19,664	17,187	0.2359	55,680	25.55	2,179	9.5
2014	269,015.90	68,275	59,675	0.2113	222,792	26.54	8,395	8.5
2015	26,699.50	5,984	5,230	0.1866	22,804	27.53	828	7.5
2016	2,618,308.70	508,981	444,864	0.1618	2,304,360	28.52	80,797	6.5
2017	151,533.54	24,940	21,798	0.1370	137,312	29.51	4,652	5.5
TOTAL	5,678,375.46	1,764,912	1,542,584		4,419,710		183,442	

COMPOSITE ANNUAL ACCRUAL RATE	3.23%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.27
COMPOSITE AVERAGE AGE (YEARS)	10.66
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	24.64

Kentucky - American Water Company

Account #: 311.200 - Pumping Equipment - Electric

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	5,827.95	6,994	3,373	0.4823	3,621	3.00	1,207	89.5
1940	2,338.33	2,806	1,353	0.4823	1,453	3.00	484	83.5
1947	282.63	325	157	0.4627	182	3.00	61	75.5
1949	15,991.09	18,087	8,723	0.4546	10,466	3.00	3,489	73.5
1950	465.46	522	252	0.4505	307	3.00	102	72.5
1954	212.25	229	111	0.4345	144	3.97	36	68.5
1955	23,877.32	25,572	12,333	0.4304	16,320	4.30	3,795	67.5
1959	18,866.00	19,446	9,379	0.4143	13,260	5.64	2,351	63.5
1970	70,211.93	64,281	31,003	0.3680	53,252	9.48	5,617	52.5
1974	4,227.52	3,682	1,776	0.3500	3,297	10.97	301	48.5
1976	142,214.10	120,570	58,151	0.3407	112,506	11.74	9,583	46.5
1979	1,256.95	1,021	492	0.3264	1,016	12.93	79	43.5
1981	151,435.32	119,268	57,523	0.3165	124,200	13.75	9,033	41.5
1984	7,346.21	5,505	2,655	0.3012	6,160	15.02	410	38.5
1985	57,704.18	42,490	20,493	0.2959	48,752	15.46	3,153	37.5
1986	5,114.00	3,698	1,783	0.2906	4,353	15.90	274	36.5
1987	371,765.61	263,778	127,220	0.2852	318,899	16.35	19,505	35.5
1988	499,829.62	347,782	167,735	0.2797	432,061	16.81	25,703	34.5
1989	316,522.51	215,820	104,089	0.2740	275,738	17.27	15,966	33.5
1990	52,917.53	35,331	17,040	0.2683	46,461	17.74	2,619	32.5
1991	6,158.00	4,023	1,940	0.2625	5,450	18.23	299	31.5
1992	1,541,808.27	984,480	474,813	0.2566	1,375,357	18.72	73,470	30.5
1993	28,748.56	17,927	8,646	0.2506	25,852	19.21	1,346	29.5
1998	277,433.61	151,034	72,843	0.2188	260,077	21.85	11,903	24.5
1999	234,405.06	123,674	59,648	0.2121	221,638	22.41	9,890	23.5
2000	69,872.51	35,668	17,203	0.2052	66,644	22.98	2,900	22.5
2002	896.22	426	205	0.1910	870	24.16	36	20.5
2003	38,738.20	17,698	8,535	0.1836	37,950	24.77	1,532	19.5

Kentucky - American Water Company

Account #: 311.200 - Pumping Equipment - Electric

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	240.99	106	51	0.1761	238	25.39	9	18.5
2005	615.71	258	124	0.1685	614	26.03	24	17.5
2008	5,842.76	2,099	1,012	0.1444	5,999	28.03	214	14.5
2010	5,506,121.57	1,744,947	841,585	0.1274	5,765,761	29.44	195,848	12.5
2011	82,535.98	24,348	11,743	0.1186	87,300	30.17	2,894	11.5
2012	74,828.57	20,395	9,836	0.1095	79,958	30.91	2,587	10.5
2013	2,340,760.96	584,154	281,736	0.1003	2,527,177	31.68	79,772	9.5
2014	868,207.44	196,214	94,634	0.0908	947,215	32.47	29,172	8.5
2015	120,302.68	24,284	11,712	0.0811	132,651	33.27	3,987	7.5
2016	1,641,126.88	290,674	140,192	0.0712	1,829,161	34.10	53,641	6.5
2017	671,082.17	101,843	49,119	0.0610	756,180	34.94	21,642	5.5
2018	3,531,194.93	444,089	214,183	0.0505	4,023,251	35.81	112,350	4.5
2019	1,106,426.69	109,650	52,884	0.0398	1,274,828	36.70	34,736	3.5
2020	1,123,828.53	80,641	38,893	0.0288	1,309,701	37.61	34,823	2.5
2021	209,219.46	9,138	4,407	0.0176	246,656	38.54	6,400	1.5
2022	536,002.36	7,931	3,825	0.0059	639,378	39.51	16,183	0.5
TOTAL	21,764,804.62	6,272,905	3,025,410		23,092,356		799,426	

COMPOSITE ANNUAL ACCRUAL RATE	3.67%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.14
COMPOSITE AVERAGE AGE (YEARS)	12.33
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	30.40

Kentucky - American Water Company

Account #: 311.300 - Pumping Equipment - Diesel

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1965	22,657.13	21,955	15,808	0.5814	11,380	7.70	1,478	57.5
1972	1,003.12	896	645	0.5361	558	10.22	55	50.5
1981	95,017.92	74,834	53,882	0.4726	60,139	13.75	4,375	41.5
1987	100,246.21	71,128	51,213	0.4257	69,082	16.35	4,225	35.5
1988	1,109.18	772	556	0.4175	775	16.81	46	34.5
2006	129,930.05	51,920	37,383	0.2398	118,533	26.68	4,443	16.5
TOTAL	349,963.61	221,505	159,488		260,468		14,622	

COMPOSITE ANNUAL ACCRUAL RATE	4.18%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.46
COMPOSITE AVERAGE AGE (YEARS)	31.54
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	18.90

Kentucky - American Water Company

Account #: 311.400 - Pumping Equipment - Hydraulic

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2006	1,015.16	406	1,218	1.0000	0	26.68	0	16.5
TOTAL	1,015.16	406	1,218		0		0	

COMPOSITE ANNUAL ACCRUAL RATE	0.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	1.20
COMPOSITE AVERAGE AGE (YEARS)	16.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	26.68

Kentucky - American Water Company

Account #: 311.520 - Pumping Equipment - SOS & Pumping

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	513,279.07	194,861	165,208	0.2682	450,727	27.35	16,483	15.5
2008	3,783,282.13	1,359,015	1,152,208	0.2538	3,387,730	28.03	120,878	14.5
2009	3,515,846.82	1,189,452	1,008,448	0.2390	3,210,568	28.72	111,777	13.5
2010	702,866.78	222,746	188,850	0.2239	654,591	29.44	22,238	12.5
2011	238,765.58	70,435	59,716	0.2084	226,802	30.17	7,518	11.5
2012	191,866.24	52,293	44,336	0.1926	185,904	30.91	6,013	10.5
2013	1,081,377.06	269,865	228,799	0.1763	1,068,854	31.68	33,738	9.5
2014	1,374,649.99	310,670	263,394	0.1597	1,386,186	32.47	42,696	8.5
2015	499,853.97	100,900	85,546	0.1426	514,279	33.27	15,457	7.5
2016	3,712,474.35	657,548	557,486	0.1251	3,897,483	34.10	114,309	6.5
2017	1,509,433.09	229,071	194,212	0.1072	1,617,108	34.94	46,281	5.5
2018	139,718.27	17,571	14,897	0.0889	152,765	35.81	4,266	4.5
2019	21,314.17	2,112	1,791	0.0700	23,786	36.70	648	3.5
TOTAL	17,284,727.52	4,676,540	3,964,891		16,776,782		542,302	

COMPOSITE ANNUAL ACCRUAL RATE	3.14%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.23
COMPOSITE AVERAGE AGE (YEARS)	10.57
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	30.98

Kentucky - American Water Company

Account #: 311.530 - Pumping Equipment - Water Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	605,807.17	76,187	32,024	0.0441	694,945	35.81	19,408	4.5
2019	1,421,901.22	140,915	59,231	0.0347	1,647,051	36.70	44,883	3.5
2020	614,510.88	44,095	18,534	0.0251	718,879	37.61	19,115	2.5
2021	27,138.16	1,185	498	0.0153	32,068	38.54	832	1.5
2022	7,499.00	111	47	0.0052	8,952	39.51	227	0.5
TOTAL	2,676,856.43	262,493	110,334		3,101,894		84,465	

COMPOSITE ANNUAL ACCRUAL RATE	3.16%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.04
COMPOSITE AVERAGE AGE (YEARS)	3.47
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	36.73

Kentucky - American Water Company

Account #: 311.540 - Pumping Equipment - T&D

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	35,100.14	13,325	-69	-0.0016	42,189	27.35	1,543	15.5
2012	17,283.69	4,711	-24	-0.0012	20,765	30.91	672	10.5
2015	122,575.56	24,743	-128	-0.0009	147,219	33.27	4,425	7.5
2016	444,062.86	78,652	-408	-0.0008	533,283	34.10	15,641	6.5
2017	743,852.14	112,887	-586	-0.0007	893,208	34.94	25,563	5.5
2018	812,788.24	102,218	-530	-0.0005	975,876	35.81	27,253	4.5
2022	145,085.39	2,147	-11	-0.0001	174,114	39.51	4,407	0.5
TOTAL	2,320,748.02	338,682	-1,757		2,786,655		79,504	

COMPOSITE ANNUAL ACCRUAL RATE	3.43%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.00
COMPOSITE AVERAGE AGE (YEARS)	5.32
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	35.14

Kentucky - American Water Company

Account #: 320.100 - Water Treatment Equipment - Non-Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 50
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1900	8,975.48	10,322	8,586	0.8318	1,736	3.00	579	123.5
1934	799.75	898	747	0.8123	173	3.00	58	88.5
1936	342.12	380	316	0.8037	77	3.00	26	86.5
1938	138.71	152	127	0.7948	33	3.00	11	84.5
1948	3,147.72	3,252	2,705	0.7474	915	5.07	180	74.5
1950	9,495.15	9,684	8,055	0.7377	2,865	5.66	506	72.5
1953	22,789.91	22,777	18,946	0.7229	7,263	6.55	1,109	69.5
1958	53,933.14	51,970	43,228	0.6970	18,795	8.10	2,320	64.5
1959	233,556.24	223,282	185,723	0.6915	82,867	8.43	9,830	63.5
1960	7,813.41	7,409	6,163	0.6859	2,823	8.77	322	62.5
1962	4,219.69	3,933	3,272	0.6742	1,581	9.47	167	60.5
1966	1,061,804.67	952,667	792,417	0.6489	428,659	10.99	39,004	56.5
1970	667,737.81	573,127	476,720	0.6208	291,179	12.68	22,964	52.5
1972	11,330.58	9,487	7,891	0.6056	5,139	13.60	378	50.5
1974	293.75	239	199	0.5896	139	14.56	10	48.5
1977	436,810.02	340,637	283,337	0.5640	218,994	16.09	13,611	45.5
1978	747.80	574	477	0.5551	383	16.63	23	44.5
1979	6,198.57	4,680	3,892	0.5460	3,236	17.18	188	43.5
1981	1,074,394.08	783,227	651,478	0.5273	584,075	18.30	31,917	41.5
1982	82,883.48	59,313	49,336	0.5176	45,980	18.89	2,434	40.5
1984	4,000.00	2,752	2,289	0.4977	2,311	20.08	115	38.5
1987	227,797.50	146,923	122,209	0.4665	139,759	21.96	6,364	35.5
1988	3,892,466.82	2,452,673	2,040,103	0.4558	2,436,234	22.60	107,798	34.5
1989	11,939.22	7,343	6,108	0.4448	7,623	23.26	328	33.5
1990	634.52	381	317	0.4337	413	23.93	17	32.5
1991	231,585.65	135,275	112,520	0.4225	153,803	24.60	6,252	31.5
1992	55,184.95	31,364	26,088	0.4111	37,374	25.29	1,478	30.5
1993	633,434.95	349,881	291,027	0.3995	437,424	25.98	16,837	29.5

Kentucky - American Water Company

Account #: 320.100 - Water Treatment Equipment - Non-Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 50
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1994	4,177.83	2,240	1,863	0.3878	2,941	26.69	110	28.5
1995	448.70	233	194	0.3759	322	27.40	12	27.5
1996	11,662.75	5,868	4,881	0.3639	8,532	28.13	303	26.5
1997	753,250.18	366,291	304,677	0.3517	561,561	28.86	19,458	25.5
1998	94,740.35	44,458	36,979	0.3394	71,972	29.60	2,431	24.5
1999	921,832.62	416,707	346,612	0.3270	713,496	30.35	23,509	23.5
2000	462,111.15	200,850	167,064	0.3144	364,364	31.10	11,716	22.5
2001	2,410.09	1,005	836	0.3016	1,936	31.87	61	21.5
2002	1,034,038.75	412,855	343,408	0.2888	845,737	32.64	25,911	20.5
2003	1,315.82	502	417	0.2758	1,096	33.42	33	19.5
2006	28,728.75	9,377	7,800	0.2361	25,238	35.81	705	16.5
2007	1,781,623.80	548,304	456,072	0.2226	1,592,795	36.62	43,495	15.5
2008	1,496,335.08	432,368	359,638	0.2090	1,361,147	37.44	36,355	14.5
2009	237,989.08	64,254	53,446	0.1953	220,242	38.26	5,756	13.5
2010	14,148,454.52	3,549,388	2,952,337	0.1815	13,318,385	39.09	340,711	12.5
2011	528,512.99	122,401	101,811	0.1675	505,979	39.93	12,672	11.5
2012	111,775.29	23,716	19,726	0.1535	108,815	40.78	2,668	10.5
2013	1,410,260.55	271,618	225,929	0.1393	1,395,871	41.63	33,530	9.5
2014	908,360.21	157,045	130,628	0.1250	913,986	42.48	21,516	8.5
2015	406,926.86	62,274	51,799	0.1107	416,167	43.35	9,600	7.5
2016	11,777,326.95	1,566,902	1,303,330	0.0962	12,240,596	44.22	276,811	6.5
2017	3,587,556.16	405,106	336,962	0.0817	3,788,728	45.09	84,026	5.5
2018	1,181,960.90	109,527	91,103	0.0670	1,268,152	45.97	27,587	4.5
2019	12,494,036.71	903,115	751,200	0.0523	13,616,942	46.86	290,588	3.5
2020	8,279,215.14	428,686	356,576	0.0375	9,164,522	47.75	191,927	2.5
2021	171,949.58	5,357	4,456	0.0225	193,286	48.65	3,973	1.5
2022	199,030.67	2,072	1,724	0.0075	227,162	49.55	4,585	0.5

Kentucky - American Water Company

Account #: 320.100 - Water Treatment Equipment - Non-Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 50
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	70,780,487.17	16,297,116	13,555,741		67,841,819		1,734,874	

COMPOSITE ANNUAL ACCRUAL RATE	2.45%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	12.15
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.99

Kentucky - American Water Company

Account #: 320.200 - Water Treatment Equipment - Filter Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S3
ASL: 10
Net Salvage: -10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2009	28,120.15	27,703	24,420	0.7895	6,512	3.00	2,171	13.5
2010	400,855.20	385,476	339,797	0.7706	101,144	3.00	33,715	12.5
2011	163,320.47	152,452	134,387	0.7480	45,266	3.00	15,089	11.5
2016	192,449.84	129,399	114,065	0.5388	97,630	3.89	25,098	6.5
2017	15,975.79	9,361	8,251	0.4695	9,322	4.67	1,996	5.5
2020	6,052.91	1,664	1,466	0.2202	5,192	7.50	692	2.5
TOTAL	806,774.36	706,055	622,386		265,065		78,760	

COMPOSITE ANNUAL ACCRUAL RATE	9.76%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.77
COMPOSITE AVERAGE AGE (YEARS)	10.69
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.28

Kentucky - American Water Company

Account #: 330.000 - Distribution Reservoirs & Standpipes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	1,656,707.98	583,060	433,063	0.2273	1,472,152	41.64	35,356	18.5
2008	11,716.56	3,241	2,407	0.1787	11,067	45.57	243	14.5
2010	102,741.97	24,525	18,216	0.1542	99,938	47.55	2,102	12.5
2019	6,659.68	446	331	0.0433	7,327	56.50	130	3.5
TOTAL	1,777,826.19	611,272	454,017		1,590,483		37,831	

COMPOSITE ANNUAL ACCRUAL RATE	2.13%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.26
COMPOSITE AVERAGE AGE (YEARS)	18.07
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	42.06

Kentucky - American Water Company

Account #: 330.100 - Elevated Tanks & Standpipes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1949	29,618.47	31,675	33,047	0.9702	1,014	4.20	241	73.5
1953	31.05	33	34	0.9508	2	5.32	0	69.5
1954	84,170.71	87,727	91,527	0.9456	5,269	5.62	937	68.5
1965	367,671.17	352,118	367,372	0.8689	55,450	10.03	5,527	57.5
1966	723.36	685	715	0.8593	117	10.58	11	56.5
1968	173,533.59	160,480	167,432	0.8390	32,132	11.75	2,734	54.5
1970	582.65	525	547	0.8170	123	13.01	9	52.5
1974	19,721.60	16,739	17,464	0.7700	5,216	15.72	332	48.5
1975	559.58	467	488	0.7577	156	16.42	9	47.5
1976	5,189.13	4,263	4,447	0.7453	1,520	17.14	89	46.5
1977	5,027.00	4,059	4,235	0.7326	1,546	17.87	87	45.5
1980	2,486.15	1,900	1,982	0.6932	877	20.13	44	42.5
1982	223,500.00	164,040	171,146	0.6659	85,879	21.71	3,956	40.5
1985	17,247.00	11,848	12,362	0.6233	7,472	24.16	309	37.5
1987	767,712.54	502,498	524,266	0.5938	358,604	25.85	13,872	35.5
1988	7,755.79	4,948	5,162	0.5788	3,757	26.71	141	34.5
1989	1,070,509.38	665,054	693,863	0.5636	537,222	27.59	19,474	33.5
1990	650,436.57	393,065	410,092	0.5482	337,910	28.47	11,869	32.5
1991	15,711.58	9,226	9,625	0.5327	8,443	29.36	288	31.5
1992	3,704.09	2,111	2,202	0.5170	2,057	30.27	68	30.5
1994	26,620.29	14,236	14,853	0.4852	15,761	32.10	491	28.5
1996	1,383,565.06	690,538	720,451	0.4528	870,649	33.96	25,637	26.5
1999	785,425.59	349,225	364,353	0.4034	538,887	36.80	14,643	23.5
2000	28,301.04	12,064	12,586	0.3867	19,960	37.76	529	22.5
2001	876,535.70	357,450	372,935	0.3700	635,081	38.72	16,400	21.5
2005	3,333,193.00	1,110,571	1,158,679	0.3023	2,674,493	42.62	62,757	17.5
2006	169,043.00	53,143	55,445	0.2852	138,954	43.60	3,187	16.5
2009	85,427.55	22,013	22,966	0.2338	75,275	46.56	1,617	13.5

Kentucky - American Water Company

Account #: 330.100 - Elevated Tanks & Standpipes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2014	3,804,100.02	618,360	645,146	0.1475	3,729,569	51.52	72,392	8.5
2015	28,070.07	4,027	4,201	0.1302	28,079	52.51	535	7.5
2016	243,407.43	30,271	31,582	0.1128	248,336	53.51	4,641	6.5
TOTAL	14,209,580.16	5,675,358	5,921,206		10,419,811		262,826	

COMPOSITE ANNUAL ACCRUAL RATE	1.85%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.42
COMPOSITE AVERAGE AGE (YEARS)	21.59
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.16

Kentucky - American Water Company

Account #: 330.200 - Ground Level Tanks

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	108,616.26	32,098	27,407	0.2194	97,502	44.58	2,187	15.5
2009	8,939.49	2,304	1,967	0.1913	8,314	46.56	179	13.5
2010	2,079,601.48	496,410	423,857	0.1772	1,967,685	47.55	41,385	12.5
2012	141,581.45	28,411	24,259	0.1490	138,560	49.53	2,797	10.5
2013	573,874.81	104,228	88,994	0.1348	570,962	50.52	11,301	9.5
TOTAL	2,912,613.49	663,451	566,484		2,783,022		57,849	

COMPOSITE ANNUAL ACCRUAL RATE	1.99%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	11.93
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	48.12

Kentucky - American Water Company

Account #: 330.400 - Clearwell

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	581.91	172	187	0.2793	482	44.58	11	15.5
2010	1,095,733.70	261,556	284,126	0.2255	975,968	47.55	20,527	12.5
TOTAL	1,096,315.61	261,728	284,313		976,450		20,538	

COMPOSITE ANNUAL ACCRUAL RATE	1.87%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.26
COMPOSITE AVERAGE AGE (YEARS)	12.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	47.54

Kentucky - American Water Company

Account #: 331.001 - TD Mains

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1906	25.20	29	26	0.8750	4	4.65	1	116.5
1933	43,861.44	44,791	41,329	0.7852	11,304	13.41	843	89.5
1934	261,398.70	265,255	244,756	0.7803	68,922	13.89	4,961	88.5
1935	41,009.24	41,340	38,146	0.7751	11,065	14.39	769	87.5
1936	24,245.43	24,273	22,398	0.7698	6,697	14.91	449	86.5
1937	51,991.79	51,680	47,686	0.7643	14,704	15.45	952	85.5
1938	15,140.57	14,937	13,783	0.7586	4,386	16.01	274	84.5
1939	15,138.25	14,819	13,674	0.7527	4,492	16.58	271	83.5
1940	11,433.41	11,102	10,244	0.7467	3,476	17.17	202	82.5
1941	10,483.17	10,095	9,315	0.7405	3,265	17.78	184	81.5
1942	1,655.71	1,581	1,459	0.7341	528	18.40	29	80.5
1943	2,011.30	1,903	1,756	0.7276	657	19.03	35	79.5
1944	265.36	249	230	0.7210	89	19.68	5	78.5
1945	4,396.19	4,083	3,768	0.7142	1,508	20.34	74	77.5
1946	7,717.33	7,100	6,551	0.7074	2,710	21.00	129	76.5
1947	33,837.28	30,824	28,442	0.7005	12,162	21.68	561	75.5
1948	104,510.22	94,252	86,968	0.6935	38,444	22.36	1,719	74.5
1949	84,017.53	74,997	69,201	0.6864	31,620	23.05	1,372	73.5
1950	102,735.73	90,749	83,736	0.6792	39,547	23.75	1,665	72.5
1951	34,202.56	29,890	27,580	0.6720	13,463	24.46	550	71.5
1952	146,320.69	126,481	116,706	0.6647	58,879	25.17	2,339	70.5
1953	300,175.36	256,587	236,758	0.6573	123,453	25.89	4,768	69.5
1954	142,793.91	120,670	111,345	0.6498	60,008	26.62	2,254	68.5
1955	505,220.20	421,977	389,366	0.6422	216,898	27.36	7,928	67.5
1956	1,036,074.41	855,048	788,969	0.6346	454,321	28.10	16,166	66.5
1957	390,828.91	318,607	293,985	0.6268	175,010	28.86	6,064	65.5
1958	639,271.50	514,634	474,862	0.6190	292,263	29.62	9,866	64.5
1959	460,874.35	366,277	337,971	0.6111	215,078	30.39	7,076	63.5

Kentucky - American Water Company

Account #: 331.001 - TD Mains

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1960	413,641.57	324,438	299,365	0.6031	197,005	31.17	6,320	62.5
1961	242,609.29	187,740	173,231	0.5950	117,900	31.96	3,689	61.5
1962	324,659.52	247,786	228,637	0.5869	160,955	32.76	4,913	60.5
1963	284,281.30	213,919	197,387	0.5786	143,750	33.56	4,283	59.5
1964	403,748.24	299,442	276,301	0.5703	208,197	34.38	6,056	58.5
1965	477,338.64	348,792	321,837	0.5619	250,970	35.20	7,130	57.5
1966	4,141,499.93	2,980,394	2,750,065	0.5534	2,219,735	36.03	61,613	56.5
1967	682,464.24	483,511	446,145	0.5448	372,812	36.86	10,113	55.5
1968	525,955.63	366,704	338,365	0.5361	292,782	37.71	7,764	54.5
1969	669,365.92	459,087	423,608	0.5274	379,631	38.56	9,845	53.5
1970	436,066.71	294,081	271,354	0.5186	251,926	39.42	6,391	52.5
1971	526,196.31	348,784	321,830	0.5097	309,606	40.29	7,685	51.5
1972	1,507,231.21	981,500	905,648	0.5007	903,029	41.16	21,939	50.5
1973	842,895.06	538,996	497,342	0.4917	514,132	42.04	12,229	49.5
1974	3,054,393.14	1,917,012	1,768,862	0.4826	1,896,409	42.93	44,176	48.5
1975	663,547.09	408,551	376,977	0.4734	419,279	43.82	9,568	47.5
1976	767,271.97	463,209	427,411	0.4642	493,315	44.72	11,031	46.5
1977	1,276,216.76	755,050	696,699	0.4549	834,761	45.63	18,295	45.5
1978	1,108,170.91	642,162	592,535	0.4456	737,270	46.54	15,842	44.5
1979	1,451,181.87	823,188	759,571	0.4362	981,847	47.46	20,690	43.5
1980	1,247,670.91	692,406	638,895	0.4267	858,310	48.38	17,742	42.5
1981	498,248.72	270,348	249,455	0.4172	348,443	49.31	7,067	41.5
1982	413,042.15	218,982	202,059	0.4077	293,591	50.24	5,844	40.5
1983	550,370.05	284,913	262,894	0.3981	397,550	51.17	7,769	39.5
1984	1,794,947.65	906,669	836,600	0.3884	1,317,337	52.12	25,277	38.5
1985	5,122,897.89	2,523,106	2,328,117	0.3787	3,819,360	53.06	71,980	37.5
1986	1,759,782.34	844,442	779,182	0.3690	1,332,556	54.01	24,672	36.5
1987	8,210,344.12	3,835,436	3,539,029	0.3592	6,313,384	54.96	114,864	35.5

Kentucky - American Water Company

Account #: 331.001 - TD Mains

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	5,313,717.84	2,414,504	2,227,908	0.3494	4,148,553	55.92	74,186	34.5
1989	3,254,592.80	1,437,197	1,326,128	0.3396	2,579,383	56.88	45,347	33.5
1990	3,652,028.75	1,565,801	1,444,794	0.3297	2,937,641	57.84	50,786	32.5
1991	1,913,138.08	795,611	734,125	0.3198	1,561,641	58.81	26,554	31.5
1992	3,697,611.30	1,489,933	1,374,789	0.3098	3,062,345	59.78	51,228	30.5
1993	3,219,988.34	1,255,758	1,158,712	0.2999	2,705,274	60.75	44,531	29.5
1994	6,528,362.47	2,461,194	2,270,990	0.2899	5,563,045	61.72	90,126	28.5
1995	4,005,451.17	1,457,913	1,345,244	0.2799	3,461,298	62.70	55,203	27.5
1996	5,538,531.67	1,943,673	1,793,464	0.2698	4,852,774	63.68	76,206	26.5
1997	6,223,550.35	2,102,719	1,940,218	0.2598	5,528,042	64.66	85,494	25.5
1998	5,194,888.79	1,687,141	1,556,756	0.2497	4,677,110	65.64	71,251	24.5
1999	8,430,760.74	2,627,460	2,424,406	0.2396	7,692,507	66.63	115,458	23.5
2000	7,435,307.31	2,219,537	2,048,008	0.2295	6,874,361	67.61	101,674	22.5
2001	5,055,926.79	1,442,729	1,331,233	0.2194	4,735,879	68.60	69,038	21.5
2002	190,725.21	51,911	47,899	0.2093	180,971	69.59	2,601	20.5
2003	761.64	197	182	0.1991	732	70.58	10	19.5
2004	69,375.66	17,051	15,733	0.1890	67,517	71.57	943	18.5
2005	574,365.56	133,574	123,252	0.1788	565,987	72.56	7,800	17.5
2006	15,320,311.43	3,360,173	3,100,495	0.1686	15,283,879	73.55	207,801	16.5
2007	32,414,115.90	6,680,073	6,163,828	0.1585	32,733,111	74.54	439,114	15.5
2008	9,275,843.10	1,788,686	1,650,454	0.1483	9,480,558	75.54	125,508	14.5
2009	3,552,869.25	637,992	588,687	0.1381	3,674,756	76.53	48,016	13.5
2010	75,331,936.13	12,527,724	11,559,565	0.1279	78,838,758	77.53	1,016,914	12.5
2011	3,892,512.77	595,642	549,610	0.1177	4,121,406	78.52	52,486	11.5
2012	3,798,661.40	530,817	489,795	0.1074	4,068,599	79.52	51,165	10.5
2013	4,630,862.05	585,562	540,309	0.0972	5,016,726	80.52	62,307	9.5
2014	18,671,276.45	2,112,695	1,949,423	0.0870	20,456,109	81.51	250,953	8.5
2015	7,206,744.44	719,607	663,995	0.0768	7,984,098	82.51	96,764	7.5

Kentucky - American Water Company

Account #: 331.001 - TD Mains

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2016	15,328,422.26	1,326,636	1,224,112	0.0665	17,169,995	83.51	205,607	6.5
2017	12,439,042.91	911,027	840,622	0.0563	14,086,230	84.51	166,687	5.5
2018	10,599,768.63	635,222	586,131	0.0461	12,133,591	85.51	141,904	4.5
2019	9,440,558.68	440,055	406,047	0.0358	10,922,623	86.50	126,267	3.5
2020	11,533,932.22	384,035	354,356	0.0256	13,486,362	87.50	154,125	2.5
2021	20,981,107.35	419,132	386,741	0.0154	24,790,588	88.50	280,114	1.5
2022	29,510,003.59	196,398	181,220	0.0051	35,230,784	89.50	393,636	0.5
TOTAL	398,094,727.91	85,410,262	78,809,643		398,904,030		5,424,097	

COMPOSITE ANNUAL ACCRUAL RATE	1.36%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.20
COMPOSITE AVERAGE AGE (YEARS)	16.32
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	73.91

Kentucky - American Water Company

Account #: 333.000 - Services

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 55
Net Salvage: -65%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	510.72	843	843	1.0000	0	3.00	0	89.5
1939	81.44	133	134	1.0000	0	3.00	0	83.5
1940	159.49	261	263	1.0000	0	3.00	0	82.5
1941	70.77	115	117	1.0000	0	3.00	0	81.5
1942	804.00	1,308	1,327	1.0000	0	3.00	0	80.5
1946	281.15	450	460	0.9920	4	3.00	1	76.5
1953	490.46	761	777	0.9605	32	3.29	10	69.5
1955	835.85	1,283	1,311	0.9507	68	3.82	18	67.5
1956	1,057.00	1,614	1,649	0.9456	95	4.09	23	66.5
1957	2,334.42	3,546	3,623	0.9405	229	4.37	52	65.5
1958	3,897.27	5,887	6,014	0.9353	416	4.65	89	64.5
1959	861.29	1,293	1,321	0.9299	100	4.94	20	63.5
1960	6,994.67	10,441	10,667	0.9243	874	5.24	167	62.5
1961	5,263.34	7,807	7,976	0.9185	708	5.56	127	61.5
1962	40,628.47	59,864	61,163	0.9124	5,874	5.88	998	60.5
1963	7,682.97	11,241	11,485	0.9060	1,192	6.23	191	59.5
1964	4,843.24	7,033	7,186	0.8992	805	6.59	122	58.5
1965	12,435.33	17,915	18,303	0.8920	2,215	6.98	317	57.5
1966	32,078.45	45,818	46,812	0.8844	6,118	7.39	828	56.5
1967	14,292.62	20,227	20,666	0.8763	2,917	7.83	373	55.5
1968	64,503.96	90,388	92,348	0.8677	14,083	8.29	1,699	54.5
1969	82,738.10	114,711	117,199	0.8585	19,319	8.79	2,199	53.5
1970	61,531.63	84,342	86,171	0.8487	15,356	9.31	1,649	52.5
1971	39,880.94	54,003	55,174	0.8385	10,630	9.86	1,078	51.5
1972	109,193.89	145,953	149,118	0.8277	31,052	10.45	2,973	50.5
1973	37,354.02	49,248	50,316	0.8164	11,318	11.05	1,024	49.5
1974	95,240.69	123,758	126,442	0.8046	30,705	11.69	2,628	48.5
1975	72,245.50	92,465	94,471	0.7925	24,734	12.34	2,005	47.5

Kentucky - American Water Company

Account #: 333.000 - Services

ALG - Remaining Life
Survivor Curve: R4
ASL: 55
Net Salvage: -65%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1976	199,351.71	251,154	256,601	0.7801	72,330	13.00	5,562	46.5
1977	294,222.76	364,669	372,577	0.7675	112,890	13.69	8,249	45.5
1978	295,796.55	360,471	368,289	0.7546	119,776	14.38	8,330	44.5
1979	322,714.27	386,443	394,824	0.7415	137,655	15.08	9,126	43.5
1980	292,385.41	343,819	351,275	0.7281	131,161	15.80	8,300	42.5
1981	164,833.30	190,209	194,334	0.7145	77,641	16.53	4,696	41.5
1982	269,523.82	304,990	311,605	0.7007	133,110	17.28	7,703	40.5
1983	245,011.96	271,675	277,567	0.6866	126,703	18.04	7,024	39.5
1984	332,469.71	360,945	368,773	0.6722	179,802	18.81	9,558	38.5
1985	459,948.33	488,480	499,073	0.6576	259,841	19.60	13,258	37.5
1986	557,881.87	579,090	591,648	0.6427	328,857	20.40	16,121	36.5
1987	644,977.27	653,750	667,927	0.6276	396,285	21.21	18,681	35.5
1988	629,969.17	622,913	636,422	0.6123	403,028	22.04	18,286	34.5
1989	790,694.37	761,926	778,449	0.5967	526,196	22.88	22,999	33.5
1990	755,472.61	708,672	724,041	0.5808	522,489	23.73	22,017	32.5
1991	744,136.27	678,741	693,461	0.5648	534,364	24.60	21,726	31.5
1992	928,911.28	822,876	840,721	0.5485	691,982	25.47	27,167	30.5
1993	772,404.39	663,693	678,086	0.5321	596,381	26.36	22,626	29.5
1994	860,174.12	715,969	731,496	0.5154	687,791	27.25	25,236	28.5
1995	949,010.57	764,105	780,676	0.4986	785,192	28.16	27,882	27.5
1996	1,041,896.35	810,254	827,826	0.4815	891,303	29.08	30,653	26.5
1997	975,567.84	731,609	747,475	0.4644	862,212	30.00	28,738	25.5
1998	1,440,245.34	1,039,789	1,062,339	0.4470	1,314,066	30.93	42,478	24.5
1999	1,665,637.64	1,155,542	1,180,602	0.4296	1,567,700	31.87	49,183	23.5
2000	1,934,097.32	1,286,854	1,314,761	0.4120	1,876,499	32.82	57,173	22.5
2001	9,201,395.89	5,859,041	5,986,104	0.3943	9,196,199	33.77	272,280	21.5
2002	13,621.18	8,281	8,461	0.3765	14,014	34.73	403	20.5
2003	39,072.44	22,625	23,116	0.3586	41,353	35.70	1,158	19.5

Kentucky - American Water Company

Account #: 333.000 - Services

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 55
Net Salvage: -65%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	79,081.40	43,495	44,438	0.3406	86,046	36.67	2,347	18.5
2006	4,901,354.31	2,409,088	2,461,333	0.3043	5,625,902	38.62	145,688	16.5
2007	1,150,010.89	531,433	542,958	0.2861	1,354,560	39.60	34,209	15.5
2008	2,533,662.39	1,096,114	1,119,885	0.2679	3,060,658	40.58	75,424	14.5
2009	3,796,601.55	1,530,234	1,563,419	0.2496	4,700,973	41.56	113,100	13.5
2010	1,854,091.51	692,354	707,369	0.2312	2,351,882	42.55	55,270	12.5
2011	1,673,854.52	575,350	587,827	0.2128	2,174,033	43.54	49,929	11.5
2012	2,319,787.63	728,374	744,170	0.1944	3,083,479	44.53	69,239	10.5
2013	1,080,773.17	307,150	313,811	0.1760	1,469,465	45.53	32,277	9.5
2014	820,410.45	208,688	213,213	0.1575	1,140,464	46.52	24,515	8.5
2015	927,013.10	208,127	212,641	0.1390	1,316,931	47.52	27,715	7.5
2016	1,136,851.25	221,267	226,065	0.1205	1,649,739	48.51	34,007	6.5
2017	1,235,888.41	203,583	207,998	0.1020	1,831,218	49.51	36,987	5.5
2018	2,429,421.17	327,491	334,593	0.0835	3,673,952	50.51	72,742	4.5
2019	2,558,798.90	268,323	274,142	0.0649	3,947,876	51.50	76,651	3.5
2020	1,252,504.84	93,827	95,862	0.0464	1,970,771	52.50	37,536	2.5
2021	3,574,761.12	160,684	164,169	0.0278	5,734,187	53.50	107,178	1.5
2022	2,870,303.23	42,995	43,928	0.0093	4,692,073	54.50	86,092	0.5
TOTAL	63,714,885.26	31,809,870	32,499,686		72,629,874		1,886,110	

COMPOSITE ANNUAL ACCRUAL RATE	2.96%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.51
COMPOSITE AVERAGE AGE (YEARS)	17.11
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	38.36

Kentucky - American Water Company

Account #: 334.100 - Meters

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1986	1,456.34	1,675	332	0.1979	1,343	3.00	448	36.5
1988	2,096.79	2,411	477	0.1977	1,935	3.00	645	34.5
2002	56,623.00	65,116	12,871	0.1977	52,246	3.00	17,415	20.5
2003	29,910.50	34,397	6,799	0.1977	27,598	3.00	9,199	19.5
2006	14,513.75	15,856	3,134	0.1878	13,557	3.00	4,519	16.5
2008	1,293,087.40	1,384,353	273,628	0.1840	1,213,422	3.00	404,474	14.5
2009	468,655.96	489,562	96,766	0.1795	442,189	3.00	147,396	13.5
2010	2,261,724.27	2,298,315	454,280	0.1747	2,146,703	3.00	715,568	12.5
2011	5,310,049.34	5,218,338	1,031,446	0.1689	5,075,111	3.00	1,691,704	11.5
2012	2,482,230.07	2,334,730	461,478	0.1617	2,393,087	3.00	797,696	10.5
2013	1,932,824.26	1,715,546	339,091	0.1526	1,883,657	3.00	627,886	9.5
2014	327,351.57	269,577	53,284	0.1415	323,170	3.00	107,723	8.5
2015	208,809.43	156,504	30,934	0.1288	209,197	3.48	60,070	7.5
2016	57,115.56	38,109	7,533	0.1147	58,150	4.20	13,852	6.5
2017	34,596.67	19,997	3,953	0.0993	35,834	4.97	7,204	5.5
2018	3,746,567.82	1,808,636	357,491	0.0830	3,951,062	5.80	680,957	4.5
2019	3,313,169.36	1,265,981	250,231	0.0657	3,559,914	6.68	533,133	3.5
2020	689,125.79	190,799	37,713	0.0476	754,782	7.59	99,412	2.5
2021	1,363,288.86	229,009	45,265	0.0289	1,522,517	8.54	178,296	1.5
2022	3,532,307.73	199,395	39,412	0.0097	4,022,742	9.51	423,040	0.5
TOTAL	27,125,504.47	17,738,309	3,506,116		27,688,214		6,520,637	

COMPOSITE ANNUAL ACCRUAL RATE	24.04%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.13
COMPOSITE AVERAGE AGE (YEARS)	7.37
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	5.09

Kentucky - American Water Company

Account #: 334.110 - Meters - Bronze Case

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2006	37,862.01	41,364	15,917	0.3656	27,624	3.00	9,208	16.5
2007	438.29	478	184	0.3649	320	3.00	107	15.5
2008	1,966,990.53	2,105,821	810,341	0.3582	1,451,698	3.00	483,899	14.5
2009	263,744.72	275,510	106,019	0.3495	197,287	3.00	65,762	13.5
2019	159,756.32	61,044	23,490	0.1279	160,229	6.68	23,996	3.5
TOTAL	2,428,791.87	2,484,217	955,952		1,837,159		582,972	

COMPOSITE ANNUAL ACCRUAL RATE	24.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	13.70
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.24

Kentucky - American Water Company

Account #: 334.120 - Meters - Plastic Case

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1976	303.88	349	-268	-0.7656	617	3.00	206	46.5
1977	296.96	342	-262	-0.7662	603	3.00	201	45.5
1979	106.98	123	-94	-0.7662	217	3.00	72	43.5
1981	465.52	535	-410	-0.7662	946	3.00	315	41.5
1983	108.98	125	-96	-0.7662	221	3.00	74	39.5
1984	38.00	44	-33	-0.7661	77	3.00	26	38.5
1985	3,175.62	3,652	-2,798	-0.7662	6,450	3.00	2,150	37.5
1986	1,053.79	1,212	-929	-0.7662	2,140	3.00	713	36.5
1987	937.01	1,078	-826	-0.7662	1,903	3.00	634	35.5
1988	1,711.33	1,968	-1,508	-0.7662	3,476	3.00	1,159	34.5
1989	3,353.34	3,856	-2,955	-0.7662	6,811	3.00	2,270	33.5
1992	1,881.27	2,163	-1,658	-0.7662	3,821	3.00	1,274	30.5
1993	6,609.64	7,601	-5,824	-0.7662	13,425	3.00	4,475	29.5
1994	45,303.92	52,100	-39,919	-0.7662	92,019	3.00	30,673	28.5
1995	11,934.36	13,725	-10,516	-0.7662	24,240	3.00	8,080	27.5
1997	9,263.92	10,654	-8,163	-0.7662	18,816	3.00	6,272	25.5
2001	282,382.96	324,740	-248,821	-0.7662	573,561	3.00	191,187	21.5
2007	4,165.32	4,542	-3,480	-0.7265	8,270	3.00	2,757	15.5
2013	5,815.36	5,162	-3,955	-0.5914	10,643	3.00	3,548	9.5
2014	16,203.31	13,344	-10,224	-0.5487	28,858	3.00	9,619	8.5
2019	72,034.73	27,525	-21,090	-0.2546	103,930	6.68	15,565	3.5
2020	653.38	181	-139	-0.1845	890	7.59	117	2.5
2021	8,269.77	1,389	-1,064	-0.1119	10,575	8.54	1,238	1.5

Kentucky - American Water Company

Account #: 334.120 - Meters - Plastic Case

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	476,069.35	476,409	-365,031		912,511		282,625	

COMPOSITE ANNUAL ACCRUAL RATE	59.37%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.77
COMPOSITE AVERAGE AGE (YEARS)	19.16
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.66

Kentucky - American Water Company

Account #: 334.130 - Meters - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	221.37	255	81	0.3186	173	3.00	58	88.5
1935	46.68	54	17	0.3185	37	3.00	12	87.5
1936	184.20	212	67	0.3186	144	3.00	48	86.5
1937	118.84	137	44	0.3186	93	3.00	31	85.5
1939	69.91	80	26	0.3187	55	3.00	18	83.5
1941	274.11	315	100	0.3186	215	3.00	72	81.5
1946	90.46	104	33	0.3187	71	3.00	24	76.5
1950	63.27	73	23	0.3186	50	3.00	17	72.5
1951	434.51	500	159	0.3186	340	3.00	113	71.5
1952	56.86	65	21	0.3186	45	3.00	15	70.5
1953	528.43	608	194	0.3186	414	3.00	138	69.5
1954	567.11	652	208	0.3186	444	3.00	148	68.5
1956	913.13	1,050	335	0.3186	716	3.00	239	66.5
1957	566.29	651	207	0.3186	444	3.00	148	65.5
1958	94.99	109	35	0.3187	74	3.00	25	64.5
1959	828.81	953	304	0.3186	649	3.00	216	63.5
1960	1,132.35	1,302	415	0.3186	887	3.00	296	62.5
1961	782.01	899	287	0.3186	613	3.00	204	61.5
1962	333.51	384	122	0.3186	261	3.00	87	60.5
1963	1,615.14	1,857	592	0.3186	1,266	3.00	422	59.5
1964	554.45	638	203	0.3186	434	3.00	145	58.5
1965	2,628.95	3,023	963	0.3186	2,060	3.00	687	57.5
1966	2,689.20	3,093	985	0.3186	2,107	3.00	702	56.5
1967	3,381.70	3,889	1,239	0.3186	2,650	3.00	883	55.5
1971	1,116.84	1,284	409	0.3186	875	3.00	292	51.5
1977	594.85	684	218	0.3186	466	3.00	155	45.5
1978	1,487.77	1,711	545	0.3186	1,166	3.00	389	44.5
1980	1,729.52	1,989	634	0.3186	1,355	3.00	452	42.5

Kentucky - American Water Company

Account #: 334.130 - Meters - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1981	560.70	645	205	0.3186	439	3.00	146	41.5
1983	376.27	433	138	0.3186	295	3.00	98	39.5
1985	6,562.14	7,546	2,404	0.3186	5,142	3.00	1,714	37.5
1986	6,691.30	7,695	2,452	0.3186	5,243	3.00	1,748	36.5
1987	157.20	181	58	0.3186	123	3.00	41	35.5
1988	2,180.02	2,507	799	0.3186	1,708	3.00	569	34.5
1989	4,247.33	4,884	1,556	0.3186	3,328	3.00	1,109	33.5
1990	2,580.38	2,967	945	0.3186	2,022	3.00	674	32.5
1992	9,519.28	10,947	3,488	0.3186	7,459	3.00	2,486	30.5
1993	8,582.94	9,870	3,145	0.3186	6,726	3.00	2,242	29.5
1994	10,008.78	11,510	3,667	0.3186	7,843	3.00	2,614	28.5
1995	9,026.06	10,380	3,307	0.3186	7,073	3.00	2,358	27.5
1996	91,710.15	105,467	33,603	0.3186	71,863	3.00	23,954	26.5
1997	126,486.24	145,459	46,346	0.3186	99,114	3.00	33,038	25.5
1998	172,258.15	198,097	63,117	0.3186	134,980	3.00	44,993	24.5
1999	102,800.26	118,220	37,667	0.3186	80,553	3.00	26,851	23.5
2000	298,668.92	343,469	109,435	0.3186	234,035	3.00	78,012	22.5
2003	50,508.48	58,085	18,507	0.3186	39,578	3.00	13,193	19.5
2004	18,050.92	20,759	6,614	0.3186	14,145	3.00	4,715	18.5
2006	5,319,740.33	5,811,816	1,851,734	0.3027	4,265,968	3.00	1,421,989	16.5
2007	67,524.64	73,633	23,461	0.3021	54,193	3.00	18,064	15.5
2008	20,002.65	21,414	6,823	0.2966	16,180	3.00	5,393	14.5
2009	147,426.61	154,003	49,068	0.2894	120,473	3.00	40,158	13.5
2019	177,047.35	67,651	21,555	0.1059	182,050	6.68	27,264	3.5

Kentucky - American Water Company

Account #: 334.130 - Meters - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	6,675,822.36	7,214,211	2,298,558		5,378,638		1,759,459	

COMPOSITE ANNUAL ACCRUAL RATE	26.36%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.34
COMPOSITE AVERAGE AGE (YEARS)	17.27
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.10

Kentucky - American Water Company

Account #: 334.131 - Meter Reading Units

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2006	270,917.62	295,978	117,516	0.3772	194,039	3.00	64,680	16.5
2008	5,583.31	5,977	2,373	0.3696	4,048	3.00	1,349	14.5
2011	17,183.36	16,887	6,705	0.3393	13,056	3.00	4,352	11.5
2012	30,826.98	28,995	11,512	0.3247	23,939	3.00	7,980	10.5
2013	688.47	611	243	0.3064	549	3.00	183	9.5
2014	127,744.37	105,199	41,768	0.2843	105,138	3.00	35,046	8.5
2015	214.05	160	64	0.2588	182	3.48	52	7.5
2019	22,538.95	8,612	3,419	0.1319	22,500	6.68	3,370	3.5
2020	251,930.65	69,752	27,695	0.0956	262,026	7.59	34,511	2.5
TOTAL	727,627.76	532,171	211,295		625,477		151,523	

COMPOSITE ANNUAL ACCRUAL RATE	20.82%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.29
COMPOSITE AVERAGE AGE (YEARS)	9.45
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.70

Kentucky - American Water Company

Account #: 334.200 - Meter Installations

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	744.57	847	893	1.0000	0	3.15	0	88.5
1935	992.35	1,123	1,191	1.0000	0	3.41	0	87.5
1936	61.55	69	74	1.0000	0	3.66	0	86.5
1939	1,448.05	1,609	1,738	1.0000	0	4.43	0	83.5
1940	535.79	593	643	1.0000	0	4.69	0	82.5
1941	347.81	383	417	1.0000	0	4.95	0	81.5
1942	940.92	1,031	1,129	1.0000	0	5.20	0	80.5
1945	280.47	303	337	1.0000	0	5.99	0	77.5
1946	151.10	162	181	1.0000	0	6.26	0	76.5
1947	4,661.39	4,985	5,594	1.0000	0	6.53	0	75.5
1948	3,785.57	4,027	4,543	1.0000	0	6.81	0	74.5
1949	18,030.66	19,078	21,637	1.0000	0	7.09	0	73.5
1950	1,898.88	1,998	2,279	1.0000	0	7.39	0	72.5
1951	8,985.34	9,400	10,782	1.0000	0	7.69	0	71.5
1952	14,692.46	15,278	17,631	1.0000	0	8.01	0	70.5
1953	19,557.52	20,209	23,469	1.0000	0	8.33	0	69.5
1954	20,262.60	20,801	24,315	1.0000	0	8.67	0	68.5
1955	23,485.62	23,945	28,183	1.0000	0	9.02	0	67.5
1956	22,655.35	22,934	27,186	1.0000	0	9.39	0	66.5
1957	33,014.32	33,171	39,390	0.9943	228	9.76	23	65.5
1958	23,041.57	22,970	27,276	0.9865	374	10.16	37	64.5
1959	15,562.28	15,387	18,272	0.9784	403	10.56	38	63.5
1960	32,153.68	31,521	37,430	0.9701	1,155	10.98	105	62.5
1961	33,915.57	32,951	39,128	0.9614	1,571	11.42	138	61.5
1962	30,073.81	28,945	34,372	0.9524	1,717	11.88	145	60.5
1963	51,082.20	48,686	57,813	0.9431	3,485	12.35	282	59.5
1964	48,998.21	46,224	54,889	0.9335	3,909	12.83	305	58.5
1965	25,892.69	24,167	28,698	0.9236	2,374	13.33	178	57.5

Kentucky - American Water Company

Account #: 334.200 - Meter Installations

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1966	69,841.88	64,465	76,550	0.9134	7,260	13.85	524	56.5
1967	59,006.87	53,834	63,927	0.9028	6,881	14.38	478	55.5
1968	56,327.53	50,773	60,291	0.8920	7,302	14.93	489	54.5
1969	42,542.88	37,868	44,967	0.8808	6,084	15.49	393	53.5
1970	49,874.98	43,817	52,031	0.8694	7,819	16.07	486	52.5
1971	52,828.42	45,785	54,369	0.8576	9,025	16.67	542	51.5
1972	80,028.66	68,387	81,208	0.8456	14,827	17.27	858	50.5
1973	67,141.80	56,540	67,140	0.8333	13,431	17.90	751	49.5
1974	134,756.14	111,768	132,721	0.8207	28,986	18.53	1,564	48.5
1975	87,694.99	71,598	85,021	0.8079	20,213	19.18	1,054	47.5
1976	99,024.44	79,539	94,451	0.7948	24,378	19.84	1,229	46.5
1977	150,703.81	119,022	141,336	0.7815	39,508	20.51	1,926	45.5
1978	200,757.84	155,804	185,014	0.7680	55,896	21.20	2,637	44.5
1979	199,613.81	152,135	180,656	0.7542	58,880	21.89	2,689	43.5
1980	201,904.28	151,025	179,338	0.7402	62,947	22.60	2,785	42.5
1981	169,704.75	124,501	147,842	0.7260	55,804	23.32	2,393	41.5
1982	200,412.55	144,106	171,122	0.7115	69,373	24.05	2,885	40.5
1983	183,597.83	129,302	153,543	0.6969	66,774	24.79	2,694	39.5
1984	272,649.01	187,933	223,166	0.6821	104,013	25.54	4,073	38.5
1985	384,431.99	259,147	307,730	0.6671	153,588	26.29	5,841	37.5
1986	366,628.21	241,513	286,791	0.6519	153,163	27.06	5,660	36.5
1987	438,871.25	282,276	335,196	0.6365	191,449	27.84	6,877	35.5
1988	381,481.31	239,359	284,233	0.6209	173,545	28.63	6,062	34.5
1989	512,074.49	313,153	371,861	0.6052	242,628	29.42	8,246	33.5
1990	353,485.91	210,482	249,943	0.5892	174,240	30.23	5,764	32.5
1991	408,384.36	236,529	280,873	0.5731	209,189	31.04	6,739	31.5
1992	306,722.19	172,610	204,971	0.5569	163,096	31.86	5,119	30.5
1993	490,162.24	267,708	317,897	0.5405	270,298	32.69	8,268	29.5

Kentucky - American Water Company

Account #: 334.200 - Meter Installations

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1994	429,065.08	227,147	269,732	0.5239	245,146	33.53	7,311	28.5
1995	347,971.51	178,331	211,764	0.5071	205,802	34.38	5,987	27.5
1996	490,082.15	242,793	288,311	0.4902	299,787	35.23	8,510	26.5
1997	694,381.88	332,041	394,291	0.4732	438,967	36.09	12,163	25.5
1998	519,293.39	239,295	284,157	0.4560	338,995	36.96	9,172	24.5
1999	755,970.39	335,111	397,936	0.4387	509,228	37.84	13,459	23.5
2000	540,687.26	230,125	273,268	0.4212	375,556	38.72	9,699	22.5
2001	8,078.12	3,294	3,912	0.4036	5,782	39.61	146	21.5
2002	17,074.50	6,657	7,905	0.3858	12,584	40.51	311	20.5
2006	4,268,166.63	1,352,372	1,605,909	0.3135	3,515,891	44.16	79,622	16.5
2007	163,821.85	48,869	58,031	0.2952	138,556	45.08	3,073	15.5
2008	129,715.27	36,275	43,075	0.2767	112,583	46.02	2,447	14.5
2009	1,029,296.17	268,529	318,872	0.2582	916,283	46.96	19,514	13.5
2010	866,604.40	209,745	249,068	0.2395	790,858	47.90	16,511	12.5
2011	456,990.21	101,946	121,058	0.2208	427,330	48.85	8,749	11.5
2012	642,116.96	131,017	155,580	0.2019	614,961	49.80	12,349	10.5
2013	3,302,377.11	610,673	725,159	0.1830	3,237,693	50.75	63,792	9.5
2014	1,055,140.59	174,856	207,637	0.1640	1,058,531	51.71	20,469	8.5
2015	1,276,882.09	186,989	222,046	0.1449	1,310,213	52.68	24,872	7.5
2016	2,033,663.62	258,480	306,939	0.1258	2,133,458	53.64	39,770	6.5
2017	2,338,232.75	251,812	299,020	0.1066	2,506,859	54.62	45,900	5.5
2018	558,646.98	49,286	58,526	0.0873	611,850	55.59	11,007	4.5
2019	416,229.16	28,596	33,957	0.0680	465,518	56.56	8,230	3.5
2020	520,359.65	25,565	30,358	0.0486	594,074	57.54	10,324	2.5
2021	832,339.28	24,561	29,165	0.0292	969,642	58.52	16,568	1.5
2022	1,396,934.94	13,753	16,332	0.0097	1,659,990	59.51	27,895	0.5

Kentucky - American Water Company

Account #: 334.200 - Meter Installations

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	31,548,028.69	10,071,894	11,955,688		25,901,947		568,127	

COMPOSITE ANNUAL ACCRUAL RATE	1.80%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.38
COMPOSITE AVERAGE AGE (YEARS)	17.33
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	44.04

Kentucky - American Water Company

Account #: 334.300 - Meter Vaults

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 60
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1982	2,000.00	1,170	-151	-0.0627	2,551	30.75	83	40.5
1996	12,500.00	5,279	-680	-0.0453	15,680	38.88	403	26.5
2008	112.43	28	-4	-0.0272	139	47.33	3	14.5
2009	25,379.86	6,037	-777	-0.0255	31,233	48.11	649	13.5
2010	3,096.52	688	-88	-0.0238	3,804	48.90	78	12.5
2011	226,395.07	46,623	-6,001	-0.0221	277,675	49.70	5,587	11.5
2012	201,622.79	38,221	-4,920	-0.0203	246,867	50.52	4,886	10.5
2013	121,774.13	21,060	-2,711	-0.0185	148,840	51.35	2,898	9.5
2014	189,771.62	29,612	-3,811	-0.0167	231,537	52.20	4,436	8.5
2015	194,887.40	27,059	-3,483	-0.0149	237,348	53.06	4,473	7.5
2016	61,667.48	7,485	-963	-0.0130	74,964	53.93	1,390	6.5
2017	160,729.92	16,652	-2,143	-0.0111	195,019	54.82	3,557	5.5
2018	173,677.04	14,852	-1,912	-0.0092	210,324	55.72	3,774	4.5
2019	232,285.39	15,594	-2,007	-0.0072	280,750	56.64	4,956	3.5
2020	501,784.81	24,295	-3,127	-0.0052	605,269	57.58	10,512	2.5
2021	794,961.95	23,327	-3,002	-0.0031	956,957	58.53	16,349	1.5
2022	753,724.24	7,458	-960	-0.0011	905,429	59.51	15,216	0.5
TOTAL	3,656,370.65	285,439	-36,739		4,424,384		79,250	

COMPOSITE ANNUAL ACCRUAL RATE	2.17%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.01
COMPOSITE AVERAGE AGE (YEARS)	4.23
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	56.10

Kentucky - American Water Company

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	113.96	154	106	0.6621	54	3.00	18	88.5
1937	15.89	21	15	0.6545	8	3.03	3	85.5
1939	85.34	113	78	0.6491	42	3.53	12	83.5
1941	9.80	13	9	0.6436	5	4.05	1	81.5
1948	191.71	244	167	0.6230	101	6.00	17	74.5
1949	123.52	156	107	0.6198	66	6.31	10	73.5
1950	69.48	87	60	0.6165	37	6.62	6	72.5
1951	91.98	115	79	0.6130	50	6.95	7	71.5
1952	272.56	339	233	0.6094	149	7.29	20	70.5
1953	628.37	776	533	0.6056	347	7.65	45	69.5
1954	336.69	413	284	0.6016	188	8.03	23	68.5
1955	1,151.46	1,403	963	0.5974	649	8.43	77	67.5
1956	929.09	1,124	771	0.5930	529	8.85	60	66.5
1957	1,087.87	1,305	896	0.5883	627	9.29	68	65.5
1958	1,048.39	1,248	856	0.5834	611	9.75	63	64.5
1959	3,491.85	4,118	2,827	0.5782	2,062	10.24	201	63.5
1960	13,810.36	16,135	11,075	0.5728	8,260	10.76	768	62.5
1961	26,074.69	30,159	20,701	0.5671	15,803	11.30	1,399	61.5
1962	22,992.05	26,314	18,062	0.5611	14,127	11.86	1,191	60.5
1963	25,232.32	28,558	19,602	0.5549	15,723	12.45	1,263	59.5
1964	41,970.50	46,951	32,227	0.5485	26,531	13.06	2,031	58.5
1965	20,120.91	22,235	15,262	0.5418	12,907	13.69	943	57.5
1966	87,278.17	95,233	65,368	0.5350	56,821	14.34	3,962	56.5
1967	27,402.04	29,508	20,255	0.5280	18,108	15.00	1,207	55.5
1968	22,811.86	24,234	16,635	0.5209	15,302	15.68	976	54.5
1969	54,353.84	56,941	39,085	0.5136	37,010	16.36	2,262	53.5
1970	44,633.13	46,090	31,636	0.5063	30,850	17.06	1,809	52.5
1971	44,054.99	44,823	30,767	0.4988	30,910	17.76	1,740	51.5

Kentucky - American Water Company

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1972	32,899.75	32,966	22,628	0.4913	23,432	18.48	1,268	50.5
1973	125,785.21	124,066	85,160	0.4836	90,939	19.21	4,735	49.5
1974	179,481.08	174,169	119,551	0.4758	131,723	19.95	6,604	48.5
1975	88,075.45	84,046	57,690	0.4679	65,616	20.70	3,171	47.5
1976	35,176.40	32,989	22,644	0.4598	26,603	21.46	1,240	46.5
1977	100,007.87	92,124	63,234	0.4516	76,777	22.23	3,453	45.5
1978	53,535.94	48,408	33,228	0.4433	41,723	23.02	1,813	44.5
1979	148,919.71	132,101	90,675	0.4349	117,813	23.81	4,947	43.5
1980	127,182.96	110,603	75,918	0.4264	102,138	24.62	4,148	42.5
1981	74,378.92	63,370	43,497	0.4177	60,633	25.44	2,383	41.5
1982	78,637.32	65,590	45,021	0.4089	65,071	26.27	2,477	40.5
1983	60,248.76	49,160	33,744	0.4001	50,604	27.12	1,866	39.5
1984	158,254.11	126,223	86,640	0.3911	134,915	27.97	4,824	38.5
1985	163,231.19	127,161	87,284	0.3819	141,240	28.83	4,899	37.5
1986	109,635.48	83,350	57,212	0.3727	96,278	29.70	3,241	36.5
1987	221,049.19	163,853	112,470	0.3634	196,999	30.58	6,441	35.5
1988	230,761.84	166,628	114,375	0.3540	208,692	31.47	6,630	34.5
1989	222,642.15	156,451	107,389	0.3445	204,310	32.37	6,311	33.5
1990	342,379.97	233,903	160,552	0.3350	318,780	33.28	9,578	32.5
1991	201,918.67	133,961	91,952	0.3253	190,734	34.20	5,577	31.5
1992	330,450.09	212,670	145,978	0.3155	316,652	35.12	9,016	30.5
1993	222,042.76	138,454	95,036	0.3057	215,824	36.05	5,987	29.5
1994	261,284.08	157,656	108,216	0.2958	257,582	36.99	6,964	28.5
1995	216,035.95	125,969	86,466	0.2859	215,984	37.93	5,695	27.5
1996	326,606.99	183,774	126,144	0.2759	331,106	38.88	8,517	26.5
1997	254,178.45	137,802	94,588	0.2658	261,262	39.83	6,560	25.5
1998	270,789.51	141,220	96,934	0.2557	282,171	40.79	6,918	24.5
1999	365,298.22	182,935	125,567	0.2455	385,850	41.75	9,242	23.5

Kentucky - American Water Company

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2000	254,827.56	122,307	83,952	0.2353	272,806	42.72	6,386	22.5
2001	2,190.16	1,005	690	0.2251	2,376	43.69	54	21.5
2002	12,327.86	5,401	3,707	0.2148	13,552	44.66	303	20.5
2004	1,604.05	635	436	0.1941	1,810	46.62	39	18.5
2005	1,380.30	517	355	0.1837	1,577	47.60	33	17.5
2006	3,692,496.36	1,305,561	896,145	0.1734	4,273,350	48.58	87,958	16.5
2007	543,977.26	180,775	124,085	0.1629	637,483	49.57	12,860	15.5
2008	505,443.04	157,208	107,909	0.1525	599,711	50.56	11,862	14.5
2009	465,734.99	134,927	92,614	0.1420	559,415	51.55	10,852	13.5
2010	696,780.97	186,983	128,346	0.1316	847,147	52.54	16,124	12.5
2011	486,945.31	120,261	82,548	0.1211	599,175	53.53	11,193	11.5
2012	629,915.43	142,087	97,530	0.1106	784,352	54.53	14,385	10.5
2013	1,160,567.96	236,918	162,622	0.1001	1,462,173	55.52	26,335	9.5
2014	2,105,605.76	384,689	264,053	0.0896	2,683,795	56.52	47,486	8.5
2015	2,128,590.85	343,211	235,582	0.0791	2,744,445	57.51	47,718	7.5
2016	2,303,671.40	321,979	221,008	0.0685	3,004,132	58.51	51,343	6.5
2017	1,248,001.87	147,619	101,327	0.0580	1,645,876	59.51	27,658	5.5
2018	983,940.52	95,238	65,372	0.0475	1,312,145	60.51	21,686	4.5
2019	1,733,616.08	130,527	89,594	0.0369	2,337,468	61.50	38,005	3.5
2020	1,602,875.10	86,210	59,175	0.0264	2,184,850	62.50	34,956	2.5
2021	3,068,864.47	99,036	67,979	0.0158	4,228,431	63.50	66,588	1.5
2022	3,076,057.80	33,078	22,705	0.0053	4,283,776	64.50	66,414	0.5

Kentucky - American Water Company

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	32,146,685.94	8,196,587	5,626,185		39,379,175		764,925	

COMPOSITE ANNUAL ACCRUAL RATE	2.38%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.18
COMPOSITE AVERAGE AGE (YEARS)	12.11
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	53.16

Kentucky - American Water Company

Account #: 339.600 - Other P/E - CPS

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2013	297,442.08	282,570	237,745	0.7993	59,697	3.00	19,899	9.5
2015	9,028.20	6,771	5,697	0.6310	3,331	3.00	1,110	7.5
2016	3,870.78	2,516	2,117	0.5469	1,754	3.50	501	6.5
2017	64,425.00	35,434	29,813	0.4628	34,612	4.50	7,692	5.5
2018	421,694.23	189,762	159,660	0.3786	262,034	5.50	47,643	4.5
2019	89,615.41	31,365	26,390	0.2945	63,226	6.50	9,727	3.5
2020	84,309.17	21,077	17,734	0.2103	66,575	7.50	8,877	2.5
TOTAL	970,384.87	569,496	479,155		491,230		95,449	

COMPOSITE ANNUAL ACCRUAL RATE	9.84%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.49
COMPOSITE AVERAGE AGE (YEARS)	5.87
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.90

Kentucky - American Water Company

Account #: 340.100 - Office Furniture & Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	4,361.47	4,034	3,257	0.7467	1,105	3.00	368	18.5
2005	14,130.29	12,364	9,980	0.7063	4,150	3.00	1,383	17.5
2006	20,545.69	16,950	13,682	0.6659	6,863	3.50	1,961	16.5
2007	24,682.76	19,129	15,441	0.6256	9,242	4.50	2,054	15.5
2008	16,838.09	12,208	9,854	0.5852	6,984	5.50	1,270	14.5
2010	77,677.74	48,549	39,188	0.5045	38,489	7.50	5,132	12.5
2011	14,392.26	8,276	6,680	0.4641	7,712	8.50	907	11.5
2012	160,805.49	84,423	68,146	0.4238	92,659	9.50	9,754	10.5
2013	2,424.49	1,152	930	0.3834	1,495	10.50	142	9.5
2014	821.90	349	282	0.3431	540	11.50	47	8.5
2015	16,513.93	6,193	4,999	0.3027	11,515	12.50	921	7.5
2016	52,041.75	16,914	13,653	0.2623	38,389	13.50	2,844	6.5
2017	12,079.79	3,322	2,681	0.2220	9,398	14.50	648	5.5
2018	49,171.29	11,064	8,931	0.1816	40,241	15.50	2,596	4.5
2019	50,093.17	8,766	7,076	0.1413	43,017	16.50	2,607	3.5
2020	2,505.75	313	253	0.1009	2,253	17.50	129	2.5
2021	5,448.16	409	330	0.0605	5,118	18.50	277	1.5
2022	32,732.48	818	661	0.0202	32,072	19.50	1,645	0.5
TOTAL	557,266.50	255,231	206,023		351,243		34,685	

COMPOSITE ANNUAL ACCRUAL RATE	6.22%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.37
COMPOSITE AVERAGE AGE (YEARS)	9.16
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	10.86

Kentucky - American Water Company

Account #: 340.200 - Computer & Peripheral - Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2019	35,492.98	12,423	23,662	0.6667	11,831	6.50	1,820	3.5
TOTAL	35,492.98	12,423	23,662		11,831		1,820	

COMPOSITE ANNUAL ACCRUAL RATE	5.13%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.67
COMPOSITE AVERAGE AGE (YEARS)	3.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	6.50

Kentucky - American Water Company

Account #: 340.210 - Computer & Peripheral - Mainframe

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	9,823.67	8,841	347	0.0353	9,477	3.00	3,159	4.5
TOTAL	9,823.67	8,841	347		9,477		3,159	

COMPOSITE ANNUAL ACCRUAL RATE	32.16%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.04
COMPOSITE AVERAGE AGE (YEARS)	4.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.00

Kentucky - American Water Company

Account #: 340.220 - Computer & Peripheral - Personal

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	60,858.54	54,773	-23,325	-0.3833	84,183	3.00	28,061	4.5
2019	60,499.12	42,349	-18,034	-0.2981	78,533	3.00	26,178	3.5
2020	71,979.55	35,990	-15,326	-0.2129	87,306	3.00	29,102	2.5
2021	42,047.31	12,614	-5,372	-0.1278	47,419	3.50	13,548	1.5
2022	178,873.14	17,887	-7,617	-0.0426	186,490	4.50	41,442	0.5
TOTAL	414,257.66	163,613	-69,674		483,932		138,331	

COMPOSITE ANNUAL ACCRUAL RATE	33.39%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.17
COMPOSITE AVERAGE AGE (YEARS)	1.97
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.70

Kentucky - American Water Company

Account #: 340.230 - Computer & Peripheral - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	84,453.77	76,008	73,111	0.8657	11,343	3.00	3,781	4.5
2019	128,287.89	89,802	86,378	0.6733	41,910	3.00	13,970	3.5
2020	157,112.24	78,556	75,561	0.4809	81,551	3.00	27,184	2.5
2021	413,875.57	124,163	119,429	0.2886	294,447	3.50	84,128	1.5
2022	121,965.85	12,197	11,732	0.0962	110,234	4.50	24,497	0.5
TOTAL	905,695.32	380,725	366,210		539,485		153,560	

COMPOSITE ANNUAL ACCRUAL RATE	16.95%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.40
COMPOSITE AVERAGE AGE (YEARS)	2.10
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.43

Kentucky - American Water Company

Account #: 340.300 - Computer Software

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	1,796,954.83	1,617,259	1,386,204	0.7714	410,751	3.00	136,917	4.5
2019	2,666,409.33	1,866,487	1,599,824	0.6000	1,066,585	3.00	355,528	3.5
2020	3,348,481.56	1,674,241	1,435,044	0.4286	1,913,437	3.00	637,812	2.5
2021	3,339,752.02	1,001,926	858,782	0.2571	2,480,970	3.50	708,849	1.5
2022	2,533,715.54	253,372	217,173	0.0857	2,316,543	4.50	514,787	0.5
TOTAL	13,685,313.28	6,413,284	5,497,027		8,188,286		2,353,893	

COMPOSITE ANNUAL ACCRUAL RATE	17.20%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.40
COMPOSITE AVERAGE AGE (YEARS)	2.34
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.40

Kentucky - American Water Company

Account #: 340.315 - Computer Software - Special Depreciation Rate

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2013	6,596,195.41	6,266,386	5,930,654	0.8991	665,542	3.00	221,847	9.5
2014	193,921.98	164,834	156,002	0.8045	37,920	3.00	12,640	8.5
TOTAL	6,790,117.39	6,431,219	6,086,656		703,461		234,487	

COMPOSITE ANNUAL ACCRUAL RATE	3.45%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.90
COMPOSITE AVERAGE AGE (YEARS)	9.47
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.00

Kentucky - American Water Company

Account #: 340.325 - Computer Software - Customized

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	332.88	277	333	1.0000	0	3.00	0	12.5
2018	764,491.32	229,347	764,491	1.0000	0	10.50	0	4.5
2019	1,088,690.04	254,028	1,002,135	0.9205	86,555	11.50	7,527	3.5
TOTAL	1,853,514.24	483,652	1,766,959		86,555		7,527	

COMPOSITE ANNUAL ACCRUAL RATE	0.41%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.95
COMPOSITE AVERAGE AGE (YEARS)	3.91
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.09

Kentucky - American Water Company

Account #: 340.330 - Computer Software - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2019	128,613.14	30,010	50,940	0.3961	77,673	11.50	6,754	3.5
2020	64,303.26	10,717	18,192	0.2829	46,111	12.50	3,689	2.5
TOTAL	192,916.40	40,727	69,132		123,784		10,443	

COMPOSITE ANNUAL ACCRUAL RATE	5.41%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.36
COMPOSITE AVERAGE AGE (YEARS)	3.17
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.83

Kentucky - American Water Company

Account #: 340.500 - Other Office Equipment

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2020	32,291.43	5,382	9,417	0.2916	22,874	12.50	1,830	2.5
2021	12,248.04	1,225	2,143	0.1750	10,105	13.50	749	1.5
TOTAL	44,539.47	6,607	11,560		32,979		2,579	

COMPOSITE ANNUAL ACCRUAL RATE	5.79%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.26
COMPOSITE AVERAGE AGE (YEARS)	2.23
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	12.77

Kentucky - American Water Company

Account #: 341.100 - Transportation Equipment - Light Duty Trucks

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: L2.5
ASL: 5
Net Salvage: 25%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2001	1,752.14	1,314	1,314	1.0000	0	3.00	0	21.5
2007	25,016.41	18,762	18,762	1.0000	0	3.00	0	15.5
2009	40,628.13	30,471	30,471	1.0000	0	3.00	0	13.5
2010	593,569.45	400,659	422,149	0.9483	23,028	3.00	7,676	12.5
2011	120,499.89	77,406	81,558	0.9024	8,817	3.00	2,939	11.5
2012	526,179.18	333,561	351,452	0.8906	43,182	3.00	14,394	10.5
2014	193,762.99	115,201	121,380	0.8352	23,942	3.00	7,981	8.5
2015	196,596.06	111,163	117,125	0.7944	30,322	3.00	10,107	7.5
2016	689,092.69	366,290	385,936	0.7468	130,884	3.00	43,628	6.5
2017	446,558.99	222,919	234,876	0.7013	100,043	3.00	33,348	5.5
2018	401,754.44	189,227	199,376	0.6617	101,939	3.00	33,980	4.5
2019	1,082,902.80	460,404	485,099	0.5973	327,079	3.00	109,026	3.5
2020	375,073.59	126,929	133,737	0.4754	147,568	3.00	49,189	2.5
2021	145,087.07	31,333	33,014	0.3034	75,801	3.56	21,292	1.5
2022	113,637.26	8,474	8,929	0.1048	76,299	4.50	16,955	0.5
TOTAL	4,952,111.09	2,494,116	2,625,179		1,088,905		350,516	

COMPOSITE ANNUAL ACCRUAL RATE 7.08%

THEORETICAL ACCUMULATED DEPRECIATION FACTOR 0.53

COMPOSITE AVERAGE AGE (YEARS) 6.50

DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS) 3.05

Kentucky - American Water Company

Account #: 341.200 - Transportation Equipment - Heavy Duty Trucks

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: L2
ASL: 15
Net Salvage: 15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	147,234.81	75,353	102,226	0.8168	22,923	5.97	3,841	14.5
2010	262,297.20	126,673	171,849	0.7708	51,103	6.48	7,889	12.5
2011	213,147.21	99,410	134,863	0.7444	46,312	6.77	6,841	11.5
2012	300,009.42	134,207	182,069	0.7140	72,939	7.11	10,265	10.5
2013	455,959.49	193,704	262,785	0.6780	124,780	7.50	16,631	9.5
2014	527,746.56	209,998	284,890	0.6351	163,694	7.98	20,518	8.5
2015	454,040.14	166,091	225,325	0.5838	160,609	8.54	18,797	7.5
2017	117,560.12	33,532	45,491	0.4552	54,435	9.97	5,462	5.5
2021	300,024.34	25,237	34,238	0.1343	220,783	13.52	16,335	1.5
2022	206,395.77	5,839	7,921	0.0452	167,515	14.50	11,552	0.5
TOTAL	2,984,415.06	1,070,044	1,451,659		1,085,094		118,131	

COMPOSITE ANNUAL ACCRUAL RATE	3.96%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.49
COMPOSITE AVERAGE AGE (YEARS)	8.19
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	8.67

Kentucky - American Water Company

Account #: 341.300 - Transportation Equipment - Autos

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S2.5
ASL: 5
Net Salvage: 20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1981	2,269.65	1,816	1,816	1.0000	0	3.00	0	41.5
2007	16,571.50	13,257	13,257	1.0000	0	3.00	0	15.5
2008	13,152.34	10,522	10,522	1.0000	0	3.00	0	14.5
2022	116,144.05	9,289	43,518	0.4684	49,397	4.50	10,977	0.5
TOTAL	148,137.54	34,884	69,113		49,397		10,977	

COMPOSITE ANNUAL ACCRUAL RATE	7.41%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.47
COMPOSITE AVERAGE AGE (YEARS)	4.05
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.18

Kentucky - American Water Company

Account #: 342.000 - Stores Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 25
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	23,374.96	11,687	7,355	0.3147	16,020	12.50	1,282	12.5
2012	4,296.10	1,804	1,136	0.2643	3,161	14.50	218	10.5
2015	37,852.66	11,356	7,146	0.1888	30,706	17.50	1,755	7.5
2020	11,407.25	1,141	718	0.0629	10,689	22.50	475	2.5
TOTAL	76,930.97	25,988	16,355		60,576		3,730	

COMPOSITE ANNUAL ACCRUAL RATE	4.85%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.21
COMPOSITE AVERAGE AGE (YEARS)	8.45
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	16.55

Kentucky - American Water Company

Account #: 343.000 - Tools, Shop & Garage Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2005	7,699.03	6,737	6,045	0.7852	1,654	3.00	551	17.5
2006	348,304.03	287,351	257,858	0.7403	90,446	3.50	25,842	16.5
2007	238,682.81	184,979	165,993	0.6955	72,690	4.50	16,153	15.5
2008	112,398.90	81,489	73,125	0.6506	39,274	5.50	7,141	14.5
2009	33,720.99	22,762	20,425	0.6057	13,296	6.50	2,046	13.5
2010	133,295.37	83,310	74,759	0.5609	58,537	7.50	7,805	12.5
2011	93,034.37	53,495	48,004	0.5160	45,030	8.50	5,298	11.5
2012	188,064.77	98,734	88,600	0.4711	99,465	9.50	10,470	10.5
2013	221,459.18	105,193	94,396	0.4262	127,063	10.50	12,101	9.5
2014	132,898.53	56,482	50,685	0.3814	82,214	11.50	7,149	8.5
2015	174,259.51	65,347	58,640	0.3365	115,619	12.50	9,250	7.5
2016	129,757.01	42,171	37,843	0.2916	91,914	13.50	6,808	6.5
2017	115,563.74	31,780	28,518	0.2468	87,046	14.50	6,003	5.5
2018	123,697.35	27,832	24,975	0.2019	98,722	15.50	6,369	4.5
2019	95,076.61	16,638	14,931	0.1570	80,146	16.50	4,857	3.5
2020	265,082.44	33,135	29,734	0.1122	235,348	17.50	13,448	2.5
2021	25,112.90	1,883	1,690	0.0673	23,423	18.50	1,266	1.5
2022	335,957.11	8,399	7,537	0.0224	328,420	19.50	16,842	0.5
TOTAL	2,774,064.65	1,207,717	1,083,759		1,690,306		159,399	

COMPOSITE ANNUAL ACCRUAL RATE	5.75%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	8.71
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.29

Kentucky - American Water Company

Account #: 344.000 - Laboratory Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2013	15,686.06	14,902	15,686	1.0000	0	3.00	0	9.5
2014	17,910.62	15,224	17,911	1.0000	0	3.00	0	8.5
2015	4,643.03	3,482	4,643	1.0000	0	3.00	0	7.5
2016	74,831.43	48,640	74,831	1.0000	0	3.50	0	6.5
2017	80,256.63	44,141	40,738	0.5076	39,518	4.50	8,782	5.5
2018	92,441.49	41,599	-18,769	-0.2030	111,211	5.50	20,220	4.5
2019	130,328.76	45,615	-165,387	-1.2690	295,716	6.50	45,495	3.5
2020	77,356.57	19,339	-235,597	-3.0456	312,954	7.50	41,727	2.5
2021	16,835.23	2,525	16,835	1.0000	0	8.50	0	1.5
2022	42,369.59	2,118	4,301	0.1015	38,068	9.50	4,007	0.5
TOTAL	552,659.41	237,586	-244,808		797,467		120,231	

COMPOSITE ANNUAL ACCRUAL RATE	21.75%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.44
COMPOSITE AVERAGE AGE (YEARS)	4.30
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	5.82

Kentucky - American Water Company

Account #: 345.000 - Power Operated Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2.5
ASL: 25
Net Salvage: 10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	54,566.42	43,340	49,110	1.0000	0	3.00	0	34.5
1989	701.44	551	631	1.0000	0	3.18	0	33.5
1990	20,380.67	15,831	18,343	1.0000	0	3.42	0	32.5
1991	1,470.02	1,128	1,323	1.0000	0	3.68	0	31.5
1995	53,978.20	38,973	48,580	1.0000	0	4.94	0	27.5
1997	66,151.11	45,829	59,536	1.0000	0	5.76	0	25.5
1999	28,034.41	18,462	25,231	1.0000	0	6.71	0	23.5
2003	4,874.22	2,807	4,290	0.9780	96	9.00	11	19.5
2005	990,821.38	523,508	800,193	0.8973	91,546	10.32	8,868	17.5
2008	27,086.46	12,211	18,665	0.7657	5,712	12.48	458	14.5
2012	8,380.95	2,829	4,323	0.5732	3,219	15.63	206	10.5
2014	39,460.19	10,935	16,715	0.4707	18,799	17.30	1,087	8.5
2015	10,413.35	2,563	3,917	0.4180	5,455	18.16	300	7.5
2017	34,503.67	6,302	9,632	0.3102	21,421	19.93	1,075	5.5
2018	626.03	94	144	0.2552	420	20.83	20	4.5
2020	18,777.83	1,582	2,419	0.1431	14,481	22.66	639	2.5
2021	70,728.81	3,592	5,490	0.0862	58,166	23.59	2,466	1.5
2022	10,324.30	175	268	0.0289	9,024	24.53	368	0.5
TOTAL	1,441,279.46	730,713	1,068,812		228,339		15,498	

COMPOSITE ANNUAL ACCRUAL RATE	1.08%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.74
COMPOSITE AVERAGE AGE (YEARS)	17.43
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	10.92

Kentucky - American Water Company

Account #: 346.100 - Communication Equipment - Non-Telephone

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	599.38	579	486	0.8107	113	3.00	38	14.5
2009	4,859.41	4,373	3,664	0.7541	1,195	3.00	398	13.5
2010	4,414.77	3,679	3,083	0.6982	1,332	3.00	444	12.5
2012	116,058.89	81,241	68,071	0.5865	47,988	4.50	10,664	10.5
2013	100,676.34	63,762	53,425	0.5307	47,251	5.50	8,591	9.5
2014	3,933.85	2,229	1,868	0.4748	2,066	6.50	318	8.5
2015	981.27	491	411	0.4189	570	7.50	76	7.5
2016	76,817.55	33,288	27,891	0.3631	48,926	8.50	5,756	6.5
2018	13,274.68	3,982	3,337	0.2514	9,938	10.50	946	4.5
2019	125,949.09	29,388	24,624	0.1955	101,325	11.50	8,811	3.5
2020	27,120.20	4,520	3,787	0.1396	23,333	12.50	1,867	2.5
2021	654,624.68	65,462	54,850	0.0838	599,774	13.50	44,428	1.5
2022	211,775.54	7,059	5,915	0.0279	205,861	14.50	14,197	0.5
TOTAL	1,341,085.65	300,054	251,412		1,089,673		96,534	

COMPOSITE ANNUAL ACCRUAL RATE	7.20%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	3.36
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.65

Kentucky - American Water Company

Account #: 346.190 - Remote Control & Instrument

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	20,185.63	19,513	16,354	0.8102	3,832	3.00	1,277	14.5
2010	683,657.00	569,714	477,471	0.6984	206,186	3.00	68,729	12.5
2011	1,019,739.21	781,800	655,218	0.6425	364,521	3.50	104,149	11.5
2012	990,490.18	693,343	581,083	0.5867	409,407	4.50	90,979	10.5
2013	2.11	1	1	0.5308	1	5.50	0	9.5
2014	397,889.03	225,470	188,964	0.4749	208,925	6.50	32,142	8.5
2015	99,117.12	49,559	41,534	0.4190	57,583	7.50	7,678	7.5
2016	41,954.79	18,180	15,237	0.3632	26,718	8.50	3,143	6.5
2018	109,683.89	32,905	27,577	0.2514	82,106	10.50	7,820	4.5
2019	149,865.74	34,969	29,307	0.1956	120,559	11.50	10,483	3.5
2021	32,935.54	3,294	2,760	0.0838	30,175	13.50	2,235	1.5
2022	51,716.35	1,724	1,445	0.0279	50,272	14.50	3,467	0.5
TOTAL	3,597,236.59	2,430,472	2,036,952		1,560,284		332,102	

COMPOSITE ANNUAL ACCRUAL RATE	9.23%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.57
COMPOSITE AVERAGE AGE (YEARS)	10.13
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.97

Kentucky - American Water Company

Account #: 346.200 - Communication Equipment - Telephone

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	20,843.96	20,149	18,653	0.8949	2,191	3.00	730	14.5
2010	27,048.52	22,540	20,866	0.7714	6,182	3.00	2,061	12.5
2012	43,979.06	30,785	28,499	0.6480	15,480	4.50	3,440	10.5
2016	85,756.23	37,161	34,401	0.4011	51,355	8.50	6,042	6.5
2020	5,183.68	864	800	0.1543	4,384	12.50	351	2.5
TOTAL	182,811.45	111,500	103,218		79,593		12,624	

COMPOSITE ANNUAL ACCRUAL RATE	6.91%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.56
COMPOSITE AVERAGE AGE (YEARS)	9.15
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	6.21

Kentucky - American Water Company

Account #: 347.000 - Miscellaneous Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2003	34,611.32	33,746	25,851	0.7469	8,761	3.00	2,920	19.5
2005	594,506.53	520,193	398,483	0.6703	196,024	3.00	65,341	17.5
2007	10,564.45	8,187	6,272	0.5937	4,293	4.50	954	15.5
2008	2,882.94	2,090	1,601	0.5554	1,282	5.50	233	14.5
2009	2,124.82	1,434	1,099	0.5171	1,026	6.50	158	13.5
2010	127,572.58	79,733	61,078	0.4788	66,495	7.50	8,866	12.5
2011	7,169.19	4,122	3,158	0.4405	4,011	8.50	472	11.5
2012	45,559.87	23,919	18,323	0.4022	27,237	9.50	2,867	10.5
2013	493,630.28	234,474	179,614	0.3639	314,016	10.50	29,906	9.5
2015	29,357.25	11,009	8,433	0.2873	20,924	12.50	1,674	7.5
2016	154,283.79	50,142	38,410	0.2490	115,873	13.50	8,583	6.5
2017	78,712.22	21,646	16,581	0.2107	62,131	14.50	4,285	5.5
2018	67,878.88	15,273	11,699	0.1724	56,180	15.50	3,625	4.5
2019	372,458.24	65,180	49,930	0.1341	322,528	16.50	19,547	3.5
2020	243,509.48	30,439	23,317	0.0958	220,193	17.50	12,582	2.5
2021	414,911.46	31,118	23,838	0.0575	391,074	18.50	21,139	1.5
2022	179,817.83	4,495	3,444	0.0192	176,374	19.50	9,045	0.5
TOTAL	2,859,551.13	1,137,202	871,129		1,988,422		192,197	

COMPOSITE ANNUAL ACCRUAL RATE	6.72%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.30
COMPOSITE AVERAGE AGE (YEARS)	7.95
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	12.18

Kentucky - American Water Company

Account #: 348.000 - Other Tangible Property

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2019	12,906.90	2,259	12,907	1.0000	0	16.50	0	3.5
TOTAL	12,906.90	2,259	12,907		0		0	

COMPOSITE ANNUAL ACCRUAL RATE	0.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	1.00
COMPOSITE AVERAGE AGE (YEARS)	3.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	16.50

American Water Works - Kentucky

Account #: 304.100 - Structures & Improvements - Supply

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2.5
ASL: 45
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1984	6.36	5	4	0.5360	3	14.14	0	38.5
1991	39.99	27	21	0.4584	25	18.58	1	31.5
2002	199,476.16	92,676	72,336	0.3153	157,062	26.82	5,856	20.5
2003	404,298.72	179,443	140,061	0.3012	324,883	27.63	11,757	19.5
2004	42,189.32	17,840	13,924	0.2870	34,593	28.45	1,216	18.5
2006	1,656,048.41	629,557	491,386	0.2580	1,413,069	30.12	46,908	16.5
2008	58,979.41	19,852	15,495	0.2285	52,331	31.83	1,644	14.5
2010	14,388,408.94	4,204,460	3,281,696	0.1983	13,264,974	33.57	395,195	12.5
2012	706,370.32	174,521	136,219	0.1677	676,107	35.33	19,136	10.5
2013	163,104.43	36,573	28,547	0.1522	159,024	36.23	4,390	9.5
2014	1,545,881.13	311,075	242,802	0.1366	1,534,961	37.13	41,345	8.5
2015	93,662.22	16,678	13,017	0.1209	94,694	38.03	2,490	7.5
2016	285,010.40	44,104	34,425	0.1050	293,337	38.94	7,532	6.5
2017	122,713.51	16,111	12,575	0.0891	128,546	39.86	3,225	5.5
2018	266,533.69	28,704	22,404	0.0731	284,109	40.79	6,966	4.5
2019	434,429.72	36,477	28,472	0.0570	471,123	41.71	11,294	3.5
2020	3,060,348.65	183,979	143,600	0.0408	3,375,801	42.65	79,156	2.5
2021	1,108,464.33	40,076	31,280	0.0245	1,243,454	43.59	28,529	1.5
2022	931,778.07	11,260	8,788	0.0082	1,062,756	44.53	23,868	0.5
TOTAL	25,467,743.78	6,043,418	4,717,053		24,570,852		690,508	

COMPOSITE ANNUAL ACCRUAL RATE	2.71%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	10.16
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	35.71

American Water Works - Kentucky

Account #: 304.200 - Structures & Improvements - Pumping

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	10,283.77	9,667	11,826	1.0000	0	11.87	0	88.5
1948	2,166.09	1,848	2,455	0.9855	36	16.78	2	74.5
1951	8,700.53	7,234	9,611	0.9606	394	18.00	22	71.5
1955	5,281.79	4,230	5,619	0.9251	455	19.74	23	67.5
1957	24,208.77	18,994	25,235	0.9064	2,605	20.65	126	65.5
1958	23,751.19	18,438	24,495	0.8968	2,818	21.12	133	64.5
1959	51,381.05	39,452	52,414	0.8870	6,674	21.60	309	63.5
1962	4,217.13	3,128	4,155	0.8568	695	23.08	30	60.5
1966	8,053.51	5,675	7,540	0.8141	1,722	25.17	68	56.5
1967	65,756.77	45,707	60,724	0.8030	14,897	25.71	579	55.5
1970	69,922.36	46,535	61,824	0.7688	18,587	27.38	679	52.5
1971	23,550.63	15,435	20,506	0.7572	6,577	27.96	235	51.5
1972	55,567.95	35,849	47,627	0.7453	16,276	28.54	570	50.5
1973	3,602.44	2,287	3,038	0.7333	1,105	29.12	38	49.5
1974	2,872.93	1,793	2,383	0.7212	921	29.72	31	48.5
1975	12,121.04	7,438	9,881	0.7089	4,058	30.32	134	47.5
1978	6,162.43	3,580	4,756	0.6711	2,331	32.16	72	44.5
1987	264,561.62	126,136	167,577	0.5508	136,669	38.05	3,592	35.5
1988	14,014.08	6,512	8,652	0.5368	7,465	38.74	193	34.5
1989	416,036.69	188,246	250,093	0.5227	228,350	39.43	5,792	33.5
1991	26,254.00	11,231	14,921	0.4942	15,271	40.82	374	31.5
1992	1,875,689.30	779,021	1,034,963	0.4798	1,122,080	41.53	27,022	30.5
1993	21,577.08	8,690	11,545	0.4653	13,268	42.24	314	29.5
1997	802.79	282	375	0.4063	548	45.12	12	25.5
1998	21,873.51	7,409	9,843	0.3913	15,312	45.86	334	24.5
1999	778,890.09	253,655	336,992	0.3762	558,732	46.59	11,992	23.5
2006	9,354.00	2,174	2,888	0.2685	7,869	51.86	152	16.5
2007	170,042.12	37,211	49,436	0.2528	146,112	52.63	2,776	15.5

American Water Works - Kentucky

Account #: 304.200 - Structures & Improvements - Pumping

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	100,990.47	20,721	27,529	0.2370	88,610	53.40	1,659	14.5
2010	4,552,377.38	808,906	1,074,667	0.2053	4,160,567	54.96	75,706	12.5
2011	18,733.60	3,069	4,078	0.1893	17,466	55.74	313	11.5
2013	52,732.79	7,170	9,525	0.1571	51,117	57.32	892	9.5
2014	699,722.81	85,319	113,350	0.1409	691,331	58.11	11,897	8.5
2015	7,528.64	812	1,079	0.1246	7,579	58.91	129	7.5
2016	39,193.67	3,671	4,878	0.1082	40,195	59.71	673	6.5
2017	39,418.03	3,131	4,160	0.0918	41,170	60.51	680	5.5
2018	50,059.81	3,262	4,333	0.0753	53,235	61.32	868	4.5
2019	21,742.09	1,105	1,467	0.0587	23,536	62.13	379	3.5
2021	96,254.67	2,109	2,802	0.0253	107,891	63.76	1,692	1.5
2022	40,418.66	298	396	0.0085	46,085	64.58	714	0.5
TOTAL	9,695,868.28	2,627,430	3,489,639		7,660,610		151,206	

COMPOSITE ANNUAL ACCRUAL RATE	1.56%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.36
COMPOSITE AVERAGE AGE (YEARS)	19.78
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	49.68

American Water Works - Kentucky

Account #: 304.300 - Structures & Improvements - Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1925	232.33	229	255	0.9531	13	9.18	1	97.5
1938	876.34	804	892	0.8852	116	13.16	9	84.5
1941	369.39	332	369	0.8678	56	14.18	4	81.5
1959	6,925.11	5,317	5,902	0.7411	2,062	21.60	95	63.5
1970	13,665.34	9,095	10,094	0.6423	5,621	27.38	205	52.5
1971	54,239.73	35,549	39,457	0.6326	22,919	27.96	820	51.5
1972	3,371.98	2,175	2,415	0.6227	1,463	28.54	51	50.5
1973	66.17	42	47	0.6127	29	29.12	1	49.5
1974	4,654.28	2,905	3,225	0.6025	2,128	29.72	72	48.5
1975	723.00	444	492	0.5922	339	30.32	11	47.5
1976	1,114.00	672	745	0.5818	536	30.93	17	46.5
1977	2,634.51	1,560	1,731	0.5713	1,299	31.54	41	45.5
1982	152,885.57	81,907	90,912	0.5171	84,906	34.72	2,446	40.5
1983	1,276.58	669	743	0.5059	725	35.37	21	39.5
1984	7,500.00	3,844	4,266	0.4946	4,359	36.03	121	38.5
1987	20,385.23	9,719	10,788	0.4602	12,655	38.05	333	35.5
1988	1,492,186.09	693,386	769,617	0.4485	946,397	38.74	24,432	34.5
1989	26,178.51	11,845	13,147	0.4367	16,958	39.43	430	33.5
1990	28,515.04	12,552	13,932	0.4249	18,860	40.12	470	32.5
1991	1,925.00	824	914	0.4129	1,300	40.82	32	31.5
1992	8,000.00	3,323	3,688	0.4009	5,512	41.53	133	30.5
1993	161,534.80	65,059	72,212	0.3887	113,553	42.24	2,689	29.5
1994	10,388.09	4,053	4,498	0.3765	7,448	42.95	173	28.5
1995	42,170.57	15,914	17,664	0.3642	30,832	43.67	706	27.5
1996	2,309,207.01	841,854	934,408	0.3519	1,721,180	44.39	38,770	26.5
1997	546,573.87	192,215	213,347	0.3394	415,213	45.12	9,202	25.5
1999	138,649.18	45,153	50,117	0.3143	109,330	46.59	2,346	23.5
2000	168,478.81	52,657	58,446	0.3017	135,304	47.33	2,858	22.5

American Water Works - Kentucky

Account #: 304.300 - Structures & Improvements - Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2001	99,872.41	29,898	33,185	0.2889	81,668	48.08	1,699	21.5
2002	11,650.51	3,333	3,700	0.2761	9,698	48.83	199	20.5
2003	7,407.94	2,021	2,243	0.2633	6,276	49.58	127	19.5
2005	31,219.61	7,678	8,522	0.2374	27,380	51.10	536	17.5
2006	121,065.14	28,138	31,231	0.2243	107,994	51.86	2,082	16.5
2007	260,339.27	56,971	63,234	0.2112	236,156	52.63	4,487	15.5
2008	57,998.81	11,900	13,209	0.1980	53,490	53.40	1,002	14.5
2009	33,441.24	6,403	7,107	0.1848	31,351	54.18	579	13.5
2010	23,046,363.26	4,095,078	4,545,293	0.1715	21,958,025	54.96	399,551	12.5
2011	57,455.23	9,414	10,449	0.1581	55,625	55.74	998	11.5
2012	24,932.42	3,738	4,149	0.1447	24,523	56.53	434	10.5
2013	1,983.30	270	299	0.1312	1,981	57.32	35	9.5
2014	5,009,806.59	610,860	678,018	0.1177	5,083,259	58.11	87,479	8.5
2015	27,430.21	2,958	3,283	0.1041	28,262	58.91	480	7.5
2016	3,343,842.71	313,228	347,665	0.0904	3,497,754	59.71	58,584	6.5
2017	496,170.25	39,417	43,751	0.0767	526,845	60.51	8,707	5.5
2018	446,584.92	29,098	32,298	0.0629	481,275	61.32	7,849	4.5
2019	7,227,236.46	367,164	407,530	0.0490	7,903,792	62.13	127,217	3.5
2020	9,318,068.75	339,094	376,374	0.0351	10,339,405	62.94	164,266	2.5
2021	2,908.98	64	71	0.0211	3,275	63.76	51	1.5
2022	13,484.73	99	110	0.0071	15,397	64.58	238	0.5

American Water Works - Kentucky

Account #: 304.300 - Structures & Improvements - Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R1.5
ASL: 65
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	54,843,989.27	8,050,921	8,936,044		54,134,544		953,089	

COMPOSITE ANNUAL ACCRUAL RATE	1.74%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.16
COMPOSITE AVERAGE AGE (YEARS)	10.42
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	56.70

American Water Works - Kentucky

Account #: 304.400 - Structures & Improvements - T&D

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 40
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1991	28,804.37	20,494	-6,071	-0.2007	36,316	12.90	2,816	31.5
1992	3,241.57	2,250	-666	-0.1958	4,070	13.56	300	30.5
1996	4,311.28	2,671	-791	-0.1748	5,318	16.40	324	26.5
1997	26.54	16	-5	-0.1694	33	17.15	2	25.5
1998	139,105.41	80,647	-23,892	-0.1636	169,953	17.91	9,487	24.5
1999	28,241.70	15,797	-4,680	-0.1578	34,334	18.69	1,837	23.5
2000	6,176.47	3,327	-986	-0.1520	7,471	19.48	383	22.5
2006	73,847.79	30,057	-8,905	-0.1148	86,445	24.49	3,529	16.5
2008	25,387.15	9,158	-2,713	-0.1018	29,370	26.26	1,119	14.5
2009	92,187.89	31,085	-9,209	-0.0951	106,007	27.15	3,904	13.5
2010	25,516.58	7,997	-2,369	-0.0884	29,161	28.06	1,039	12.5
2011	4,504.67	1,303	-386	-0.0816	5,116	28.98	177	11.5
2014	352,752.28	76,162	-22,564	-0.0609	392,953	31.77	12,367	8.5
2015	22,892.11	4,373	-1,296	-0.0539	25,332	32.72	774	7.5
2016	4,367.21	725	-215	-0.0468	4,800	33.68	143	6.5
2017	49,625.80	6,987	-2,070	-0.0397	54,177	34.64	1,564	5.5
2018	253,438.83	29,259	-8,668	-0.0326	274,779	35.60	7,718	4.5
2021	4,364,849.75	168,916	-50,043	-0.0109	4,633,135	38.53	120,261	1.5
TOTAL	5,479,277.40	491,223	-145,529		5,898,770		167,744	

COMPOSITE ANNUAL ACCRUAL RATE	3.06%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.03
COMPOSITE AVERAGE AGE (YEARS)	3.59
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	36.58

American Water Works - Kentucky

Account #: 304.500 - Structures & Improvements - General

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 25
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2005	0.52	0	0	0.3663	0	11.14	0	17.5
2007	31,349.70	16,493	10,740	0.3263	22,177	12.47	1,778	15.5
2008	109,721.69	54,520	35,504	0.3082	79,704	13.17	6,052	14.5
2009	21,407.09	9,995	6,509	0.2896	15,968	13.88	1,150	13.5
2010	2,731,392.26	1,191,433	775,879	0.2705	2,092,083	14.61	143,153	12.5
2011	643,595.11	260,506	169,645	0.2510	506,129	15.36	32,945	11.5
2012	57,151.00	21,297	13,869	0.2311	46,140	16.13	2,861	10.5
2013	167,718.84	57,001	37,120	0.2108	138,985	16.91	8,220	9.5
2014	590,365.20	180,910	117,811	0.1901	502,072	17.70	28,359	8.5
2015	138,512.01	37,731	24,571	0.1689	120,867	18.51	6,528	7.5
2016	2,841,016.36	675,526	439,913	0.1475	2,543,155	19.34	131,506	6.5
2017	746,046.06	151,138	98,423	0.1256	684,925	20.18	33,947	5.5
2018	337,773.15	56,358	36,701	0.1035	317,961	21.03	15,121	4.5
2019	416,398.11	54,382	35,414	0.0810	401,804	21.89	18,355	3.5
2020	98,849.33	9,277	6,042	0.0582	97,750	22.77	4,294	2.5
2021	51,716.66	2,929	1,908	0.0351	52,395	23.65	2,215	1.5
2022	587,754.37	11,154	7,264	0.0118	609,878	24.55	24,844	0.5
TOTAL	9,570,767.46	2,790,651	1,817,313		8,231,993		461,328	

COMPOSITE ANNUAL ACCRUAL RATE	4.82%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	8.18
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	18.06

American Water Works - Kentucky

Account #: 304.600 - Structures & Improvements - Offices

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1970	637,016.69	482,927	514,342	0.7021	218,227	20.45	10,673	52.5
1971	756.95	566	603	0.6923	268	21.00	13	51.5
1972	19,510.13	14,372	15,307	0.6823	7,129	21.57	331	50.5
1977	4,946.00	3,363	3,582	0.6297	2,106	24.53	86	45.5
1979	5,098.00	3,344	3,562	0.6075	2,301	25.78	89	43.5
1982	72,800.40	45,049	47,979	0.5731	35,741	27.71	1,290	40.5
1984	1,886.00	1,119	1,192	0.5494	977	29.05	34	38.5
1986	24,125.00	13,679	14,569	0.5251	13,175	30.42	433	36.5
1987	135,815.04	75,200	80,091	0.5128	76,096	31.11	2,446	35.5
1988	45,634.12	24,652	26,256	0.5003	26,224	31.82	824	34.5
1989	44,800.88	23,592	25,126	0.4877	26,395	32.53	812	33.5
1990	18,070.07	9,267	9,870	0.4749	10,911	33.24	328	32.5
1991	1,100.00	549	585	0.4621	681	33.97	20	31.5
1992	16,106.41	7,809	8,317	0.4490	10,205	34.70	294	30.5
1994	7,768.27	3,545	3,776	0.4226	5,158	36.19	143	28.5
1995	26,046.75	11,510	12,259	0.4093	17,695	36.94	479	27.5
1996	7,455.45	3,186	3,393	0.3958	5,181	37.70	137	26.5
1997	2,091,767.73	863,076	919,221	0.3821	1,486,312	38.47	38,633	25.5
1998	226,122.80	89,945	95,796	0.3684	164,245	39.25	4,185	24.5
2005	23,878.25	6,937	7,388	0.2691	20,072	44.84	448	17.5
2006	57,796.03	15,879	16,912	0.2544	49,554	45.67	1,085	16.5
2008	1,698,053.43	412,376	439,201	0.2249	1,513,560	47.33	31,979	14.5
2013	6,248.83	1,008	1,074	0.1494	6,113	51.58	118	9.5
2014	194,379.25	28,130	29,960	0.1340	193,576	52.45	3,691	8.5
2015	30,859.52	3,951	4,208	0.1186	31,281	53.32	587	7.5
2016	15,059.54	1,675	1,784	0.1030	15,534	54.20	287	6.5
2020	165,020.59	7,128	7,592	0.0400	182,182	57.75	3,155	2.5
2021	10,008.14	260	277	0.0241	11,233	58.64	192	1.5

American Water Works - Kentucky

Account #: 304.600 - Structures & Improvements - Offices

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2022	6,565.18	57	61	0.0080	7,489	59.55	126	0.5
TOTAL	5,594,695.45	2,154,150	2,294,281		4,139,619		102,918	

COMPOSITE ANNUAL ACCRUAL RATE	1.84%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.41
COMPOSITE AVERAGE AGE (YEARS)	24.36
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.91

American Water Works - Kentucky

Account #: 304.700 - Structures & Improvements - Stores, Shop & Garage

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 55
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	41,614.47	23,449	21,633	0.5198	19,982	24.01	832	34.5
1990	17,912.83	9,590	8,848	0.4939	9,065	25.55	355	32.5
1993	546,102.20	268,631	247,822	0.4538	298,281	27.95	10,674	29.5
1996	147,253.93	65,808	60,710	0.4123	86,544	30.42	2,845	26.5
1999	70,632.43	28,285	26,094	0.3694	44,539	32.98	1,351	23.5
2002	4,796.09	1,691	1,560	0.3253	3,236	35.60	91	20.5
2009	799,355.85	189,111	174,462	0.2183	624,894	41.99	14,883	13.5
2011	7,549.73	1,528	1,410	0.1867	6,140	43.87	140	11.5
2014	3,312.34	498	460	0.1388	2,853	46.72	61	8.5
2015	9,065.45	1,206	1,112	0.1227	7,953	47.69	167	7.5
2016	24,525.08	2,831	2,612	0.1065	21,913	48.65	450	6.5
2017	2,984.03	292	269	0.0903	2,715	49.62	55	5.5
2022	6,577.32	59	54	0.0083	6,523	54.51	120	0.5
TOTAL	1,681,681.75	592,979	547,045		1,134,637		32,024	

COMPOSITE ANNUAL ACCRUAL RATE	1.90%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.33
COMPOSITE AVERAGE AGE (YEARS)	20.78
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	35.61

American Water Works - Kentucky

Account #: 304.800 - Structures & Improvements - Miscellaneous

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 25
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1985	20,864.76	17,295	11,808	0.5659	9,057	4.28	2,117	37.5
1987	23,786.05	19,056	13,010	0.5470	10,776	4.97	2,168	35.5
1989	65,469.45	50,589	34,539	0.5276	30,931	5.68	5,443	33.5
1990	13,875.00	10,520	7,182	0.5176	6,693	6.05	1,107	32.5
1991	6,522.00	4,849	3,310	0.5076	3,212	6.41	501	31.5
1992	5,113.58	3,725	2,543	0.4973	2,571	6.79	379	30.5
1994	3,145.91	2,194	1,498	0.4762	1,648	7.56	218	28.5
1997	532.14	345	236	0.4430	296	8.78	34	25.5
1998	34,995.42	22,116	15,099	0.4315	19,896	9.20	2,162	24.5
2000	9,043.98	5,398	3,685	0.4075	5,359	10.08	532	22.5
2001	19,040.39	11,017	7,521	0.3950	11,519	10.54	1,093	21.5
2002	21,530.03	12,054	8,230	0.3822	13,300	11.00	1,209	20.5
2003	314,782.79	170,178	116,186	0.3691	198,597	11.48	17,293	19.5
2005	130,702.15	65,408	44,656	0.3417	86,046	12.49	6,890	17.5
2006	180,858.20	86,708	59,198	0.3273	121,660	13.01	9,348	16.5
2007	78,551.61	35,957	24,549	0.3125	54,003	13.56	3,984	15.5
2011	1,875.00	682	465	0.2482	1,410	15.91	89	11.5
2012	124,046.63	41,913	28,616	0.2307	95,431	16.55	5,765	10.5
2019	14,472.01	1,861	1,271	0.0878	13,201	21.79	606	3.5
2020	113,275.01	10,621	7,251	0.0640	106,024	22.66	4,680	2.5
TOTAL	1,182,482.11	572,484	390,853		791,629		65,618	

COMPOSITE ANNUAL ACCRUAL RATE	5.55%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.33
COMPOSITE AVERAGE AGE (YEARS)	17.70
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	12.90

American Water Works - Kentucky

Account #: 305.000 - Collecting & Impounding Reservoirs

ALG - Remaining Life
Survivor Curve: R2
ASL: 75
Net Salvage: 0%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	24,854.61	19,873	20,357	0.8191	4,497	15.03	299	88.5
1972	3,956.11	2,124	2,176	0.5501	1,780	34.73	51	50.5
1988	756,540.13	291,674	298,780	0.3949	457,760	46.08	9,933	34.5
1989	2,284.00	857	878	0.3845	1,406	46.84	30	33.5
1991	14,013.00	4,974	5,095	0.3636	8,918	48.38	184	31.5
1992	9,151.62	3,154	3,230	0.3530	5,921	49.16	120	30.5
1993	3,586.34	1,198	1,228	0.3423	2,359	49.94	47	29.5
1996	1,591.87	482	493	0.3099	1,099	52.31	21	26.5
2005	3,282.30	670	687	0.2092	2,596	59.69	43	17.5
TOTAL	819,259.98	325,006	332,925		486,335		10,728	

COMPOSITE ANNUAL ACCRUAL RATE	1.31%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.41
COMPOSITE AVERAGE AGE (YEARS)	36.01
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	45.25

American Water Works - Kentucky

Account #: 306.000 - Lake, River & Other Intakes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S1.5
ASL: 55
Net Salvage: -10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1961	449.15	374	470	0.9523	24	13.38	2	61.5
1966	19,532.24	15,542	19,556	0.9102	1,929	15.22	127	56.5
1970	31,574.52	24,111	30,339	0.8735	4,393	16.82	261	52.5
1971	23,098.06	17,443	21,949	0.8639	3,459	17.24	201	51.5
1991	164,120.57	89,014	112,008	0.6204	68,525	27.88	2,458	31.5
1992	6,000.00	3,175	3,995	0.6053	2,605	28.54	91	30.5
1993	6,985.00	3,601	4,532	0.5898	3,152	29.22	108	29.5
1994	169.67	85	107	0.5740	80	29.91	3	28.5
1997	3,365.94	1,544	1,942	0.5246	1,760	32.07	55	25.5
2002	245,293.78	93,417	117,548	0.4356	152,275	35.96	4,235	20.5
2007	2,378.59	704	886	0.3387	1,730	40.19	43	15.5
2010	820,061.67	198,621	249,927	0.2771	652,141	42.89	15,205	12.5
2012	257,591.23	52,840	66,490	0.2347	216,861	44.74	4,847	10.5
2013	49,161.46	9,158	11,524	0.2131	42,554	45.69	931	9.5
2016	50,743.32	6,530	8,216	0.1472	47,602	48.57	980	6.5
TOTAL	1,680,525.20	516,159	649,489		1,199,088		29,547	

COMPOSITE ANNUAL ACCRUAL RATE	1.76%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	16.93
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.64

American Water Works - Kentucky

Account #: 309.000 - Supply Mains

ALG - Remaining Life
Survivor Curve: R3
ASL: 80
Net Salvage: -10%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	222,234.89	206,040	244,458	1.0000	0	12.57	0	88.5
1940	503.19	450	554	1.0000	0	15.01	0	82.5
1941	433.53	385	477	1.0000	0	15.45	0	81.5
1944	41.85	36	45	0.9875	1	16.86	0	78.5
1951	218.11	178	223	0.9296	17	20.56	1	71.5
1953	1,629.41	1,306	1,634	0.9115	159	21.72	7	69.5
1956	59,882.73	46,484	58,162	0.8830	7,709	23.55	327	66.5
1959	109,730.59	82,289	102,962	0.8530	17,741	25.46	697	63.5
1964	16,403.53	11,539	14,438	0.8002	3,606	28.84	125	58.5
1965	440,490.69	305,616	382,398	0.7892	102,142	29.54	3,458	57.5
1967	2,613.29	1,762	2,204	0.7668	670	30.97	22	55.5
1968	5,722.03	3,800	4,755	0.7555	1,539	31.70	49	54.5
1970	3,226.09	2,077	2,599	0.7324	950	33.17	29	52.5
1972	10,673.26	6,651	8,322	0.7089	3,418	34.68	99	50.5
1976	127,784.70	74,192	92,831	0.6604	47,732	37.77	1,264	46.5
1980	3,498.25	1,877	2,348	0.6103	1,500	40.98	37	42.5
1981	2,370.70	1,245	1,558	0.5975	1,050	41.80	25	41.5
1982	53,151.82	27,318	34,182	0.5846	24,285	42.62	570	40.5
1983	358.65	180	226	0.5717	169	43.45	4	39.5
1984	14,163.31	6,955	8,703	0.5586	6,877	44.29	155	38.5
1987	96,069.30	43,816	54,825	0.5188	50,852	46.83	1,086	35.5
1988	100,191.76	44,513	55,696	0.5054	54,515	47.69	1,143	34.5
1989	1,976,228.33	854,488	1,069,166	0.4918	1,104,685	48.55	22,752	33.5
1991	9,330.23	3,810	4,767	0.4645	5,496	50.30	109	31.5
1992	1,765,551.22	699,586	875,347	0.4507	1,066,760	51.18	20,842	30.5
1993	5,475.01	2,103	2,631	0.4368	3,392	52.07	65	29.5
1994	29,331.77	10,905	13,645	0.4229	18,620	52.96	352	28.5
2000	25,261.98	7,498	9,381	0.3376	18,407	58.41	315	22.5

American Water Works - Kentucky

Account #: 309.000 - Supply Mains

ALG - Remaining Life
Survivor Curve: R3
ASL: 80
Net Salvage: -10%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	42,178.70	8,717	10,907	0.2351	35,490	64.97	546	15.5
2008	5,454.04	1,056	1,321	0.2202	4,678	65.92	71	14.5
2010	13,377,790.18	2,238,265	2,800,595	0.1903	11,914,974	67.83	175,655	12.5
2012	2,585.07	364	456	0.1602	2,388	69.75	34	10.5
2013	49,211.71	6,279	7,857	0.1451	46,276	70.72	654	9.5
2019	7,444.15	352	440	0.0538	7,748	76.56	101	3.5
TOTAL	18,567,234.07	4,702,134	5,870,114		14,553,843		230,594	

COMPOSITE ANNUAL ACCRUAL RATE	1.24%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.32
COMPOSITE AVERAGE AGE (YEARS)	19.63
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	61.58

American Water Works - Kentucky

Account #: 310.000 - Power Generation Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 35
Net Salvage: -5%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	141,116.13	125,443	109,641	0.7400	38,531	5.37	7,177	34.5
1989	45,199.86	39,487	34,513	0.7272	12,947	5.88	2,202	33.5
1996	209,151.84	154,001	134,601	0.6129	85,009	10.46	8,130	26.5
2007	170,728.73	78,000	68,174	0.3803	111,091	19.77	5,619	15.5
2008	133,198.85	57,086	49,895	0.3567	89,964	20.71	4,343	14.5
2009	32,060.10	12,823	11,208	0.3329	22,455	21.67	1,036	13.5
2010	1,755,075.06	651,357	569,305	0.3089	1,273,524	22.63	56,278	12.5
2011	36,789.08	12,584	10,998	0.2847	27,630	23.60	1,171	11.5
2012	20,101.38	6,287	5,495	0.2604	15,611	24.57	635	10.5
2013	69,396.79	19,664	17,187	0.2359	55,680	25.55	2,179	9.5
2014	269,015.90	68,275	59,675	0.2113	222,792	26.54	8,395	8.5
2015	26,699.50	5,984	5,230	0.1866	22,804	27.53	828	7.5
2016	2,618,308.70	508,981	444,864	0.1618	2,304,360	28.52	80,797	6.5
2017	151,533.54	24,940	21,798	0.1370	137,312	29.51	4,652	5.5
TOTAL	5,678,375.46	1,764,912	1,542,584		4,419,710		183,442	

COMPOSITE ANNUAL ACCRUAL RATE	3.23%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.27
COMPOSITE AVERAGE AGE (YEARS)	10.66
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	24.64

American Water Works - Kentucky

Account #: 311.200 - Pumping Equipment - Electric

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	5,827.95	6,994	3,373	0.4823	3,621		3,621	89.5
1940	2,338.33	2,806	1,353	0.4823	1,453		1,453	83.5
1947	282.63	325	157	0.4627	182	1.63	112	75.5
1949	15,991.09	18,087	8,723	0.4546	10,466	2.30	4,553	73.5
1950	465.46	522	252	0.4505	307	2.63	117	72.5
1954	212.25	229	111	0.4345	144	3.97	36	68.5
1955	23,877.32	25,572	12,333	0.4304	16,320	4.30	3,794	67.5
1959	18,866.00	19,446	9,379	0.4143	13,260	5.64	2,350	63.5
1970	70,211.93	64,281	31,003	0.3680	53,252	9.48	5,616	52.5
1974	4,227.52	3,682	1,776	0.3500	3,297	10.97	301	48.5
1976	142,214.10	120,570	58,151	0.3407	112,506	11.74	9,583	46.5
1979	1,256.95	1,021	492	0.3264	1,016	12.93	79	43.5
1981	151,435.32	119,268	57,523	0.3165	124,200	13.75	9,034	41.5
1984	7,346.21	5,505	2,655	0.3012	6,160	15.02	410	38.5
1985	57,704.18	42,490	20,493	0.2959	48,752	15.46	3,154	37.5
1986	5,114.00	3,698	1,783	0.2906	4,353	15.90	274	36.5
1987	371,765.61	263,778	127,220	0.2852	318,899	16.35	19,506	35.5
1988	499,829.62	347,782	167,735	0.2797	432,061	16.81	25,708	34.5
1989	316,522.51	215,820	104,089	0.2740	275,738	17.27	15,965	33.5
1990	52,917.53	35,331	17,040	0.2683	46,461	17.74	2,618	32.5
1991	6,158.00	4,023	1,940	0.2625	5,450	18.23	299	31.5
1992	1,541,808.27	984,480	474,813	0.2566	1,375,357	18.72	73,486	30.5
1993	28,748.56	17,927	8,646	0.2506	25,852	19.21	1,345	29.5
1998	277,433.61	151,034	72,843	0.2188	260,077	21.85	11,901	24.5
1999	234,405.06	123,674	59,648	0.2121	221,638	22.41	9,889	23.5
2000	69,872.51	35,668	17,203	0.2052	66,644	22.98	2,900	22.5
2002	896.22	426	205	0.1910	870	24.16	36	20.5
2003	38,738.20	17,698	8,535	0.1836	37,950	24.77	1,532	19.5

American Water Works - Kentucky

Account #: 311.200 - Pumping Equipment - Electric

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	240.99	106	51	0.1761	238	25.39	9	18.5
2005	615.71	258	124	0.1685	614	26.03	24	17.5
2008	5,842.76	2,099	1,012	0.1444	5,999	28.03	214	14.5
2010	5,506,121.57	1,744,947	841,585	0.1274	5,765,761	29.44	195,872	12.5
2011	82,535.98	24,348	11,743	0.1186	87,300	30.17	2,894	11.5
2012	74,828.57	20,395	9,836	0.1095	79,958	30.91	2,586	10.5
2013	2,340,760.96	584,154	281,736	0.1003	2,527,177	31.68	79,768	9.5
2014	868,207.44	196,214	94,634	0.0908	947,215	32.47	29,175	8.5
2015	120,302.68	24,284	11,712	0.0811	132,651	33.27	3,987	7.5
2016	1,641,126.88	290,674	140,192	0.0712	1,829,161	34.10	53,647	6.5
2017	671,082.17	101,843	49,119	0.0610	756,180	34.94	21,641	5.5
2018	3,531,194.93	444,089	214,183	0.0505	4,023,251	35.81	112,356	4.5
2019	1,106,426.69	109,650	52,884	0.0398	1,274,828	36.70	34,740	3.5
2020	1,123,828.53	80,641	38,893	0.0288	1,309,701	37.61	34,825	2.5
2021	209,219.46	9,138	4,407	0.0176	246,656	38.54	6,399	1.5
2022	536,002.36	7,931	3,825	0.0059	639,378	39.51	16,184	0.5
TOTAL	21,764,804.62	6,272,905	3,025,410		23,092,356		803,993	

COMPOSITE ANNUAL ACCRUAL RATE	3.69%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.14
COMPOSITE AVERAGE AGE (YEARS)	12.33
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	30.39

American Water Works - Kentucky

Account #: 311.300 - Pumping Equipment - Diesel

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1965	22,657.13	21,955	15,808	0.5814	11,380	7.70	1,478	57.5
1972	1,003.12	896	645	0.5361	558	10.22	55	50.5
1981	95,017.92	74,834	53,882	0.4726	60,139	13.75	4,375	41.5
1987	100,246.21	71,128	51,213	0.4257	69,082	16.35	4,225	35.5
1988	1,109.18	772	556	0.4175	775	16.81	46	34.5
2006	129,930.05	51,920	37,383	0.2398	118,533	26.68	4,443	16.5
TOTAL	349,963.61	221,505	159,488		260,468		14,622	

COMPOSITE ANNUAL ACCRUAL RATE	4.18%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.46
COMPOSITE AVERAGE AGE (YEARS)	31.54
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	18.90

American Water Works - Kentucky

Account #: 311.400 - Pumping Equipment - Hydraulic

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2006	1,015.16	406	1,218	1.0000	0	26.68	0	16.5
TOTAL	1,015.16	406	1,218		0		0	

COMPOSITE ANNUAL ACCRUAL RATE	0.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	1.20
COMPOSITE AVERAGE AGE (YEARS)	16.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	26.68

American Water Works - Kentucky

Account #: 311.520 - Pumping Equipment - SOS & Pumping

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	513,279.07	194,861	165,208	0.2682	450,727	27.35	16,483	15.5
2008	3,783,282.13	1,359,015	1,152,208	0.2538	3,387,730	28.03	120,878	14.5
2009	3,515,846.82	1,189,452	1,008,448	0.2390	3,210,568	28.72	111,777	13.5
2010	702,866.78	222,746	188,850	0.2239	654,591	29.44	22,238	12.5
2011	238,765.58	70,435	59,716	0.2084	226,802	30.17	7,518	11.5
2012	191,866.24	52,293	44,336	0.1926	185,904	30.91	6,013	10.5
2013	1,081,377.06	269,865	228,799	0.1763	1,068,854	31.68	33,738	9.5
2014	1,374,649.99	310,670	263,394	0.1597	1,386,186	32.47	42,696	8.5
2015	499,853.97	100,900	85,546	0.1426	514,279	33.27	15,457	7.5
2016	3,712,474.35	657,548	557,486	0.1251	3,897,483	34.10	114,309	6.5
2017	1,509,433.09	229,071	194,212	0.1072	1,617,108	34.94	46,281	5.5
2018	139,718.27	17,571	14,897	0.0889	152,765	35.81	4,266	4.5
2019	21,314.17	2,112	1,791	0.0700	23,786	36.70	648	3.5
TOTAL	17,284,727.52	4,676,540	3,964,891		16,776,782		542,302	

COMPOSITE ANNUAL ACCRUAL RATE	3.14%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.23
COMPOSITE AVERAGE AGE (YEARS)	10.57
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	30.98

American Water Works - Kentucky

Account #: 311.530 - Pumping Equipment - Water Treatment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	605,807.17	76,187	32,024	0.0441	694,945	35.81	19,408	4.5
2019	1,421,901.22	140,915	59,231	0.0347	1,647,051	36.70	44,883	3.5
2020	614,510.88	44,095	18,534	0.0251	718,879	37.61	19,115	2.5
2021	27,138.16	1,185	498	0.0153	32,068	38.54	832	1.5
2022	7,499.00	111	47	0.0052	8,952	39.51	227	0.5
TOTAL	2,676,856.43	262,493	110,334		3,101,894		84,465	

COMPOSITE ANNUAL ACCRUAL RATE	3.16%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.04
COMPOSITE AVERAGE AGE (YEARS)	3.47
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	36.73

American Water Works - Kentucky

Account #: 311.540 - Pumping Equipment - T&D

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 40
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	35,100.14	13,325	-69	-0.0016	42,189	27.35	1,543	15.5
2012	17,283.69	4,711	-24	-0.0012	20,765	30.91	672	10.5
2015	122,575.56	24,743	-128	-0.0009	147,219	33.27	4,425	7.5
2016	444,062.86	78,652	-408	-0.0008	533,283	34.10	15,641	6.5
2017	743,852.14	112,887	-586	-0.0007	893,208	34.94	25,563	5.5
2018	812,788.24	102,218	-530	-0.0005	975,876	35.81	27,253	4.5
2022	145,085.39	2,147	-11	-0.0001	174,114	39.51	4,407	0.5
TOTAL	2,320,748.02	338,682	-1,757		2,786,655		79,504	

COMPOSITE ANNUAL ACCRUAL RATE	3.43%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.00
COMPOSITE AVERAGE AGE (YEARS)	5.32
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	35.14

American Water Works - Kentucky

Account #: 320.100 - Water Treatment Equipment - Non-Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 50
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1900	8,975.48	10,322	8,586	0.8318	1,736		1,736	123.5
1934	799.75	898	747	0.8123	173	1.17	147	88.5
1936	342.12	380	316	0.8037	77	1.69	46	86.5
1938	138.71	152	127	0.7948	33	2.22	15	84.5
1948	3,147.72	3,252	2,705	0.7474	915	5.07	180	74.5
1950	9,495.15	9,684	8,055	0.7377	2,865	5.66	506	72.5
1953	22,789.91	22,777	18,946	0.7229	7,263	6.55	1,109	69.5
1958	53,933.14	51,970	43,228	0.6970	18,795	8.10	2,319	64.5
1959	233,556.24	223,282	185,723	0.6915	82,867	8.43	9,825	63.5
1960	7,813.41	7,409	6,163	0.6859	2,823	8.77	322	62.5
1962	4,219.69	3,933	3,272	0.6742	1,581	9.47	167	60.5
1966	1,061,804.67	952,667	792,417	0.6489	428,659	10.99	39,002	56.5
1970	667,737.81	573,127	476,720	0.6208	291,179	12.68	22,960	52.5
1972	11,330.58	9,487	7,891	0.6056	5,139	13.60	378	50.5
1974	293.75	239	199	0.5896	139	14.56	10	48.5
1977	436,810.02	340,637	283,337	0.5640	218,994	16.09	13,607	45.5
1978	747.80	574	477	0.5551	383	16.63	23	44.5
1979	6,198.57	4,680	3,892	0.5460	3,236	17.18	188	43.5
1981	1,074,394.08	783,227	651,478	0.5273	584,075	18.30	31,909	41.5
1982	82,883.48	59,313	49,336	0.5176	45,980	18.89	2,435	40.5
1984	4,000.00	2,752	2,289	0.4977	2,311	20.08	115	38.5
1987	227,797.50	146,923	122,209	0.4665	139,759	21.96	6,365	35.5
1988	3,892,466.82	2,452,673	2,040,103	0.4558	2,436,234	22.60	107,779	34.5
1989	11,939.22	7,343	6,108	0.4448	7,623	23.26	328	33.5
1990	634.52	381	317	0.4337	413	23.93	17	32.5
1991	231,585.65	135,275	112,520	0.4225	153,803	24.60	6,251	31.5
1992	55,184.95	31,364	26,088	0.4111	37,374	25.29	1,478	30.5
1993	633,434.95	349,881	291,027	0.3995	437,424	25.98	16,834	29.5

American Water Works - Kentucky

Account #: 320.100 - Water Treatment Equipment - Non-Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 50
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1994	4,177.83	2,240	1,863	0.3878	2,941	26.69	110	28.5
1995	448.70	233	194	0.3759	322	27.40	12	27.5
1996	11,662.75	5,868	4,881	0.3639	8,532	28.13	303	26.5
1997	753,250.18	366,291	304,677	0.3517	561,561	28.86	19,460	25.5
1998	94,740.35	44,458	36,979	0.3394	71,972	29.60	2,432	24.5
1999	921,832.62	416,707	346,612	0.3270	713,496	30.35	23,512	23.5
2000	462,111.15	200,850	167,064	0.3144	364,364	31.10	11,715	22.5
2001	2,410.09	1,005	836	0.3016	1,936	31.87	61	21.5
2002	1,034,038.75	412,855	343,408	0.2888	845,737	32.64	25,911	20.5
2003	1,315.82	502	417	0.2758	1,096	33.42	33	19.5
2006	28,728.75	9,377	7,800	0.2361	25,238	35.81	705	16.5
2007	1,781,623.80	548,304	456,072	0.2226	1,592,795	36.62	43,496	15.5
2008	1,496,335.08	432,368	359,638	0.2090	1,361,147	37.44	36,358	14.5
2009	237,989.08	64,254	53,446	0.1953	220,242	38.26	5,756	13.5
2010	14,148,454.52	3,549,388	2,952,337	0.1815	13,318,385	39.09	340,687	12.5
2011	528,512.99	122,401	101,811	0.1675	505,979	39.93	12,671	11.5
2012	111,775.29	23,716	19,726	0.1535	108,815	40.78	2,669	10.5
2013	1,410,260.55	271,618	225,929	0.1393	1,395,871	41.63	33,534	9.5
2014	908,360.21	157,045	130,628	0.1250	913,986	42.48	21,514	8.5
2015	406,926.86	62,274	51,799	0.1107	416,167	43.35	9,601	7.5
2016	11,777,326.95	1,566,902	1,303,330	0.0962	12,240,596	44.22	276,840	6.5
2017	3,587,556.16	405,106	336,962	0.0817	3,788,728	45.09	84,025	5.5
2018	1,181,960.90	109,527	91,103	0.0670	1,268,152	45.97	27,586	4.5
2019	12,494,036.71	903,115	751,200	0.0523	13,616,942	46.86	290,605	3.5
2020	8,279,215.14	428,686	356,576	0.0375	9,164,522	47.75	191,932	2.5
2021	171,949.58	5,357	4,456	0.0225	193,286	48.65	3,973	1.5
2022	199,030.67	2,072	1,724	0.0075	227,162	49.55	4,585	0.5

American Water Works - Kentucky

Account #: 320.100 - Water Treatment Equipment - Non-Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2
ASL: 50
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	70,780,487.17	16,297,116	13,555,741		67,841,819		1,736,137	

COMPOSITE ANNUAL ACCRUAL RATE	2.45%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	12.15
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.99

American Water Works - Kentucky

Account #: 320.200 - Water Treatment Equipment - Filter Media

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S3
ASL: 10
Net Salvage: -10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2009	28,120.15	27,703	24,420	0.7895	6,512	1.04	6,237	13.5
2010	400,855.20	385,476	339,797	0.7706	101,144	1.26	80,409	12.5
2011	163,320.47	152,452	134,387	0.7480	45,266	1.51	29,897	11.5
2016	192,449.84	129,399	114,065	0.5388	97,630	3.89	25,114	6.5
2017	15,975.79	9,361	8,251	0.4695	9,322	4.67	1,995	5.5
2020	6,052.91	1,664	1,466	0.2202	5,192	7.50	692	2.5
TOTAL	806,774.36	706,055	622,386		265,065		144,344	

COMPOSITE ANNUAL ACCRUAL RATE	17.89%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.77
COMPOSITE AVERAGE AGE (YEARS)	10.69
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.04

American Water Works - Kentucky

Account #: 330.000 - Distribution Reservoirs & Standpipes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	1,656,707.98	583,060	433,063	0.2273	1,472,152	41.64	35,356	18.5
2008	11,716.56	3,241	2,407	0.1787	11,067	45.57	243	14.5
2010	102,741.97	24,525	18,216	0.1542	99,938	47.55	2,102	12.5
2019	6,659.68	446	331	0.0433	7,327	56.50	130	3.5
TOTAL	1,777,826.19	611,272	454,017		1,590,483		37,831	

COMPOSITE ANNUAL ACCRUAL RATE	2.13%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.26
COMPOSITE AVERAGE AGE (YEARS)	18.07
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	42.06

American Water Works - Kentucky

Account #: 330.100 - Elevated Tanks & Standpipes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1949	29,618.47	31,675	33,047	0.9702	1,014	4.20	241	73.5
1953	31.05	33	34	0.9508	2	5.32	0	69.5
1954	84,170.71	87,727	91,527	0.9456	5,269	5.62	937	68.5
1965	367,671.17	352,118	367,372	0.8689	55,450	10.03	5,527	57.5
1966	723.36	685	715	0.8593	117	10.58	11	56.5
1968	173,533.59	160,480	167,432	0.8390	32,132	11.75	2,734	54.5
1970	582.65	525	547	0.8170	123	13.01	9	52.5
1974	19,721.60	16,739	17,464	0.7700	5,216	15.72	332	48.5
1975	559.58	467	488	0.7577	156	16.42	9	47.5
1976	5,189.13	4,263	4,447	0.7453	1,520	17.14	89	46.5
1977	5,027.00	4,059	4,235	0.7326	1,546	17.87	87	45.5
1980	2,486.15	1,900	1,982	0.6932	877	20.13	44	42.5
1982	223,500.00	164,040	171,146	0.6659	85,879	21.71	3,956	40.5
1985	17,247.00	11,848	12,362	0.6233	7,472	24.16	309	37.5
1987	767,712.54	502,498	524,266	0.5938	358,604	25.85	13,872	35.5
1988	7,755.79	4,948	5,162	0.5788	3,757	26.71	141	34.5
1989	1,070,509.38	665,054	693,863	0.5636	537,222	27.59	19,474	33.5
1990	650,436.57	393,065	410,092	0.5482	337,910	28.47	11,869	32.5
1991	15,711.58	9,226	9,625	0.5327	8,443	29.36	288	31.5
1992	3,704.09	2,111	2,202	0.5170	2,057	30.27	68	30.5
1994	26,620.29	14,236	14,853	0.4852	15,761	32.10	491	28.5
1996	1,383,565.06	690,538	720,451	0.4528	870,649	33.96	25,637	26.5
1999	785,425.59	349,225	364,353	0.4034	538,887	36.80	14,643	23.5
2000	28,301.04	12,064	12,586	0.3867	19,960	37.76	529	22.5
2001	876,535.70	357,450	372,935	0.3700	635,081	38.72	16,400	21.5
2005	3,333,193.00	1,110,571	1,158,679	0.3023	2,674,493	42.62	62,757	17.5
2006	169,043.00	53,143	55,445	0.2852	138,954	43.60	3,187	16.5
2009	85,427.55	22,013	22,966	0.2338	75,275	46.56	1,617	13.5

American Water Works - Kentucky

Account #: 330.100 - Elevated Tanks & Standpipes

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2014	3,804,100.02	618,360	645,146	0.1475	3,729,569	51.52	72,392	8.5
2015	28,070.07	4,027	4,201	0.1302	28,079	52.51	535	7.5
2016	243,407.43	30,271	31,582	0.1128	248,336	53.51	4,641	6.5
TOTAL	14,209,580.16	5,675,358	5,921,206		10,419,811		262,826	

COMPOSITE ANNUAL ACCRUAL RATE	1.85%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.42
COMPOSITE AVERAGE AGE (YEARS)	21.59
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	39.16

American Water Works - Kentucky

Account #: 330.200 - Ground Level Tanks

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	108,616.26	32,098	27,407	0.2194	97,502	44.58	2,187	15.5
2009	8,939.49	2,304	1,967	0.1913	8,314	46.56	179	13.5
2010	2,079,601.48	496,410	423,857	0.1772	1,967,685	47.55	41,385	12.5
2012	141,581.45	28,411	24,259	0.1490	138,560	49.53	2,797	10.5
2013	573,874.81	104,228	88,994	0.1348	570,962	50.52	11,301	9.5
TOTAL	2,912,613.49	663,451	566,484		2,783,022		57,849	

COMPOSITE ANNUAL ACCRUAL RATE	1.99%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	11.93
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	48.12

American Water Works - Kentucky

Account #: 330.400 - Clearwell

ALG - Remaining Life
Survivor Curve: R4
ASL: 60
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	581.91	172	187	0.2793	482	44.58	11	15.5
2010	1,095,733.70	261,556	284,126	0.2255	975,968	47.55	20,527	12.5
TOTAL	1,096,315.61	261,728	284,313		976,450		20,538	

COMPOSITE ANNUAL ACCRUAL RATE	1.87%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.26
COMPOSITE AVERAGE AGE (YEARS)	12.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	47.54

American Water Works - Kentucky

Account #: 331.001 - TD Mains

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1906	25.20	29	26	0.8750	4	4.65	1	116.5
1933	43,861.44	44,791	41,329	0.7852	11,304	13.41	843	89.5
1934	261,398.70	265,255	244,756	0.7803	68,922	13.89	4,961	88.5
1935	41,009.24	41,340	38,146	0.7751	11,065	14.39	769	87.5
1936	24,245.43	24,273	22,398	0.7698	6,697	14.91	449	86.5
1937	51,991.79	51,680	47,686	0.7643	14,704	15.45	952	85.5
1938	15,140.57	14,937	13,783	0.7586	4,386	16.01	274	84.5
1939	15,138.25	14,819	13,674	0.7527	4,492	16.58	271	83.5
1940	11,433.41	11,102	10,244	0.7467	3,476	17.17	202	82.5
1941	10,483.17	10,095	9,315	0.7405	3,265	17.78	184	81.5
1942	1,655.71	1,581	1,459	0.7341	528	18.40	29	80.5
1943	2,011.30	1,903	1,756	0.7276	657	19.03	35	79.5
1944	265.36	249	230	0.7210	89	19.68	5	78.5
1945	4,396.19	4,083	3,768	0.7142	1,508	20.34	74	77.5
1946	7,717.33	7,100	6,551	0.7074	2,710	21.00	129	76.5
1947	33,837.28	30,824	28,442	0.7005	12,162	21.68	561	75.5
1948	104,510.22	94,252	86,968	0.6935	38,444	22.36	1,719	74.5
1949	84,017.53	74,997	69,201	0.6864	31,620	23.05	1,372	73.5
1950	102,735.73	90,749	83,736	0.6792	39,547	23.75	1,665	72.5
1951	34,202.56	29,890	27,580	0.6720	13,463	24.46	550	71.5
1952	146,320.69	126,481	116,706	0.6647	58,879	25.17	2,339	70.5
1953	300,175.36	256,587	236,758	0.6573	123,453	25.89	4,768	69.5
1954	142,793.91	120,670	111,345	0.6498	60,008	26.62	2,254	68.5
1955	505,220.20	421,977	389,366	0.6422	216,898	27.36	7,928	67.5
1956	1,036,074.41	855,048	788,969	0.6346	454,321	28.10	16,166	66.5
1957	390,828.91	318,607	293,985	0.6268	175,010	28.86	6,064	65.5
1958	639,271.50	514,634	474,862	0.6190	292,263	29.62	9,866	64.5
1959	460,874.35	366,277	337,971	0.6111	215,078	30.39	7,076	63.5

American Water Works - Kentucky

Account #: 331.001 - TD Mains

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1960	413,641.57	324,438	299,365	0.6031	197,005	31.17	6,320	62.5
1961	242,609.29	187,740	173,231	0.5950	117,900	31.96	3,689	61.5
1962	324,659.52	247,786	228,637	0.5869	160,955	32.76	4,913	60.5
1963	284,281.30	213,919	197,387	0.5786	143,750	33.56	4,283	59.5
1964	403,748.24	299,442	276,301	0.5703	208,197	34.38	6,056	58.5
1965	477,338.64	348,792	321,837	0.5619	250,970	35.20	7,130	57.5
1966	4,141,499.93	2,980,394	2,750,065	0.5534	2,219,735	36.03	61,613	56.5
1967	682,464.24	483,511	446,145	0.5448	372,812	36.86	10,113	55.5
1968	525,955.63	366,704	338,365	0.5361	292,782	37.71	7,764	54.5
1969	669,365.92	459,087	423,608	0.5274	379,631	38.56	9,845	53.5
1970	436,066.71	294,081	271,354	0.5186	251,926	39.42	6,391	52.5
1971	526,196.31	348,784	321,830	0.5097	309,606	40.29	7,685	51.5
1972	1,507,231.21	981,500	905,648	0.5007	903,029	41.16	21,939	50.5
1973	842,895.06	538,996	497,342	0.4917	514,132	42.04	12,229	49.5
1974	3,054,393.14	1,917,012	1,768,862	0.4826	1,896,409	42.93	44,176	48.5
1975	663,547.09	408,551	376,977	0.4734	419,279	43.82	9,568	47.5
1976	767,271.97	463,209	427,411	0.4642	493,315	44.72	11,031	46.5
1977	1,276,216.76	755,050	696,699	0.4549	834,761	45.63	18,295	45.5
1978	1,108,170.91	642,162	592,535	0.4456	737,270	46.54	15,842	44.5
1979	1,451,181.87	823,188	759,571	0.4362	981,847	47.46	20,690	43.5
1980	1,247,670.91	692,406	638,895	0.4267	858,310	48.38	17,742	42.5
1981	498,248.72	270,348	249,455	0.4172	348,443	49.31	7,067	41.5
1982	413,042.15	218,982	202,059	0.4077	293,591	50.24	5,844	40.5
1983	550,370.05	284,913	262,894	0.3981	397,550	51.17	7,769	39.5
1984	1,794,947.65	906,669	836,600	0.3884	1,317,337	52.12	25,277	38.5
1985	5,122,897.89	2,523,106	2,328,117	0.3787	3,819,360	53.06	71,980	37.5
1986	1,759,782.34	844,442	779,182	0.3690	1,332,556	54.01	24,672	36.5
1987	8,210,344.12	3,835,436	3,539,029	0.3592	6,313,384	54.96	114,864	35.5

American Water Works - Kentucky

Account #: 331.001 - TD Mains

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	5,313,717.84	2,414,504	2,227,908	0.3494	4,148,553	55.92	74,186	34.5
1989	3,254,592.80	1,437,197	1,326,128	0.3396	2,579,383	56.88	45,347	33.5
1990	3,652,028.75	1,565,801	1,444,794	0.3297	2,937,641	57.84	50,786	32.5
1991	1,913,138.08	795,611	734,125	0.3198	1,561,641	58.81	26,554	31.5
1992	3,697,611.30	1,489,933	1,374,789	0.3098	3,062,345	59.78	51,228	30.5
1993	3,219,988.34	1,255,758	1,158,712	0.2999	2,705,274	60.75	44,531	29.5
1994	6,528,362.47	2,461,194	2,270,990	0.2899	5,563,045	61.72	90,126	28.5
1995	4,005,451.17	1,457,913	1,345,244	0.2799	3,461,298	62.70	55,203	27.5
1996	5,538,531.67	1,943,673	1,793,464	0.2698	4,852,774	63.68	76,206	26.5
1997	6,223,550.35	2,102,719	1,940,218	0.2598	5,528,042	64.66	85,494	25.5
1998	5,194,888.79	1,687,141	1,556,756	0.2497	4,677,110	65.64	71,251	24.5
1999	8,430,760.74	2,627,460	2,424,406	0.2396	7,692,507	66.63	115,458	23.5
2000	7,435,307.31	2,219,537	2,048,008	0.2295	6,874,361	67.61	101,674	22.5
2001	5,055,926.79	1,442,729	1,331,233	0.2194	4,735,879	68.60	69,038	21.5
2002	190,725.21	51,911	47,899	0.2093	180,971	69.59	2,601	20.5
2003	761.64	197	182	0.1991	732	70.58	10	19.5
2004	69,375.66	17,051	15,733	0.1890	67,517	71.57	943	18.5
2005	574,365.56	133,574	123,252	0.1788	565,987	72.56	7,800	17.5
2006	15,320,311.43	3,360,173	3,100,495	0.1686	15,283,879	73.55	207,801	16.5
2007	32,414,115.90	6,680,073	6,163,828	0.1585	32,733,111	74.54	439,114	15.5
2008	9,275,843.10	1,788,686	1,650,454	0.1483	9,480,558	75.54	125,508	14.5
2009	3,552,869.25	637,992	588,687	0.1381	3,674,756	76.53	48,016	13.5
2010	75,331,936.13	12,527,724	11,559,565	0.1279	78,838,758	77.53	1,016,914	12.5
2011	3,892,512.77	595,642	549,610	0.1177	4,121,406	78.52	52,486	11.5
2012	3,798,661.40	530,817	489,795	0.1074	4,068,599	79.52	51,165	10.5
2013	4,630,862.05	585,562	540,309	0.0972	5,016,726	80.52	62,307	9.5
2014	18,671,276.45	2,112,695	1,949,423	0.0870	20,456,109	81.51	250,953	8.5
2015	7,206,744.44	719,607	663,995	0.0768	7,984,098	82.51	96,764	7.5

American Water Works - Kentucky

Account #: 331.001 - TD Mains

ALG - Remaining Life
Survivor Curve: R4
ASL: 90
Net Salvage: -20%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2016	15,328,422.26	1,326,636	1,224,112	0.0665	17,169,995	83.51	205,607	6.5
2017	12,439,042.91	911,027	840,622	0.0563	14,086,230	84.51	166,687	5.5
2018	10,599,768.63	635,222	586,131	0.0461	12,133,591	85.51	141,904	4.5
2019	9,440,558.68	440,055	406,047	0.0358	10,922,623	86.50	126,267	3.5
2020	11,533,932.22	384,035	354,356	0.0256	13,486,362	87.50	154,125	2.5
2021	20,981,107.35	419,132	386,741	0.0154	24,790,588	88.50	280,114	1.5
2022	29,510,003.59	196,398	181,220	0.0051	35,230,784	89.50	393,636	0.5
TOTAL	398,094,727.91	85,410,262	78,809,643		398,904,030		5,424,097	

COMPOSITE ANNUAL ACCRUAL RATE	1.36%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.20
COMPOSITE AVERAGE AGE (YEARS)	16.32
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	73.91

American Water Works - Kentucky

Account #: 333.000 - Services

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 55
Net Salvage: -65%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	510.72	843	843	1.0000	0		0	89.5
1939	81.44	133	134	1.0000	0	0.50	0	83.5
1940	159.49	261	263	1.0000	0	0.54	0	82.5
1941	70.77	115	117	1.0000	0	0.63	0	81.5
1942	804.00	1,308	1,327	1.0000	0	0.79	0	80.5
1946	281.15	450	460	0.9920	4	1.60	2	76.5
1953	490.46	761	777	0.9605	32	3.29	10	69.5
1955	835.85	1,283	1,311	0.9507	68	3.82	18	67.5
1956	1,057.00	1,614	1,649	0.9456	95	4.09	23	66.5
1957	2,334.42	3,546	3,623	0.9405	229	4.37	52	65.5
1958	3,897.27	5,887	6,014	0.9353	416	4.65	89	64.5
1959	861.29	1,293	1,321	0.9299	100	4.94	20	63.5
1960	6,994.67	10,441	10,667	0.9243	874	5.24	167	62.5
1961	5,263.34	7,807	7,976	0.9185	708	5.56	127	61.5
1962	40,628.47	59,864	61,163	0.9124	5,874	5.88	998	60.5
1963	7,682.97	11,241	11,485	0.9060	1,192	6.23	191	59.5
1964	4,843.24	7,033	7,186	0.8992	805	6.59	122	58.5
1965	12,435.33	17,915	18,303	0.8920	2,215	6.98	317	57.5
1966	32,078.45	45,818	46,812	0.8844	6,118	7.39	828	56.5
1967	14,292.62	20,227	20,666	0.8763	2,917	7.83	373	55.5
1968	64,503.96	90,388	92,348	0.8677	14,083	8.29	1,699	54.5
1969	82,738.10	114,711	117,199	0.8585	19,319	8.79	2,199	53.5
1970	61,531.63	84,342	86,171	0.8487	15,356	9.31	1,649	52.5
1971	39,880.94	54,003	55,174	0.8385	10,630	9.86	1,078	51.5
1972	109,193.89	145,953	149,118	0.8277	31,052	10.45	2,973	50.5
1973	37,354.02	49,248	50,316	0.8164	11,318	11.05	1,024	49.5
1974	95,240.69	123,758	126,442	0.8046	30,705	11.69	2,628	48.5
1975	72,245.50	92,465	94,471	0.7925	24,734	12.34	2,005	47.5

American Water Works - Kentucky

Account #: 333.000 - Services

ALG - Remaining Life
Survivor Curve: R4
ASL: 55
Net Salvage: -65%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1976	199,351.71	251,154	256,601	0.7801	72,330	13.00	5,562	46.5
1977	294,222.76	364,669	372,577	0.7675	112,890	13.69	8,249	45.5
1978	295,796.55	360,471	368,289	0.7546	119,776	14.38	8,330	44.5
1979	322,714.27	386,443	394,824	0.7415	137,655	15.08	9,126	43.5
1980	292,385.41	343,819	351,275	0.7281	131,161	15.80	8,300	42.5
1981	164,833.30	190,209	194,334	0.7145	77,641	16.53	4,696	41.5
1982	269,523.82	304,990	311,605	0.7007	133,110	17.28	7,703	40.5
1983	245,011.96	271,675	277,567	0.6866	126,703	18.04	7,024	39.5
1984	332,469.71	360,945	368,773	0.6722	179,802	18.81	9,558	38.5
1985	459,948.33	488,480	499,073	0.6576	259,841	19.60	13,258	37.5
1986	557,881.87	579,090	591,648	0.6427	328,857	20.40	16,121	36.5
1987	644,977.27	653,750	667,927	0.6276	396,285	21.21	18,681	35.5
1988	629,969.17	622,913	636,422	0.6123	403,028	22.04	18,286	34.5
1989	790,694.37	761,926	778,449	0.5967	526,196	22.88	22,999	33.5
1990	755,472.61	708,672	724,041	0.5808	522,489	23.73	22,017	32.5
1991	744,136.27	678,741	693,461	0.5648	534,364	24.60	21,726	31.5
1992	928,911.28	822,876	840,721	0.5485	691,982	25.47	27,167	30.5
1993	772,404.39	663,693	678,086	0.5321	596,381	26.36	22,626	29.5
1994	860,174.12	715,969	731,496	0.5154	687,791	27.25	25,236	28.5
1995	949,010.57	764,105	780,676	0.4986	785,192	28.16	27,882	27.5
1996	1,041,896.35	810,254	827,826	0.4815	891,303	29.08	30,653	26.5
1997	975,567.84	731,609	747,475	0.4644	862,212	30.00	28,738	25.5
1998	1,440,245.34	1,039,789	1,062,339	0.4470	1,314,066	30.93	42,478	24.5
1999	1,665,637.64	1,155,542	1,180,602	0.4296	1,567,700	31.87	49,183	23.5
2000	1,934,097.32	1,286,854	1,314,761	0.4120	1,876,499	32.82	57,173	22.5
2001	9,201,395.89	5,859,041	5,986,104	0.3943	9,196,199	33.77	272,280	21.5
2002	13,621.18	8,281	8,461	0.3765	14,014	34.73	403	20.5
2003	39,072.44	22,625	23,116	0.3586	41,353	35.70	1,158	19.5

American Water Works - Kentucky

Account #: 333.000 - Services

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 55
Net Salvage: -65%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	79,081.40	43,495	44,438	0.3406	86,046	36.67	2,347	18.5
2006	4,901,354.31	2,409,088	2,461,333	0.3043	5,625,902	38.62	145,688	16.5
2007	1,150,010.89	531,433	542,958	0.2861	1,354,560	39.60	34,209	15.5
2008	2,533,662.39	1,096,114	1,119,885	0.2679	3,060,658	40.58	75,424	14.5
2009	3,796,601.55	1,530,234	1,563,419	0.2496	4,700,973	41.56	113,100	13.5
2010	1,854,091.51	692,354	707,369	0.2312	2,351,882	42.55	55,270	12.5
2011	1,673,854.52	575,350	587,827	0.2128	2,174,033	43.54	49,929	11.5
2012	2,319,787.63	728,374	744,170	0.1944	3,083,479	44.53	69,239	10.5
2013	1,080,773.17	307,150	313,811	0.1760	1,469,465	45.53	32,277	9.5
2014	820,410.45	208,688	213,213	0.1575	1,140,464	46.52	24,515	8.5
2015	927,013.10	208,127	212,641	0.1390	1,316,931	47.52	27,715	7.5
2016	1,136,851.25	221,267	226,065	0.1205	1,649,739	48.51	34,007	6.5
2017	1,235,888.41	203,583	207,998	0.1020	1,831,218	49.51	36,987	5.5
2018	2,429,421.17	327,491	334,593	0.0835	3,673,952	50.51	72,742	4.5
2019	2,558,798.90	268,323	274,142	0.0649	3,947,876	51.50	76,651	3.5
2020	1,252,504.84	93,827	95,862	0.0464	1,970,771	52.50	37,536	2.5
2021	3,574,761.12	160,684	164,169	0.0278	5,734,187	53.50	107,178	1.5
2022	2,870,303.23	42,995	43,928	0.0093	4,692,073	54.50	86,092	0.5
TOTAL	63,714,885.26	31,809,870	32,499,686		72,629,874		1,886,111	

COMPOSITE ANNUAL ACCRUAL RATE	2.96%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.51
COMPOSITE AVERAGE AGE (YEARS)	17.11
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	38.36

American Water Works - Kentucky

Account #: 334.100 - Meters

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1986	1,456.34	1,675	332	0.1979	1,343		1,343	36.5
1988	2,096.79	2,411	477	0.1977	1,935		1,935	34.5
2002	56,623.00	65,116	12,871	0.1977	52,246		52,246	20.5
2003	29,910.50	34,397	6,799	0.1977	27,598		27,598	19.5
2006	14,513.75	15,856	3,134	0.1878	13,557	0.50	13,557	16.5
2008	1,293,087.40	1,384,353	273,628	0.1840	1,213,422	0.69	1,213,422	14.5
2009	468,655.96	489,562	96,766	0.1795	442,189	0.92	442,189	13.5
2010	2,261,724.27	2,298,315	454,280	0.1747	2,146,703	1.16	1,844,775	12.5
2011	5,310,049.34	5,218,338	1,031,446	0.1689	5,075,111	1.45	3,489,171	11.5
2012	2,482,230.07	2,334,730	461,478	0.1617	2,393,087	1.82	1,314,114	10.5
2013	1,932,824.26	1,715,546	339,091	0.1526	1,883,657	2.28	825,489	9.5
2014	327,351.57	269,577	53,284	0.1415	323,170	2.84	113,831	8.5
2015	208,809.43	156,504	30,934	0.1288	209,197	3.48	60,070	7.5
2016	57,115.56	38,109	7,533	0.1147	58,150	4.20	13,852	6.5
2017	34,596.67	19,997	3,953	0.0993	35,834	4.97	7,204	5.5
2018	3,746,567.82	1,808,636	357,491	0.0830	3,951,062	5.80	680,957	4.5
2019	3,313,169.36	1,265,981	250,231	0.0657	3,559,914	6.68	533,133	3.5
2020	689,125.79	190,799	37,713	0.0476	754,782	7.59	99,412	2.5
2021	1,363,288.86	229,009	45,265	0.0289	1,522,517	8.54	178,296	1.5
2022	3,532,307.73	199,395	39,412	0.0097	4,022,742	9.51	423,040	0.5
TOTAL	27,125,504.47	17,738,309	3,506,116		27,688,214		11,335,634	

COMPOSITE ANNUAL ACCRUAL RATE	41.79%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.13
COMPOSITE AVERAGE AGE (YEARS)	7.37
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.31

American Water Works - Kentucky

Account #: 334.110 - Meters - Bronze Case

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2006	37,862.01	41,364	15,917	0.3656	27,624	0.50	27,624	16.5
2007	438.29	478	184	0.3649	320	0.52	320	15.5
2008	1,966,990.53	2,105,821	810,341	0.3582	1,451,698	0.69	1,451,698	14.5
2009	263,744.72	275,510	106,019	0.3495	197,287	0.92	197,287	13.5
2019	159,756.32	61,044	23,490	0.1279	160,229	6.68	23,996	3.5
TOTAL	2,428,791.87	2,484,217	955,952		1,837,159		1,700,925	

COMPOSITE ANNUAL ACCRUAL RATE	70.03%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	13.70
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	1.11

American Water Works - Kentucky

Account #: 334.120 - Meters - Plastic Case

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1976	303.88	349	-268	-0.7656	617		617	46.5
1977	296.96	342	-262	-0.7662	603		603	45.5
1979	106.98	123	-94	-0.7662	217		217	43.5
1981	465.52	535	-410	-0.7662	946		946	41.5
1983	108.98	125	-96	-0.7662	221		221	39.5
1984	38.00	44	-33	-0.7661	77		77	38.5
1985	3,175.62	3,652	-2,798	-0.7662	6,450		6,450	37.5
1986	1,053.79	1,212	-929	-0.7662	2,140		2,140	36.5
1987	937.01	1,078	-826	-0.7662	1,903		1,903	35.5
1988	1,711.33	1,968	-1,508	-0.7662	3,476		3,476	34.5
1989	3,353.34	3,856	-2,955	-0.7662	6,811		6,811	33.5
1992	1,881.27	2,163	-1,658	-0.7662	3,821		3,821	30.5
1993	6,609.64	7,601	-5,824	-0.7662	13,425		13,425	29.5
1994	45,303.92	52,100	-39,919	-0.7662	92,019		92,019	28.5
1995	11,934.36	13,725	-10,516	-0.7662	24,240		24,240	27.5
1997	9,263.92	10,654	-8,163	-0.7662	18,816		18,816	25.5
2001	282,382.96	324,740	-248,821	-0.7662	573,561		573,561	21.5
2007	4,165.32	4,542	-3,480	-0.7265	8,270	0.52	8,270	15.5
2013	5,815.36	5,162	-3,955	-0.5914	10,643	2.28	4,664	9.5
2014	16,203.31	13,344	-10,224	-0.5487	28,858	2.84	10,165	8.5
2019	72,034.73	27,525	-21,090	-0.2546	103,930	6.68	15,565	3.5
2020	653.38	181	-139	-0.1845	890	7.59	117	2.5
2021	8,269.77	1,389	-1,064	-0.1119	10,575	8.54	1,238	1.5

American Water Works - Kentucky

Account #: 334.120 - Meters - Plastic Case

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	476,069.35	476,409	-365,031		912,511		789,362	

COMPOSITE ANNUAL ACCRUAL RATE	165.81%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.77
COMPOSITE AVERAGE AGE (YEARS)	19.16
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	1.30

American Water Works - Kentucky

Account #: 334.130 - Meters - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	221.37	255	81	0.3186	173		173	88.5
1935	46.68	54	17	0.3185	37		37	87.5
1936	184.20	212	67	0.3186	144		144	86.5
1937	118.84	137	44	0.3186	93		93	85.5
1939	69.91	80	26	0.3187	55		55	83.5
1941	274.11	315	100	0.3186	215		215	81.5
1946	90.46	104	33	0.3187	71		71	76.5
1950	63.27	73	23	0.3186	50		50	72.5
1951	434.51	500	159	0.3186	340		340	71.5
1952	56.86	65	21	0.3186	45		45	70.5
1953	528.43	608	194	0.3186	414		414	69.5
1954	567.11	652	208	0.3186	444		444	68.5
1956	913.13	1,050	335	0.3186	716		716	66.5
1957	566.29	651	207	0.3186	444		444	65.5
1958	94.99	109	35	0.3187	74		74	64.5
1959	828.81	953	304	0.3186	649		649	63.5
1960	1,132.35	1,302	415	0.3186	887		887	62.5
1961	782.01	899	287	0.3186	613		613	61.5
1962	333.51	384	122	0.3186	261		261	60.5
1963	1,615.14	1,857	592	0.3186	1,266		1,266	59.5
1964	554.45	638	203	0.3186	434		434	58.5
1965	2,628.95	3,023	963	0.3186	2,060		2,060	57.5
1966	2,689.20	3,093	985	0.3186	2,107		2,107	56.5
1967	3,381.70	3,889	1,239	0.3186	2,650		2,650	55.5
1971	1,116.84	1,284	409	0.3186	875		875	51.5
1977	594.85	684	218	0.3186	466		466	45.5
1978	1,487.77	1,711	545	0.3186	1,166		1,166	44.5
1980	1,729.52	1,989	634	0.3186	1,355		1,355	42.5

American Water Works - Kentucky

Account #: 334.130 - Meters - Other

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1981	560.70	645	205	0.3186	439		439	41.5
1983	376.27	433	138	0.3186	295		295	39.5
1985	6,562.14	7,546	2,404	0.3186	5,142		5,142	37.5
1986	6,691.30	7,695	2,452	0.3186	5,243		5,243	36.5
1987	157.20	181	58	0.3186	123		123	35.5
1988	2,180.02	2,507	799	0.3186	1,708		1,708	34.5
1989	4,247.33	4,884	1,556	0.3186	3,328		3,328	33.5
1990	2,580.38	2,967	945	0.3186	2,022		2,022	32.5
1992	9,519.28	10,947	3,488	0.3186	7,459		7,459	30.5
1993	8,582.94	9,870	3,145	0.3186	6,726		6,726	29.5
1994	10,008.78	11,510	3,667	0.3186	7,843		7,843	28.5
1995	9,026.06	10,380	3,307	0.3186	7,073		7,073	27.5
1996	91,710.15	105,467	33,603	0.3186	71,863		71,863	26.5
1997	126,486.24	145,459	46,346	0.3186	99,114		99,114	25.5
1998	172,258.15	198,097	63,117	0.3186	134,980		134,980	24.5
1999	102,800.26	118,220	37,667	0.3186	80,553		80,553	23.5
2000	298,668.92	343,469	109,435	0.3186	234,035		234,035	22.5
2003	50,508.48	58,085	18,507	0.3186	39,578		39,578	19.5
2004	18,050.92	20,759	6,614	0.3186	14,145		14,145	18.5
2006	5,319,740.33	5,811,816	1,851,734	0.3027	4,265,968	0.50	4,265,968	16.5
2007	67,524.64	73,633	23,461	0.3021	54,193	0.52	54,193	15.5
2008	20,002.65	21,414	6,823	0.2966	16,180	0.69	16,180	14.5
2009	147,426.61	154,003	49,068	0.2894	120,473	0.92	120,473	13.5
2019	177,047.35	67,651	21,555	0.1059	182,050	6.68	27,264	3.5

American Water Works - Kentucky

Account #: 334.130 - Meters - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	6,675,822.36	7,214,211	2,298,558		5,378,638		5,223,851	

COMPOSITE ANNUAL ACCRUAL RATE	78.25%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.34
COMPOSITE AVERAGE AGE (YEARS)	17.27
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	0.60

American Water Works - Kentucky

Account #: 334.131 - Meter Reading Units

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 10
Net Salvage: -15%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2006	270,917.62	295,978	117,516	0.3772	194,039	0.50	194,039	16.5
2008	5,583.31	5,977	2,373	0.3696	4,048	0.69	4,048	14.5
2011	17,183.36	16,887	6,705	0.3393	13,056	1.45	8,976	11.5
2012	30,826.98	28,995	11,512	0.3247	23,939	1.82	13,145	10.5
2013	688.47	611	243	0.3064	549	2.28	241	9.5
2014	127,744.37	105,199	41,768	0.2843	105,138	2.84	37,033	8.5
2015	214.05	160	64	0.2588	182	3.48	52	7.5
2019	22,538.95	8,612	3,419	0.1319	22,500	6.68	3,370	3.5
2020	251,930.65	69,752	27,695	0.0956	262,026	7.59	34,511	2.5
TOTAL	727,627.76	532,171	211,295		625,477		295,415	

COMPOSITE ANNUAL ACCRUAL RATE	40.60%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.29
COMPOSITE AVERAGE AGE (YEARS)	9.45
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.64

American Water Works - Kentucky

Account #: 334.200 - Meter Installations

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	744.57	847	893	1.0000	0	3.15	0	88.5
1935	992.35	1,123	1,191	1.0000	0	3.41	0	87.5
1936	61.55	69	74	1.0000	0	3.66	0	86.5
1939	1,448.05	1,609	1,738	1.0000	0	4.43	0	83.5
1940	535.79	593	643	1.0000	0	4.69	0	82.5
1941	347.81	383	417	1.0000	0	4.95	0	81.5
1942	940.92	1,031	1,129	1.0000	0	5.20	0	80.5
1945	280.47	303	337	1.0000	0	5.99	0	77.5
1946	151.10	162	181	1.0000	0	6.26	0	76.5
1947	4,661.39	4,985	5,594	1.0000	0	6.53	0	75.5
1948	3,785.57	4,027	4,543	1.0000	0	6.81	0	74.5
1949	18,030.66	19,078	21,637	1.0000	0	7.09	0	73.5
1950	1,898.88	1,998	2,279	1.0000	0	7.39	0	72.5
1951	8,985.34	9,400	10,782	1.0000	0	7.69	0	71.5
1952	14,692.46	15,278	17,631	1.0000	0	8.01	0	70.5
1953	19,557.52	20,209	23,469	1.0000	0	8.33	0	69.5
1954	20,262.60	20,801	24,315	1.0000	0	8.67	0	68.5
1955	23,485.62	23,945	28,183	1.0000	0	9.02	0	67.5
1956	22,655.35	22,934	27,186	1.0000	0	9.39	0	66.5
1957	33,014.32	33,171	39,390	0.9943	228	9.76	23	65.5
1958	23,041.57	22,970	27,276	0.9865	374	10.16	37	64.5
1959	15,562.28	15,387	18,272	0.9784	403	10.56	38	63.5
1960	32,153.68	31,521	37,430	0.9701	1,155	10.98	105	62.5
1961	33,915.57	32,951	39,128	0.9614	1,571	11.42	138	61.5
1962	30,073.81	28,945	34,372	0.9524	1,717	11.88	145	60.5
1963	51,082.20	48,686	57,813	0.9431	3,485	12.35	282	59.5
1964	48,998.21	46,224	54,889	0.9335	3,909	12.83	305	58.5
1965	25,892.69	24,167	28,698	0.9236	2,374	13.33	178	57.5

American Water Works - Kentucky

Account #: 334.200 - Meter Installations

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1966	69,841.88	64,465	76,550	0.9134	7,260	13.85	524	56.5
1967	59,006.87	53,834	63,927	0.9028	6,881	14.38	478	55.5
1968	56,327.53	50,773	60,291	0.8920	7,302	14.93	489	54.5
1969	42,542.88	37,868	44,967	0.8808	6,084	15.49	393	53.5
1970	49,874.98	43,817	52,031	0.8694	7,819	16.07	486	52.5
1971	52,828.42	45,785	54,369	0.8576	9,025	16.67	542	51.5
1972	80,028.66	68,387	81,208	0.8456	14,827	17.27	858	50.5
1973	67,141.80	56,540	67,140	0.8333	13,431	17.90	751	49.5
1974	134,756.14	111,768	132,721	0.8207	28,986	18.53	1,564	48.5
1975	87,694.99	71,598	85,021	0.8079	20,213	19.18	1,054	47.5
1976	99,024.44	79,539	94,451	0.7948	24,378	19.84	1,229	46.5
1977	150,703.81	119,022	141,336	0.7815	39,508	20.51	1,926	45.5
1978	200,757.84	155,804	185,014	0.7680	55,896	21.20	2,637	44.5
1979	199,613.81	152,135	180,656	0.7542	58,880	21.89	2,689	43.5
1980	201,904.28	151,025	179,338	0.7402	62,947	22.60	2,785	42.5
1981	169,704.75	124,501	147,842	0.7260	55,804	23.32	2,393	41.5
1982	200,412.55	144,106	171,122	0.7115	69,373	24.05	2,885	40.5
1983	183,597.83	129,302	153,543	0.6969	66,774	24.79	2,694	39.5
1984	272,649.01	187,933	223,166	0.6821	104,013	25.54	4,073	38.5
1985	384,431.99	259,147	307,730	0.6671	153,588	26.29	5,841	37.5
1986	366,628.21	241,513	286,791	0.6519	153,163	27.06	5,660	36.5
1987	438,871.25	282,276	335,196	0.6365	191,449	27.84	6,877	35.5
1988	381,481.31	239,359	284,233	0.6209	173,545	28.63	6,062	34.5
1989	512,074.49	313,153	371,861	0.6052	242,628	29.42	8,246	33.5
1990	353,485.91	210,482	249,943	0.5892	174,240	30.23	5,764	32.5
1991	408,384.36	236,529	280,873	0.5731	209,189	31.04	6,739	31.5
1992	306,722.19	172,610	204,971	0.5569	163,096	31.86	5,119	30.5
1993	490,162.24	267,708	317,897	0.5405	270,298	32.69	8,268	29.5

American Water Works - Kentucky

Account #: 334.200 - Meter Installations

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1994	429,065.08	227,147	269,732	0.5239	245,146	33.53	7,311	28.5
1995	347,971.51	178,331	211,764	0.5071	205,802	34.38	5,987	27.5
1996	490,082.15	242,793	288,311	0.4902	299,787	35.23	8,510	26.5
1997	694,381.88	332,041	394,291	0.4732	438,967	36.09	12,163	25.5
1998	519,293.39	239,295	284,157	0.4560	338,995	36.96	9,172	24.5
1999	755,970.39	335,111	397,936	0.4387	509,228	37.84	13,459	23.5
2000	540,687.26	230,125	273,268	0.4212	375,556	38.72	9,699	22.5
2001	8,078.12	3,294	3,912	0.4036	5,782	39.61	146	21.5
2002	17,074.50	6,657	7,905	0.3858	12,584	40.51	311	20.5
2006	4,268,166.63	1,352,372	1,605,909	0.3135	3,515,891	44.16	79,622	16.5
2007	163,821.85	48,869	58,031	0.2952	138,556	45.08	3,073	15.5
2008	129,715.27	36,275	43,075	0.2767	112,583	46.02	2,447	14.5
2009	1,029,296.17	268,529	318,872	0.2582	916,283	46.96	19,514	13.5
2010	866,604.40	209,745	249,068	0.2395	790,858	47.90	16,511	12.5
2011	456,990.21	101,946	121,058	0.2208	427,330	48.85	8,749	11.5
2012	642,116.96	131,017	155,580	0.2019	614,961	49.80	12,349	10.5
2013	3,302,377.11	610,673	725,159	0.1830	3,237,693	50.75	63,792	9.5
2014	1,055,140.59	174,856	207,637	0.1640	1,058,531	51.71	20,469	8.5
2015	1,276,882.09	186,989	222,046	0.1449	1,310,213	52.68	24,872	7.5
2016	2,033,663.62	258,480	306,939	0.1258	2,133,458	53.64	39,770	6.5
2017	2,338,232.75	251,812	299,020	0.1066	2,506,859	54.62	45,900	5.5
2018	558,646.98	49,286	58,526	0.0873	611,850	55.59	11,007	4.5
2019	416,229.16	28,596	33,957	0.0680	465,518	56.56	8,230	3.5
2020	520,359.65	25,565	30,358	0.0486	594,074	57.54	10,324	2.5
2021	832,339.28	24,561	29,165	0.0292	969,642	58.52	16,568	1.5
2022	1,396,934.94	13,753	16,332	0.0097	1,659,990	59.51	27,895	0.5

American Water Works - Kentucky

Account #: 334.200 - Meter Installations

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R3
ASL: 60
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	31,548,028.69	10,071,894	11,955,688		25,901,947		568,127	

COMPOSITE ANNUAL ACCRUAL RATE	1.80%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.38
COMPOSITE AVERAGE AGE (YEARS)	17.33
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	44.04

American Water Works - Kentucky

Account #: 334.300 - Meter Vaults

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S0.5
ASL: 60
Net Salvage: -20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1982	2,000.00	1,170	-151	-0.0627	2,551	30.75	83	40.5
1996	12,500.00	5,279	-680	-0.0453	15,680	38.88	403	26.5
2008	112.43	28	-4	-0.0272	139	47.33	3	14.5
2009	25,379.86	6,037	-777	-0.0255	31,233	48.11	649	13.5
2010	3,096.52	688	-88	-0.0238	3,804	48.90	78	12.5
2011	226,395.07	46,623	-6,001	-0.0221	277,675	49.70	5,587	11.5
2012	201,622.79	38,221	-4,920	-0.0203	246,867	50.52	4,886	10.5
2013	121,774.13	21,060	-2,711	-0.0185	148,840	51.35	2,898	9.5
2014	189,771.62	29,612	-3,811	-0.0167	231,537	52.20	4,436	8.5
2015	194,887.40	27,059	-3,483	-0.0149	237,348	53.06	4,473	7.5
2016	61,667.48	7,485	-963	-0.0130	74,964	53.93	1,390	6.5
2017	160,729.92	16,652	-2,143	-0.0111	195,019	54.82	3,557	5.5
2018	173,677.04	14,852	-1,912	-0.0092	210,324	55.72	3,774	4.5
2019	232,285.39	15,594	-2,007	-0.0072	280,750	56.64	4,956	3.5
2020	501,784.81	24,295	-3,127	-0.0052	605,269	57.58	10,512	2.5
2021	794,961.95	23,327	-3,002	-0.0031	956,957	58.53	16,349	1.5
2022	753,724.24	7,458	-960	-0.0011	905,429	59.51	15,216	0.5
TOTAL	3,656,370.65	285,439	-36,739		4,424,384		79,250	

COMPOSITE ANNUAL ACCRUAL RATE	2.17%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.01
COMPOSITE AVERAGE AGE (YEARS)	4.23
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	56.10

American Water Works - Kentucky

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1934	113.96	154	106	0.6621	54	2.31	23	88.5
1937	15.89	21	15	0.6545	8	3.03	3	85.5
1939	85.34	113	78	0.6491	42	3.53	12	83.5
1941	9.80	13	9	0.6436	5	4.05	1	81.5
1948	191.71	244	167	0.6230	101	6.00	17	74.5
1949	123.52	156	107	0.6198	66	6.31	10	73.5
1950	69.48	87	60	0.6165	37	6.62	6	72.5
1951	91.98	115	79	0.6130	50	6.95	7	71.5
1952	272.56	339	233	0.6094	149	7.29	20	70.5
1953	628.37	776	533	0.6056	347	7.65	45	69.5
1954	336.69	413	284	0.6016	188	8.03	23	68.5
1955	1,151.46	1,403	963	0.5974	649	8.43	77	67.5
1956	929.09	1,124	771	0.5930	529	8.85	60	66.5
1957	1,087.87	1,305	896	0.5883	627	9.29	68	65.5
1958	1,048.39	1,248	856	0.5834	611	9.75	63	64.5
1959	3,491.85	4,118	2,827	0.5782	2,062	10.24	201	63.5
1960	13,810.36	16,135	11,075	0.5728	8,260	10.76	768	62.5
1961	26,074.69	30,159	20,701	0.5671	15,803	11.30	1,399	61.5
1962	22,992.05	26,314	18,062	0.5611	14,127	11.86	1,191	60.5
1963	25,232.32	28,558	19,602	0.5549	15,723	12.45	1,263	59.5
1964	41,970.50	46,951	32,227	0.5485	26,531	13.06	2,031	58.5
1965	20,120.91	22,235	15,262	0.5418	12,907	13.69	943	57.5
1966	87,278.17	95,233	65,368	0.5350	56,821	14.34	3,962	56.5
1967	27,402.04	29,508	20,255	0.5280	18,108	15.00	1,207	55.5
1968	22,811.86	24,234	16,635	0.5209	15,302	15.68	976	54.5
1969	54,353.84	56,941	39,085	0.5136	37,010	16.36	2,262	53.5
1970	44,633.13	46,090	31,636	0.5063	30,850	17.06	1,809	52.5
1971	44,054.99	44,823	30,767	0.4988	30,910	17.76	1,740	51.5

American Water Works - Kentucky

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1972	32,899.75	32,966	22,628	0.4913	23,432	18.48	1,268	50.5
1973	125,785.21	124,066	85,160	0.4836	90,939	19.21	4,735	49.5
1974	179,481.08	174,169	119,551	0.4758	131,723	19.95	6,604	48.5
1975	88,075.45	84,046	57,690	0.4679	65,616	20.70	3,171	47.5
1976	35,176.40	32,989	22,644	0.4598	26,603	21.46	1,240	46.5
1977	100,007.87	92,124	63,234	0.4516	76,777	22.23	3,453	45.5
1978	53,535.94	48,408	33,228	0.4433	41,723	23.02	1,813	44.5
1979	148,919.71	132,101	90,675	0.4349	117,813	23.81	4,947	43.5
1980	127,182.96	110,603	75,918	0.4264	102,138	24.62	4,148	42.5
1981	74,378.92	63,370	43,497	0.4177	60,633	25.44	2,383	41.5
1982	78,637.32	65,590	45,021	0.4089	65,071	26.27	2,477	40.5
1983	60,248.76	49,160	33,744	0.4001	50,604	27.12	1,866	39.5
1984	158,254.11	126,223	86,640	0.3911	134,915	27.97	4,824	38.5
1985	163,231.19	127,161	87,284	0.3819	141,240	28.83	4,899	37.5
1986	109,635.48	83,350	57,212	0.3727	96,278	29.70	3,241	36.5
1987	221,049.19	163,853	112,470	0.3634	196,999	30.58	6,441	35.5
1988	230,761.84	166,628	114,375	0.3540	208,692	31.47	6,630	34.5
1989	222,642.15	156,451	107,389	0.3445	204,310	32.37	6,311	33.5
1990	342,379.97	233,903	160,552	0.3350	318,780	33.28	9,578	32.5
1991	201,918.67	133,961	91,952	0.3253	190,734	34.20	5,577	31.5
1992	330,450.09	212,670	145,978	0.3155	316,652	35.12	9,016	30.5
1993	222,042.76	138,454	95,036	0.3057	215,824	36.05	5,987	29.5
1994	261,284.08	157,656	108,216	0.2958	257,582	36.99	6,964	28.5
1995	216,035.95	125,969	86,466	0.2859	215,984	37.93	5,695	27.5
1996	326,606.99	183,774	126,144	0.2759	331,106	38.88	8,517	26.5
1997	254,178.45	137,802	94,588	0.2658	261,262	39.83	6,560	25.5
1998	270,789.51	141,220	96,934	0.2557	282,171	40.79	6,918	24.5
1999	365,298.22	182,935	125,567	0.2455	385,850	41.75	9,242	23.5

American Water Works - Kentucky

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2000	254,827.56	122,307	83,952	0.2353	272,806	42.72	6,386	22.5
2001	2,190.16	1,005	690	0.2251	2,376	43.69	54	21.5
2002	12,327.86	5,401	3,707	0.2148	13,552	44.66	303	20.5
2004	1,604.05	635	436	0.1941	1,810	46.62	39	18.5
2005	1,380.30	517	355	0.1837	1,577	47.60	33	17.5
2006	3,692,496.36	1,305,561	896,145	0.1734	4,273,350	48.58	87,958	16.5
2007	543,977.26	180,775	124,085	0.1629	637,483	49.57	12,860	15.5
2008	505,443.04	157,208	107,909	0.1525	599,711	50.56	11,862	14.5
2009	465,734.99	134,927	92,614	0.1420	559,415	51.55	10,852	13.5
2010	696,780.97	186,983	128,346	0.1316	847,147	52.54	16,124	12.5
2011	486,945.31	120,261	82,548	0.1211	599,175	53.53	11,193	11.5
2012	629,915.43	142,087	97,530	0.1106	784,352	54.53	14,385	10.5
2013	1,160,567.96	236,918	162,622	0.1001	1,462,173	55.52	26,335	9.5
2014	2,105,605.76	384,689	264,053	0.0896	2,683,795	56.52	47,486	8.5
2015	2,128,590.85	343,211	235,582	0.0791	2,744,445	57.51	47,718	7.5
2016	2,303,671.40	321,979	221,008	0.0685	3,004,132	58.51	51,343	6.5
2017	1,248,001.87	147,619	101,327	0.0580	1,645,876	59.51	27,658	5.5
2018	983,940.52	95,238	65,372	0.0475	1,312,145	60.51	21,686	4.5
2019	1,733,616.08	130,527	89,594	0.0369	2,337,468	61.50	38,005	3.5
2020	1,602,875.10	86,210	59,175	0.0264	2,184,850	62.50	34,956	2.5
2021	3,068,864.47	99,036	67,979	0.0158	4,228,431	63.50	66,588	1.5
2022	3,076,057.80	33,078	22,705	0.0053	4,283,776	64.50	66,414	0.5

American Water Works - Kentucky

Account #: 335.000 - Hydrants

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R4
ASL: 65
Net Salvage: -40%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
TOTAL	32,146,685.94	8,196,587	5,626,185		39,379,175		764,930	

COMPOSITE ANNUAL ACCRUAL RATE	2.38%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.18
COMPOSITE AVERAGE AGE (YEARS)	12.11
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	53.16

American Water Works - Kentucky

Account #: 339.600 - Other P/E - CPS

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2009	69,543.33	69,543	60,787	0.8741	8,756		8,756	14.5
2012	78,472.72	78,473	68,592	0.8741	9,880		9,880	11.5
2013	297,442.08	282,570	246,992	0.8304	50,450	0.50	50,450	9.5
2015	9,028.20	6,771	5,919	0.6556	3,110	2.50	1,244	7.5
2016	3,870.78	2,516	2,199	0.5682	1,672	3.50	478	6.5
2017	64,425.00	35,434	30,972	0.4808	33,453	4.50	7,434	5.5
2018	421,694.23	189,762	165,870	0.3933	255,825	5.50	46,514	4.5
2019	89,615.41	31,365	27,416	0.3059	62,199	6.50	9,569	3.5
2020	84,309.17	21,077	18,423	0.2185	65,886	7.50	8,785	2.5
TOTAL	1,118,400.92	717,512	627,171		491,230		143,110	

COMPOSITE ANNUAL ACCRUAL RATE	12.80%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.56
COMPOSITE AVERAGE AGE (YEARS)	6.80
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.58

American Water Works - Kentucky

Account #: 340.100 - Office Furniture & Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2004	4,361.47	4,034	3,257	0.7467	1,105	1.50	737	18.5
2005	14,130.29	12,364	9,980	0.7063	4,150	2.50	1,660	17.5
2006	20,545.69	16,950	13,682	0.6659	6,863	3.50	1,961	16.5
2007	24,682.76	19,129	15,441	0.6256	9,242	4.50	2,054	15.5
2008	16,838.09	12,208	9,854	0.5852	6,984	5.50	1,270	14.5
2010	77,677.74	48,549	39,188	0.5045	38,489	7.50	5,132	12.5
2011	14,392.26	8,276	6,680	0.4641	7,712	8.50	907	11.5
2012	160,805.49	84,423	68,146	0.4238	92,659	9.50	9,754	10.5
2013	2,424.49	1,152	930	0.3834	1,495	10.50	142	9.5
2014	821.90	349	282	0.3431	540	11.50	47	8.5
2015	16,513.93	6,193	4,999	0.3027	11,515	12.50	921	7.5
2016	52,041.75	16,914	13,653	0.2623	38,389	13.50	2,844	6.5
2017	12,079.79	3,322	2,681	0.2220	9,398	14.50	648	5.5
2018	49,171.29	11,064	8,931	0.1816	40,241	15.50	2,596	4.5
2019	50,093.17	8,766	7,076	0.1413	43,017	16.50	2,607	3.5
2020	2,505.75	313	253	0.1009	2,253	17.50	129	2.5
2021	5,448.16	409	330	0.0605	5,118	18.50	277	1.5
2022	32,732.48	818	661	0.0202	32,072	19.50	1,645	0.5
TOTAL	557,266.50	255,231	206,023		351,243		35,331	

COMPOSITE ANNUAL ACCRUAL RATE	6.34%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.37
COMPOSITE AVERAGE AGE (YEARS)	9.16
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	10.84

American Water Works - Kentucky

Account #: 340.200 - Computer & Peripheral - Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2019	35,492.98	12,423	23,662	0.6667	11,831	6.50	1,820	3.5
TOTAL	35,492.98	12,423	23,662		11,831		1,820	

COMPOSITE ANNUAL ACCRUAL RATE	5.13%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.67
COMPOSITE AVERAGE AGE (YEARS)	3.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	6.50

American Water Works - Kentucky

Account #: 340.210 - Computer & Peripheral - Mainframe

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	332.88	333	25	0.0741	308		308	13.5
2018	9,823.67	8,841	655	0.0667	9,168	0.50	9,168	4.5
TOTAL	10,156.55	9,174	680		9,477		9,476	

COMPOSITE ANNUAL ACCRUAL RATE	93.30%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.07
COMPOSITE AVERAGE AGE (YEARS)	4.79
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	0.48

American Water Works - Kentucky

Account #: 340.220 - Computer & Peripheral - Personal

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	332.88	333	-141	-0.4229	474		474	13.5
2018	60,858.54	54,773	-23,166	-0.3807	84,025	0.50	84,025	4.5
2019	60,499.12	42,349	-17,912	-0.2961	78,411	1.50	52,274	3.5
2020	71,979.55	35,990	-15,222	-0.2115	87,201	2.50	34,881	2.5
2021	42,047.31	12,614	-5,335	-0.1269	47,382	3.50	13,538	1.5
2022	178,873.14	17,887	-7,565	-0.0423	186,439	4.50	41,431	0.5
TOTAL	414,590.54	163,946	-69,341		483,932		226,623	

COMPOSITE ANNUAL ACCRUAL RATE	54.66%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	-0.17
COMPOSITE AVERAGE AGE (YEARS)	1.98
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.02

American Water Works - Kentucky

Account #: 340.230 - Computer & Peripheral - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION

BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2018	84,453.77	76,008	73,111	0.8657	11,343	0.50	11,343	4.5
2019	128,287.89	89,802	86,378	0.6733	41,910	1.50	27,940	3.5
2020	157,112.24	78,556	75,561	0.4809	81,551	2.50	32,620	2.5
2021	413,875.57	124,163	119,429	0.2886	294,447	3.50	84,128	1.5
2022	121,965.85	12,197	11,732	0.0962	110,234	4.50	24,497	0.5
TOTAL	905,695.32	380,725	366,210		539,485		180,528	

COMPOSITE ANNUAL ACCRUAL RATE	19.93%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.40
COMPOSITE AVERAGE AGE (YEARS)	2.10
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.90

American Water Works - Kentucky

Account #: 340.300 - Computer Software

ALG - Remaining Life
Survivor Curve: SQ
ASL: 5
Net Salvage: 0%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	332.88	333	285	0.8576	47		47	13.5
2018	1,796,954.83	1,617,259	1,386,216	0.7714	410,739	0.50	410,739	4.5
2019	2,666,409.33	1,866,487	1,599,838	0.6000	1,066,571	1.50	711,047	3.5
2020	3,348,481.56	1,674,241	1,435,057	0.4286	1,913,425	2.50	765,370	2.5
2021	3,339,752.02	1,001,926	858,789	0.2571	2,480,963	3.50	708,846	1.5
2022	2,533,715.54	253,372	217,175	0.0857	2,316,541	4.50	514,787	0.5
TOTAL	13,685,646.16	6,413,617	5,497,360		8,188,286		3,110,836	

COMPOSITE ANNUAL ACCRUAL RATE	22.73%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.40
COMPOSITE AVERAGE AGE (YEARS)	2.34
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	2.66

American Water Works - Kentucky

Account #: 340.315 - Computer Software - Special Depreciation Rate

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2013	6,596,195.41	6,266,386	5,930,654	0.8991	665,542	0.50	665,542	9.5
2014	193,921.98	164,834	156,002	0.8045	37,920	1.50	25,280	8.5
TOTAL	6,790,117.39	6,431,219	6,086,656		703,461		690,822	

COMPOSITE ANNUAL ACCRUAL RATE	10.17%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.90
COMPOSITE AVERAGE AGE (YEARS)	9.47
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	0.53

American Water Works - Kentucky

Account #: 340.325 - Computer Software - Customized

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	332.88	277	333	1.0000	0	2.50	0	12.5
2018	764,491.32	229,347	764,491	1.0000	0	10.50	0	4.5
2019	1,088,690.04	254,028	1,002,135	0.9205	86,555	11.50	7,527	3.5
TOTAL	1,853,514.24	483,652	1,766,959		86,555		7,527	

COMPOSITE ANNUAL ACCRUAL RATE	0.41%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.95
COMPOSITE AVERAGE AGE (YEARS)	3.91
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.09

American Water Works - Kentucky

Account #: 340.330 - Computer Software - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2019	128,613.14	30,010	50,940	0.3961	77,673	11.50	6,754	3.5
2020	64,303.26	10,717	18,192	0.2829	46,111	12.50	3,689	2.5
TOTAL	192,916.40	40,727	69,132		123,784		10,443	

COMPOSITE ANNUAL ACCRUAL RATE	5.41%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.36
COMPOSITE AVERAGE AGE (YEARS)	3.17
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.83

American Water Works - Kentucky

Account #: 340.500 - Other Office Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2020	32,291.43	5,382	9,417	0.2916	22,874	12.50	1,830	2.5
2021	12,248.04	1,225	2,143	0.1750	10,105	13.50	749	1.5
TOTAL	44,539.47	6,607	11,560		32,979		2,579	

COMPOSITE ANNUAL ACCRUAL RATE	5.79%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.26
COMPOSITE AVERAGE AGE (YEARS)	2.23
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	12.77

American Water Works - Kentucky

Account #: 341.100 - Transporation Equipment - Light Duty Trucks

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: L2.5
ASL: 5
Net Salvage: 25%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2001	1,752.14	1,314	1,314	1.0000	0		0	21.5
2007	25,016.41	18,762	18,762	1.0000	0		0	15.5
2009	40,628.13	30,471	30,471	1.0000	0		0	13.5
2010	593,569.45	400,659	422,149	0.9483	23,028	0.50	23,028	12.5
2011	120,499.89	77,406	81,558	0.9024	8,817	0.72	8,817	11.5
2012	526,179.18	333,561	351,452	0.8906	43,182	0.77	43,182	10.5
2014	193,762.99	115,201	121,380	0.8352	23,942	1.04	23,102	8.5
2015	196,596.06	111,163	117,125	0.7944	30,322	1.23	24,644	7.5
2016	689,092.69	366,290	385,936	0.7468	130,884	1.46	89,873	6.5
2017	446,558.99	222,919	234,876	0.7013	100,043	1.67	59,833	5.5
2018	401,754.44	189,227	199,376	0.6617	101,939	1.86	54,807	4.5
2019	1,082,902.80	460,404	485,099	0.5973	327,079	2.17	151,033	3.5
2020	375,073.59	126,929	133,737	0.4754	147,568	2.74	53,780	2.5
2021	145,087.07	31,333	33,014	0.3034	75,801	3.56	21,291	1.5
2022	113,637.26	8,474	8,929	0.1048	76,299	4.50	16,945	0.5
TOTAL	4,952,111.09	2,494,116	2,625,179		1,088,905		570,335	

COMPOSITE ANNUAL ACCRUAL RATE	11.52%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.53
COMPOSITE AVERAGE AGE (YEARS)	6.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	1.64

American Water Works - Kentucky

Account #: 341.200 - Transportation Equipment - Heavy Duty Trucks

ALG - Remaining Life
Survivor Curve: L2
ASL: 15
Net Salvage: 15%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	147,234.81	75,353	102,226	0.8168	22,923	5.97	3,841	14.5
2010	262,297.20	126,673	171,849	0.7708	51,103	6.48	7,889	12.5
2011	213,147.21	99,410	134,863	0.7444	46,312	6.77	6,841	11.5
2012	300,009.42	134,207	182,069	0.7140	72,939	7.11	10,265	10.5
2013	455,959.49	193,704	262,785	0.6780	124,780	7.50	16,631	9.5
2014	527,746.56	209,998	284,890	0.6351	163,694	7.98	20,518	8.5
2015	454,040.14	166,091	225,325	0.5838	160,609	8.54	18,797	7.5
2017	117,560.12	33,532	45,491	0.4552	54,435	9.97	5,462	5.5
2021	300,024.34	25,237	34,238	0.1343	220,783	13.52	16,335	1.5
2022	206,395.77	5,839	7,921	0.0452	167,515	14.50	11,552	0.5
TOTAL	2,984,415.06	1,070,044	1,451,659		1,085,094		118,131	

COMPOSITE ANNUAL ACCRUAL RATE	3.96%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.49
COMPOSITE AVERAGE AGE (YEARS)	8.19
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	8.67

American Water Works - Kentucky

Account #: 341.300 - Transportation Equipment - Autos

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: S2.5
ASL: 5
Net Salvage: 20%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1981	2,269.65	1,816	1,816	1.0000	0		0	41.5
2007	16,571.50	13,257	13,257	1.0000	0		0	15.5
2008	13,152.34	10,522	10,522	1.0000	0		0	14.5
2022	116,144.05	9,289	43,518	0.4684	49,397	4.50	10,977	0.5
TOTAL	148,137.54	34,884	69,113		49,397		10,977	

COMPOSITE ANNUAL ACCRUAL RATE	7.41%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.47
COMPOSITE AVERAGE AGE (YEARS)	4.05
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	3.53

American Water Works - Kentucky

Account #: 341.400 - Transporation Equipment - Other

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: L2.5
ASL: 5
Net Salvage: 25%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2007	92,190.78	69,143	92,191	1.3333	-23,048		-23,048	15.5
2008	97,618.80	73,214	97,619	1.3333	-24,405		-24,405	14.5
2009	14,207.52	10,656	14,208	1.3333	-3,552		-3,552	13.5
2010	104,700.26	70,673	89,316	1.1374	-10,791	0.50	-10,791	12.5
2011	38,104.29	24,477	28,578	1.0000	0	0.72	0	11.5
2012	287,567.62	182,298	215,676	1.0000	0	0.77	0	10.5
2013	152,233.28	93,970	114,175	1.0000	0	0.88	0	9.5
2014	99,553.08	59,189	74,665	1.0000	0	1.04	0	8.5
2015	241,181.41	136,373	180,886	1.0000	0	1.23	0	7.5
2016	155,365.09	82,585	116,524	1.0000	0	1.46	0	6.5
2017	13,627.14	6,803	10,220	1.0000	0	1.67	0	5.5
2018	144,046.04	67,846	108,035	1.0000	0	1.86	0	4.5
2019	49,678.65	21,121	37,259	1.0000	0	2.17	0	3.5
TOTAL	1,490,073.96	898,347	1,179,351		-61,795		-61,796	

COMPOSITE ANNUAL ACCRUAL RATE	-4.15%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.79
COMPOSITE AVERAGE AGE (YEARS)	9.27
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	0.98

American Water Works - Kentucky

Account #: 342.000 - Stores Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 25
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2010	23,374.96	11,687	7,355	0.3147	16,020	12.50	1,282	12.5
2012	4,296.10	1,804	1,136	0.2643	3,161	14.50	218	10.5
2015	37,852.66	11,356	7,146	0.1888	30,706	17.50	1,755	7.5
2020	11,407.25	1,141	718	0.0629	10,689	22.50	475	2.5
TOTAL	76,930.97	25,988	16,355		60,576		3,730	

COMPOSITE ANNUAL ACCRUAL RATE	4.85%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.21
COMPOSITE AVERAGE AGE (YEARS)	8.45
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	16.55

American Water Works - Kentucky

Account #: 343.000 - Tools, Shop & Garage Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2005	7,699.03	6,737	6,045	0.7852	1,654	2.50	661	17.5
2006	348,304.03	287,351	257,858	0.7403	90,446	3.50	25,842	16.5
2007	238,682.81	184,979	165,993	0.6955	72,690	4.50	16,153	15.5
2008	112,398.90	81,489	73,125	0.6506	39,274	5.50	7,141	14.5
2009	33,720.99	22,762	20,425	0.6057	13,296	6.50	2,045	13.5
2010	133,295.37	83,310	74,759	0.5609	58,537	7.50	7,805	12.5
2011	93,034.37	53,495	48,004	0.5160	45,030	8.50	5,298	11.5
2012	188,064.77	98,734	88,600	0.4711	99,465	9.50	10,470	10.5
2013	221,459.18	105,193	94,396	0.4262	127,063	10.50	12,101	9.5
2014	132,898.53	56,482	50,685	0.3814	82,214	11.50	7,149	8.5
2015	174,259.51	65,347	58,640	0.3365	115,619	12.50	9,250	7.5
2016	129,757.01	42,171	37,843	0.2916	91,914	13.50	6,808	6.5
2017	115,563.74	31,780	28,518	0.2468	87,046	14.50	6,003	5.5
2018	123,697.35	27,832	24,975	0.2019	98,722	15.50	6,369	4.5
2019	95,076.61	16,638	14,931	0.1570	80,146	16.50	4,857	3.5
2020	265,082.44	33,135	29,734	0.1122	235,348	17.50	13,448	2.5
2021	25,112.90	1,883	1,690	0.0673	23,423	18.50	1,266	1.5
2022	335,957.11	8,399	7,537	0.0224	328,420	19.50	16,842	0.5
TOTAL	2,774,064.65	1,207,717	1,083,759		1,690,306		159,508	

COMPOSITE ANNUAL ACCRUAL RATE	5.75%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.39
COMPOSITE AVERAGE AGE (YEARS)	8.71
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.29

American Water Works - Kentucky

Account #: 344.000 - Laboratory Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 10
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	5,578.43	5,578	3,454	0.6192	2,125		2,125	15.5
2009	6,594.63	6,595	4,083	0.6192	2,512		2,512	14.5
2010	580,597.31	580,597	359,480	0.6192	221,117		221,117	13.5
2011	426,976.51	426,977	264,365	0.6192	162,612		162,612	12.5
2012	9,309.72	9,310	5,764	0.6192	3,546		3,546	11.5
2013	15,686.06	14,902	9,227	0.5882	6,460	0.50	6,460	9.5
2014	17,910.62	15,224	9,426	0.5263	8,485	1.50	5,656	8.5
2015	4,643.03	3,482	2,156	0.4644	2,487	2.50	995	7.5
2016	74,831.43	48,640	30,116	0.4025	44,715	3.50	12,776	6.5
2017	80,256.63	44,141	27,330	0.3405	52,926	4.50	11,761	5.5
2018	92,441.49	41,599	25,756	0.2786	66,685	5.50	12,125	4.5
2019	130,328.76	45,615	28,243	0.2167	102,086	6.50	15,706	3.5
2020	77,356.57	19,339	11,974	0.1548	65,383	7.50	8,718	2.5
2021	16,835.23	2,525	1,564	0.0929	15,272	8.50	1,797	1.5
2022	42,369.59	2,118	1,312	0.0310	41,058	9.50	4,322	0.5
TOTAL	1,581,716.01	1,266,643	784,249		797,467		472,228	

COMPOSITE ANNUAL ACCRUAL RATE	29.86%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.50
COMPOSITE AVERAGE AGE (YEARS)	10.01
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	1.99

American Water Works - Kentucky

Account #: 345.000 - Power Operated Equipment

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: R2.5
ASL: 25
Net Salvage: 10%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
1988	54,566.42	43,340	49,110	1.0000	0	2.94	0	34.5
1989	701.44	551	631	1.0000	0	3.18	0	33.5
1990	20,380.67	15,831	18,343	1.0000	0	3.42	0	32.5
1991	1,470.02	1,128	1,323	1.0000	0	3.68	0	31.5
1995	53,978.20	38,973	48,580	1.0000	0	4.94	0	27.5
1997	66,151.11	45,829	59,536	1.0000	0	5.76	0	25.5
1999	28,034.41	18,462	25,231	1.0000	0	6.71	0	23.5
2003	4,874.22	2,807	4,290	0.9780	96	9.00	11	19.5
2005	990,821.38	523,508	800,193	0.8973	91,546	10.32	8,868	17.5
2008	27,086.46	12,211	18,665	0.7657	5,712	12.48	458	14.5
2012	8,380.95	2,829	4,323	0.5732	3,219	15.63	206	10.5
2014	39,460.19	10,935	16,715	0.4707	18,799	17.30	1,087	8.5
2015	10,413.35	2,563	3,917	0.4180	5,455	18.16	300	7.5
2017	34,503.67	6,302	9,632	0.3102	21,421	19.93	1,075	5.5
2018	626.03	94	144	0.2552	420	20.83	20	4.5
2020	18,777.83	1,582	2,419	0.1431	14,481	22.66	639	2.5
2021	70,728.81	3,592	5,490	0.0862	58,166	23.59	2,466	1.5
2022	10,324.30	175	268	0.0289	9,024	24.53	368	0.5
TOTAL	1,441,279.46	730,713	1,068,812		228,339		15,498	

COMPOSITE ANNUAL ACCRUAL RATE	1.08%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.74
COMPOSITE AVERAGE AGE (YEARS)	17.43
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	10.92

American Water Works - Kentucky

Account #: 346.100 - Communication Equipment - Non-Telephone

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	599.38	579	486	0.8107	113	0.50	113	14.5
2009	4,859.41	4,373	3,664	0.7541	1,195	1.50	797	13.5
2010	4,414.77	3,679	3,083	0.6982	1,332	2.50	533	12.5
2012	116,058.89	81,241	68,071	0.5865	47,988	4.50	10,664	10.5
2013	100,676.34	63,762	53,425	0.5307	47,251	5.50	8,591	9.5
2014	3,933.85	2,229	1,868	0.4748	2,066	6.50	318	8.5
2015	981.27	491	411	0.4189	570	7.50	76	7.5
2016	76,817.55	33,288	27,891	0.3631	48,926	8.50	5,756	6.5
2018	13,274.68	3,982	3,337	0.2514	9,938	10.50	946	4.5
2019	125,949.09	29,388	24,624	0.1955	101,325	11.50	8,811	3.5
2020	27,120.20	4,520	3,787	0.1396	23,333	12.50	1,867	2.5
2021	654,624.68	65,462	54,850	0.0838	599,774	13.50	44,428	1.5
2022	211,775.54	7,059	5,915	0.0279	205,861	14.50	14,197	0.5
TOTAL	1,341,085.65	300,054	251,412		1,089,673		97,097	

COMPOSITE ANNUAL ACCRUAL RATE	7.24%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.19
COMPOSITE AVERAGE AGE (YEARS)	3.36
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	11.64

American Water Works - Kentucky

Account #: 346.190 - Remote Control & Instrument

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	20,185.63	19,513	16,354	0.8102	3,832	0.50	3,832	14.5
2010	683,657.00	569,714	477,471	0.6984	206,186	2.50	82,474	12.5
2011	1,019,739.21	781,800	655,218	0.6425	364,521	3.50	104,149	11.5
2012	990,490.18	693,343	581,083	0.5867	409,407	4.50	90,979	10.5
2013	2.11	1	1	0.5308	1	5.50	0	9.5
2014	397,889.03	225,470	188,964	0.4749	208,925	6.50	32,142	8.5
2015	99,117.12	49,559	41,534	0.4190	57,583	7.50	7,678	7.5
2016	41,954.79	18,180	15,237	0.3632	26,718	8.50	3,143	6.5
2018	109,683.89	32,905	27,577	0.2514	82,106	10.50	7,820	4.5
2019	149,865.74	34,969	29,307	0.1956	120,559	11.50	10,483	3.5
2021	32,935.54	3,294	2,760	0.0838	30,175	13.50	2,235	1.5
2022	51,716.35	1,724	1,445	0.0279	50,272	14.50	3,467	0.5
TOTAL	3,597,236.59	2,430,472	2,036,952		1,560,284		348,402	

COMPOSITE ANNUAL ACCRUAL RATE	9.69%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.57
COMPOSITE AVERAGE AGE (YEARS)	10.13
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	4.87

American Water Works - Kentucky

Account #: 346.200 - Communication Equipment - Telephone

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

ALG - Remaining Life
Survivor Curve: SQ
ASL: 15
Net Salvage: 0%
Truncation Year:

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2008	20,843.96	20,149	18,653	0.8949	2,191	0.50	2,191	14.5
2010	27,048.52	22,540	20,866	0.7714	6,182	2.50	2,473	12.5
2012	43,979.06	30,785	28,499	0.6480	15,480	4.50	3,440	10.5
2016	85,756.23	37,161	34,401	0.4011	51,355	8.50	6,042	6.5
2020	5,183.68	864	800	0.1543	4,384	12.50	351	2.5
TOTAL	182,811.45	111,500	103,218		79,593		14,497	

COMPOSITE ANNUAL ACCRUAL RATE	7.93%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.56
COMPOSITE AVERAGE AGE (YEARS)	9.15
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	5.85

American Water Works - Kentucky

Account #: 347.000 - Miscellaneous Equipment

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION
BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2003	34,611.32	33,746	25,851	0.7469	8,761	0.50	8,761	19.5
2005	594,506.53	520,193	398,483	0.6703	196,024	2.50	78,410	17.5
2007	10,564.45	8,187	6,272	0.5937	4,293	4.50	954	15.5
2008	2,882.94	2,090	1,601	0.5554	1,282	5.50	233	14.5
2009	2,124.82	1,434	1,099	0.5171	1,026	6.50	158	13.5
2010	127,572.58	79,733	61,078	0.4788	66,495	7.50	8,866	12.5
2011	7,169.19	4,122	3,158	0.4405	4,011	8.50	472	11.5
2012	45,559.87	23,919	18,323	0.4022	27,237	9.50	2,867	10.5
2013	493,630.28	234,474	179,614	0.3639	314,016	10.50	29,906	9.5
2015	29,357.25	11,009	8,433	0.2873	20,924	12.50	1,674	7.5
2016	154,283.79	50,142	38,410	0.2490	115,873	13.50	8,583	6.5
2017	78,712.22	21,646	16,581	0.2107	62,131	14.50	4,285	5.5
2018	67,878.88	15,273	11,699	0.1724	56,180	15.50	3,624	4.5
2019	372,458.24	65,180	49,930	0.1341	322,528	16.50	19,547	3.5
2020	243,509.48	30,439	23,317	0.0958	220,193	17.50	12,582	2.5
2021	414,911.46	31,118	23,838	0.0575	391,074	18.50	21,139	1.5
2022	179,817.83	4,495	3,444	0.0192	176,374	19.50	9,045	0.5
TOTAL	2,859,551.13	1,137,202	871,129		1,988,422		211,106	

COMPOSITE ANNUAL ACCRUAL RATE	7.38%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	0.30
COMPOSITE AVERAGE AGE (YEARS)	7.95
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	12.05

American Water Works - Kentucky

Account #: 348.000 - Other Tangible Property

ALG - Remaining Life
Survivor Curve: SQ
ASL: 20
Net Salvage: 0%
Truncation Year:

CALCULATED ANNUAL ACCRUAL AND ACCRUED DEPRECIATION BASED ON ORIGINAL COST AS OF December 31, 2022

Year	Original Cost	Calculated Accumulated Depreciation	Allocated Actual Booked Amount	Accumulated Depreciation Factor	Net Book Value	ALG Remaining Life	Annual Accrual	Average Age
2019	12,906.90	2,259	12,907	1.0000	0	16.50	0	3.5
TOTAL	12,906.90	2,259	12,907		0		0	

COMPOSITE ANNUAL ACCRUAL RATE	0.00%
THEORETICAL ACCUMULATED DEPRECIATION FACTOR	1.00
COMPOSITE AVERAGE AGE (YEARS)	3.50
DIRECTED WEIGHTED ALG COMPOSITE REMAINING LIFE (YEARS)	16.50

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Larry Kennedy

51. Refer to the Kennedy Direct Testimony, Exhibit LEK-1, 2022 Depreciation Study, Section 5, pages 5-2 and 5-3. The previous depreciation rate was 2.61 percent as approved in Kentucky-American's 2018 rate case.[4]

    a. Explain whether major changes occurred between the issuance of the June 27, 2019 final Order in Case No. 2018-00358 and the application tendered in this case that impacted in the deprecation rate increase proposed in this case.

    b. Provide the depreciation rates approved in Case No. 2018-00358 in a similar format to the tables on pages 5-2 and 5-3. Include in the response the total depreciable plant from the previous depreciation study.

    c. Explain whether any capital projects have been added to this depreciation study.

Response:

a. Yes. Please see Witness Porter's testimony beginning on pg. 15, Line 1 for a listing of Investment Projects placed into service since the last issuance. This includes $36.8M in treatment plant facilities associated with two chemical feed facilities improvements projects located at Richmond Road WTP and KRS I WTP. Additionally, KAW moved from a 15-year meter replacement to a 10-year meter replacement term.

b. Please see Attachment KAW_R_PSCDR2_NUM051_Attachment.

c. All assets placed into service and posted to Continuing Property Records (CPRs) on or before December 31, 2022, are captured in the 2022 Depreciation study.

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[4] Case No. 2018-00358, *Electronic Application of Kentucky-American Water Company for an Adjustment of Rates* (Ky. PSC Nov. 28, 2018).

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

52. Refer to the Newcomb Direct Testimony, page 6, lines 6-9.

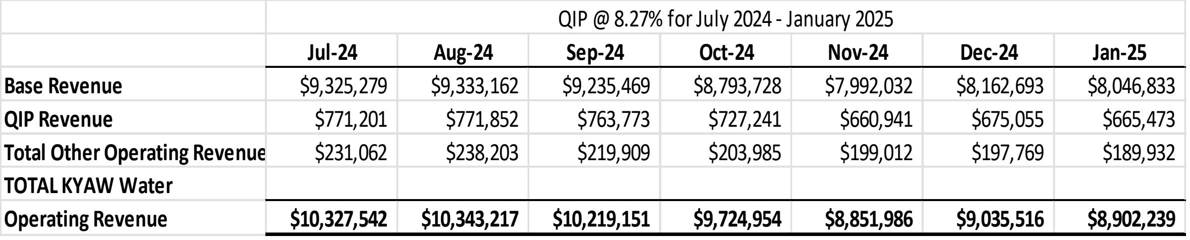
a. Explain why Kentucky-American is proposing a theoretical 10.57 percent qualified infrastructure program (QIP) rider charge in this case, as opposed to proposing 8.27 percent in in Case No. 2023-00030.[5]

b. Provide the base revenue at present water rates for July 1, 2024, to January 31, 2025 with the QIP rider charge at 8.27 percent.

Response:

a. The forecasted test year is February 1, 2024, to January 31, 2025. The 8.27 percent from Case No. 2023-00030 is for a QIP period that ends June 30, 2024, making it appropriate to forecast what the QIP rate would be for July 1, 2024, to January 31, 2025. The revenue deficiency in this proceeding would be overstated if Kentucky-American were to use the 8.27 percent instead of the theoretical 10.57 percent for July 1, 2024, to January 31, 2025, because the resulting overstatement of the revenue deficiency is revenue that Kentucky-American would forecast to collect from customers with or without a rate case.

b. Kentucky-American presumes this request is asking for total operating revenue at present water rates and not just base revenue. Base revenues are not impacted by QIP since QIP is a surcharge applied on top of base revenues. Please see below for total operating revenue at present water rates for July 1, 2024, to January 31, 2025, with the QIP rider charge at 8.27 percent:



	QIP @ 8.27% for July 2024 - January 2025						
	Jul-24	**Aug-24**	**Sep-24**	**Oct-24**	**Nov-24**	**Dec-24**	**Jan-25**
Base Revenue	$9,325,279	$9,333,162	$9,235,469	$8,793,728	$7,992,032	$8,162,693	$8,046,833
QIP Revenue	$771,201	$771,852	$763,773	$727,241	$660,941	$675,055	$665,473
Total Other Operating Revenue	$231,062	$238,203	$219,909	$203,985	$199,012	$197,769	$189,932
TOTAL KYAW Water Operating Revenue	**$10,327,542**	**$10,343,217**	**$10,219,151**	**$9,724,954**	**$8,851,986**	**$9,035,516**	**$8,902,239**

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[5] Case No. 2023-00030, *Electronic Application of Kentucky-American Water Company to Amend Tariff to Revise Qualified Infrastructure Charge* (Ky. PSC Mar. 1, 2023).

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

53. Refer to the Newcomb Direct Testimony, page 24, generally. Explain whether any Kentucky-American affiliates have received approval for regulatory accounting deferral treatment in other jurisdictions. If so, provide the amount, the purpose of the deferral treatment, the type of deferral treatment (regulatory asset or liability), and a link to the order approving the regulatory asset or liability.

Response:

Yes, Kentucky-American affiliates within American Water have received approval for regulatory accounting deferral, and in some cases surcharge or rider recovery, for items requested by Kentucky-American Water in this proceeding. Please reference KAW_R_PSCDR2_NUM053_081823_Attachment for the requested information. Please note that this attachment provides links to the order approving the regulatory asset or liability, where applicable and available, or to the respective company's tariff or applicable regulation that provides such authorization.

American Water
Regulated Jurisdictions - Pension/OPEB, Production Cost, and Tax Deferral/Surcharge Authorization

Line No.	American Water Affiliate	Category	Deferral or Surcharge?	Notes	Authorization for Deferral
1	New Jersey-American Water	Pension/OPEB Expense	Deferral		WR22010019 (Page 4) - https://nj.gov/bpu/pdf/boardorders/2022/20220817/5B%20ORDER%20NJAWC%20Base%20Rate%20Case.pdf
2	Virginia-American Water	Pension/OPEB Expense	Deferral		PUR-2021-00255 (Page 4) - https://www.scc.virginia.gov/docketsearch/DOCS/7r_g01!.PDF
3	Missouri-American Water	Pension/OPEB Expense	Deferral	[A]	WR-2022-0303 Order, Attachment C - https://efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=939707477
4	California-American Water	Pension/OPEB Expense	Deferral	[B]	A.19-07-004 Order (pages 121-122) - https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M425/K808/425808218.PDF
5	California-American Water	Purchased Power and Water	Surcharge		https://www.amwater.com/caaw/Customer-Service-Billing/Water-Rates/Rate-Design
6	Tennessee-American Water	Production Costs	Surcharge		Production Costs and Other Pass-Throughs Rider (page 67 - Second Revised Sheet No. 12-PCOP) - https://www.amwater.com/tnaw/resources/pdf/Customer-Service/Your-Water-Rates/TRA_Rates_and_Rules.pdf
7	Illinois-American Water	Production Costs (Volumetric)	Surcharge		Volume Balancing Adjustment (pages 279-280 - First Revised Sheet No. 10 to 10.2) - https://www.amwater.com/ilaw/resources/rates/IAWC%20Full%20Tariffs.pdf
8	Illinois-American Water	Income Taxes	Surcharge		Variable Income Tax (pages 287-291 - First Revised Sheet No. 12 to 12.4) - https://www.amwater.com/ilaw/resources/rates/IAWC%20Full%20Tariffs.pdf
9	Illinois-American Water	Other Taxes	Surcharge		Invested Capital Tax (pages 284-286 - First Revised Sheet No. 11 to 11.2) - https://www.amwater.com/ilaw/resources/rates/IAWC%20Full%20Tariffs.pdf
10	Indiana-American Water	Income Taxes	Surcharge		Indiana Code 8-1-2-4.1 - https://iga.in.gov/laws/2023/ic/titles/8#8-1-2-4.1
11	Indiana-American Water	Property Taxes	Surcharge		Indiana Code 8-1-2-42(a) - https://iga.in.gov/laws/2023/ic/titles/8#8-1-2-42
12	Maryland-American Water	Property Taxes	Surcharge		Property Tax Surcharge (pages 11-12 - Third Revised Page No. 3(d) and 3(e) - https://www.amwater.com/mdaw/resources/PDF/customer-service-billing/maryland-amwater-propertytax-surcharge-tariff.pdf
13	Missouri-American Water	Property Taxes	Deferral		Missouri Revised Code RSMo 393.1275 - https://revisor.mo.gov/main/OneSection.aspx?section=393.400
14	Pennsylvania-American Water	State Taxes	Surcharge	[C]	State Tax Adjustment Surcharge (page 42, First Revised Page 33) - https://www.amwater.com/paaw/Resources/PDF/Rates/PAWC-WaterTariff-No.-5-Active%204.01.2023.pdf

All authorization noted above represent a symmetrical accounting, whereby any deviation is eligible for deferral and/or recovery.

[A] Missouri-American Water was originally approved for deferral in Rate Case WR-2007-0216. Each subsequent rate case has approved the continuation of the deferral.
WR-2007-0216 Order - https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=WR-2007-0216&attach_id=2008004876
WR-2007-0216 Stipulation & Agreemen, Appendix E - https://www.efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=WR-2007-0216&attach_id=2008002055

[B] California-American Water was originally approved for deferral in A.09-01-013; A.09-07-002
A.09-01-013; A.09-07-002 - https://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/119999.PDF

[C] Pennsylvania Code Title 52, Chapter 69, Section 51-56 provide authorization for the establishment of the State Tax Adjustment Surcharge.
https://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/052/chapter69/chap69toc.html&d=reduce

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

54. Refer to the Newcomb Direct Testimony, page 27, lines 8-14.

a. Explain how production costs are considered volatile and extraordinary expenses that should be granted accounting deferral treatment. Include in the response how production costs are outside of Kentucky-American's control.

b. Explain why Kentucky-American has not requested a regulatory asset or liability previously for production expenses.

c. Identify any American Water affiliate that has received approval for regulatory asset or liability accounting treatment for production expenses. Provide a copy of the Order or document authorizing that treatment for those affiliates.

Response:

a. Please reference the Direct Testimony of Kentucky-American Witness Newcomb, page 29, specifically the table on line 13, which shows the deviation in production costs since 2014. Looking at the variations against the level included in Kentucky-American's rates, the fluctuations over the past 4 years have become material both in total dollars and percentage of authorized. Using the same information, year-over-year changes demonstrate movement out of the norm over the past 3 years.

Total Production Expense					
	Authorized	Actual	Variance	% Variance to Authorized	YoY Variance
2014	$6,262,927	$5,708,789	$ (554,138)	-8.8%	
2015	$6,262,927	$5,915,196	$ (347,731)	-5.6%	3.6%
2016	$6,355,162	$6,442,729	$ 87,567	1.4%	8.9%
2017	$6,532,991	$6,426,312	$ (106,679)	-1.6%	-0.3%
2018	$6,532,991	$6,506,304	$ (26,687)	-0.4%	1.2%
2019	$7,021,201	$6,726,850	$ (294,351)	-4.2%	3.4%
2020	$7,502,812	$6,715,508	$ (787,304)	-10.5%	-0.2%
2021	$7,502,812	$7,320,602	$ (182,210)	-2.4%	9.0%
2022	$7,502,812	$9,230,012	$1,727,200	23.0%	26.1%

Please also reference the Direct Testimony of Kentucky-American Witness O'Drain, who explains how the current chemical market has changed over the past two years, and the key drivers of this change. The Company does not have the ability to choose to use chemicals for water treatment, and the market has shown that securing contracts for even a one-year time period are less frequent and come with significant premiums to insulate suppliers from other market factors (e.g., rising transportation costs, rising raw material costs, rising production costs).

On top of this, the Company's Fuel and Power Expenses are primarily driven by other Kentucky utility rate adjustments, transmission charges, and environmental costs which are adjusted frequently. The inability to see beyond the current rate and cost structure to reasonably predict the fixed, known, and measurable costs for future periods results in uncertainty outside of the Company's direct control.

Finally, the proposed Environmental Protection Agency ("EPA") National Primary Drinking Water Regulation for six Per- and Polyfluoroalkyl Substances ("PFAS") has created uncertainty within the water industry and chemicals market. Kentucky-American believes it is well positioned to meet the EPA Maximum Contaminant Levels ("MCLs") without the need for additional investment; however, the rules are still pending and the potential impacts on the production expenses when considering increased demand and reduced supply, along with increased waste disposal requirements and costs, are still unknown.

b. The Company has acknowledged in previous rate cases the materiality, volatility, and inability to control chemical and other production costs. Within the past 10 years, in its 2012 base rate case, Kentucky-American requested a Purchased Power and Chemicals Charge ("PPACC") (2012-00520). This 2012 case proposal requested a full rider to be charged to customers annually for any deviations, whereas the current request in this proceeding is for regulatory asset/liability deferral between rate cases.

c. Reference KAW_R_PSCDR2_NUM053_081823_Attachment.

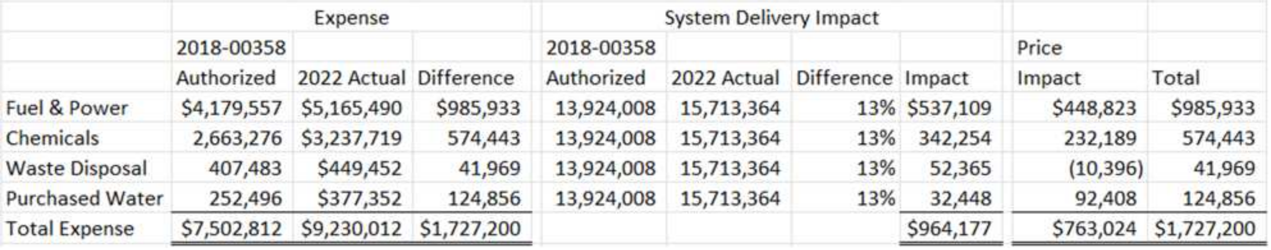
KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb and John Watkins

55. Refer to the Newcomb Direct Testimony, page 29, line 13. Explain the $1,727,200 difference between actual production expenses and authorized production expenses in 2022.

Response:

The $1,727,200 difference between actual and authorized production expenses in 2022 is primarily due to differences in system delivery ("volume variance") and prices ("price variance"). Please see the below detail by production expense category and note that authorized system delivery includes a reduction of 4.37 percent for unaccounted water loss in excess of 15 percent as ordered by the Commission in Case No. 2018-00358.



	Expense			System Delivery Impact					
	2018-00358			2018-00358				Price	
	Authorized	2022 Actual	Difference	Authorized	2022 Actual	Difference	Impact	Impact	Total
Fuel & Power	$4,179,557	$5,165,490	$985,933	13,924,008	15,713,364	13%	$537,109	$448,823	$985,933
Chemicals	2,663,276	$3,237,719	574,443	13,924,008	15,713,364	13%	342,254	232,189	574,443
Waste Disposal	407,483	$449,452	41,969	13,924,008	15,713,364	13%	52,365	(10,396)	41,969
Purchased Water	252,496	$377,352	124,856	13,924,008	15,713,364	13%	32,448	92,408	124,856
Total Expense	$7,502,812	$9,230,012	$1,727,200				$964,177	$763,024	$1,727,200

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

56. Refer to the Newcomb Direct Testimony, page 30, lines 9-21.

    a. Explain how pension and other post-employment benefits (OPEB) expenses would qualify for a deferral treatment under KRS 278.220.

    b. Explain how pension and OPEB expenses are considered volatile and should be granted accounting deferral treatment. Include in the response how pension and OPEB expenses are outside of Kentucky-American's control.

Response:

a. KRS 278.220 provides that "the Commission may establish a system of accounts to be kept by utilities subject to its jurisdiction" and that this system "shall conform as nearly as practicable to the uniform system of accounts prescribed by the National Association of Regulatory Utility Commissioners ["NARUC"]". The 1996 version of the NARUC Uniform System of Accounts was modified and adopted by the Kentucky Public Service Commission in 2002. Within this Uniform System of Accounts, "Regulatory Assets and Liabilities" are defined as follows:

> "'Regulatory Assets and Liabilities' are assets and liabilities that result from rate actions of regulatory agencies. Regulatory assets and liabilities arise from specific revenues, expenses, gains or losses that would have been included in determination of net income in one period under the general requirements of the Uniform System of Accounts but for it being probable that; (1) such items will be included in a different period(s) for purposes of developing the rates the utility is authorized to charge for its utility services; or (2) in the case of regulatory liabilities, that refunds to customers, not provided for in other accounts, will be required."

In accordance with this definition, the Company's request in this proceeding is for authorization from the Commission, as an "action of regulatory agency(ies)", to establish a Regulatory Asset or Liability for an incurred expense for pension and OPEB above or below an authorized level, such that it can be included or refunded to customers via rates in a different period than it otherwise would have been included in the determination of net income.

b. As explained in Witness Newcomb's direct testimony, "Pension and OPEB expenses are a complex calculation based upon actuarial reports that consider a number of variables. The level of fluctuation in these expenses from year to year can change drastically based on market fluctuations and the factors used to calculated the expenses." Kentucky-American cannot control the items that are used to determine the level of expense each year, specifically market fluctuations and other economic variables (interest rates, discount rates) along with how the population of employees and retirees will "behave" when considering timing of retirements and overall life expectancy. The Company has reflected a level of expense based on 2023 actual expense as it does not have the ability to predict with certainty the level of expense beyond the current year due to these uncontrollable variables. As reflected in the table on line 8 of page 32 of Witness Newcomb's direct testimony, the Company has experienced significant variances to authorized levels over the past 9 years. This request for deferral between base rate cases is in direct response to the inability to control the level of expense required to be recognized annually, and supported by the variations that the Company has experienced historically.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

57. Refer to the Newcomb Direct Testimony, page 30, lines 13-15.

   a. Explain whether Kentucky-American calculates the pension and OPEB differently year to year, and, if so, explain why.

   b. Explain whether Kentucky-American could create amendments within the pension and OPEB expenses to make them less volatile. If so, explain what amendments could be made. If not, explain why not.

Response:

a. The Company's actuary, Willis Towers Watson, calculates the pension and OPEB expense annually based on the requirements of ASC 715. The actuarial reports will change annually based on economic and demographic factors that can change daily; however, the approach for calculating the level of expense is consistent each year.
b. No, Kentucky-American cannot create any amendments to either plan. American Water controls the plans in which employees of Kentucky-American and other affiliates are eligible to participate. Under the current guidelines of the pension and OPEB programs, along with ERISA requirements, American Water cannot create any amendments to make the expense level less unpredictable. Please reference the response to KAW_R_PSCDR2_NUM056_081823 for further explanation regarding the uncontrollable and unpredictable nature of these expenses.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb and John Watkins

58. Refer to the Newcomb Direct Testimony, page 32, line 8. Explain the difference in the amounts between OPEB actual and authorized expenses.

Response:

The authorized OPEB expense is a point in time expense as of a rate case order. Case No. 2012-00520, effective July 27, 2013, authorized an OPEB expense of $672,410. Case No. 2015-00418, effective August 28,2016, authorized an OPEB expense of $581,184. Case No. 2018-00358, effective June 28, 2019, authorized an OPEB expense of $74,033. In the years 2016 and 2019, when the Company had two orders effective, the OPEB expense was prorated based on the effective date of the orders.

The actual OPEB expense is the amount of service cost and non-service cost expense provided by the Company's actuary Willis Towers Watson ("WTW"), net of the portion of service cost expense that is capitalized. WTW calculates the amount of the service and non-service costs each January and issues an Actuarial Report that supports the calculations in the third quarter of the year.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Jeffrey Newcomb

59. Refer to the Newcomb Direct Testimony, page 35, line 12. Explain whether Kentucky-American is aware of any current proposed changes in the federal or state income tax rates. If so, provide a link to the proposal.

Response:

Kentucky-American is not aware of any current proposed changes in the federal or state income tax rates.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

60. Refer to the Direct Testimony of Charles B. Rea (Rea Direct Testimony), page 5, lines 18-19.

    a. Is the MHI for the Company's service territory as presented in the exhibits based solely on owner-occupied and single-unit renter occupied homes?

    b. Please define a single-unit renter occupied home.

    c. If the response to part (a) is yes, how much of the population percentage in the Company's service territory live in those specific households?

Response:

a. MHI for the Company's service territory as presented in the exhibits is an estimate of MHI for the Company's direct residential customers which is based on a weighted average of owner-occupied and single-unit renter occupied homes.

b. For the purpose of this analysis, single-unit renter occupied home is the same as a renter-occupied housing unit with one unit in the structure with either an attached or detached garage as defined in Table S2504 of the U.S. Census Bureau's American Community Survey.

c. The Company estimates that 13.7% of the population in the Company's service territory live in single-family renter-occupied homes. Please see KAW_R_PSCDR2_NUM060_081823_Attachment.

											ESTIMATED POPULATION		
City	State	Zip Code	District	Customers	Households	Owner Occupied	Renter Occupied Single	Renter Occupied Multi	Owner Occupied Size	Renter Occupied Size	Owner Occupied	Renter Occupied Single	Renter Occupied Multi
Carlisle	KY	40311	Kentucky	58	2710	0.7011	0.1391	0.1598	2.91	2.28	5,529	860	987
Georgetown	KY	40324	Kentucky	6187	18718	0.7007	0.1134	0.1859	2.73	2.29	35,804	4,862	7,969
Midway	KY	40347	Kentucky	35	1362	0.7496	0.1711	0.0793	2.68	2.26	2,736	527	244
Millersburg	KY	40348	Kentucky	222	352	0.4688	0.2443	0.2869	2.02	1.44	333	124	145
North Middletown	KY	40357	North Middlet	63	64	0.2656	0.1406	0.5938	2.06	2.62	35	24	100
Owenton	KY	40359	Kentucky	2685	2602	0.8278	0.0638	0.1084	2.61	2.70	5,622	448	761
Paris	KY	40361	Kentucky	1168	7203	0.6388	0.1958	0.1655	2.47	2.59	11,364	3,652	3,087
Sadieville	KY	40370	Kentucky	563	1047	0.9016	0.0936	0.0048	2.32	3.35	2,190	328	17
Stamping Ground	KY	40379	Kentucky	10	1562	0.8540	0.0615	0.0845	2.39	2.51	3,188	241	331
Versailles	KY	40383	Kentucky	180	9447	0.7003	0.1750	0.1247	2.64	2.42	17,466	4,000	2,851
Winchester	KY	40391	Kentucky	1393	14703	0.7160	0.1199	0.1641	2.49	2.33	26,212	4,108	5,622
Livingston	KY	40445	East Rockcastle	217	263	0.8707	0.0152	0.1141	2.85	1.88	653	8	56
Mc Kee	KY	40447	East Rockcastle	52	3041	0.7333	0.1213	0.1453	2.65	1.94	5,910	716	857
Mount Vernon	KY	40456	East Rockcastle	242	3622	0.7463	0.1149	0.1389	2.35	2.38	6,352	990	1,197
Orlando	KY	40460	East Rockcastle	116	352	0.9233	0.0313	0.0455	3.18	2.81	1,034	31	45
Lexington	KY	40502	Kentucky	10235	12866	0.5809	0.1280	0.2911	2.18	1.97	16,293	3,245	7,378
Lexington	KY	40503	Kentucky	11043	12543	0.6387	0.1300	0.2314	2.35	2.19	18,826	3,570	6,355
Lexington	KY	40504	Kentucky	7880	11881	0.3155	0.1465	0.5380	2.19	2.17	8,210	3,776	13,871
Lexington	KY	40505	Kentucky	9887	11010	0.6007	0.1987	0.2005	2.24	2.56	14,815	5,601	5,652
Lexington	KY	40507	Kentucky	291	1339	0.3032	0.0239	0.6729	1.71	1.30	694	42	1,171
Lexington	KY	40508	Kentucky	5937	10190	0.2834	0.1928	0.5237	2.31	1.85	6,671	3,635	9,873
Lexington	KY	40509	Kentucky	15460	18044	0.6249	0.1525	0.2226	2.67	2.10	30,104	5,779	8,436
Lexington	KY	40510	Kentucky	258	417	0.7266	0.2734	-	1.84	1.61	558	184	-
Lexington	KY	40511	Kentucky	12423	13036	0.6302	0.1772	0.1926	2.45	2.44	20,127	5,636	6,127
Lexington	KY	40513	Kentucky	4428	4395	0.7506	0.0885	0.1609	2.61	2.04	8,610	794	1,442
Lexington	KY	40514	Kentucky	6388	6393	0.7173	0.2019	0.0807	2.70	2.59	12,382	3,344	1,336
Lexington	KY	40515	Kentucky	13331	14686	0.6219	0.1582	0.2199	2.62	2.18	23,928	5,064	7,041
Lexington	KY	40516	Kentucky	1071	1051	0.8306	0.1113	0.0580	2.32	3.71	2,025	434	226
Lexington	KY	40517	Kentucky	10976	16778	0.3676	0.1662	0.4662	2.18	2.22	13,446	6,189	17,365
Frankfort	KY	40601	Kentucky	1	22318	0.6266	0.1092	0.2642	2.28	2.10	31,884	5,120	12,382
Corinth	KY	41010	Kentucky	380	1304	0.8620	0.0521	0.0859	2.31	3.29	2,596	224	368
Cynthiana	KY	41031	Kentucky	97	6433	0.7045	0.1629	0.1326	2.57	2.45	11,647	2,568	2,090
Dry Ridge	KY	41035	Kentucky	55	4386	0.7041	0.0634	0.2326	2.57	2.97	7,936	826	3,029
Glencoe	KY	41046	Kentucky	286	543	0.8324	0.0755	0.0921	3.26	5.93	1,474	243	297
Jonesville	KY	41052	Kentucky	60	89	0.6966	0.1348	0.1685	1.73	3.26	107	39	49
Sanders	KY	41083	Kentucky	16	475	0.8463	0.0716	0.0821	3.01	2.81	1,210	96	110
Sparta	KY	41086	Kentucky	279	802	0.8529	0.1185	0.0287	2.32	3.44	1,587	327	79
Worthville	KY	41098	Kentucky	151	638	0.7524	0.0909	0.1567	2.59	2.35	1,243	136	235
											360,804	77,787	129,184
												0.137003	

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

61. Refer to the Direct Testimony of Charles B. Rea (Rea Direct Testimony), page 6, Chart 1. The Chart states that the current median household income (MHI) is approximately $80,000. The United States Census Bureau has the MHI in Lexington, Kentucky in 2021 at $61,526.[6]

  a. Explain the basis for an increase in MHI shown in Chart 1.

  b. Explain whether the entire Kentucky-American service territory is included in this study and, if not, provide an updated Chart 1 with data for Kentucky-American's entire service territory.

  c. Provide all assumptions used in calculating the previous years' MHI and modeling the forecasted MHI.

Response:

  a. The MHI shown on Chart 1 of Mr. Rea's Direct Testimony is estimated MHI for residential households that are direct customers of Kentucky-American Water Company across the Company's service territory (not just the City of Lexington) which includes owner-occupied households and single-family renter-occupied households.

  b. The entire service territory is included in Chart 1.

  c. Please see KAW_R_PSCDR2_NUM061_081823_Attachment for a fully functioning affordability model including assumptions and calculations supporting Mr. Rea's direct testimony including charts, tables, and graphs contained within and the affordability analysis provided in Exhibit CBR-1.

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[6] United States Census, Quick Facts, Lexington-Fayette Urban County, Kentucky, https://www.census.gov/quickfacts/fact/table/lexingtonfayetteurbancountykentucky,KY/PST045222.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

62. Refer to the Rea Direct Testimony, page 7, Chart 2. Provide a BTI Ratio Chart that includes 2025 and 2026.

Response:

See KAW_R_PSCDR2_NUM062_081823_Attachment.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

63. Refer to the Rea Direct Testimony, page 7, lines 3-4. Explain whether the benchmark for affordability expressed as a total bill's percentage of MHI is Kentucky-American's own policy decision or is a standard that is nationally recognized. If this is based on a nationally recognized standard, provide a copy of that standard.

Response:

The benchmarks described at p. 7 lines 3-4 in Mr. Rea's Direct Testimony are discussed in the article identified in Footnote 1 on p. 7 of Mr. Rea's Direct Testimony. The article, titled "Measuring Household Affordability for Water and Sewer Utilities," was published in the *Journal AWWA*, which is an American Water Works Association publication and is available at https://awwa.onlinelibrary.wiley.com/doi/epdf/10.5942/jawwa.2018.110.0002.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

64. Refer to the Rea Direct Testimony, page 10, lines 10-12. Provide the supporting documentation for the Federal Poverty Level (FPL) guidelines.

Response:

Please see attached. The numbers at lines 10-12 p. 10 of Rea Direct Testimony are not correct and should read "For Kentucky, the FPL guidelines for 2023 are set at $14,580 for a household size of one and $5,140 per year for each additional household member." The Federal Poverty Guidelines for 2023 at Table 7 on p. 21 of Rea Direct Testimony are correct.

Opportunities to present oral comments to the Committee will be provided at a future meeting.

- *Online (preferred method):* Follow the instructions for submitting comments at *www.regulations.gov.* Comments submitted electronically, including attachments, will be posted to Docket OASH–2022–0021.
- *Mail:* Mail/courier to Janet M. de Jesus, MS, RD, HHS/OASH/ODPHP, 1101 Wootton Parkway, Suite 420, Rockville, MD 20852. For written/paper submissions, ODPHP will post your comment, as well as any attachments, to *www.regulations.gov.*

Meeting materials for each meeting will be accessible at *www.DietaryGuidelines.gov.* Materials may be requested by email at *dietaryguidelines@hhs.gov.*

Paul Reed,

Deputy Assistant Secretary for Health, Office of Disease Prevention and Health Promotion.

[FR Doc. 2023–00921 Filed 1–18–23; 8:45 am]
BILLING CODE 4150–32–P

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Office of the Secretary

Annual Update of the HHS Poverty Guidelines

AGENCY: Department of Health and Human Services.

ACTION: Notice.

SUMMARY: This notice provides an update of the Department of Health and Human Services (HHS) poverty guidelines to account for last calendar year's increase in prices as measured by the Consumer Price Index.

DATES: January 12, 2023 unless an office administering a program using the guidelines specifies a different effective date for that particular program.

ADDRESSES: Office of the Assistant Secretary for Planning and Evaluation, Room 404E, Humphrey Building, Department of Health and Human Services, Washington, DC 20201.

FOR FURTHER INFORMATION CONTACT: For information about how the guidelines are used or how income is defined in a particular program, contact the federal, state, or local office that is responsible for that program. For information about poverty figures for immigration forms, the Hill-Burton Uncompensated Services Program, and the number of people in poverty, use the specific telephone numbers and addresses given below.

For general questions about the poverty guidelines themselves, contact Kendall Swenson, Office of the Assistant Secretary for Planning and Evaluation, Room 404E.3, Humphrey Building, Department of Health and Human Services, Washington, DC 20201—telephone: (202) 795–7309—or visit *http://aspe.hhs.gov/poverty/.*

For information about the percentage multiple of the poverty guidelines to be used on immigration forms such as USCIS Form I–864, Affidavit of Support, contact U.S. Citizenship and Immigration Services at 1–800–375–5283. You also may visit *https://www.uscis.gov/i-864.*

For information about the Hill-Burton Uncompensated Services Program (free or reduced-fee health care services at certain hospitals and other facilities for persons meeting eligibility criteria involving the poverty guidelines), visit *https://www.hrsa.gov/get-health-care/affordable/hill-burton/index.html.*

For information about the number of people in poverty, visit the Poverty section of the Census Bureau's website at *https://www.census.gov/topics/income-poverty/poverty.html* or contact the Census Bureau's Customer Service Center at 1–800–923–8282 (toll-free) or visit *https://ask.census.gov* for further information.

SUPPLEMENTARY INFORMATION:

Background

Section 673(2) of the Omnibus Budget Reconciliation Act (OBRA) of 1981 (42 U.S.C. 9902(2)) requires the Secretary of the Department of Health and Human Services to update the poverty guidelines at least annually, adjusting them on the basis of the Consumer Price Index for All Urban Consumers (CPI–U). The poverty guidelines are used as an eligibility criterion by Medicaid and a number of other federal programs. The *poverty guidelines* issued here are a simplified version of the *poverty thresholds* that the Census Bureau uses to prepare its estimates of the number of individuals and families in poverty.

As required by law, this update is accomplished by increasing the latest published Census Bureau poverty thresholds by the relevant percentage change in the Consumer Price Index for All Urban Consumers (CPI–U). The guidelines in this 2023 notice reflect the 8.0 percent price increase between calendar years 2021 and 2022. After this inflation adjustment, the guidelines are rounded and adjusted to standardize the differences between family sizes. In rare circumstances, the rounding and standardizing adjustments in the formula result in small decreases in the poverty guidelines for some household sizes even when the inflation factor is not negative. In cases where the year-to-year change in inflation is not negative and the rounding and standardizing adjustments in the formula result in reductions to the guidelines from the previous year for some household sizes, the guidelines for the affected household sizes are fixed at the prior year's guidelines. As in prior years, these 2023 guidelines are roughly equal to the poverty thresholds for calendar year 2022 which the Census Bureau expects to publish in final form in September 2023.

The poverty guidelines continue to be derived from the Census Bureau's current official poverty thresholds; they are not derived from the Census Bureau's Supplemental Poverty Measure (SPM).

The following guideline figures represent annual income.

2023 POVERTY GUIDELINES FOR THE 48 CONTIGUOUS STATES AND THE DISTRICT OF COLUMBIA

Persons in family/household	Poverty guideline
1	$14,580
2	19,720
3	24,860
4	30,000
5	35,140
6	40,280
7	45,420
8	50,560

For families/households with more than 8 persons, add $5,140 for each additional person.

2023 POVERTY GUIDELINES FOR ALASKA

Persons in family/household	Poverty guideline
1	$18,210
2	24,640
3	31,070
4	37,500
5	43,930
6	50,360
7	56,790
8	63,220

For families/households with more than 8 persons, add $6,430 for each additional person.

2023 POVERTY GUIDELINES FOR HAWAII

Persons in family/household	Poverty guideline
1	$16,770
2	22,680
3	28,590
4	34,500

2023 POVERTY GUIDELINES FOR HAWAII—Continued

Persons in family/household	Poverty guideline
5	40,410
6	46,320
7	52,230
8	58,140

For families/households with more than 8 persons, add $5,910 for each additional person.

Separate poverty guideline figures for Alaska and Hawaii reflect Office of Economic Opportunity administrative practice beginning in the 1966–1970 period. (Note that the Census Bureau poverty thresholds—the version of the poverty measure used for statistical purposes—have never had separate figures for Alaska and Hawaii.) The poverty guidelines are not defined for Puerto Rico or other outlying jurisdictions. In cases in which a federal program using the poverty guidelines serves any of those jurisdictions, the federal office that administers the program is generally responsible for deciding whether to use the contiguous-states-and-DC guidelines for those jurisdictions or to follow some other procedure.

Due to confusing legislative language dating back to 1972, the poverty guidelines sometimes have been mistakenly referred to as the ''OMB'' (Office of Management and Budget) poverty guidelines or poverty line. In fact, OMB has never issued the guidelines; the guidelines are issued each year by the Department of Health and Human Services. The poverty guidelines may be formally referenced as ''the poverty guidelines updated periodically in the **Federal Register** by the U.S. Department of Health and Human Services under the authority of 42 U.S.C. 9902(2).''

Some federal programs use a percentage multiple of the guidelines (for example, 125 percent or 185 percent of the guidelines), as noted in relevant authorizing legislation or program regulations. Non-federal organizations that use the poverty guidelines under their own authority in non-federally-funded activities also may choose to use a percentage multiple of the guidelines.

The poverty guidelines do not make a distinction between farm and non-farm families, or between aged and non-aged units. (Only the Census Bureau poverty thresholds have separate figures for aged and non-aged one-person and two-person units.)

This notice does not provide definitions of such terms as ''income'' or ''family'' as there is considerable variation of these terms among programs that use the poverty guidelines. The legislation or regulations governing each program define these terms and determine how the program applies the poverty guidelines. In cases where legislation or regulations do not establish these definitions, the entity that administers or funds the program is responsible to define such terms as ''income'' and ''family.'' Therefore questions such as net or gross income, counted or excluded income, or household size should be directed to the entity that administers or funds the program.

Dated: January 12, 2023.

Xavier Becerra,

Secretary, Department of Health and Human Services.

[FR Doc. 2023–00885 Filed 1–18–23; 8:45 am]

BILLING CODE 4150–05–P

DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health

National Center for Advancing Translational Sciences; Notice of Closed Meeting

Pursuant to section 10(d) of the Federal Advisory Committee Act, as amended, notice is hereby given of the following meeting.

The meetings will be closed to the public in accordance with the provisions set forth in sections 552b(c)(4) and 552b(c)(6), Title 5 U.S.C., as amended. The contract proposals and the discussions could disclose confidential trade secrets or commercial property such as patentable material, and personal information concerning individuals associated with the contract proposals, the disclosure of which would constitute a clearly unwarranted invasion of personal privacy.

Name of Committee: National Center for Advancing Translational Sciences Special Emphasis Panel; SBIR Phase I Topic 023 Contract Review.

Date: February 15, 2023.

Time: 9 a.m. to 1 p.m.

Agenda: To review and evaluate contract proposals.

Place: National Center for Advancing Translational Sciences, National Institutes of Health, 6701 Democracy Boulevard, Room 1037, Bethesda, MD 20892.

Contact Person: Rahat (Rani) Khan, Ph.D., Scientific Review Officer, Office of Scientific Review, National Center for Advancing Translational Sciences, National Institutes of Health, 6701 Democracy Boulevard, Room 1037, Bethesda, MD 20892, (301) 594–7319, *khanr2@csr.nih.gov.*

(Catalogue of Federal Domestic Assistance Program Nos. 93.859, Pharmacology, Physiology, and Biological Chemistry Research; 93.350, B—Cooperative Agreements; 93.859, Biomedical Research and Research Training, National Institutes of Health, HHS)

Dated: January 13, 2023.

Melanie J. Pantoja,

Program Analyst, Office of Federal Advisory Committee Policy.

[FR Doc. 2023–00993 Filed 1–18–23; 8:45 am]

BILLING CODE 4140–01–P

DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health

National Institute of Dental and Craniofacial Research; Notice of Closed Meeting

Pursuant to section 10(d) of the Federal Advisory Committee Act, as amended, notice is hereby given of the following meeting.

The meeting will be closed to the public in accordance with the provisions set forth in sections 552b(c)(4) and 552b(c)(6), Title 5 U.S.C., as amended. The grant applications and the discussions could disclose confidential trade secrets or commercial property such as patentable material, and personal information concerning individuals associated with the grant applications, the disclosure of which would constitute a clearly unwarranted invasion of personal privacy.

Name of Committee: National Institute of Dental and Craniofacial Research Special Emphasis Panel; DSR Member Conflict Applications Meeting.

Date: February 17, 2023.

Time: 11 a.m. to 5 p.m.

Agenda: To review and evaluate grant applications.

Place: National Institute of Dental and Craniofacial Research, 6701 Democracy Boulevard, Bethesda, MD 20892 (Virtual Meeting).

Contact Person: Aiwu Cheng, Ph.D., MD, Scientific Review Officer, Scientific Review Branch, Division of Extramural Activities, National Institute of Dental and Craniofacial Research, 6701 Democracy Blvd., Bethesda, MD 20892, 301–594–4859, *Aiwu.cheng@nih.gov.*

(Catalogue of Federal Domestic Assistance Program No. 93.121, Oral Diseases and Disorders Research, National Institutes of Health, HHS)

Dated: January 13, 2023.

Melanie J. Pantoja,

Program Analyst, Office of Federal Advisory Committee Policy.

[FR Doc. 2023–00995 Filed 1–18–23; 8:45 am]

BILLING CODE 4140–01–P

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

65. Refer to the Rea Direct Testimony, page 13, Table 1. Provide supporting documentation for the Affordability Index by AHI and include in the explanation a complete assumptions list that was used.

Response:

Please refer to Page 11, Chart 3, which shows approximately 12% of the customer population above 2% of their household income. Two percent is assumed to be the benchmark for affordability for the purpose of this discussion. The Affordability Index value is calculated based on modeling of proposed rates and community-level demographic information which assesses affordability across the entire range of customer demographics in each community we serve.

The data in Table 1 on p. 13 also appears in the "Summary" tab of the affordability model provided in KAW_R_PSCDR2_NUM061_081823_Attachment.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

66. Refer to the Rea Direct Testimony, Exhibit CBR-1, Exhibit CBR-2, Exhibit CBR-3. Provide these exhibits in Excel spreadsheet format with all formulas, columns, and rows unprotected and fully accessible. Identify any source material used to develop these exhibits and provide copies of any studies or documents that provided data or assumptions relied on to prepare these exhibits.

Response:

Please refer to KAW_R_PSCDR2_NUM066_081823_Attachments 1, 2, and 3.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

67. Refer to Rea Direct Testimony, Table 10, page 29.

a. Please identify the zip code areas in Kentucky American's service area that are in each income group.

b. Reconcile the number of customers listed in Table 10 with the number of customers listed in the Application, Exhibit I.

Response:

a. Please see table below:

Town	Zip	MHI	Bucket
Lexington	40513	$143,838.02	High
Lexington	40510	$142,353.15	High
Lexington	40507	$125,079.47	High
Lexington	40502	$106,858.96	High
Lexington	40509	$99,577.15	Middle
Midway	40347	$98,751.34	Middle
Lexington	40515	$95,700.29	Middle
Lexington	40514	$90,127.17	Middle
Georgetown	40324	$85,771.37	Middle
Lexington	40516	$85,257.74	Middle
Lexington	40503	$83,546.50	Middle
Sadieville	40370	$78,772.49	Middle
Versailles	40383	$78,106.96	Middle
Lexington	40511	$77,914.54	Middle
Dry Ridge	41035	$73,901.68	Middle
Frankfort	40601	$71,986.52	Middle
Paris	40361	$68,496.87	Middle
Glencoe	41046	$67,986.69	Middle
Winchester	40391	$66,760.46	Middle
Corinth	41010	$62,697.31	Middle
Stamping Ground	40379	$61,688.83	Middle
Cynthiana	41031	$59,859.63	Middle
Owenton	40359	$58,666.12	Middle
Lexington	40517	$58,543.79	Middle

Lexington	40504	$57,125.77	Middle
Lexington	40505	$55,241.57	Middle
Carlisle	40311	$47,730.72	Low
Lexington	40508	$43,340.30	Low
Mount Vernon	40456	$42,736.65	Low
Sparta	41086	$38,487.51	Low
Sanders	41083	$38,347.67	Low
Orlando	40460	$37,793.82	Low
North Middletown	40357	$36,719.73	Low
Worthville	41098	$34,957.57	Low
Livingston	40445	$32,006.93	Low
Millersburg	40348	$28,807.29	Low
Mc Kee	40447	$28,266.42	Low
Jonesville	41052	$0.00	Low

b. Table 10 at p. 29 lists the number of residential customers that had usage in any month of calendar year 2022 which includes customers that came onto the system or left the system part way through the year. This count will be more than the average number of residential customers during the year.

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

68. Refer to Rea Direct Testimony, page 8. Please provide all source material used to determine the Basic Water Service as 40 gallons of water per household member per day. Provide any studies or documents used as the basis for that value.

Response:

For calendar year 2022, median monthly residential use per customer is as follows;

Jan: 2992
Feb: 2900
Mar: 2400
Apr: 2992
May: 2992
Jun: 2992
Jul: 3700
Aug: 2992
Sep: 2992
Oct: 3200
Nov: 2700
Dec: 2992

40 gallons per household member per day for a household size of 2.5 persons per household is 3000 gallons per month, which is consistent with median household use per customer listed above. This validates the assumption of 40 gallons per household member per day.

Median use per customer is used in this particular analysis instead of average use per customer in order to eliminate the effects of residential users that are multi-family buildings with more than one household behind a single meter.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Charles Rea

69. Refer to Rea Direct Testimony, Universal Affordability. Explain how the proposed Universal Affordability Tariff is consistent with KRS 278.170.

Response:

KAW submits that its proposed Universal Affordability Tariff is consistent with KRS 278.170. That statute states:

> No utility shall, as to rates or service, give any *unreasonable* preference or advantage to any person or subject any person to any unreasonable prejudice or disadvantage, or establish or maintain any *unreasonable* difference between localities or between classes of service for doing a like and contemporaneous service under the same or substantially the same conditions. (emphasis added).

The statute is clear: the Commission has the statutory authority to permit *reasonable* preferences and advantages, and to establish *reasonable* differences between classes of service. The Commission has frequently exercised this authority to allow preferential rates for economic development purposes and for specific individual customers through special contracts.

KAW believes that providing discounts based on different levels of household income stated as multiples of the Federal Poverty Level is a reasonable difference the Commission can permit for several reasons. First, the tariff discount is based on federal guidelines that determine eligibility for many federal and other assistance programs, including KAW's H2O – Help to Others Program. Second, the cost impact of the program is minimal, as the expected total amount of discounts the Company is proposing to roll directly back into base rates is approximately $116,000 (assuming a 10% participation rate). Finally and most importantly, as demonstrated fully in Mr. Rea's testimony, high income customers tend to be seasonal use customers at almost twice the rate than residential customers in low-income communities. Given that Mr. Rea also demonstrates that it is cheaper on a per unit basis to provide Basic Water Service than it is to provide peakier seasonal service, and therefore cheaper generally to provide service to lower income customers than to higher income customers, it is reasonable to provide a tariff that recognizes that cost difference for low-income customers.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

70. Refer to the Direct Testimony of William A. Lewis (Lewis Direct Testimony), page 26, line 16. Provide the name of the third-party vendor Kentucky-American entered a contract with on April 24, 2023.

Response:

The name of the third-party vendor that KAW entered into a contract with on April 24, 2023, is US Infrastructure Company (USIC Locating Services, LLC).

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

71. Explain how Kentucky-American will meet its obligations under the Kentucky Underground Facilities Damage Prevention Act with the third-party vendor.

Response:

KAWC will continue to meet its obligations under the Kentucky Underground Facilities Damage Prevention Act by partnering with USIC, a highly experienced utility locating entity. USIC performs approximately 80 million locates annually for telecommunications, gas, electric, sewer, and water utility providers, as well as many municipalities across North America. USIC has over 9,000 highly-trained technicians in the field outfitted with the latest technology so they can provide accurate and timely service to our customers. KAWC will closely monitor and supervise USIC to ensure compliance with obligations.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

72. Provide the number of location requests under the Kentucky Underground Facilities Damage Prevention Act that Kentucky-American has received in the last 12 months, and the number of these requests that remained unmarked after two business days in the last 12 months.

Response:

KAWC received 61,584 locate requests between 07/01/2022 and 07/31/2023. 1,688 of these were listed as unmarked after 2 business days. This unmarked number also includes locate requests that are not required to be located in the 2-day timeframe, such as project labeled requests that are generally large, may require additional time, and are coordinated with the excavator to ensure locates do not out-pace the proposed construction sequence.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

73. Explain the current process Kentucky-American and its third-party vendor uses for untonable lines.

Response:

The third-party vendor reaches out to KAWC when it encounters untonable lines. KAWC provides the third-party vendor with the approximate locations of the untonable facilities based on field records, as-builts designs, and all other relevant documentation so the third-party vendor can mark the facilities based on most accurate available information. Once the untonable facilities are marked in the approximate location, the excavator is notified of the inability to accurately locate the facility and directed to use non-intrusive excavation methods.

KENTUCKY-AMERICAN WATER COMPANY
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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

74. Provide the number of locate requests under the Kentucky Underground Facilities Damage Prevention Act that have been deemed to involve untonable since the start of the third-party contract on April 24, 2023.

Response:

KAW does not compile or maintain locate records of untonable requests to provide an exact number but receives 5-10 calls a day for untonable locates.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

75. Provide the number of locate requests under the Kentucky Underground Facilities Damage Prevention Act that were deemed unmarkable due to extreme conditions since the start of the third-party contract on April 24, 2023.

Response:

No locate requests have been identified as unmarkable due to extreme conditions since April 24, 2023.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

76. Provide the number of inactive accounts that still have an active billing ID.

    a. Explain why the inactive accounts have not been shut off.

    b. Explain the effect on water loss the inactive account has.

Response:

Inactive accounts do not have an active billing ID.

a. Generally, domestic inactive accounts are shut off when final reading for billing is requested. However, there are situations when a service remains on after the final reading. For example, apartment complexes, University of Kentucky, homeowners with a same-day occupancy transfer, may request for the service to remain on after final billing. There are also situations where non-domestic inactive accounts may have services that remain on. For example, the Georgetown Emergency connection to KAW is left on with an inactive account. There are cases where inactive meters register usage. The Company has a process in place to identify inactive meters that have registered usage. When the Company identifies a meter registering usage at a location with an inactive account, a Company representative is sent to the location to determine why the meter is registering usage. The resolution to the inactive meter registering usage is dependent on the representative's findings.

b. Water loss associated with inactive accounts is included in the Company's total non-revenue water.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

77. Provide the number of employees that currently read meters.

    a. Explain how many would be needed to physically read all active meters.

    b. Provide the projected salaries needed to pay for the employees to physically read all active meters.

Response:

There are seven full-time employees that currently read meters.

a. Twenty-three full-time employees would be required to manually read all active meters monthly, which is an increase of sixteen employes from the current level. At present, there are approximately 140,000 active meters. Given an approximate average of twenty-one working days each month, the Company would need to read 6,667 meters each day. A full-time meter reader could likely read 300 meters per day manually, resulting in twenty-three full time employees in order to manually read each meter monthly.

b. The current salary for full time meter readers is $29.51 per hour, and the additional expense associated with employee benefits is $14.76 (50% of wage) per hour. This results in a yearly salary for twenty-three full-time meter readers of $2.12 million each year.

Please note that in addition to employee salaries, the Company would require the purchase of 16 additional vehicles, additional vehicle fuel and maintenance expense, purchase of new manual meter reader data entry devices that would interface with existing meter software, additional employee uniform expense and additional employee safety training expenses.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

78. Refer to Lewis Direct Testimony, page 35.

   a. Identify the number of employees, by year dedicated to identifying and reducing unaccounted-for water for the last ten years. Provide detail on their job title and specific job duties.

   b. Identify the amount of operating expenses, by year spent on identifying and reducing unaccounted-for water in the last ten years. Provide detail regarding what the expenses were.

   c. Identify amount of any capital expenditures, by year, spent on identifying and reducing unaccounted-for water in the last ten years. Provide detail regarding the projects or expenditures and how they contributed to reducing unaccounted-for water.

Response:

a. Many employees at KAWC are involved with identifying and reducing unaccounted for water. For example, KAWC holds a monthly non-revenue water task force meeting focusing on the reduction of unaccounted for water. This task force includes representatives from Production, Field Operations, Customer Service, Water Quality, Engineering Planning, Finance, External Affairs, and Union Labor. Please see KAW_R_PSCDR2_NUM078_081823_Attachment for a list of employees, their job title, and duties related to the reduction of Unaccounted for Water, along with a list of activities to be performed in 2023. KAWC does not retain a specific list of all employees engaged with identifying and reducing unaccounted-for water over the last decade, but the job titles in the attachment reflect the positions that have been working on these issues over the last ten years.

b. KAWC does not record time specific to Unaccounted-for-Water activities but does undertake many activities focused on the reduction of unaccounted for water, including the activities in the KAWC leak detection yearly plan. Other operating expenses include maintenance of the leak detection equipment, service contracts with the leak detection equipment vendors, and employee review of leaks alerted from the detection software. In 2020, KAWC began affirmatively replacing older meters, instead of recertifying them, which is a combination of O&M and capital expense. Additionally, KAWC calibrates its water plant meters annually. KAWC engages outside entities and has conducted training on leak monitoring devices on hydrants with the Lexington Fire Department and engaged our large customers with private mains, such as the University of Kentucky, on the benefits of leak detection equipment and sounding areas of concern. KAWC also has required the submission of a report from the fire departments in the service area on usage as a condition of eligibility for our Kentucky American Water fire support grants.

c. Please see below a summary of the capital expenditures from 2013 to 2022.

2022 – KAWC completed approximately $26.9M in planned main replacements, $1.6M in unscheduled main replacements, and $1M in service line replacements. The company performed evaluations at the Kentucky Horse Park ($21,000), Bluegrass Airport ($11,500), and the University of Kentucky's ($122,000) facilities to characterize their assets and identify potential sources of unaccounted for water. This enabled these entities to locate leaks within their private system, the installation of detection check meters in detector check assemblies that still contained manufacturer meters, and additional identification of potential sources of authorized use on fire services. The Company has designed and is working with the Kentucky Horse Park for securing land for the establishment of a District Metering Area (DMA) which will isolate this area of the system and allow Kentucky American Water to continually measure potential leakage is this area of the system. KAWC engages with the University of Kentucky through the University of Kentucky's Long Range Growth Planning meeting and a Utility Provide Checkpoint Meeting which provides the opportunity to be aware of potential demolition of UK facilities to make sure that services along private main are properly abandoned. The Company invested approximately $32,000 in Portable ultrasonic flow meters, purchasing 4 ultrasonic flow meters to audit special connections and commercial/industrial fire connections to the KAW distribution system. These audits are ongoing, and each have been documented with results.

2021 – KAWC completed approximately $14.5M in planned main replacements, $1.5M in unscheduled main replacements, and $0.9M in service line replacements. The company invested approximately $23,000 in additional permanent leak detection loggers were purchased and deployed.

2020 – KAWC completed approximately $3.8M in planned main replacements, $1.46M in unscheduled main replacements, and $0.8M in service line replacements. KAWC invested $150,000 - Echologics Leak Monitoring, installing hydrant mounted lead sound devices on131 fire hydrants. Similar reporting to other permanent leak sounding devices.

2019 – KAWC completed approximately $3.2M in planned main replacement, $1.2M in unscheduled main replacements, and $0.45M in service line replacements to towards reducing unaccounted for water. The company invested approximately $8,000 in Perma-net Leak Sounding Equipment, and deployed permanent mounted leak sounding equipment that reports potential leaks back to the main office. This allows KAWC to investigate potential leaks upon each report of activity.

Additionally, KAWC purchased 2 handheld leak sounding units and deployed a 2-person leak team to conduct leak sounding.

2018 – KAWC completed approximately $3.5M in planned main replacements, $0.95M in unscheduled main replacements, and $0.475M in service line replacements to reduce unaccounted for water.

2017 – KAWC completed approximately $4M in main replacements, $0.9M in unscheduled main replacements, and $0.5M in service line replacements towards the reduction of unaccounted for water. KAWC conducted a leak detection survey at a cost of $36,000 through Asterra Satellite Imagery. This trial consisted of obtaining satellite imagery for leak detection in two areas of the distribution system by looking for chemical signatures in leaking water.

2016 – KAWC completed approximately $1.9M in main replacements, $0.8M in unscheduled main replacements, and $0.5M in service line replacements towards the reduction of unaccounted for water.

2015 – KAWC completed approximately $5.3M in main replacements, $0.2M in unscheduled main replacements, and $0.4M in service line replacements towards the reduction of unaccounted for water.

2014 – KAWC completed approximately $3.66M in main replacements, $0.3M in unscheduled main replacements, and $0.4M in service line replacements towards the reduction of unaccounted for water.

2013 – KAWC completed approximately $1.65M in main replacements, $0.37M in unscheduled main replacements, and $0.65M in service line replacements towards the reduction of unaccounted for water.

Kentucky American Water
Employee List Unaccounted For Water Activities
KAW_R_PSCDR2_NUM078_081823

Employee	**Job Title**	**Duties Related to identifying and reducing Non-Revenue Water**
Justin Sensabaugh*	Sr Manager Operations	Coordinate field ops NRW activities - meter replacements, leak detection, facility audits, main break repair, Utility locates - 811
Donald Simpson*	Field Services Rep	Bargaining unit representative, meter replacements
Jason Sutton*	Meter Technician (Field Services Rep in 2022)	Bargaining unit representative, meter replacements, meter testing
Erik Mosby	Meter Technician	Bargaining unit representative, meter replacements, meter testing
Rick Mattingly*	Meter Technician - Retired June 2023	Bargaining unit representative, meter replacements, meter testing
Roderick Sherman*	Mgr Operational Excellence	Reporting and tracking; major account engagement
Tyler Fryman	Supervisor Operations	Service Line replacement, main break repair, meter replacements
Chis Marshall	Supervisor Operations	Service Line replacement, main break repair, meter replacements
Jon W Felts*	Sr Supervisor Operations	Leak detection, NRW tracking, and service line replacements, leak detection training, Utility locates - 811
Brandon Smith*	Sr Supervisor Production	Plant meter calibration, NRW tracking
Micheal Maggard*	Sr Supervisor Production	Plant meter calibration, NRW tracking
Dorothy Rader*	Manager Operations	Coordinate production NRW activities - Plant meter calibration, NRW tracking, NRW calculation and reporting
Steven Nash*	Supervisor Operations	Meter replacements and large meter testing
Nathan Clark*	Project Manager Operations	Conducting fire service audits and follow-ups on detector checks
Erin Hall*	Supervisor Operations	NRW tracking, prep, reporting, leak detection, meter replacements, Utility Locates - 811, Inactive with consumption account physical lock install
Daniel Prater*	Operations Specialist	NRW tracking, prep, reporting, leak detection, service line replacements, main break repair, Utility locates - 811
Charles Dick*	Sr Superintendent Operations	NRW tracking, prep, reporting, large meter replacements, leak detection, fire service audits
Meriah Osbourne*	Supervisor Customer Advocacy	Customer engagement with leak concerns
Rebecca Broaddus*	Director of Finance	Data support and budget/forecasting updates
Bob Money*	Mgr of Wtr Quality and Env Compliance	Environmental compliance
Krista Citron*	Sr Project Engineer	QIP program planning for replacement of main and model prioritization, Capital Planning
Tyler Wells	Project Engineer	Engaging with LFUCG on flow monitoring technology installed on Hydrant Caps and training; Hydraulic Modeling and flow verification studies, training on hydrant flows; Coordination with third party engineering consultants for leak detection planning for PCCP pipe;
John Magner	Engineering Project Manager	Design of DMA Vaults and Engaging the Kentucky Horse Park for ROW activities
Tyler Singer	Staff Engineer	Engaging University of Kentucky in Growth Planning and Utility Touch Point meetings
Erik Hall	Construction Project Manager	Coordination of capital main replacement construction activities, including flushing
Denny Dotson	Construction Inspector	Capital main replacement construction activities, including flushing
Shane Crow	Construction Inspector	Capital main replacement construction activities, including flushing
Corey Allender	Construction Inspector	Capital main replacement construction activities, including flushing
Dennis Blevins	Construction Inspector	Capital main replacement construction activities, including flushing
Shelley Porter	Director of Engineering	Coordinating engineering services - engaging service company on pipe analysis post leak events, engaging University of Kentucky on planning, assistance for conducting audit of large customer special connections.
Andy Lewis	Vice President of Operations	Oversees all operations; strategic planning of non-revenue water acitivies
Justin Lane	Sr. Manager of Business Development	Account Manager engaging with Large Customers on leaks
David Pippen	Sr. Director Corp Counsel	Legal direction and documents for third party engagement
Molly VanOver	Sr. Paralegal/GA Liaison	Legal assistance and documents for third party engagement
Susan Lancho	Sr Manager Government and External Affairs	Customer education on main break/leak reporting; requiring fire department grant applicants to be compliant with water usage reporting; customer education on proper use of fire hydrants through outreach/hydrant sleeves to reduce unauthorized use/water theft.

*** Denotes Task Force Members**

KENTUCKY
AMERICAN WATER

NRW Reduction Plan 2023

Central Division

Scope of 2023 NRW Reduction Activities
KAW – Central Division System

A. Background

Kentucky American Water has established a goal of reducing NRW volume to meet required compliance levels. This proposal establishes what activities must take place in 2023 to support the reduction of NRW for the yearly goal to be achievable.

B. Scope of Activities

Various leak detection methods and tools will be utilized to monitor the system for leakage and account for known, unbilled usage. Active acoustic methods of sounding will be employed for surveying purposes. This method is the most labor intensive but is very effective on all types of iron and AC piping materials and will be the primary approach to surveying the system in 2023. Cellular leak loggers will be deployed for continuous monitoring purposes in the city of Millersburg and use of this technology will be expanded to other areas throughout the year.

1. **Task Number 1 - *Right of Way Sounding*** Right of ways in the Central system, those having main lines running through them that do not have any service laterals connected to the main will require manual sounding where possible and visible inspections for signs of leakage.

2. **Task Number 2 - *Sounding of Creek Crossings*** Locations where main lines cross creeks will be inspected for leakage by manual sounding and visible inspections. Leaks that occur in or near creeks could go unnoticed without periodic investigations of these areas.

3. **Task Number 3 - *Visual Inspection (Walking) of River Lines*** Transmission lines originating at the Kentucky River Station cross country, sometimes in isolated areas and any leakage that occurs goes undetected. Visual surveying of these areas is required to confirm that losses are not taking place.

4. **Task Number 4 - *Manual Sounding of Downtown Lexington*** the complete sounding of downtown Lexington will be performed each year due to the age of the assets in this area and geographical location. Deployment of leak loggers is being considered for continuous monitory of downtown.

5. **Task Number 5 - *Manual Sounding of Distribution System*** The hydrant and valve approach will be utilized to leak sound a segment of the distribution system in 2023. Tasks associated with this initiative will be determined by utilizing historical leak and construction related data to identify an area of focus.

6. **Task Number 6 - *Survey of Mains Served by Special Connections*** - Private properties served by special connection valves should each be investigated for leakage and unauthorized, unmetered usage. Private fire hydrants and extensive lengths of private mains on these properties can both be sources of unmetered losses.

7. **Task Number 7 - *Theft of Service Signage*** - Hydrant anti-theft markers will be installed on all fire hydrants as they are inspected in the Central system to discourage theft of service and unauthorized usage.

8. **Task Number 8 - *Cellular Leak Logger Monitoring*** - cellular leak loggers have been deployed in the city of Millersburg for continuous leak monitoring purposes. Expansion of this technology will provide a permanent solution for managing leak losses in outer lying areas of the system and has the potential for monitoring unauthorized usage on properties served by special connections.

9. **Task Number 9 - *2" Cast Iron Mains*** - Related activities will be prioritized according to break history.

10. **Task Number 10 - *Management of Continuous Blow-offs*** - Blow-offs running for water quality purposes have the potential for unnecessary losses when left unmonitored. The installation of ultrasonic meters with cellular endpoints on all continuous blowoffs as management tools will provide better monitoring and tracking of usage.

11. **Task Number 11 – *Mueller ESDX Pilot Study*** – Leak detecting caps were installed on 131 fire hydrants in the Palomar area in 2020.The hydrant caps are continually monitored for possible leakage. Expansion of this technology will provide a permanent solution for managing leak losses in many areas of the system and has the potential for monitoring unauthorized usage.

12. **Task Number 12 – *Horse Park District Metering Project*** – A project was designed in 2023 and is anticipated to begin in 2023. The purpose of this project is to install a district meter to serve as a check meter against current usage thus potentially reducing NRW.

13. **Task Number 13 – *Surge Modeling and Large Meter Evaluation***– Stantec Engineering has been contracted to complete a study involving pressure surges and their effect on the distribution system. Also, will consider production meter calibration as a part of this project.

14. **Task Number 14 - *Large Meter Replacement Project*** – Replacing all meters 3”.

15. **Task Number 15 – *Fire Service Usage Project*** – this project has been designed to identify and eliminate all unauthorized usage on fire services.

Large Meter Low Flow Losses

It is apparent that there is the potential for water loss through large meters that are not registering low flow usage due to the nature of the operation being served and inconsistent demand throughout the year. Large meter accounts will be investigated to determine if the most suitable type of meter is being used and meters changed where warranted. This process will continue until all in the distribution system have been assessed.

Special Connection Investigation

Properties served by special connections with the largest length of private mains will be manually leak sounded and investigated by KAW personnel to provide assurance that large or numerous leaks and unbilled usage are not occurring on these properties. The following properties will be part of the investigation:

- Kentucky Horse Park
- Bluegrass Airport
- University of Kentucky Main Campus
- UK Agriculture Center
- Fayette Mall
- Keeneland
- Lexmark

Because these properties are not metered or continuously monitored, KAW will consider the use of cellular leak loggers as a permanent solution to managing leaks and unauthorized usage on properties served by special connections. A project to master meter the Kentucky Horse Park is anticipated to begin in 2023.

C. Schedule

The dates provided in the schedule below represent the targets by which leak detection activities will be managed. These targets are contingent upon having the proposed level of staffing, which will be necessary to complete all program objectives.

Task #	Task	Start Date	50% Complete	75% Complete	100% Complete
1	**R/W Sounding** (60)	**3/1/23**			
2	**Creek Crossing Sounding** (43)	**8/2/23**			
3	**Walking of River Lines**	**3/1/23**			
4	**Sounding of Downtown**	**5/31/23**			
5	**Manual Sounding of System**	**3/29/23**			
6	**SPC Investigations** (263)	**1/28/23**			
7	**Hydrant Theft of Service Signage Inst.**	**2/2/23**			
8	**Leak Logger Monitoring (Millersburg)**	**1/1/23**			
9	**2" CI Main Leak Investigations**	**4/1/23**			
10	**Install ultrasonic meters with cellular endpoints on all continuous blowoffs**	**TBD**			
11.	**ESDX-Mueller Leak Detecting Hydrant Caps**	**3/1/23**			
12	**Horse Park District Metering Project**	**3/1/23**			
13	**Surge Modeling and Large Meter Evaluation**	**6/1/23**			
14	**Large Meter Replacement Project**	**1/2/23**			
15	**Fire Service Usage Project**	**6/1/23**			

D. Deliverables

1. **<u>Task Number 1 - *Right of Way Sounding*</u>** -There are 60 documented right of ways in the Central system all of which will be manually surveyed for leakage. These are areas that have main lines running through them that do not have any service laterals connected to the main and often are not visible therefore, allowing for leakage to occur that would not be noticed or accounted for if not periodically surveyed. Company drones will be utilized to provide visual inspections of these areas, when possible starting in Q2. Also, their thermal imaging capabilities will be employed to look for variations in surface temperatures, possibly indicating the existence of hidden leakage.

2. **<u>Task Number 2 - *Sounding of Creek Crossings*</u> -**There are 51 documented creek crossings in the Central system, and each will be sounded yearly for leaks. Main lines crossing these streams are of various sizes and material types, ranging from 3” AC to 24” DI. Any leaks that occur in or near these creeks could go unnoticed without periodic investigations of these areas.

3. **<u>Task Number 3 - *Visual Inspection (Walking) of River Lines*</u> -**The 30” lines originating at the Kentucky River Station that bring treated water to Lexington cross several farms and isolated areas where leaks on these pipes would not be visible. The corridors where these mains have been laid will be walked to visually check for signs of leakage.

4. **<u>Task Number 4 - *Manual Sounding of Downtown Lexington*</u> -**The complete sounding of downtown Lexington will be performed each year. This is the oldest part of the system where leakage is most likely to occur due to the age of the infrastructure. Also, leaks in this area have a great potential to remain “hidden” due to its geographical location and close proximity to Town Branch which runs under parts of the downtown area.

5. **<u>Task Number 5 - *Sounding of the Central Distribution System*</u> -**The hydrant and valve survey method will be utilized to assess the system for leaks. Both manual and passive survey methods, where applicable will be utilized in the process.

6. **<u>Task Number 6 - *Survey of Mains Served by Special Connections*</u> -** Private properties served by special connection valves will be investigated for leakage by conducting manual acoustical leak sounding surveys, where deemed necessary. The assessments will be prioritized by size of connection, length of private main served, pipe material type and age of the infrastructure, if known. There are currently 263 properties served by special connections in the Central system. Of these, Bluegrass Airport and the Kentucky Horse Park both have the potential for large unmetered losses as identified in the 2009 Gannett Fleming NRW Study. It is recommended that both properties be considered for having Protectus Fire Meters installed.

7. **Task Number 7 - *Theft of Service Signage*** - Hydrant anti-theft markers will be installed on all fire hydrants in the Central system to discourage theft of service and unauthorized usage.

8. **Task Number 8 - *Cellular Leak Logger Monitoring*** - KAW deployed cellular leak loggers in the city of Millersburg for continuous leak monitoring purposes.

9. **Task Number 9 - *2” Cast Iron Mains*** - areas served by 2” mains will be sounded for hidden leakage.

10. **Task Number 10 - *Management of Continuous Blowoffs*** - Ultrasonic meters with cellular endpoints will be installed on all continuous blowoffs.

11. **Task Number 11 – *Mueller ESDX Pilot Study*** – Leak detecting caps will be installed on 131 fire hydrants in the Palomar area. Training of KAW employees on the use of these detectors will occur by Mueller personnel during the study period. Expansion of this technology will provide a permanent solution for managing leak losses in many areas of the system and has the potential for monitoring unauthorized usage.

12. **Task Number 12 – *Horse Park District Metering Project*** – A project has been designed and is slated to begin in 2023. The purpose of this project is to install a district meter to serve as a check meter against current usage.

13. **Task Number 13 – *Surge Modeling and Large Meter Evaluation***– Stantec Engineering has been contracted to complete a study involving pressure surges and their effect on the distribution system. Also, will consider production meter calibration as a part of this project.

14. **Task Number 14 - *Large Meter Replacement Project*** – Replacing all meters 3”, many of the company’s large meters are in efficient at capturing high or low flows. These meters will be replaced with ultrasonic meters which will increase revenue and decrease NRW.

15. **Task Number 15 – *Fire Service Usage Project*** – KAWC has invested in 4 highly accurate clamp-on style ultrasonic meters. These meters will be placed on the outside of problematic fire service mains to accurately record how much water is being lost.

E. Other Requirements

An increase in staffing will be required to perform all the tasks noted in this proposal. **Two** additional persons from the Field Operations area will be needed to assist in executing the manual survey work as well as special project assignments to meet the monthly and annual NRW operational targets. These personnel resources must be totally dedicated to the Leak Detection program for the entire year.

Scope of 2023 NRW Reduction Activities
KAW – Central Division System

F. Other Considerations

- Protectus metering of Bluegrass Airport and the main campus of the University of Kentucky

- Piloting of Smart Hydrant technology in downtown Lexington. If effective, recommend being the hydrant of choice for all new capital projects. Also, the AFC SEMPER Remote Pressure Monitor will be installed on select fire hydrants in downtown Lexington to monitor water pressure throughout this area to help identify leaks and reduce non-revenue water.

- Leverage the capabilities of drones and expand their usage as part of the NRW reduction strategy, where applicable.

- Continued close monitoring of blowoffs running for water quality purposes and installation of ultrasonic meters connected with cellular endpoints to better manage flow rates.

- Timeliness of leak repairs (Reduce repair time from acknowledgement to repair)

- Engage entire work force to be on the lookout for leaks.

- Partner with External Affairs to increase awareness regarding what constitutes theft of service.

- Communicate to developers what constitutes theft and encourage them to be on the lookout for unauthorized usage in areas of new development.

- Send communication to the owners of all properties served by special connections reminding them that all water usage must be metered except that used for the extinguishment of fires.
- Conduct refresher training for maintenance crews regarding minimizing unnecessary or excessive flushing associated with leak repairs.
- Continue communication with the LFUCG Sanitary Sewer Department regarding the reporting of areas where chlorinated water has been found entering the sewer system.

Scope of 2023 NRW Reduction Activities
KAW – Central Division System

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

79. Refer to Lewis Direct Testimony, page 38 line 13. Provide the volume of water lost in each month for the last 10 years. Also, provide the 12-month rolling average of unaccounted-for water loss for each month for the last 10 years.

Response:

Volumetric NRW Loss per Month – Previous 10 Years (in 000 gals)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	144,756	114,614	201,658	186,108	365,456	278,937	122,914	109,619	24,989	111,234	57,952	166,890
2013	172,620	68,012	218,204	181,898	241,286	66,771	185,722	166,316	202,382	135,052	108,467	175,474
2014	181,767	153,825	190,690	189,154	316,784	206,164	264,563	240,221	127,367	41,376	165,396	139,573
2015	117,653	216,467	208,448	110,934	355,410	149,187	144,042	302,034	211,172	49,327	126,352	150,601
2016	240,640	193,289	202,952	199,680	289,544	286,193	254,283	234,893	173,909	168,738	100,911	163,370
2017	280,259	59,235	274,788	237,887	312,430	230,467	338,558	295,460	72,864	239,870	144,612	268,327
2018	275,760	167,684	302,700	205,744	418,090	205,837	339,568	271,963	169,249	233,717	236,703	277,896
2019	254,886	189,946	302,492	441,691	359,511	216,198	454,963	336,166	461,953	75,234	182,284	271,525
2020	186,006	335,760	238,454	191,996	344,860	414,823	295,561	217,314	128,064	210,949	230,253	373,569
2021	269,339	330,939	360,542	252,491	352,603	303,715	242,510	321,695	160,648	256,509	189,954	265,437
2022	185,759	222,017	345,614	295,117	346,624	495,331	351,017	196,162	349,198	103,264	282,813	388,991

*Table reflects total NRW, inclusive of accounted for water loss due to flushing, water use at treatment plants, hydrant testing and use by fire departments and other sources of non-revenue, accounted for water.

12-month NRW Rolling Average – Previous 10 Years												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2012	14.1	13.9	13.9	14.2	15.0	14.6	14.0	13.0	13.8	13.6	13.0	13.1
2013	13.3	13.0	13.1	13.1	12.3	11.1	11.8	12.5	13.8	13.9	14.4	14.4
2014	14.3	14.8	14.6	14.6	15.1	16.0	16.3	16.7	16.3	15.6	16.0	15.8
2015	15.5	16.0	16.1	15.5	15.7	15.3	14.6	14.9	15.3	15.3	15.0	15.0
2016	15.8	15.6	15.6	16.1	15.7	16.6	17.2	16.7	16.4	17.1	16.8	16.8
2017	17.1	16.2	16.7	17.0	17.0	16.7	17.2	17.5	17.0	17.6	17.9	18.6
2018	18.5	19.1	19.3	19.1	19.7	19.5	19.6	19.6	20.2	20.1	20.7	20.8
2019	20.8	20.9	20.9	22.4	22.0	22.1	22.9	23.1	24.5	23.3	22.9	22.8
2020	22.4	23.4	23.0	21.6	21.8	23.0	21.8	21.2	19.4	20.5	20.9	21.6
2021	22.0	21.9	22.6	22.9	22.7	22.0	21.9	22.6	22.8	23.1	22.8	22.1
2022	21.6	21.0	20.9	21.0	21.0	21.1	22.5	21.7	22.8	21.6	22.1	22.7

*Table reflects total NRW 12-month rolling average. KAWC does not track un-accounted for water 12-month rolling average.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

80. Refer to Lewis Direct Testimony, page 35, lines 4, and Lewis Direct Testimony, Exhibit WAL-1. Explain what Kentucky-American would need to construct or install to allow or permit Kentucky-American to ascertain what percentage of unaccounted water loss is attributable to water loss occurring in the following special connections:

a. Kentucky Horse Park

b. Bluegrass Airport

c. University of Kentucky

Response:

a. To ascertain the percentage of unaccounted for water loss attributable to the private main served via two special connection valves at the Kentucky Horse Park, Kentucky-American would need to obtain easements for property from the State of Kentucky, and design and construct two District Metering Area ("DMA") vaults. Each DMA vault will consist of a concrete vault structure housing an 8" ultrasonic flow meter, check valve to prevent the reversal of flow through the meter, and two gate valves. The DMA vaults will be connected to existing piping on the site with 8" ductile iron pipe and associated valves and fittings. The unaccounted water loss would potentially include leakage, potential usage from unmetered connections along the private main and hydrant usage for purposes other than fire extinguishment. Installation of AMI metering at the vault location and the individual premises served along the private main would aid in determining if unaccounted for water is attributable to leakage, unmetered connections, or hydrant usage.

b. To ascertain the percentage of unaccounted for water loss attributable to the private main served via five special connection valves at the Bluegrass Airport, Kentucky-American would need to design and construct five DMA vaults. The unaccounted water loss would potentially include leakage, potential usage from unmetered connections along the private main and hydrant usage for purposes other than fire extinguishment. Installation of AMI metering at the vault location and the individual premises served along the private main would aid in determining if unaccounted for water is attributable to leakage, unmetered connections, or hydrant usage.

c. Based on field work and engagement with University of Kentucky, Kentucky-American anticipates that approximately twenty-one DMA locations would need to be established. Additional design evaluations need to be conducted once DMA locations and points are established, to determine if potential main reinforcements are required to isolate University of Kentucky's facilities from the grided water system, without negatively impacting the hydraulics of the grided water system. Easements or land acquisition, along with the design and construction of the twenty-one DMA vaults would be required. Definitively locating all points of interconnection between University of Kentucky's facilities and Kentucky-American's system presents difficulties as there are many areas where Kentucky-American piping runs parallel to University of Kentucky private main. It is suspected that over many years there may have been unmetered connections installed by contractors performing work for the University of Kentucky that were intended to be made on the private main but may have been made on Kentucky-American's system. The unaccounted water loss would potentially include leakage, potential usage from unmetered connections along the private main and hydrant usage for purposes other than fire extinguishment. Installation of AMI metering at the vault locations and the individual premises served along the private main would aid in accurately establishing unaccounted for water due to the complexities of this system and number of premises served.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

81. State whether Kentucky-American has any plans for the construction or installation referred to in Item 73. If so, when does Kentucky-American expects the construction or installation to be completed for each of the following:

    a. Kentucky Horse Park
    b. Bluegrass Airport
    c. University of Kentucky

Response:

a. Kentucky-American has plans for the construction and installation of two DMA vaults at the Kentucky Horse Park. Onsite meetings have been conducted with Kentucky Horse Park representatives and locations established for the vaults. Due to topography and limited land ability within right-of-way, these locations require easements from the Commonwealth of Kentucky. These vaults are estimated to cost approximately $125,000 each for expenses related to engineering and design, easement acquisition, materials, construction labor, and studies conducted to evaluate the Kentucky Horse Park's private special connection distribution system. Please see KAW_R_PSCDR2_NUM081_081823_Attachment showing the proposed vault locations and preliminary designs. The attachment is confidential and provided pursuant to a Petition for Confidential Protection. It is anticipated to construct these vaults in 2023, dependent upon the ability to obtain necessary easements and the potential transfer of ownership for piping between Kentucky-American's existing main and the new DMA vaults.
b. Kentucky-American completed field work to evaluate this system in 2022. KAWC does not currently have design plans developed for construction of permanent DMA vaults at the Bluegrass Airport.
c. Kentucky-American conducted extensive field work and engaged University of Kentucky to characterize the University of Kentucky System in 2022 to identify the specific meters serving building(s), fire service vaults and detector checks corresponding to locations, and is actively engaging UK representatives in development planning that continually modifies UK's private mains. It is anticipated that establishing DMAs for twenty-one special connection valve points with University of Kentucky facilities will cost approximately $3.5 M. This cost estimate does not include any potential costs associated with system reinforcement required, if isolation of the UK facilities have negative hydraulic impacts to the grided water system or locating and addressing unknown points of interconnection. Kentucky-American does not currently have design plans for completion of this work.

KAW_R_PSCDR2_NUM081_081823_ATTACHMENT_CONFIDENTIAL FILED UNDER SEAL PURSUANT TO THE PETITION FOR CONFIDENTIAL TREATMENT FILED ON AUGUST 18, 2023

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Shelley Porter

82. Explain what Kentucky-American would need to construct or install to isolate the cause of water loss within the special connections distribution system.

Response:

Please see KAW_R_PSCDR2_NUM082_081823_Attachment showing the location and information on the special connection valves under Special Connection Multiple Services Agreements. The attachment is confidential and provided pursuant to a Petition for Confidential Protection. The attachment shows approximately 270 entities are served by special connection valves, servicing approximately 950 premises with more than 85 miles of private piping being maintained by private entities, mostly in Fayette County, KY. To isolate these locations, a high-level estimate of $18M to $20.5M would be needed for the design and installation of DMA meter vaults. These would range in size and cost depending on the need to pass fire flows for private mains with private hydrants, the need for check valves to isolate the system, existing topography and available land, and restoration requirements. This cost estimate does not take into account potential system reinforcements required if isolation of the private systems presents hydraulic challenges.

KAW_R_PSCDR2_NUM082_081823_ATTACHMENT_CONFIDENTIAL FILED UNDER SEAL PURSUANT TO THE PETITION FOR CONFIDENTIAL TREATMENT FILED ON AUGUST 18, 2023

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

83. Provide the total number of special connections for each of the last 20 years.

Response:

KAWC serves approximately 270 entities through special connections valves under Special Connection Multiple Services agreements. The company has not served any new entities under multiple service agreements within the last twenty years. However, special connection valves have been replaced or entities such as University of Kentucky have modified and extended their private water systems served by special connection valves.

Please see attachment KAW_R_PSCDR2_NUM082_081823_Attachment showing the location and information on the approximately 270 entities with special connection valves.

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COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: William A. Lewis

84. Provide the nature of each special connection that currently exist for Kentucky American.

Response:

Please see KAW_R_PSCDR2_NUM082_081823_Attachment for information on the nature of the special connections that currently exist for Kentucky American Water.

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Witness: William A. Lewis

85. Explain what Kentucky-American does to identify water loss on a special connection and work with the owner of the special connection for reduction of water loss.

Response:

Unlike fire line connections that generally have exposed piping infrastructure and detector check meters, special connections do not have exposed piping that can be used to install permanent or temporary metering points for continuous or periodic flow testing. Due to this, and the fact that KAWC does not own the private pipelines, water loss reviews of special connections is very difficult. Where special connection owners have worked with us to perform reviews, KAWC has used those opportunities to proactively investigate their system for water loss. KAWC performed a review of a few very large special connections in coordination with property owners to investigate their systems. Two examples include the University of Kentucky and the Kentucky Horse Park. In both examples, KAWC is working with the property owners to identify leaking pipes, leaking fire lines, leaking fire hydrants, and possible unmetered connection

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Witness: William A. Lewis

86. Refer to Application, page 14, paragraph 34. Provide the length of time Kentucky-American is requesting the deviation for an alternative level of unaccounted-for water loss of 20 percent.

Response:

KAWC is requesting the deviation through the end of 2030 to allow time to implement the water loss initiatives outlined in Lewis testimony pages 31-39.

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Witness: Shelley Porter

87. Refer to the Direct Testimony of Shelley W. Porter (Porter Direct Testimony), page 23. Provide a copy of the Solids Handling Mater plan.

Response:

Please see KAW_R_PSCDR2_NUM087_081823_Attachment.

KRS1 Residuals Master Plan

Master Plan
Near-Term and Intermediate
Improvements

Prepared for:
Kentucky American Water
Company

Prepared by:
Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, KY 40513

December 21, 2017

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1.0 INTRODUCTION

Kentucky American Water Company (KAW) operates the Kentucky River Station 1 (KRS1) water treatment plant to provide drinking water to customers in Lexington, Kentucky and surrounding communities. They completed a master plan, *KRS1 Water Treatment Plant – Treatment Master Plan, Hazen and Sawyer, April 20, 2017* (Master Plan) that outlined upgrades to the plant. One component of the proposed upgrades included improvements to the residuals handling facilities. This report builds on that Master Plan and describes further evaluation for upgrades to the plant's residuals handling facilities.

1.1 BACKGROUND AND APPROACH

1.1.1 Background

The KRS1 water treatment plant is currently rated at 40 MGD, with a short-term rated capacity of up to 45 MGD that can be used under certain raw water quality conditions. It draws source water from the Kentucky River and is the largest plant serving KAW's Lexington service area. The treatment process consists of a two-stage rapid mix basin, ten integral upflow solids contact flocculator/clarifier units with integral annual granular media filters ("Aldrich Units"), free chlorine disinfection, and chloramination for secondary disinfection in the distribution system. Residuals from the clarification process, as well as settled solids from the Wash Water Holding Tanks, are sent to a series of four lagoons before being discharged to the Kentucky River.

KRS1 has a NPDES permit (No. KY009104, effective July 27, 2017) to discharge treated effluent from their Waste Filter Backwash Water and lagoon supernatant system. The Permit requirements are shown in **Appendix A.**

Figure 1 shows the KRS1 water treatment plant.

Figure 1. Existing KRS1 Water Treatment Plant

The conceptual improvements to the KRS1 are shown in Figure 2 as published in the 2017 Master Plan. That 2017 report (which is referenced as the "Master Plan" in this report) developed the preliminary concepts for future plant upgrades, including the residuals improvements. Refer to that Master Plan for additional details on the proposed plant improvements and the concept for proposed residuals handling upgrades, including adding sludge thickener(s) and mechanical residuals dewatering. This report further develops the plan for adding residuals handling, thickening, dewatering, and disposal.

Figure 2. KRS1 Conceptual Future Layout
Source: KRS1 Water Treatment Plant – Treatment Master Plan, Hazen and Sawyer, April 20, 2017

1.1.2 Project Approach

KAW reports operational difficulties and challenges due primarily to limited capacities in their holding tanks and lagoons. This project seeks to assist KAW and KRS1 staff with fast-tracked improvements to the residuals handling system. The approach for this study includes:

1. Developing and implementing near-term improvements (generally 6 months)
2. Developing mid-term improvements (generally 1½ years), that may include new or improved gravity thickeners
3. Developing long-term residuals master plan (generally 2 to 3 years) that may include sludge storage/equalization, new dewatering equipment and building, and disposal

2.0 CURRENT RESIDUALS MANAGEMENT PRACTICES

2.1 DESCRIPTION OF EXISTING RESIDUALS MANAGEMENT SYSTEMS

The existing residuals management system at KRS1 includes two Wash Water Holding Tanks with a combined capacity of 540,000± gallons, four storage lagoons with a combined capacity of 5.4± million gallons, and a 10,000-gallon lagoon supernatant pump station with two vertical turbine pumps each rated for 1,000 gallons per minute. A preliminary hydraulic profile, process schematic, and piping plan for the existing plant's residuals process is provided in **Appendix B**.

Residuals generated from water treatment at the KRS1 Plant include:

- Sludge removed by the Aldrich Units.
- Waste Filter Backwash Water.

Treatment residuals which collect in the sedimentation compartment of the Aldrich Unit exit through the bottom center of the unit via a 12-inch diameter drain line. KRS1 operations staff operate the sedimentation compartments with a very low sludge blanket to avoid sludge overflowing to the filters during operation upsets at the Plant and due to the flow change caused by starting the raw water pumps.

Waste Filter Backwash Water exits the units via a 30-inch combined sludge and wash water discharge line to the wash water holding tanks or the lagoons. Waste Filter Backwash Water can flow by gravity to the lagoons or be stored and pumped from the wash water holding tanks to the lagoons via two vertical turbine pumps in each tank.

Supernatant from the lagoons is pumped to the Kentucky River for discharge via the Supernatant Pump Station. Settled supernatant Waste Filter Backwash Water from the Wash Water Holding Tanks can be pumped to the River discharge line from supernatant pumps in each WWHT (nominally 200 gallons per minute) with two in WWHT No. 1 and three in WWHT No. 2. However, KAW typically does not send supernatant from WWHTs to the discharge due to inadequate settling time for the Waste Filter Backwash and sludge, particularly when feeding ferric chloride. A sodium thiosulfate feed system is flow-paced to ensure adequate dichlorination of any supernatant directed to the river.

Supernatant and settled Waste Filter Backwash Water is discharged to the Kentucky River in accordance with KRS1's KPDES Permit No. KY 0091049. The permit limits total suspended solids, total residual chlorine, and pH that can be discharged to the Kentucky River. KRS1 is also required to report flow, total recoverable aluminum, total recoverable iron, and total phosphorus in the water returned to the river. The monthly average and daily maximum limits for flows discharged into the Kentucky River are:

• Total Suspended Solids	Average 30 mg/l	Daily 50 mg/l
• Total Residual Chlorine	Average 0.011 mg/l	Daily 0.019 mg/l

Flows must have a minimum pH of 6.0 not to exceed 9.0.

Historically, Lagoon Nos. 2-4 have been cleaned approximately every two years and the residuals stored onsite for potential future reuse applications. Lagoon No. 1 is normally kept empty to accept emergency overflow discharges from the below ground Clearwells and Supernatant Pump Station. The Lagoons can also accept accidental overflows or controlled discharges from the Wash Water Holding Tanks and the above ground Clearwell. The Supernatant Pump Station includes an overflow into Lagoon No. 1 to prevent accidental spills into the Kentucky River should the vertical turbine pumps fail.

2.2 EVALUATION OF EXISTING RESIDUALS MANAGEMENT SYSTEMS

KRS1 operations face issues with residuals management, particularly during periods where ferric chloride is used as the primary coagulant. Feeding ferric chloride significantly increases sludge volumes at the plant.

Aldrich Units are designed to be operated with a sludge blanket. However, the sludge bed of the existing units is currently minimized to avoid negative impacts on the filters. This increases the frequency of sludge blowdown for each unit. Sludge blowdown is conducted in the absence of sludge concentration monitoring by slightly opening the drain valve, introducing the possibility of extending the blowdown period to allow clear supernatant to be discharged, and increasing the volume of flow to the Wash Water Holding Tanks and/or Lagoons. Sludge blanket depth is not monitored except through visual observation by the operations staff.

Solids analytical testing conducted by Microbac Laboratories found that the sludge blowdown had a 0.2 percent solids concentration, and the Filter Waste Backwash Water had a 0.1 percent solids concentration. The low percent solids concentration of the sludge blowdown could be an indicator that clear supernatant is being discharged during blowdown periods.

High raw water turbidities require more frequent filter backwashing, increasing the filter waste backwash volume. Settling times are supposedly insufficient in the Wash Water Holding Tanks during periods of frequent backwashing. Adding an additional WWHT would provide additional settling time and reduce the volume of wash water discharged to the Lagoon's.

KRS1 operations staff are having to clean the lagoons more frequently than what has been required in the past. Lagoon No.'s 2-4 currently require cleaning one or two times a year, increasing the volume of dried residuals that must be stored onsite.

3.0 RESIDUALS DATA EVALUATION

3.1 DATA COLLECTION

Historical operating data from Monthly Operating Reports (MORs) and the Master Plan were reviewed to evaluate the key parameters from the KRS1 residuals processes, including raw water quality, chemical usage, and wash water flows. Additionally, two site visits were made to KRS1 to collect sludge samples for:

- Geotube dewatering performance trial and cone tests.
- Solids analytical testing.

Sludge samples collected for the Geotube testing included two sludge samples taken from the Wash Water Holding Tanks and a dewatered cake sample taken from one of the Lagoons. The analysis was performed by WaterSolve, LLC in Caledonia, MI and a report provided to Stantec Consulting on August 31, 2017. This report is provided in **Appendix C**.

Sludge samples collected for the solids analytical testing included four Waste Filter Backwash Water samples, three sludge blowdown samples, and one dewatered cake sample. The backwash water and sludge blowdown samples were taken from the 30-inch Wash Water Waste Line as it discharged into Wash Water Holding Tank No. 1. Microbac Laboratories in Lexington, KY performed percent solids and total solids testing for all samples and provided a report to Stantec Consulting on August 30, 2017. This report is provided in **Appendix D**.

As-built drawings provided by KAW staff were used to develop the process schematic and hydraulic profile in Appendix B for the existing solids handling facilities.

3.2 DATA ANALYSIS

The data analyses included two related but separate tracks:

- ➢ Evaluation of the MORs to estimate the waste solids parameters
- ➢ Evaluation of the current Waste Filter Backwash Water data

KRS1 MORs from 2010 thru August 2017 were reviewed to assess raw water quality, chemical usage, and Waste Filter Backwash Water flows. The minimum, average, and maximum values for flow, raw water turbidity, TOC, and coagulant usage are calculated and compared to reported values in the Master Plan in **Appendix E**. A summary comparison for average and maximum values is provided in **Table 1** below.

Table 1. Raw Water Quality Comparison with Master Plan

	Average		Maximum	
	Master Plan	**Stantec**	**Master Plan**	**Stantec**
Flow, MGD	21.3	22.3	34.8	42.16
Turbidity, NTU	50.5	39.22	653	674
TOC, mg/l	2.47	2.33	4.80	11.30
DelPac 2020, mg/l	34.8	36.78	119.20	154.97
Ferric Chloride, mg/l	79.8	51.51	193.40	193.67

The sources of solids generated at KRS1 include turbidity solids removed from the raw water, the precipitate formed from the coagulant DelPac 2020, the precipitate formed from ferric chloride, the precipitate formed from cationic polymer, and natural organic matter that is captured with the floc. Total organic carbon (TOC) concentration is used as an indicator of the natural organic matter.

This analysis aims to develop key design parameters needed to calculated daily dry pounds of solids produced at KRS1. This information will be used to determine daily sludge volumes and to size future gravity thickeners and mechanical dewatering equipment at KRS1.

3.2.1 Raw Water Quality

Raw water quality was assessed by looking at raw water flow, turbidity, and UV-254.

Turbidity was used as an indicator of total suspended solids (TSS) concentration in the raw water because raw TSS data was not available. A suspended solids to turbidity factor (TSS to NTU) of 1.5 was applied to approximate raw water TSS concentrations. The TSS to NTU factor is site-specific but generally ranges from 1.0:1 to 2.0:1. An internal review of TSS to NTU ratios used for similar projects led to the selection of 1.5 for KRS1.

Total organic carbon (TOC) concentration in the raw water is approximated using daily UV-254 numbers from 2016 thru August 2017 and the following relationship (from Edzwald, J.K. and Kaminksi, G.S.):

$$TOC = 1.04 + 22.8 \times UV\text{-}254$$

Calculated raw water TOC is compared with TOC values in the Master Plan to confirm the above relationship. A maximum UV absorption of 0.45 cm^{-1} is reported in the master plan and found to be the maximum from 2016 - August 2017. The calculated maximum TOC concentration is significantly higher than the maximum TOC concentration reported in the Master Plan. It is recommended that the maximum TOC concentration from the Master Plan be used in solids production calculations.

Source water quality is highly variable at the Plant with turbidity spikes generally occurring over the first half of the year. **Figure 3** shows average monthly turbidity concentrations at KRS1 between 2010 and August 2017.

Monthly TOC concentrations appear to be highest at the Plant from June to November. **Figure 4** shows the average monthly TOC concentrations between 2016 and August 2017.

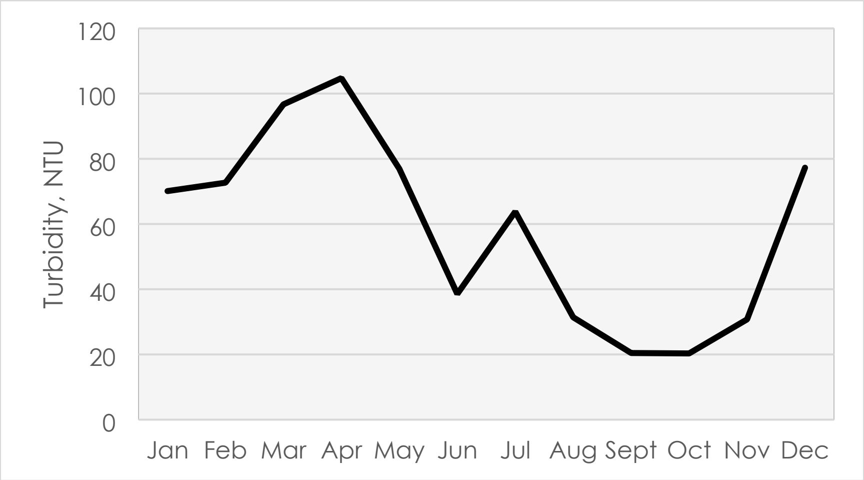


Figure 3. 2010-2017 Average Raw Water Turbidity

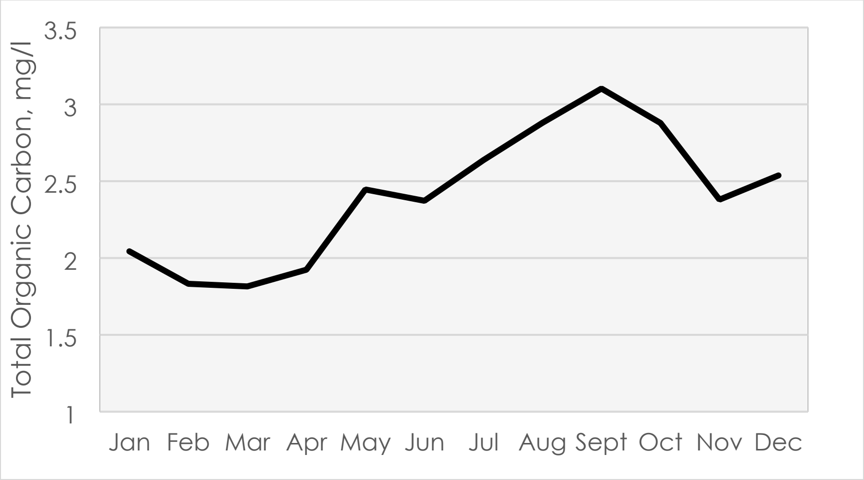


Figure 4. 2016-2017 Average Raw Water TOC Concentrations

3.2.2 Chemical Usage

KRS1 uses polyaluminum chloride (DelPac 2020), ferric chloride, and a cationic polymer to remove turbidity and natural organic matter from the raw water. The focus of the chemical evaluation was to determine minimum, average, and peak chemical dosing rates for the coagulants fed independently and jointly over the last six years. The rates below are based on the daily dosing rate reported in the MORs. A summary of the chemical usage at KRS1 is provided in **Table 2**.

Table 2. 2010-2017 Coagulant and Cationic Polymer Usage

	Minimum	Average	Peak	95th Percentile
DelPac 2020, mg/l	0.99	36.78	154.97	78.34
Ferric Chloride, mg/l	0.07	51.51	193.67	135.26
Cationic Polymer, mg/l	0.34	2.00	4.00	2.37

DelPac 2020 is the preferred coagulant used at the Plant, and ferric chloride is used for coagulation during periods when additional TOC removal is needed. Ferric chloride is typically fed as a co-coagulant with DelPac 2020 from June through October when raw water TOC concentrations are higher, this relationship is illustrated in **Figure 5** below. When DelPac 2020 and ferric chloride are fed independently of each other, peak dosing rates exceed 150 mg/l. However, dosing rates do not exceed 100 mg/l when fed as co-coagulants. The peak dosing rates for this analysis for DelPac 2020 and ferric chloride during co-coagulation are assumed to be in the 95th percentile.

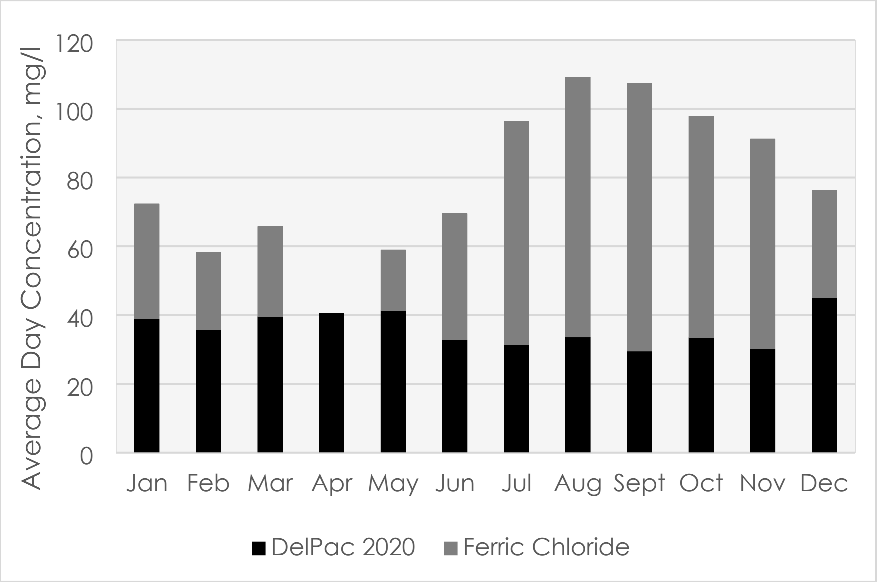


Figure 5. 2010-2017 Coagulant Usage

3.2.3 Waste Filter Backwash

The focus of this evaluation was to determine additional capacity requirements needed to handle peak Waste Filter Backwash Water (Backwash) volumes and to determine the gallons and pounds of dry solids removed in the Backwash water daily. The Backwash data shows widely varying gallons per day, as shown in **Figure 6**.

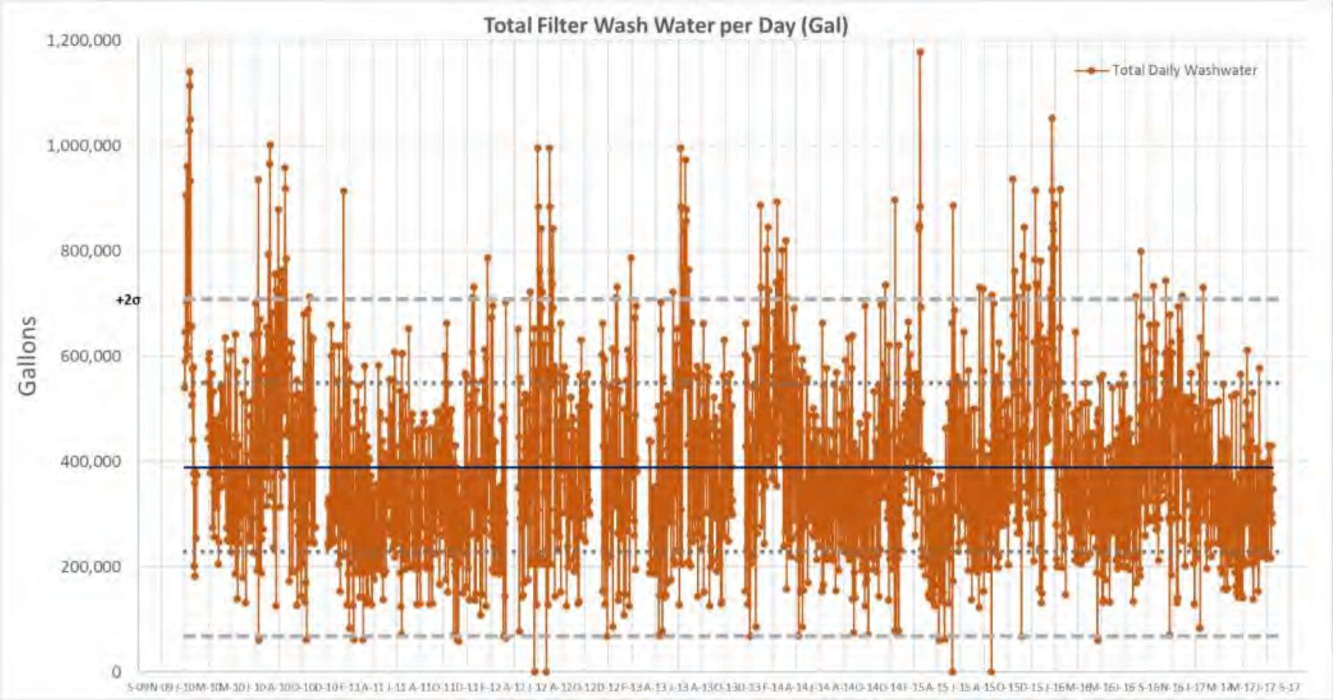


Figure 6. 2010-2017 Daily Backwash Volume

The minimum, maximum, average, and 95th percentile for daily Backwash volumes is provided in Table 3 below.

Table 3. 2010-2017 Total Daily Backwash Water Usage

	Minimum	Average	95th Percentile	Maximum
Waste Filter Backwash Water, Gallons	58,104	389,029	674,549	1,176,698

A percentile analysis was used to help determine typical peak Backwash volumes experienced at KRS1, and is illustrated in **Figure 7**. A more detailed analysis of Backwash volumes is provided in **Appendix F**.

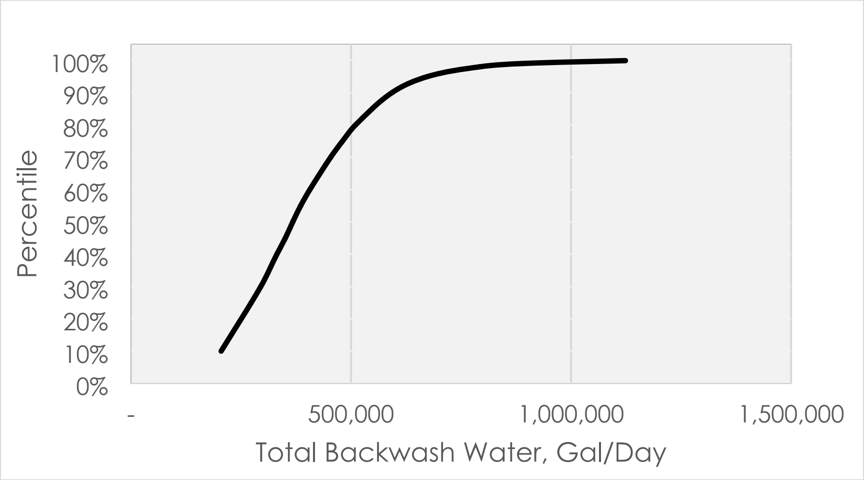


Figure 7. 2010-2017 Total Daily Backwash Water Percentile Analysis

A Backwash percent solids concentration of 0.1 percent (Microbac Laboratories) is used to calculate the pounds of solids in the Backwash water. A summary of solids removed in the Backwash water is provided in **Table 4** below.

Table 4. 2010-2017 Residuals Production from Backwash Water

	Minimum	**Average**	**95th Percentile**	**Maximum**
Gallons	58,104	389,029	674,549	1,176,696
Dry Solids, lb/day at 0.1%	485	3,245	5,626	9,814

4.0 RESIDUALS PRODUCTION ESTIMATES

Daily solids generation at KRS1 is from 1) coagulation/sedimentation sludge, and 2) solids removed by Waste Filter Backwash Water. Limited plant data is available for residual solids produced from coagulation/sedimentation sludge. A theoretical approach was used to calculate dry pounds of solids produced by this sludge stream using 2010-2017 plant data.

Theoretical solids production is based on a TSS/NTU ratio of 1.5, a solids production factor of 0.27 lbs of solids per lb of alum fed and 0.66 lbs of solids per lb of ferric chloride fed, a solids production factor of 1.0 lb of solids per lb of polymer added,1.0 lb of solids per lb of TSS removed, and 1.0 lb of solids per lb of TOC removed. The equation for the solids estimate is:

Solids (lb/day) = (Q mgd)x(1.5 x NTU + 0.27 x Al + 0.66 x FeCl3 + 1.0 x Polymer + 1.0 x TOC Removed) x 8.34

Where,

Solids =Residual solids produced daily (lbs/day),

Q =Water Flow (MGD)

NTU =Source-water turbidity

Al =DelPac 2020 dose (mg/l)

FeCl3 = Ferric Chloride dose (mg/l) x 0.36% FeCl3

Polymer =Polymer Dose (mg/l)

TOC = Total Organic Carbon removed

Theoretical solids production estimates discussed in Section 4.1 below are calculated using minimum, average, maximum, and 95th percentile values from 2010-August 2017 MORs for these parameters.

Daily solids generated by Waste Filter Backwash Water is calculated separately as discussed in Section 3.2.3 and is included in the total dry pounds per day estimate in Section 4.1 below.

4.1 EXISTING RESIDUAL SOLIDS PRODUCTION RATES

KRS1 experiences a wide range of solids production rates throughout the year. High solids production rates seem to occur during times that ferric chloride is fed simultaneously with DelPac 2020 to handle raw water TSS and TOC spikes. To quantify this variability, solids production estimates have been broken down into the following scenarios:

- Scenario 1: DelPac 2020 fed as only coagulant
- Scenario 2: DelPac 2020 and ferric chloride fed simultaneously

The minimum, average, and maximum solids production rates for Scenario 1 and Scenario 2 were calculated and compared to reported solids production rates in the Master Plan. These comparisons are presented in **Tables 5** and **6** below.

Table 5. Solids Production Comparison with Master Plan – Scenario 1: DelPac 2020 Only

	Minimum		Average		Maximum	
	Master Plan	Stantec	Master Plan	Stantec	Master Plan	Stantec
Dry lbs/day	Unknown	324	9,207	12,462	126,498	150,275

It is unclear in the Master Plan if the solids production estimates above account for TOC removed and polymer usage at the Plant. Stantec's estimates in **Table 5** include solids generation due to TOC removal and polymer usage in addition to raw water TSS and DelPac 2020 solids production.

Table 6. Solids Production Comparison with Master Plan – Scenario 2: Both Coagulants

	Minimum		Average		Maximum	
	Master Plan	**Stantec**	**Master Plan**	**Stantec**	**Master Plan**	**Stantec**
Dry lbs/day	1,796	325	14,261	14,741	137,915	154,197

Only dry solids from coagulation/sedimentation sludge are compared with values in the Master Plan because it is unclear if the Master Plan solids production estimates include solids from the Waste Filter Backwash Water. Stantec's solids production analysis presented in **Tables 5** and **6** above are believed to be based on a larger range of data than the Master Plan. The Master Plan solids production estimates for Scenario 1 is reportedly based on a 12-month period in 2015 and Scenario 2 is based on June through October 2015.

Table 7 provides a summary of average day and 95th percentile solids production for each chemical feed scenario.

Table 7. 2010-2017 Solids Production Estimates

	Scenario 1	Scenario 2
Average Day	12,462	14,741
95th Percentile	70,328	79,463

Table 8 provides the annual average day and max week for daily solids production. These values were calculated from daily solids production estimates for 2016-2017 using daily MOR data and the solids production equation in Section 4.0 above. Calculations for this analysis are provided in **Appendix G**.

Table 8. 2016-2017 Solids Production Estimates

	Average Day	Max 7-Day Average	Peaking Factor
Dry lbs/day	12,908	69,816	5.41

A comparison of the average day and 95th percentile estimates in **Table 7** to the average day and max 7-day averages in **Table 8** highlights that a typical average day and max week will follow Scenario 1, where DelPac 2020 is fed as the only coagulant.

Although the data shows that solids production at KRS1 will typically follow Scenario 1 estimates, it is recommended that Scenario 2 solids production estimates be used to avoid future solids handling systems being undersized. This approach will help ensure that the Plant has adequate capacity to handle solids production expected when ferric chloride is used.

4.2 DESIGN RESIDUAL PRODUCTION RATES

This section's intent is to identify appropriate design criteria for development of residuals management options for KRS1. The design criteria will need to consider existing and future processes at KRS1. This approach aims to accommodate the existing Aldrich Units and the expected future sedimentation basins and filter building.

4.2.1 Dry Solids

To capture and incorporate the variability in solids production at KRS1 into the design criteria, a range of average day and max day projections are considered for Scenarios 1 and 2. Due to the lack of KRS1 solids production data, theoretical calculations are relied on for these estimates.

A summary of estimated dry solids production rates is provided in **Table 10** below, by combining the estimated Waste Filter Backwash Water solids plus the settled sludge solids from calculated projections. It should be noted that **Table 10** may be conservative based on an assumption that both Backwash and settled sludge operations occur simultaneously. Detailed calculations supporting the settled sludge production results are provided **Appendix H**.

The average settled sludge projection in **Table 10** is for Scenario 1(DelPac 2020), and the max settled sludge projection is defined as the 95% day for Scenario 2 (DelPac 2020 + Ferric) at 45 MGD (see pg H-4).

Table 10. Design Dry Residual Solids Production

	Average (dry lbs/day)	Max (dry lbs/day)
Settled Sludge	12,462	104,919
Backwash Water Sludge	3,245	9,814
Total Sludge	15,707	114,733

4.2.2 Sludge Volume

Daily sludge volumes vary significantly at KRS1, and data is not readily available for the current volume of sludge wasted from each Aldrich Unit. Therefore, the design sludge volumes in **Table 11** are based on the design residual solids production estimates in **Table 10** at a range of existing and expected percent solids concentrations.

A summary of average and max sludge volumes for the calculated dry pounds in **Table 10** above at existing, expected, and recommended design percent concentrations is provided below.

Table 11. Design Sludge Volume Production

	Existing	Expected[1]	Recommended
Percent Solids, %	0.2%	1.5%	1.0%
Avg. Settled Sludge Volume, MGD	0.732	0.0977	0.146
Max Settled Sludge Volume, MGD	6.17	0.822	1.23

[1] Refers to the future expected condition with new sedimentation basins and filters as identified in the Master Plan

It is recommended that backwash cycles and sludge blowdown be monitored by operations staff to prevent the two cycles from occurring simultaneously until future gravity thickeners are installed. KRS1 will continue to have additional backup/emergency sludge storage capacity in Lagoon's 1-3 to act as an equalization basin during peak hours when the existing WWHT volume may be exceeded.

4.2.3 Backwash Water Volume

The design Backwash volume will be used to evaluate the existing capacity of the two existing Wash Water Holding Tanks at KRS1 and to determine additional capacity needs. The summary of Backwash volume data from 2010-2017 is shown in **Table 12** with the variations in volume to be handled in the near term before future plant sedimentation basin renovation is completed. The Wash Water Holding Tanks and any additional facilities need to provide the required detention time necessary to 1) settled out the solids, and 2) produce a clean decant to be discharged to the Kentucky River.

Table 12. 2010-2017 Total Daily Backwash Water Flows

	Minimum	Average	95th Percentile	Maximum
Waste Filter Backwash Water, Gal/day	58,104	389,029	674,549	1,176,698

4.2.4 Summary of Design Criteria

Future solids handling facilities must be able to handle the current residuals operations (Near-Term) and future residuals expected from a potential plant renovation with traditional sedimentation basins in lieu of the Aldrich units (Long-Term). For this study, the Near-Term parameters are based on the Waste Filter Backwash Water data and the Long-Term parameters are based on the future sludge projections.

4.2.4.1 Near-Term Design Parameters

The Near-Term residuals parameters are based on the current plant residuals operations, i.e. Waste Filter Backwash Water (Backwash) from Aldrich Units. The volume parameters are derived from the filter backwash data. The dry pounds of solids per day are calculated based on an assumed % solids concentration from the field testing. The limited % solids data from filter backwash showed 0.1% solids from the Aldrich Units to the WWHTs. It is recommended that plant operations staff monitor the waste sludge operations, especially if both filter backwash and sludge blowdown occur simultaneously, and it is suggested to perform backwash separately from the sludge waste operations. This will reduce loading and optimize sizing of the future gravity thickeners. A summary of Near-Term design parameters is provided in **Table 13**.

The wide range in dry solids per day results from the range of assumed % solids in the Backwash. It is more likely that the % solids from the current Backwash operations is expected to be in the range of 0.1% to 0.2% going to the WWHTs. Supporting Backwash data is provided in **Appendix F**.

Table 13. Near-Term Design Parameters

Vol (gal/day) From Backwash Data		Calculated Pounds Dry Solids per Day for % Solids			
		0.10%	0.20%	0.50%	0.75%
Min	**58,104**	**485**	**969**	2,423	3,634
50%	**367,659**	**3,066**	**6,133**	15,331	22,997
Average	**389,029**	**3,245**	**6,489**	16,223	24,334
90%	**593,143**	**4,947**	**9,894**	24,734	37,101
95%	**674,549**	**5,626**	**11,251**	28,129	42,193
Max Day	**1,176,698**	**9,814**	**19,627**	49,068	73,602

Mass balance schematics for Near-Term residuals parameters are provided in **Appendix I**.

4.2.4.2 Long-Term Design Parameters

Long-Term design parameters assume that the existing Aldrich Units will be replaced with conventional sedimentation basins and a new filter building. These parameters are also based on the recommendation that the plant staff backwash separately from the sludge waste operation. A summary of Long-Term design parameters is provided in **Table 14**. The limited % solids data from the current sludge waste operations showed 0.2% solids in the sludge from the Aldrich Units. However, it is likely that future sedimentation basin improvements would produce sludge in the range of 0.5% to 1.5%. The projections include estimated solids from future sedimentation basins and future filters. Supporting calculations for **Table 14** are provided in **Appendix H**.

Table 14. Long-Term Design Parameters

	Dry Pounds per Day (Backwash & Sludge)	Calculated Volume (gal/day) for % Solids			
		0.20%	0.50%	1.00%	1.50%
Minimum at 7.4 MGD (Scenario 1)	**368**	22,062	8,825	4,412	2,942
Average Day at 22.3 MGD (Scenario 1)	**13,555**	812,650	325,060	162,530	108,353
Average Day at 22.3 MGD (Scenario 2)	**15,834**	949,281	379,712	189,856	126,571
Max 7-day Average (all scenarios)	**80,601**	4,832,194	1,932,878	966,439	644,293
Average (all scenarios)	**14,832**	889,209	355,683	177,842	118,561
95% Day 34.1 MGD (Scenario 2)	**82,021**	4,917,326	1,966,930	983,465	655,643
95% at 45 MGD (Scenario 2)	**108,297**	6,492,626	2,597,050	1,298,525	865,683
Max Day at 42.2 MGD (Scenario 2)	**159,366**	9,554,317	3,821,727	1,910,863	1,273,909
Max Day at 45 MGD (Scenario 2)	**170,085**	10,196,942	4,078,777	2,039,388	1,359,592

Sludge projections in **Table 14** above for 95% Day at 34.1 MGD describe the representative 95% day at KRS1 for Scenario 2 (DelPac 2020 + Ferric) based on 95% flow and 95% parameters, and is within 2% of the Max 7-day Average for all scenarios. Mass balance schematics for Long-Term residuals parameters is provided in **Appendix I**.

4.2.4.3 Recommended Design Parameters

From the range of Backwash volumes and estimated % solids, we recommend the Near-Term improvements be capable of meeting the following rounded design parameters in **Table 15**.

Table 15. Recommended Near-Term Design Parameters

Average Day	400,000 gal/day	6,500 lbs/day DS @ 0.2%
95th percentile	675,000 gal/day	11,300 lbs/day DS @ 0.2%
Maximum Day	1,180,000 gal/day	19,700 lbs/day DS @ 0.2%

The Near-Term parameters as estimated do not include volume or pounds of solids calculation from the current sludge waste (blowdown), since no available data exists. However, the 95% and Maximum Day volume and pounds of solids should provide conservative values with added capacity to accommodate the sludge waste. We recommend monitoring the Backwash and sludge waste operations, if both occur simultaneously. The existing lagoons could provide backup capacity (if needed).

For the Long-Term design parameters, we recommend utilizing the total sludge calculations and an assumed range of expected percent solids from future plant improvements to include sedimentation basins and filters. The recommended Long-Term rounded design parameters are shown in **Table 16.**

Table 16. Recommended Long-Term Design Parameters

Average Day (Scenario 1)	325,000 gal/day	13,600 dry lbs/day @ 0.5%
Average Day (Scenario 2)	380,000 gal/day	15,800 dry lbs/day @ 0.5%
Max 7-Day Average	966,000 gal/day	80,600 dry lbs/day @ 1.0%
95th percentile at 34.1 MGD	984,000 gal/day	82,000 dry lbs/day @ 1.0%
95th percentile at 45 MGD	1,230,000 gal/day	108,300 dry lbs/day @ 1.0%

Notes: Scenario 1 = DelPAC only; Scenario 2 = DelPAC + Ferric

The percent solids for the Long-Term total sludge calculations above utilize the expected percent solids concentration from the future sedimentation basins. The sedimentation basins will improve the percent solids removal from the treated water leading to less solids in settled water and ultimately a cleaner backwash waste water. The Long-Term mass balance schematics provided in **Appendix I** use a 0.1% solids concentration to estimate expected backwash waste flows.

The estimated Maximum Day at the plant ultimate capacity of 45 MGD could produce approximately 170,000 dry lbs/day and up to 2,000,000 gal/day with solids at 1.0%. However, that assumes simultaneous sludge wasting from future sedimentation basins and future filters, which may be overly conservative.

The evaluation of Near-Term improvements and Long-Term Master Plan options should consider the range of residual projections under both Near-Term and Long-Term assumptions.

APPENDIX A
NPDES PERMIT

KPDES

KENTUCKY POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT

AUTHORIZATION TO DISCHARGE UNDER THE KENTUCKY POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT NO.: KY0091049

AGENCY INTEREST NO.: 1063

Pursuant to Authority in KRS 224,

Kentucky American Water
2300 Richmond Rd
Lexington, KY 40502

is authorized to discharge from a facility located at

Kentucky River Station
6300 Cedarcreek Ln
Lexington, Fayette County, Kentucky

to receiving waters named

Kentucky River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in this permit.

This permit shall become effective on September 1, 2017.

This permit and the authorization to discharge shall expire at midnight, August 31, 2022.

July 27, 2017

Date Signed

Sara J Anderson

Peter T. Goodmann, Director
Division of Water

DEPARTMENT FOR ENVIRONMENTAL PROTECTION
Division of Water, 300 Sower Blvd, Frankfort, Kentucky 40601

Printed on Recycled Paper

1. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1.1. Compliance Monitoring Locations (Outfalls)

The following table lists the outfalls authorized by this permit, the location and description of each, and the DOW assigned KPDES outfall number:

TABLE 1.

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall
002	External	37°54’8.7”	84°22’39.4”	Kentucky River	Filter Backwash Water and Lagoon Supernatant

1.2. Effluent Limitations and Monitoring Requirements

Beginning on the effective date and lasting through the term of this permit, discharges from Outfall 002 shall comply with the following effluent limitations:

TABLE 2.

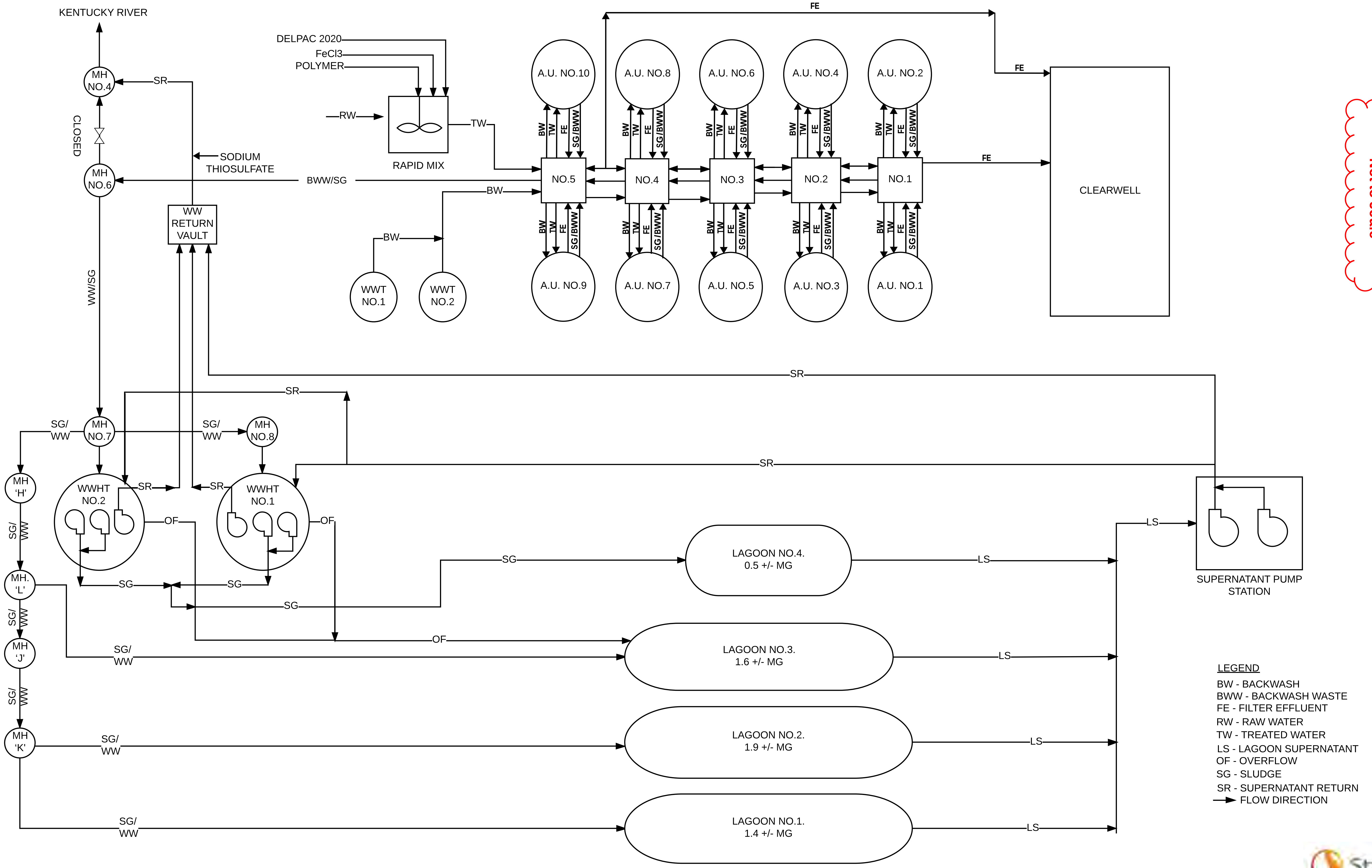
EFFLUENT LIMITATIONS								MONITORING REQUIREMENTS	
Effluent Characteristic	Units	Loadings (lbs./day)		Concentrations				Frequency	Sample Type
		Monthly Average	Daily Maximum	Minimum	Monthly Average	Daily Maximum	Maximum		
Flow	MGD	Report	Report	N/A	N/A	N/A	N/A	1/Month	Instantaneous
Total Suspended Solids	mg/l	N/A	N/A	N/A	30	50	N/A	1/Month	Grab
Total Residual Chlorine	mg/l	N/A	N/A	N/A	0.011	0.019	N/A	1/Month	Grab
Total Recoverable Aluminum	mg/l	N/A	N/A	N/A	Report	Report	N/A	1/Month	Grab
Total Recoverable Iron	mg/l	N/A	N/A	N/A	Report	Report	N/A	1/Month	Grab
Total Phosphorus	mg/l	N/A	N/A	N/A	Report	Report	N/A	1/Month	Grab
pH	SU	N/A	N/A	6.0	N/A	N/A	9.0	1/Month	Grab
Monitoring for Total Recoverable Aluminum is only required if aluminum-based coagulants are used.									
Monitoring for Total Recoverable Iron is only required if iron-based coagulants are used.									
Monitoring for Total Phosphorus is only required if phosphates are used in the distribution system and if distribution system water is present in the discharge.									

1.3. Standard Effluent Requirements

The discharges to Waters of the Commonwealth shall not produce floating solids, visible foam or a visible sheen on the surface of the receiving waters.

APPENDIX B
EXISTING PLANT RESIDUALS SCHEMATICS

Reduced Size Print
Not to Scale



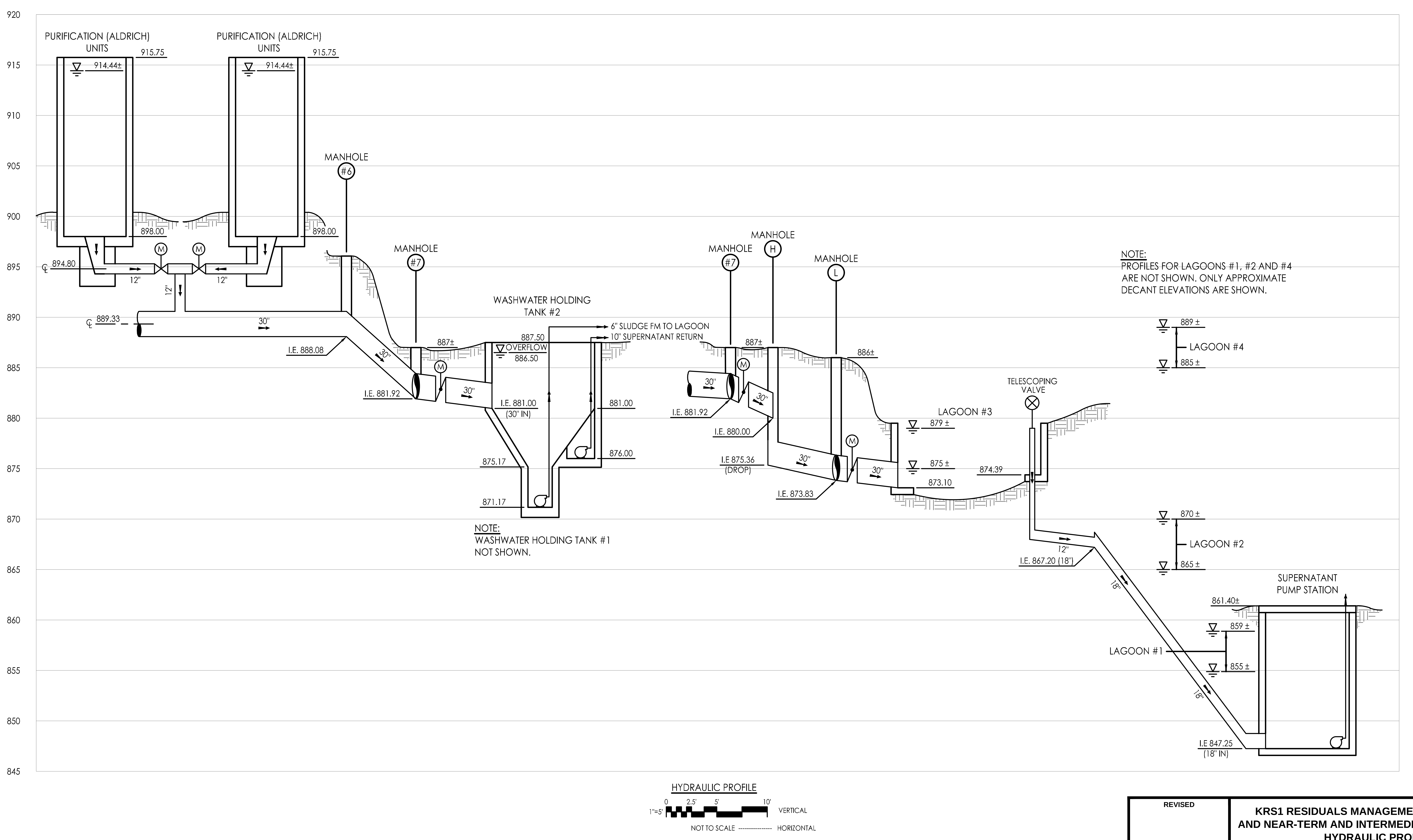
LEGEND

BW - BACKWASH
BWW - BACKWASH WASTE
FE - FILTER EFFLUENT
RW - RAW WATER
TW - TREATED WATER
LS - LAGOON SUPERNATANT
OF - OVERFLOW
SG - SLUDGE
SR - SUPERNATANT RETURN
→ FLOW DIRECTION

Stantec

KRS1 RESIDUALS MASTER PLAN
PROCESS SCHEMATIC - EXISTING PLANT

Reduced Size Print
Not to Scale



REVISED

KRS1 RESIDUALS MANAGEMENT MASTER PLAN
AND NEAR-TERM AND INTERMEDIATE IMPROVEMENTS
HYDRAULIC PROFILE

KENTUCKY AMERICAN WATER COMPANY
LEXINGTON, KENTUCKY

Stantec

STANTEC CONSULTING
SERVICES INC.
3052 BEAUMONT CENTRE CIRCLE
LEXINGTON, KENTUCKY 40513
(859) 422-3000
www.stantec.com

DRAWN BY: JFBH
DESIGNED BY: - **DATE:** –
CHECKED BY: - **PROJECT:** 175667010 **SCALE:** N.T.S.

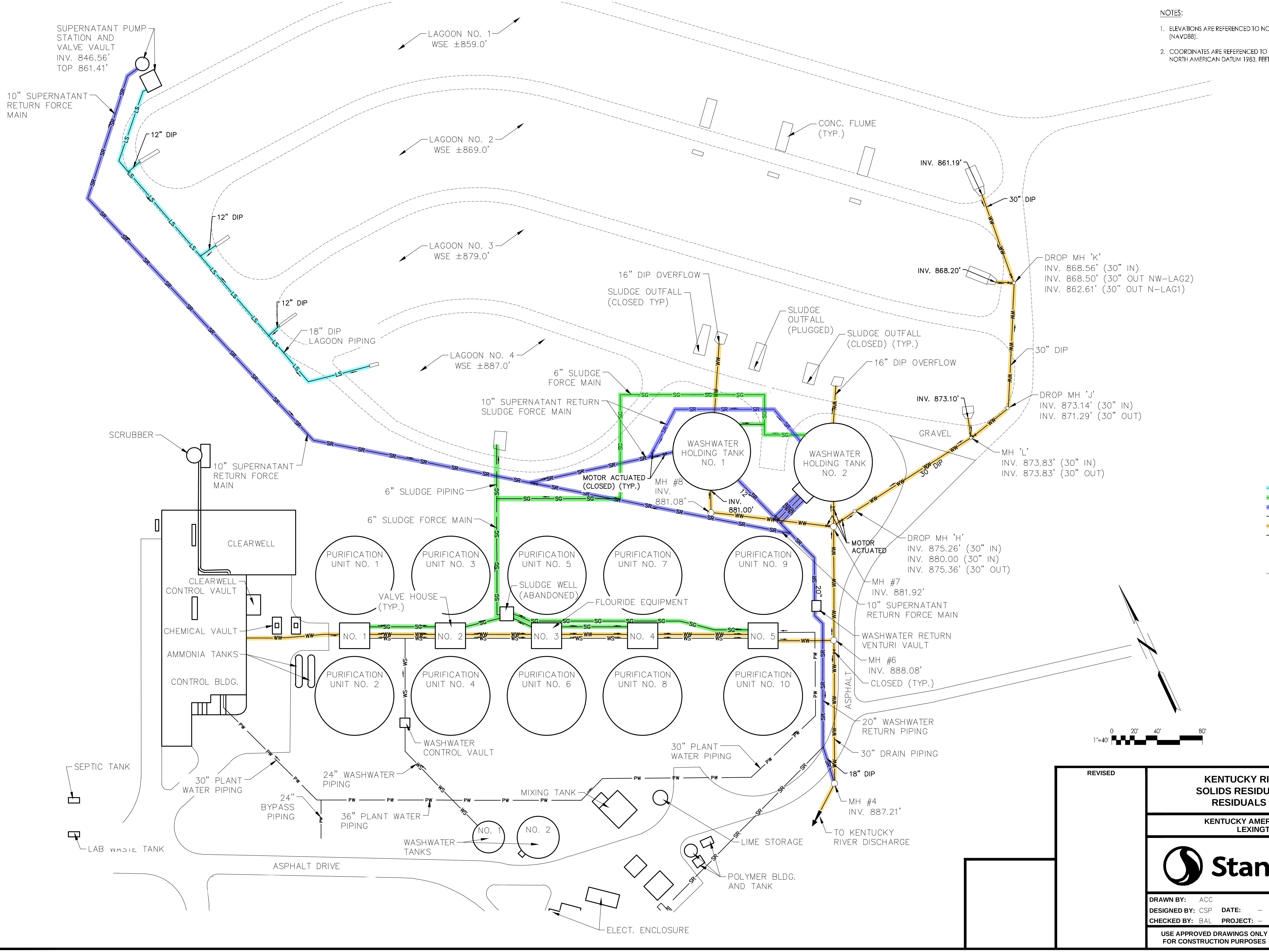
USE APPROVED DRAWINGS ONLY
FOR CONSTRUCTION PURPOSES

00G05

NOTES:

1. ELEVATIONS ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. COORDINATES ARE REFERENCED TO KENTUCKY STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM 1983, FEET.

Reduced Size Print
Not to Scale



LEGEND

LS	LAGOON SUPERNATANT
SG	SLUDGE
SR	SUPERNATANT RETURN
PW	PLANT WATER
WW	WASHWATER WASTE
WS	WASHWATER SUPPLY
→	FLOW DIRECTION
⋈	VALVE
○	MANHOLE
- - - -	EDGE OF GRAVEL

PLOT DATE: 11/07/2017 USER: HOWARD, JASON
\\US1243-F01\WORKGROUP\1756\ACTIVE\175667010\TECHNICAL_PRODUCTION\DRAWING\SHEET_FILES\67010G-00-03.DWG

REVISED

KENTUCKY RIVER STATION NO. 1
SOLIDS RESIDUALS IMPROVEMENTS
RESIDUALS SITE PIPING PLAN

KENTUCKY AMERICAN WATER COMPANY
LEXINGTON, KENTUCKY

Stantec
STANTEC CONSULTING SERVICES INC.
3052 BEAUMONT CENTRE CIRCLE
LEXINGTON, KENTUCKY 40513
(859) 422-3000
www.stantec.com

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DESIGNED BY: CSP DATE: –
CHECKED BY: BAL PROJECT: – SCALE: 1"=50'

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DRAWING NO. 3

APPENDIX C
WATERSOLVE DEWATERING REPORT

DEWATERING PERFORMANCE TRIAL
STANTEC CONSULTING SERVICES INC
KRS1 PROJECT

For:
Sam Lee
Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, KY 40513

By:
WaterSolve, LLC
5031 68th St., SE
Caledonia, MI 49316
www.gowatersolve.com
616-575-8693

August 31, 2017

1. Scope of Work

WaterSolve, LLC was tasked to perform a Geotube® dewatering performance trial and cone tests on samples provided by Stantec Consulting Services. The objectives of these dewatering trials were to identify chemical conditioning program(s), identify polymer flocculent(s), and dosing rate(s) for a potential Geotube® dewatering application. The objectives of subsequent cone tests were to measure total solids (TS) of the flocculated, contained, and dewatered residual after passage through the GT500D Geotube® fabric.

2. Materials & Methods

3 five gallon samples (x2 sludge samples, x1 dewatered cake sample) collected from the Kentucky River Drinking water treatment plant were received at WaterSolve's Laboratory (Caledonia, MI) on August 29, 2017. Samples of residual were homogenized and 150-mL samples were placed in graduated, glass jars.

Several polymers (emulsions) were "made-down" at a 0.5% concentration for this dewatering trial. Polymer (6.7 to 20-ppm) was added to a sample with a 1-mL plastic syringe and moderately tumbled five to seven times.

Observations of water release rate, water clarity, and flocculent appearance were recorded on appropriate data sheets (Appendix A). Polymer(s) that flocculated and dewatered these residuals most effectively were re-evaluated with lower doses in order to isolate the most efficient dewatering and flocculating polymer(s). A Hach DR 2800 was used to measure TSS (Total Suspended Solids) after the samples were poured through the Geotube® GT500D fabric with a measurable limit of up to 750-mg/L suspended solids.

Percent total solids (dry weight) of the initial residual samples and dewatered cake sample (captured on GT500D Geotube® fabric) were measured.

3. Results

Chemical conditioning with Solve 161 was determined to flocculate and dewater the residual most effectively compared to the other products (Appendix A). Water release volume and flocculent appearance were excellent when a 0.2-mL dose of Solve 161 (6.7-ppm, 5.6-lbs/dry ton) was added to a 150-mL sample.

The provided sludge sample sample was 0.24-percent dry weight solids. When a 1,000-mL test sample was conditioned with Solve 161 and passed through the Geotube® GT500D fabric, percent solids increased to 7.0-percent after sixty minutes of drying time (Appendix C). From this 1,000-mL conditioned sample, 650-mL and 990-mL of water was released in minute and sixty minutes, respectively, after passage though the fabric. The TSS of the filtrate was 6-mg/L.

4. Recommendations

We recommend a product application of Solve 161 (5.6-lbs/dry ton dose) for dewatering the residuals in a Geotube® application in order to pass a paint filter test for subsequent disposal. Solve 161 is required to be made-down at 0.5-percent with a polymer make-down unit or aged in batch/feed tanks prior to injection into the residual line. Moderate to high mixing energy is required between the polymer introduction points and the Geotube® containers (e.g., three to five bends in the discharge line and/or inline static mixers).

Expected time to being able pass a Paint Filter Test is unpredictable in a Geotube® container from these bench-scale experiments. An onsite or laboratory hanging bag or Geotube® dewatering trial (GDT) may be used and is recommended if the timeline for achieving project goals of dry weight solids and if Geotube® filtrate characteristics are in question for this application. Additional dewatering evaluations over time are recommended if project objectives for consolidation are greater than passing a Paint Filter Test.

Due to potential variability of the material, daily on-site testing and chemical conditioning verification are recommended during pumping operations.

WaterSolve LLC does not make any implied warranty of any kind. Customer is solely responsible for determining the means and methods of the Product(s) use and whether or not Product(s) is suitable or desirable for Customer's intended uses. Customer agrees not to make any claim against Watersolve LLC based upon, or arising out of or relating to any advice or any technical information given to the Customer by Watersolve LLC for information purposes only and shall indemnify and hold Watersolve LLC harmless from any and all claims asserted by any third party arising out of or related to the Customer's use of Watersolve LLC's Product(s). Any technical information if given by Watersolve LLC to the Customer is without any consideration and use of such information by Customer be at consumer's own risk and shall not relieve the Customer from ultimate liability to ensure Product(s) are used properly per Project and Product(s) specifications.

Appendix A – Dewatering Sheets

Page _____ of _____

WaterSolve, LLC

Clearly thinking about your water treatment!

DEWATERING PERFORMANCE TRIAL

Date: 8/30/17
Analyst: Don W

Customer: STANTEC / KRSI
Location:
Equipment in Service:

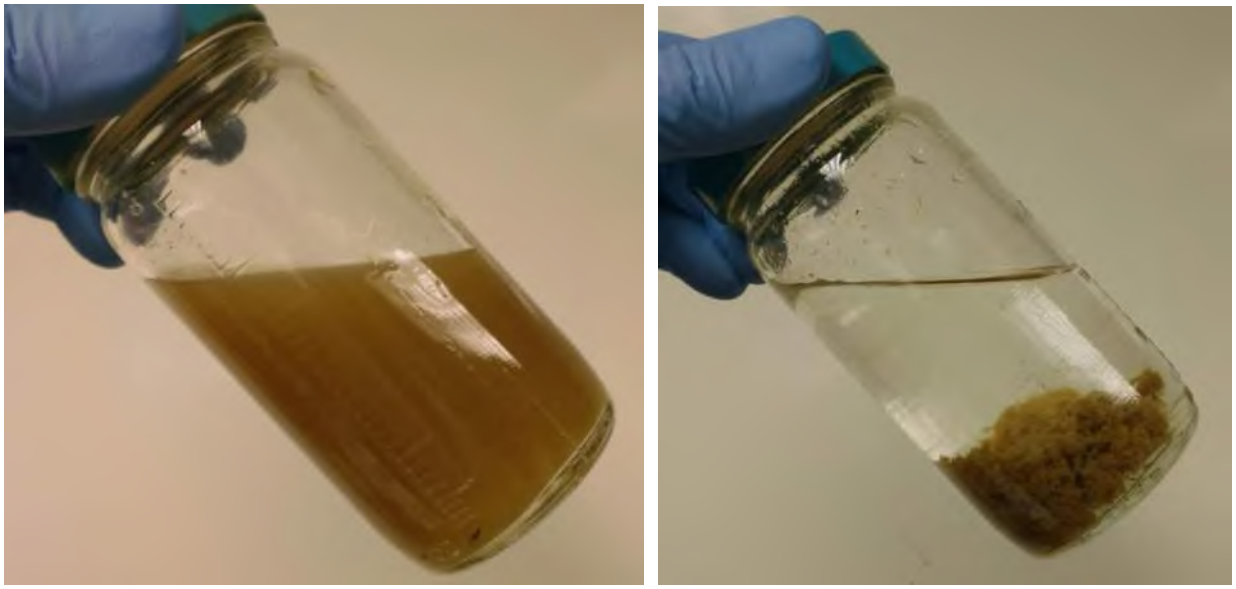
1=Best *6=Worst*

Jar Number	Polymer Name	Polymer Dosage (mL)	Sample Size (mL)	Water Rel. Rate (1 - 6)	Water Clarity (1 - 6)	Floc Appearance (1 - 6)	Comments
	Polymer make-down concentration = 0.5 % Dilution of test sample = Ø		SLUDGE SAMPLE #2				
1	9248	0.2mL	150mL	2-3	1-2	2-3	
2	9248	0.4mL	150mL	1-2	1-2	1-2	- good floc for geotube application
3	9248	0.6mL	150mL	1-2	1-2	1-2	- no improvement from 0.4mL dose
4	9330	0.2mL	150mL	1-2	1-2	1-2	↓
5							
6	151	0.2mL	150mL	2	1-2	2	
7	153	0.2mL	150mL	1-2	1-2	1-2	
8	154	0.2mL	150mL	1-2	1-2	1-2	
9	161	0.2mL	150mL	1-2	1-2	1	→ solve 161 Best product
10	162	0.2mL	150mL	1-2	1-2	1-2	
11	163	0.2mL	150mL	1-2	1-2	2	
12	164	0.2mL	150mL	1-2	1-2	2	
13	2210A	0.2mL	150mL	2	1-2	2	
14	2230C	0.2mL	150mL	1-2	1-2	2	
15	2290	0.2mL	150mL	3	1-2	3	
16	9330	0.2mL	150mL	1-2	1-2	1-2	
17	9350	0.2mL	150mL	2	1-2	2	
18							
19	161	0.1mL	150mL	2-3	1-2	2-3	
20	161	0.2mL	150mL	1-2	1-2	1	→ Recommended DOSE = 6.7 ppm
21	161	0.3mL	150mL	1-2	1-2	1	
22							
23							
24							
25							
26							
27							
28							

Cone Test / RDT: 1000 mL sample conditioned with 1.3 mL of solve 161 poured thru GT500D Geotube® filter.

Filtrate Quality: TSS- 6 mg/L Turbidity-__________ NTU Filtrate collected@ 1min: 690mL 60min: 990mL

Appendix B – Photographs



One hundred fifty milliliter sample prior to chemical conditioning (Left). One hundred fifty milliliter sample conditioned with Solve 161 (Right).

A one thousand milliliter sample conditioned with Solve 161 was poured through the GT500D Geotube® fabric. The captured cake (Left) and filtrate (Right) are shown above.

Appendix C – Percent Solids

Total Solids Determination - Percent Dry Weight

Customer Name/Application STANTEC/KRSI

Date 8/29/17 Technician Dan W Oven Temperature 105°C

Sample ID SLUDGE #1 Dish Number 2 Dilution 0

Dish (dry) = 47.337 g Dish, Sample (wet) = 146.089 g Dish, Sample (dry) = 47.574 g

Dish, sample (wet) – Dish (dry) = 98.752 (A) Dish, sample (dry) – Dish (dry) = 0.237 (B)

Total Solids B ÷ A x 100 = 0.24 % Dry Weight Solids

Sample ID SLUDGE #2 Dish Number 3 Dilution 0

Dish (dry) = 47.060 g Dish, Sample (wet) = 156.651 g Dish, Sample (dry) = 47.357 g

Dish, sample (wet) – Dish (dry) = 109.591 (A) Dish, sample (dry) – Dish (dry) = 0.297 (B)

Total Solids B ÷ A x 100 = 0.27 % Dry Weight Solids

Sample ID CAKE SAMPLE Dish Number 4 Dilution 0

Dish (dry) = 48.240 g Dish, Sample (wet) = 144.012 g Dish, Sample (dry) = 85.841 g

Dish, sample (wet) – Dish (dry) = 95.772 (A) Dish, sample (dry) – Dish (dry) = 37.601 (B)

Total Solids B ÷ A x 100 = 39.3 % Dry Weight Solids

Sample ID 60 MIN CONE TEST CAKE Dish Number 1 Dilution 0

Dish (dry) = 48.240 g Dish, Sample (wet) = 68.063 g Dish, Sample (dry) = 49.632 g

Dish, sample (wet) – Dish (dry) = 19.823 (A) Dish, sample (dry) – Dish (dry) = 1.392 (B)

Total Solids B ÷ A x 100 = 7.0 % Dry Weight Solids

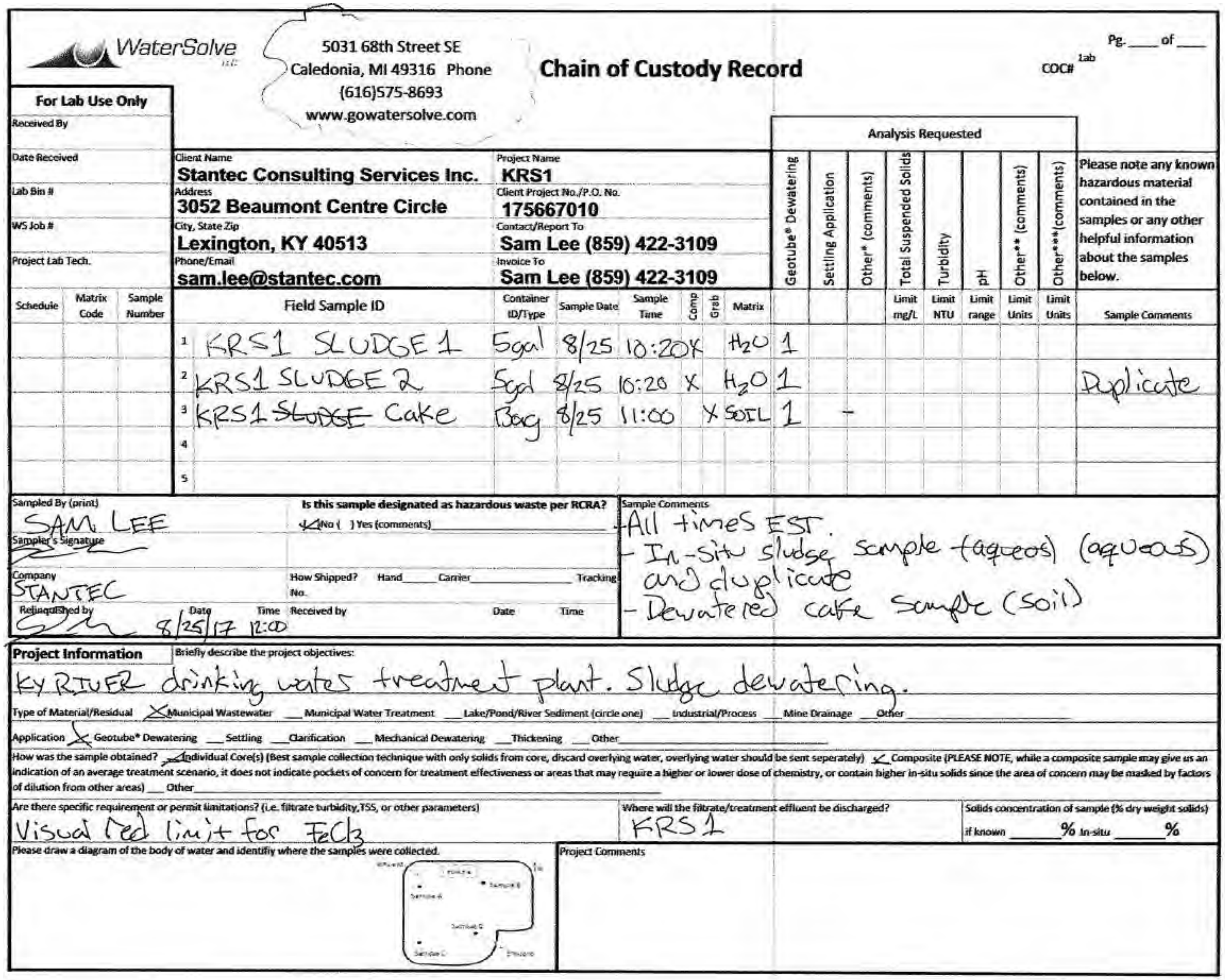
Sample ID______ Dish Number ______ Dilution ______

Dish (dry) = ______ g Dish, Sample (wet) = ______ g Dish, Sample (dry) = ______ g

Dish, sample (wet) – Dish (dry) = ______ (A) Dish, sample (dry) – Dish (dry) = ______ (B)

Total Solids B ÷ A x 100 = ______ % Dry Weight Solids

Appendix D – CHAIN OF CUSTODY RECORD SDS - Available upon request.



WaterSolve LLC

5031 68th Street SE
Caledonia, MI 49316 Phone
(616)575-8693
www.gowatersolve.com

Chain of Custody Record

COC# lab

Pg. ____ of ____

For Lab Use Only

Received By
Date Received
Lab Bin #
WS Job #
Project Lab Tech.

Client Name: **Stantec Consulting Services Inc.**
Address: **3052 Beaumont Centre Circle**
City, State Zip: **Lexington, KY 40513**
Phone/Email: **sam.lee@stantec.com**

Project Name: **KRS1**
Client Project No./P.O. No.: **175667010**
Contact/Report To: **Sam Lee (859) 422-3109**
Invoice To: **Sam Lee (859) 422-3109**

Please note any known hazardous material contained in the samples or any other helpful information about the samples below.

Schedule	Matrix Code	Sample Number		Field Sample ID	Container ID/Type	Sample Date	Sample Time	Comp	Grab	Matrix	Geotube® Dewatering	Settling Application	Other* (comments)	Total Suspended Solids	Turbidity	pH	Other** (comments)	Other***(comments)	Sample Comments
														Limit mg/L	Limit NTU	Limit range	Limit Units	Limit Units	
			1	KRS1 SLUDGE 1	5gal	8/25	10:20	X		H_2O	1								
			2	KRS1 SLUDGE 2	5gal	8/25	10:20	X		H_2O	1								Duplicate
			3	KRS1 ~~SLUDGE~~ Cake	Bag	8/25	11:00		X	SOIL	1	-							
			4																
			5																

Sampled By (print): SAM LEE
Sampler's Signature
Company: STANTEC
Relinquished by — Date: 8/25/17 Time: 12:00
Is this sample designated as hazardous waste per RCRA? [✓ No] ( ) Yes (comments)
How Shipped? Hand____ Carrier____ Tracking No.
Received by — Date — Time

Sample Comments:
- All times EST.
- In-situ sludge sample ~~(aqueos)~~ (aqueous) and duplicate
- Dewatered cake sample (soil)

Project Information

Briefly describe the project objectives: KY RIVER drinking water treatment plant. Sludge dewatering.

Type of Material/Residual [✓ Municipal Wastewater] ___ Municipal Water Treatment ___ Lake/Pond/River Sediment (circle one) ___ Industrial/Process ___ Mine Drainage ___ Other

Application [✓ Geotube® Dewatering] ___ Settling ___ Clarification ___ Mechanical Dewatering ___ Thickening ___ Other

How was the sample obtained? [✓ Individual Core(s)] (Best sample collection technique with only solids from core, discard overlying water, overlying water should be sent seperately) [✓ Composite] (PLEASE NOTE, while a composite sample may give us an indication of an average treatment scenario, it does not indicate pockets of concern for treatment effectiveness or areas that may require a higher or lower dose of chemistry, or contain higher in-situ solids since the area of concern may be masked by factors of dilution from other areas) ___ Other

Are there specific requirement or permit limitations? (i.e. filtrate turbidity,TSS, or other parameters): Visual Red limit for $FeCl_3$

Where will the filtrate/treatment effluent be discharged? KRS1

Solids concentration of sample (% dry weight solids) if known ____ % In-situ ____ %

Please draw a diagram of the body of water and identifiy where the samples were collected.

Project Comments

APPENDIX D
MICROBAC SOLIDS TESTING REPORT

MICROBAC®

CERTIFICATE OF ANALYSIS

7081757

Stantec Consulting Services - Lexington
Sam Lee
1409 North Forbes Road
Lexington, KY 40511

Date Reported	08/30/2017
Date Due	09/01/2017
Date Received	08/25/2017
Customer #	E4100

KRS1

Analysis	OOC	Qualifier	Result	Units	Min	Max	Method	Rpt Limit	Analysis Date	Tech
Sample: 01 **KRS1 Wash 1**									**Sampled** 08/24/2017 @ 15:20	
Sampled By Customer										
Moisture, Percent			99.9	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			880	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 02 **KRS1 Wash 2**									**Sampled** 08/24/2017 @ 15:30	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1900	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 03 **KRS1 Wash 3**									**Sampled** 08/24/2017 @ 15:40	
Sampled By Customer										
Moisture, Percent			99.9	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1000	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 04 **KRS1 Wash 4**									**Sampled** 08/24/2017 @ 15:50	
Sampled By Customer										
Moisture, Percent			99.9	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1200	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 05 **KRS1 002A**									**Sampled** 08/24/2017 @ 16:00	
Sampled By Customer										
Moisture, Percent			100	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			410	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 06 **KRS1 002B**									**Sampled** 08/24/2017 @ 16:05	
Sampled By Customer										
Moisture, Percent			100	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			370	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 07 **KRS1 Sludge 1**									**Sampled** 08/25/2017 @ 10:20	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1800	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL

MICROBAC

CERTIFICATE OF ANALYSIS

7081757

Stantec Consulting Services - Lexington
Sam Lee

Date Due 09/01/2017
Date Received 08/25/2017

KRS1

Analysis	OOC	Qualifier	Result	Units	Min	Max	Method	Rpt Limit	Analysis Date	Tech
Sample: 08 **KRS1 Sludge 2**							**Comp Start** 05/25/2017 @ 10:25		**Comp End** 08/25/2017 @ 10:25	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1700	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 09 **KRS1 Sludge 3**							**Comp Start** 05/25/2017 @ 10:30		**Comp End** 08/25/2017 @ 10:30	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1600	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL

Calculations

Analyte results that are indicated to have a “Calculated” method are derived from the calculation of the unrounded, raw analyte concentrations. The final, raw value is then rounded to the correct number of significant figures. Any apparent mathematical discrepancies are the result of the addition of unrounded results.

Qualifier Definitions

THIS REPORT HAS BEEN REVIEWED AND APPROVED FOR RELEASE: Lisa Martin

Lisa Martin A.M.

David Lester, Managing Director

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

For any feedback concerning our services, please contact David Lester, Managing Director at 502.962.6400 or Rob Crookston, President at president@microbac.com.

MICROBAC®

CHAIN OF CUSTODY

www.microbac.com

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Lexington, KY 40503
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812.424.0667 f

5309 Reidland Rd.
Paducah, KY 42003
270.898.3637 p
270.898.3666 f

100 Grand Vue Plaza, Ste. 22
Hazard, KY 41701
606.487.0511 p
606.910.0086 f

Client: STANTEC
Street Address: 3052 BEAUMONT CTR CIR
City / State / Zip: LEXINGTON KY
Phone: (859 422-3109 Fax: ( )
Email: sam.lee@stantec.com
Attention: SAM LEE PO #:
Sampler: SAM LEE
Site / Project Name: KRS1

Due Date: 9/1/2017

Analyses Requested

Date / Time	Sample ID / Description	Number of Containers	Type of Container Plastic, clear glass, vial, etc.	Preservative in Container None, HNO_3, H_2SO_4, NaOH, etc.	Sample Matrix Soil, Sludge, Water, Oil, etc.	RUSH* (Fill-in desired TAT)	Total Solids (%)	Total Solids (mg/L)
8/24 15:20	KRS1 WASH 1	1	Plastic	N/A	H_2O		1	1
8/24 15:30	KRS1 WASH 2	|	|	|	|		1	1
8/24 15:40	KRS21 WASH 3	|	|	|	|		1	1
8/24 15:50	KRS1 WASH 4	|	|	|	|		1	1
8/24 16:00	KRS1 ~~WASH~~ 002A	|	|	|	|		1	1
8/24 16:05	KRS1 002B	|	|	|	|		1	1
8/25 10:20	KRS1 SLUDGE 1	|	|	|	|		1	1
8/25 10:25	KRS1 SLUDGE 2	|	|	|	|		1	1
8/25 10:30	KRS1 SLUDGE 3	|	|	|	|		1	1

Relinquished By: Date: 8/25/17 Time: 11:30
Received By: Lisa Martin Date: 8/25/17 Time: 1130
Relinquished By: Date: / / Time:
Received By: Date: / / Time:
Relinquished By: Date: / / Time:
Received By: Date: / / Time:

Notes: 5 DAY TAT

To be filled out by Microbac
Temp. Upon Receipt (°C): 1.9 Thermometer ID: L16 No. Bottles Received: 9
Samples Received on Ice? [✓ Yes] No Custody Seals Intact? Yes No [✓ N/A]

Version 05.19.2015

*Standard RUSH TAT Charges: Same Day x3; Next Day x2; Three Day x1.5. Please contact us for RUSH request arrangements at 502.962.6400

Page 1 of 1

APPENDIX E
RAW WATER QUALITY COMPARISON WITH MASTER PLAN

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 10/3/2017
Title: Data Comparison with Master Plan **CHECKED BY:** DB

	Average			Min			Max		
	KRS1 MP	**Stantec**	**% Diff**	**KRS1 MP**	**Stantec**	**% Diff**	**KRS1 MP**	**Stantec**	**% Diff**
Raw Water Influent, MGD:	21.3	22.33	4.8%	11.8	7.38	37.4%	34.8	42.16	21.2%
Raw Water Turbidity, NTU:	50.5	39.22	22.3%	11.8	2.00	83.1%	653	674.00	3.2%
Ferric Chloride Dose, mg/l:	79.8	51.51	35.5%	6	0.07	98.8%	193.4	193.67	0.1%
DelPac 2020 Dose, mg/l:	34.8	36.78	5.7%	1	0.99	1.4%	119.2	154.97	30.0%
Total Dry Solids, lb/day:	14,000	17,986	28.5%	1,000	810	19.0%	140,000	161,347	15.2%
Total Sludge Volume, gal/day:	114,000	143,770	26.1%	7,800	6,474	17.0%	1,100,000	1,289,745	17.2%

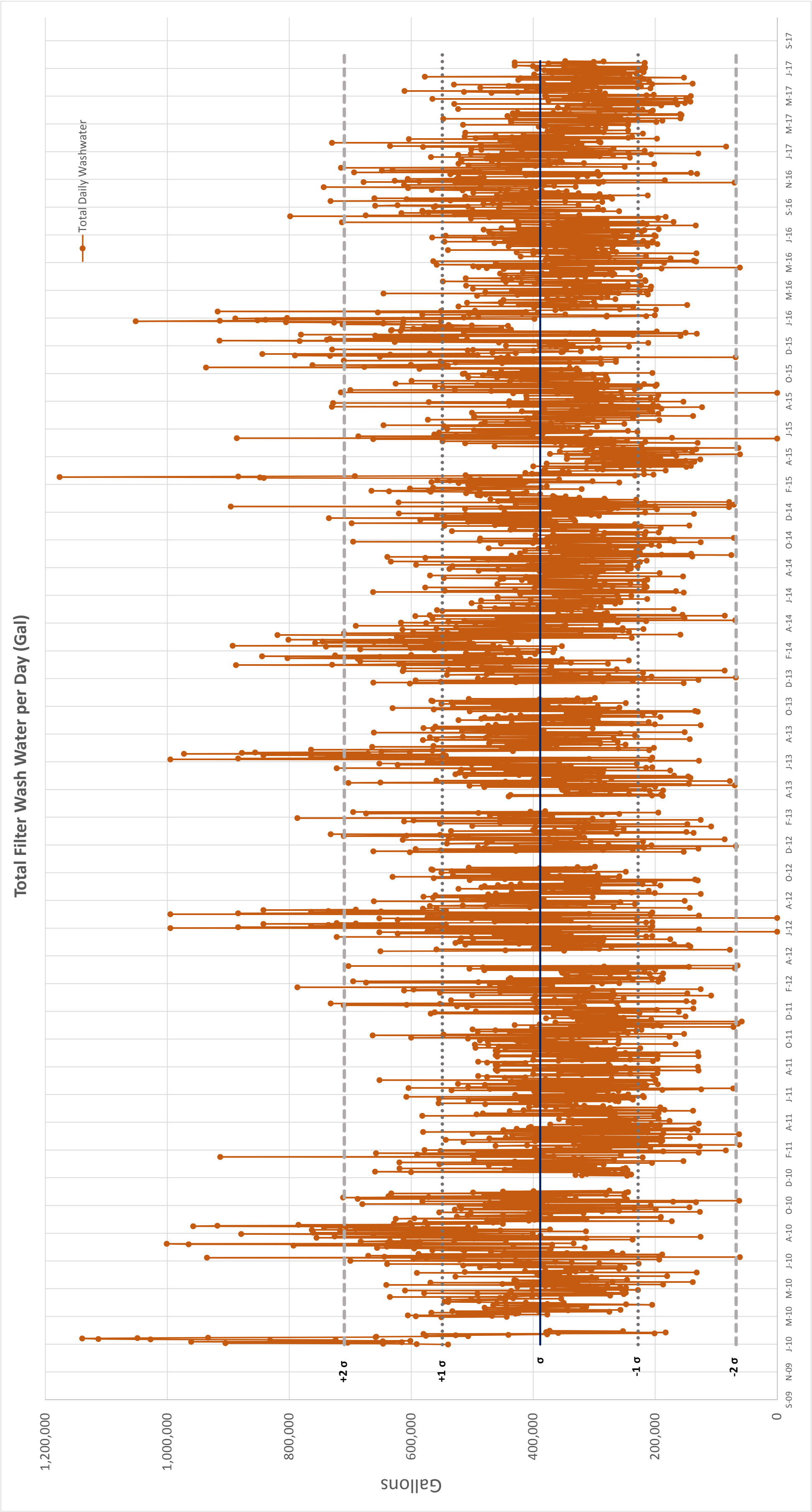
Notes:

1. KRS-1 MP analysis completed for a 12-month period from January through December 2015.
2. Stantec analysis completed for a 92-month period from January 2010 through August 2017.
3. Total Sludge Volume based on 1.5% solids concentration.

APPENDIX F
FILTER BACKWASH WASTE VOLUME ANALYSIS

Printed On: 10/3/2017
Page 1 of 1

Total Filter Wash Water per Day (Gal)



20170926_DB-SC_solids-calcs.xlsx

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Backwash Water Volume Analysis

BY: DB
DATE: 8/15/2017
CHECKED BY: SDC

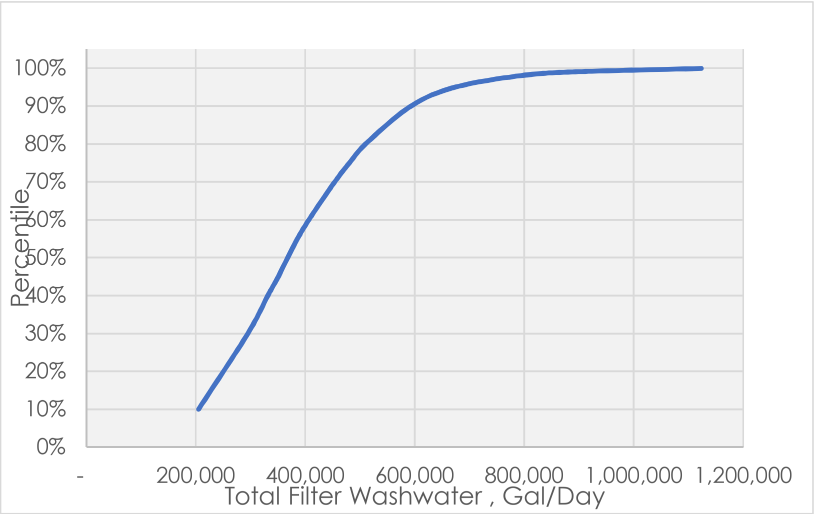
Date	Gallons
12-Jun-12	-
12-Jul-12	-
15-May-15	-
22-Aug-15	-
1-Dec-11	58,104
11-Apr-15	60,957
19-May-16	61,173
9-Jul-10	61,178
9-Mar-11	61,654
8-Nov-10	62,167
1-Apr-11	62,324
25-Apr-15	63,572
26-Nov-11	64,346
31-Mar-12	64,801
14-Dec-12	67,752
14-Dec-13	67,752
7-Nov-15	68,158
17-Apr-14	68,711
25-Mar-12	69,306
25-Apr-13	69,306
19-Nov-16	69,833
12-Oct-14	70,852
23-Dec-14	71,004
19-Nov-11	71,575
9-Jul-11	72,035
5-Sep-14	75,112
4-May-12	77,493
4-May-13	77,493
29-Dec-14	78,684
18-Dec-14	78,840
5-Feb-17	83,699

Total Washwater

Percentile	Gal/Day
10%	204,859
30%	294,979
40%	331,510
45%	350,731
50%	367,659
55%	385,615
60%	406,486
70.0%	453,712
75.0%	480,702
80.0%	510,193
90.0%	593,143
95.0%	674,549
98.0%	792,896
99.0%	888,470
99.9%	1,123,580

Avg = 389,029

Note: zero values are excluded from percentile analysis.



	GPD	% solids	Dry Lbs/Day
50%	367,659	0.1%	3,066
80%	510,193	0.1%	4,255
90%	593,143	0.1%	4,947
95%	674,549	0.1%	5,626
99%	888,470	0.1%	7,410
Max Day	1,176,698	0.1%	9,814
	390,000	0.1%	3,253
Avg	389,029	0.1%	3,245
Min	58,104	0.1%	485

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Backwash Water Volume Analysis

BY: DB
DATE: 8/15/2017
CHECKED BY: SDC

Date	Gallons
25-Feb-11	84,066
27-Apr-14	85,879
29-Dec-12	86,021
29-Dec-13	86,021
26-Jan-12	108,308
26-Jan-13	108,308
22-Jul-15	123,114
7-Jul-11	124,475
2-Sep-12	125,246
2-Sep-13	125,246
3-Oct-14	125,299
9-Feb-12	125,308
9-Feb-13	125,308
22-Aug-10	125,606
31-Mar-15	126,082
15-Oct-10	126,572
6-Mar-11	126,931
17-Jun-12	128,085
17-Jul-12	128,085
17-Jun-13	128,085
24-Apr-11	128,394
20-Feb-11	128,577
17-Aug-11	128,871
17-Sep-11	128,871
9-Dec-12	129,109
9-Dec-13	129,109
21-Jan-17	129,185
25-Aug-11	129,921
25-Sep-11	129,921
9-Apr-11	130,128
1-Oct-12	130,184

Sheets 3-85 not printed.
Available in digital (pdf) version.

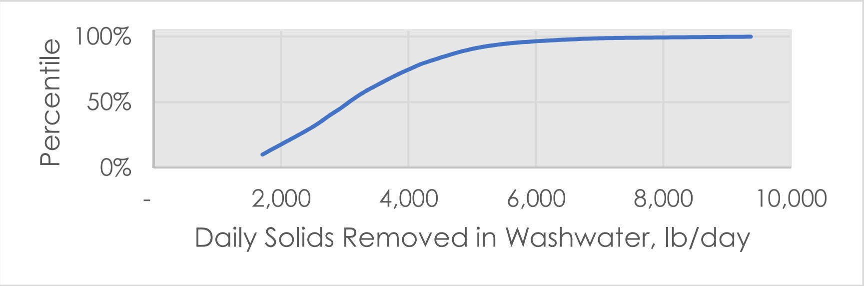
Stantec

Project No.:	175667010	**BY:**	SDC
Project:	KRS1 Residuals Management Master Plan	**DATE:**	9/15/2017
Title:	Backwash Water Sludge	**CHECKED BY:**	

Date	Gallons	% Solids	lb/day Removed
1-Dec-11	58,104	0.1	485
11-Apr-15	60,957	0.1	508
19-May-16	61,173	0.1	510
9-Jul-10	61,178	0.1	510
9-Mar-11	61,654	0.1	514
8-Nov-10	62,167	0.1	518
1-Apr-11	62,324	0.1	520
25-Apr-15	63,572	0.1	530
26-Nov-11	64,346	0.1	537
31-Mar-12	64,801	0.1	540
14-Dec-12	67,752	0.1	565
14-Dec-13	67,752	0.1	565
7-Nov-15	68,158	0.1	568
17-Apr-14	68,711	0.1	573
25-Mar-12	69,306	0.1	578
25-Apr-13	69,306	0.1	578
19-Nov-16	69,833	0.1	582
12-Oct-14	70,852	0.1	591
23-Dec-14	71,004	0.1	592
19-Nov-11	71,575	0.1	597
9-Jul-11	72,035	0.1	601
5-Sep-14	75,112	0.1	626
4-May-12	77,493	0.1	646
4-May-13	77,493	0.1	646
29-Dec-14	78,684	0.1	656
18-Dec-14	78,840	0.1	658
5-Feb-17	83,699	0.1	698
25-Feb-11	84,066	0.1	701
27-Apr-14	85,879	0.1	716
29-Dec-12	86,021	0.1	717

Percentile	lb/day
10%	1,709
30%	2,460
40%	2,765
45%	2,925
50%	3,066
55%	3,216
60%	3,390
70.0%	3,784
75.0%	4,009
80.0%	4,255
90.0%	4,947
95.0%	5,626
98.0%	6,613
99.0%	7,410
99.9%	9,371

	Gallons	% Solids	lbs/day
AVERAGE	389,029	0.1	3,245
MIN	60,957	0.1	485
MAX	1,176,698	0.1	9,814



Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Backwash Water Sludge

BY: SDC
DATE: 9/15/2017
CHECKED BY:

Date	Gallons	% Solids	lb/day Removed
29-Dec-13	86,021	0.1	717
26-Jan-12	108,308	0.1	903
26-Jan-13	108,308	0.1	903
22-Jul-15	123,114	0.1	1,027
7-Jul-11	124,475	0.1	1,038
2-Sep-12	125,246	0.1	1,045
2-Sep-13	125,246	0.1	1,045
3-Oct-14	125,299	0.1	1,045
9-Feb-12	125,308	0.1	1,045
9-Feb-13	125,308	0.1	1,045
22-Aug-10	125,606	0.1	1,048
31-Mar-15	126,082	0.1	1,052
15-Oct-10	126,572	0.1	1,056
6-Mar-11	126,931	0.1	1,059
17-Jun-12	128,085	0.1	1,068
17-Jul-12	128,085	0.1	1,068
17-Jun-13	128,085	0.1	1,068
24-Apr-11	128,394	0.1	1,071
20-Feb-11	128,577	0.1	1,072
17-Aug-11	128,871	0.1	1,075
17-Sep-11	128,871	0.1	1,075
9-Dec-12	129,109	0.1	1,077
9-Dec-13	129,109	0.1	1,077
21-Jan-17	129,185	0.1	1,077
25-Aug-11	129,921	0.1	1,084
25-Sep-11	129,921	0.1	1,084
9-Apr-11	130,128	0.1	1,085
1-Oct-12	130,184	0.1	1,086
1-Oct-13	130,184	0.1	1,086
6-May-15	130,416	0.1	1,088
8-Dec-16	131,300	0.1	1,095

Percentile	lb/day

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APPENDIX G
2016-2017 SETTLED SOLIDS CALCULATION

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	**12,908**	**Peaking Factor**	**5.41**
	Max 7 Day Avg.	**69,816**		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
1-Jan-16	19.83	44.67	5.60	39.07	58.60	0.00	62.94	22.66	1.41	1.29	69%	0.89	12,544	12,544	
2-Jan-16	15.87	39.67	5.75	33.92	58.60	0.00	55.70	20.05	1.56	1.77	69%	1.22	9,873	9,873	
3-Jan-16	20.87	39.83	6.35	33.48	50.88	0.00	56.00	20.16	1.34	1.95	69%	1.35	11,637	11,637	
4-Jan-16	28.58	47.17	9.42	37.75	50.23	0.00	50.63	18.23	1.39	2.23	69%	1.54	15,535	15,535	
5-Jan-16	18.41	44.17	9.60	34.57	56.63	0.00	46.03	16.57	1.72	1.86	69%	1.28	10,832	10,832	
6-Jan-16	19.93	41.83	9.60	32.23	51.85	0.00	54.22	19.52	1.58	1.97	69%	1.36	11,248	11,248	
7-Jan-16	22.64	37.17	6.82	30.35	48.35	9.74	48.62	17.50	1.74	1.91	69%	1.32	12,390	12,390	**12,009**
8-Jan-16	22.63	35.83	6.75	29.08	45.53	16.07	17.79	6.40	1.27	2.34	69%	1.61	10,766	10,766	**11,754**
9-Jan-16	18.64	30.50	5.72	24.78	43.63	20.30	44.18	15.90	2.16	2.13	69%	1.47	9,843	9,843	**11,750**
10-Jan-16	17.24	26.50	4.75	21.75	37.18	16.96	33.53	12.07	0.93	1.82	69%	1.25	7,473	7,473	**11,155**
11-Jan-16	19.47	21.50	4.58	16.92	32.63	17.23	39.03	14.05	2.46	1.72	69%	1.19	8,161	8,161	**10,102**
12-Jan-16	20.72	19.67	3.90	15.77	25.38	14.19	39.66	14.28	0.88	1.91	69%	1.32	7,063	7,063	**9,563**
13-Jan-16	19.80	15.00	3.38	11.62	23.65	16.22	40.10	14.44	1.69	1.77	69%	1.22	6,694	6,694	**8,913**
14-Jan-16	21.78	14.67	3.70	10.97	17.43	20.47	48.63	17.51	1.51	1.93	69%	1.33	6,797	6,797	**8,114**
15-Jan-16	20.53	14.33	3.30	11.03	16.45	33.42	0.00	0.00	1.09	1.72	69%	1.19	4,772	4,772	**7,258**
16-Jan-16	20.76	13.00	4.32	8.68	16.55	32.10	0.00	0.00	1.41	1.77	69%	1.22	4,841	4,841	**6,543**
17-Jan-16	22.48	11.83	3.60	8.23	13.03	30.99	0.00	0.00	1.34	1.70	69%	1.17	4,505	4,505	**6,119**
18-Jan-16	22.53	9.83	3.25	6.58	12.35	18.12	0.00	0.00	1.10	1.63	69%	1.13	3,671	3,671	**5,478**
19-Jan-16	22.50	8.67	3.92	4.75	9.88	33.76	0.00	0.00	1.27	1.50	69%	1.03	4,020	4,020	**5,043**
20-Jan-16	23.02	7.50	3.68	3.82	7.13	29.77	0.00	0.00	1.51	1.66	69%	1.14	3,442	3,442	**4,578**
21-Jan-16	22.15	6.83	3.67	3.17	5.73	27.79	0.00	0.00	1.96	1.50	69%	1.03	3,016	3,016	**4,038**
22-Jan-16	20.93	7.00	4.58	2.42	4.75	21.60	0.00	0.00	1.67	1.61	69%	1.11	2,347	2,347	**3,692**
23-Jan-16	19.50	7.17	4.63	2.53	3.63	20.37	0.00	0.00	1.34	1.59	69%	1.10	1,894	1,894	**3,271**
24-Jan-16	23.56	7.50	5.53	1.97	3.80	18.02	0.00	0.00	1.39	1.47	69%	1.02	2,190	2,190	**2,940**
25-Jan-16	15.11	13.25	5.90	7.35	2.95	2.03	0.00	0.00	1.49	1.75	69%	1.21	781	781	**2,527**
26-Jan-16	21.39	11.33	5.47	5.87	11.03	15.77	0.00	0.00	0.46	1.66	69%	1.14	3,022	3,022	**2,385**
27-Jan-16	20.24	12.67	4.70	7.97	8.80	25.57	0.00	0.00	2.09	1.82	69%	1.25	3,232	3,232	**2,354**
28-Jan-16	22.82	27.50	5.03	22.47	11.95	38.30	0.00	0.00	1.67	1.97	69%	1.36	4,847	4,847	**2,616**
29-Jan-16	20.46	39.17	4.15	35.02	33.70	35.25	0.00	0.00	1.58	11.30	69%	7.80	8,998	8,998	**3,566**
30-Jan-16	24.28	34.33	6.85	27.48	52.53	37.05	0.00	0.00	1.59	1.47	69%	1.02	13,215	13,215	**5,184**
31-Jan-16	22.64	43.17	6.75	36.42	41.23	36.61	0.00	0.00	1.83	2.09	69%	1.44	10,293	10,293	**6,341**
1-Feb-16	22.25	52.67	7.03	45.63	54.63	32.16	0.00	0.00	1.14	2.02	69%	1.39	12,240	12,240	**7,978**
2-Feb-16	22.48	75.50	6.48	69.02	68.45	37.85	0.00	0.00	0.95	1.66	69%	1.14	15,169	15,169	**9,714**
3-Feb-16	19.60	177.33	5.45	171.88	103.53	55.15	0.00	0.00	1.06	2.64	69%	1.82	19,856	19,856	**12,089**
4-Feb-16	22.51	330.83	5.52	325.32	257.83	64.66	0.00	0.00	1.52	2.77	69%	1.91	52,378	52,378	**18,879**
5-Feb-16	19.88	281.50	5.50	276.00	487.98	76.73	0.00	0.00	1.41	2.45	69%	1.69	84,882	84,882	**29,719**
6-Feb-16	18.07	211.50	4.83	206.67	414.00	64.25	0.00	0.00	1.39	2.34	69%	1.61	65,496	65,496	**37,188**
7-Feb-16	21.35	110.83	7.10	103.73	310.00	46.18	0.00	0.00	1.37	2.25	69%	1.55	57,982	57,982	**44,001**
8-Feb-16	24.45	91.83	7.62	84.22	155.60	36.26	0.00	0.00	1.11	1.04	69%	0.72	34,124	34,124	**47,127**
9-Feb-16	22.63	56.00	7.67	48.33	126.33	23.77	0.00	0.00	0.97	1.84	69%	1.27	25,488	25,488	**48,601**
10-Feb-16	23.28	40.17	7.33	32.83	72.50	31.48	0.00	0.00	1.27	1.86	69%	1.28	16,243	16,243	**48,085**
11-Feb-16	21.06	35.00	5.83	29.17	49.25	34.24	0.00	0.00	1.58	1.77	69%	1.22	10,786	10,786	**42,143**

G-1

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)				
	Daily Avg.	12,908	Peaking Factor	5.41
	Max 7 Day Avg.	69,816		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
12-Feb-16	27.61	39.17	6.82	32.35	43.75	33.99	0.00	0.00	1.65	2.13	69%	1.47	12,938	12,938	**31,865**
13-Feb-16	18.88	39.33	6.80	32.53	48.53	29.74	0.00	0.00	0.92	1.86	69%	1.28	9,272	9,272	**23,833**
14-Feb-16	22.49	31.33	7.98	23.35	48.80	27.46	0.00	0.00	1.36	1.72	69%	1.19	11,043	11,043	**17,128**
15-Feb-16	24.60	26.83	7.13	19.70	35.03	32.50	0.00	0.00	1.46	1.59	69%	1.10	9,534	9,534	**13,615**
16-Feb-16	19.43	74.67	5.05	69.62	29.55	43.53	0.00	0.00	1.48	2.20	69%	1.52	7,205	7,205	**11,003**
17-Feb-16	24.70	351.17	7.70	343.47	104.43	73.58	0.00	0.00	1.29	1.97	69%	1.36	26,209	26,209	**12,427**
18-Feb-16	18.31	400.33	6.77	393.57	515.20	82.80	0.00	0.00	1.43	2.77	69%	1.91	82,656	82,656	**22,694**
19-Feb-16	22.23	179.50	6.55	172.95	590.35	60.51	0.00	0.00	1.49	1.91	69%	1.32	113,037	113,037	**36,994**
20-Feb-16	20.82	115.50	6.88	108.62	259.43	49.79	0.00	0.00	1.07	1.97	69%	1.36	47,826	47,826	**42,502**
21-Feb-16	18.68	76.67	5.95	70.72	162.93	41.06	0.00	0.00	1.17	1.56	69%	1.08	27,481	27,481	**44,850**
22-Feb-16	19.82	98.33	6.13	92.20	106.08	40.61	0.00	0.00	1.34	2.00	69%	1.38	19,818	19,818	**46,319**
23-Feb-16	19.66	94.83	6.62	88.22	138.30	30.61	0.00	0.00	1.29	1.93	69%	1.33	24,479	24,479	**48,787**
24-Feb-16	20.27	69.67	6.87	62.80	132.33	42.24	0.00	0.00	1.72	1.72	69%	1.19	24,814	24,814	**48,587**
25-Feb-16	20.08	71.17	7.30	63.87	94.20	37.30	0.00	0.00	1.37	1.59	69%	1.10	17,902	17,902	**39,337**
26-Feb-16	19.28	70.67	6.63	64.03	95.80	26.64	0.00	0.00	1.31	1.86	69%	1.28	16,990	16,990	**25,616**
27-Feb-16	17.99	54.83	5.42	49.42	96.05	31.70	0.00	0.00	1.80	1.79	69%	1.24	16,165	16,165	**21,093**
28-Feb-16	17.17	42.17	6.17	36.00	74.13	35.59	0.00	0.00	1.40	1.77	69%	1.22	12,384	12,384	**18,936**
29-Feb-16	18.50	36.67	5.80	30.87	54.00	26.66	0.00	0.00	1.08	1.77	69%	1.22	9,814	9,814	**17,507**
1-Mar-16	19.37	32.83	7.43	25.40	46.30	25.29	0.00	0.00	1.40	1.70	69%	1.17	9,013	9,013	**15,297**
2-Mar-16	19.22	30.33	7.40	22.93	38.10	26.72	0.00	0.00	1.24	1.59	69%	1.10	7,654	7,654	**12,846**
3-Mar-16	19.12	28.50	7.15	21.35	34.40	24.81	0.00	0.00	1.53	1.95	69%	1.35	7,026	7,026	**11,292**
4-Mar-16	19.79	28.00	6.45	21.55	32.03	25.68	0.00	0.00	1.46	1.72	69%	1.19	6,882	6,882	**9,848**
5-Mar-16	16.51	23.17	5.12	18.05	32.33	25.82	0.00	0.00	1.29	1.68	69%	1.16	5,763	5,763	**8,362**
6-Mar-16	17.54	18.00	5.08	12.92	27.08	24.16	0.00	0.00	0.72	1.50	69%	1.03	5,184	5,184	**7,334**
7-Mar-16	20.53	19.67	5.58	14.08	19.38	25.87	0.00	0.00	1.77	1.82	69%	1.25	5,047	5,047	**6,653**
8-Mar-16	21.06	17.83	5.83	12.00	21.13	24.55	0.00	0.00	1.37	1.86	69%	1.28	5,356	5,356	**6,130**
9-Mar-16	20.93	16.50	6.75	9.75	18.00	18.48	0.00	0.00	1.59	1.66	69%	1.14	4,501	4,501	**5,680**
10-Mar-16	20.97	15.33	6.82	8.52	14.63	18.59	0.00	0.00	1.89	2.48	69%	1.71	4,078	4,078	**5,259**
11-Mar-16	19.55	14.00	6.52	7.48	12.78	17.41	0.00	0.00	1.19	1.47	69%	1.02	3,220	3,220	**4,736**
12-Mar-16	17.95	13.33	6.42	6.92	11.23	18.72	0.00	0.00	1.31	1.04	69%	0.72	2,752	2,752	**4,306**
13-Mar-16	15.43	14.17	5.83	8.33	10.38	17.96	0.00	0.00	1.12	1.54	69%	1.06	2,249	2,249	**3,886**
14-Mar-16	18.70	16.00	6.16	9.84	12.50	20.74	0.00	0.00	1.33	1.66	69%	1.14	3,220	3,220	**3,625**
15-Mar-16	19.34	14.67	4.80	9.87	14.76	23.56	0.00	0.00	1.35	1.47	69%	1.02	3,803	3,803	**3,403**
16-Mar-16	16.17	14.67	4.93	9.73	14.80	27.66	0.00	0.00	0.97	1.75	69%	1.21	3,310	3,310	**3,233**
17-Mar-16	18.32	27.67	5.53	22.13	14.60	32.70	0.00	0.00	1.95	3.14	69%	2.16	4,228	4,228	**3,255**
18-Mar-16	20.97	29.00	4.50	24.50	33.20	35.51	0.00	0.00	2.33	1.93	69%	1.33	8,149	8,149	**3,959**
19-Mar-16	15.42	29.83	5.05	24.78	36.75	37.17	0.00	0.00	1.19	1.88	69%	1.30	6,355	6,355	**4,474**
20-Mar-16	16.46	14.67	4.15	10.52	37.18	26.66	0.00	0.00	0.84	1.70	69%	1.17	6,382	6,382	**5,064**
21-Mar-16	19.16	10.50	4.20	6.30	15.78	29.74	0.00	0.00	1.90	1.43	69%	0.99	4,282	4,282	**5,216**
22-Mar-16	12.36	9.00	4.75	4.25	9.45	23.61	0.00	0.00	0.73	1.04	69%	0.72	1,790	1,790	**4,928**
23-Mar-16	18.96	8.33	4.80	3.53	6.38	23.48	0.00	0.00	1.43	1.38	69%	0.95	2,401	2,401	**4,798**
24-Mar-16	18.61	9.17	4.23	4.93	5.30	24.91	0.00	0.00	2.00	1.29	69%	0.89	2,330	2,330	**4,527**

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/20/2017
CHECKED BY:

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg. Max 7 Day Avg.	12,908 69,816	**Peaking Factor**	5.41

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
25-Mar-16	19.11	8.00	3.62	4.38	7.40	20.86	0.00	0.00	0.82	1.63	69%	1.13	2,401	2,401	**3,706**
26-Mar-16	20.33	7.50	4.63	2.87	6.58	20.95	0.00	0.00	1.82	1.04	69%	0.72	2,518	2,518	**3,158**
27-Mar-16	21.15	7.00	4.88	2.12	4.30	19.54	0.00	0.00	2.22	1.59	69%	1.10	2,287	2,287	**2,573**
28-Mar-16	18.44	6.17	4.33	1.83	3.18	19.74	0.00	0.00	1.55	1.72	69%	1.19	1,741	1,741	**2,210**
29-Mar-16	19.81	6.67	4.82	1.85	2.75	20.04	0.00	0.00	1.62	1.27	69%	0.87	1,773	1,773	**2,207**
30-Mar-16	17.92	8.33	4.50	3.83	2.78	23.82	0.00	0.00	2.06	1.47	69%	1.02	1,849	1,849	**2,128**
31-Mar-16	19.73	16.50	4.72	11.78	5.75	18.30	0.00	0.00	1.19	1.54	69%	1.06	2,143	2,143	**2,102**
1-Apr-16	19.54	10.17	3.67	6.50	17.68	20.24	0.00	0.00	1.38	1.66	69%	1.14	4,196	4,196	**2,358**
2-Apr-16	20.77	9.67	4.05	5.62	9.75	18.51	0.00	0.00	1.35	1.43	69%	0.99	2,970	2,970	**2,423**
3-Apr-16	17.37	8.67	3.85	4.82	8.43	21.21	0.00	0.00	1.91	1.43	69%	0.99	2,482	2,482	**2,451**
4-Apr-16	19.87	7.50	4.07	3.43	7.23	18.68	0.00	0.00	1.26	1.50	69%	1.03	2,424	2,424	**2,548**
5-Apr-16	19.58	7.17	3.83	3.33	5.15	7.56	0.00	0.00	1.23	1.70	69%	1.17	1,572	1,572	**2,519**
6-Apr-16	18.87	6.83	4.32	2.52	5.00	20.69	0.00	0.00	1.62	1.47	69%	1.02	2,093	2,093	**2,554**
7-Apr-16	17.48	6.50	3.80	2.70	3.78	18.36	0.00	0.00	1.51	1.47	69%	1.02	1,652	1,652	**2,484**
8-Apr-16	18.44	7.17	3.98	3.18	4.05	19.46	0.00	0.00	1.83	1.52	69%	1.05	1,884	1,884	**2,154**
9-Apr-16	15.70	5.83	3.95	1.88	4.78	18.85	0.00	0.00	1.75	1.45	69%	1.00	1,661	1,661	**1,967**
10-Apr-16	20.85	8.17	4.85	3.32	2.83	18.31	0.00	0.00	1.62	1.84	69%	1.27	1,865	1,865	**1,879**
11-Apr-16	17.72	9.83	5.45	4.38	4.98	19.80	0.00	0.00	1.30	1.79	69%	1.24	1,911	1,911	**1,805**
12-Apr-16	18.63	7.17	3.97	3.20	6.58	16.83	0.00	0.00	1.31	1.50	69%	1.03	2,102	2,102	**1,881**
13-Apr-16	20.31	6.17	3.98	2.18	4.80	17.66	0.00	0.00	0.96	1.68	69%	1.16	1,991	1,991	**1,867**
14-Apr-16	19.44	7.17	3.75	3.42	3.28	18.18	0.00	0.00	1.64	1.68	69%	1.16	1,791	1,791	**1,886**
15-Apr-16	21.38	6.67	4.72	1.95	5.13	18.52	0.00	0.00	1.93	1.61	69%	1.11	2,360	2,360	**1,954**
16-Apr-16	22.58	6.00	4.43	1.57	2.93	15.45	0.00	0.00	1.00	1.77	69%	1.22	1,767	1,767	**1,969**
17-Apr-16	22.90	5.67	3.90	1.77	2.35	21.83	0.00	0.00	2.12	1.50	69%	1.03	2,192	2,192	**2,016**
18-Apr-16	25.37	5.67	4.25	1.42	2.65	16.49	0.00	0.00	0.90	1.52	69%	1.05	1,928	1,928	**2,019**
19-Apr-16	24.65	5.33	4.20	1.13	2.13	18.07	0.00	0.00	1.43	1.72	69%	1.19	1,993	1,993	**2,003**
20-Apr-16	15.41	6.67	4.30	2.37	1.70	17.54	0.00	0.00	1.08	1.52	69%	1.05	1,109	1,109	**1,877**
21-Apr-16	18.59	6.00	3.73	2.27	3.55	19.36	0.00	0.00	0.71	1.68	69%	1.16	1,662	1,662	**1,859**
22-Apr-16	17.11	5.50	4.55	0.95	3.40	18.16	0.00	0.00	1.09	1.66	69%	1.14	1,514	1,514	**1,738**
23-Apr-16	20.30	5.00	4.43	0.57	1.43	19.94	0.00	0.00	1.05	1.59	69%	1.10	1,528	1,528	**1,704**
24-Apr-16	24.76	9.83	4.12	5.72	0.85	15.91	0.00	0.00	1.70	1.70	69%	1.17	1,669	1,669	**1,629**
25-Apr-16	25.22	6.67	4.58	2.08	8.58	17.34	0.00	0.00	1.18	1.63	69%	1.13	3,288	3,288	**1,823**
26-Apr-16	28.20	6.67	4.23	2.43	3.13	9.45	0.00	0.00	0.97	1.59	69%	1.10	1,828	1,828	**1,800**
27-Apr-16	20.98	6.67	4.12	2.55	3.65	18.81	0.00	0.00	1.17	1.59	69%	1.10	1,936	1,936	**1,918**
28-Apr-16	29.02	11.33	5.25	6.08	3.83	22.14	0.00	0.00	1.76	1.77	69%	1.22	3,114	3,114	**2,125**
29-Apr-16	23.71	26.83	5.43	21.40	9.13	38.34	0.00	0.00	2.04	2.36	69%	1.63	4,605	4,605	**2,567**
30-Apr-16	20.27	59.33	4.83	54.50	32.10	77.40	0.00	0.00	1.09	3.21	69%	2.21	9,568	9,568	**3,715**
1-May-16	22.50	40.33	2.42	37.91	81.75	81.17	24.07	8.67	1.40	2.41	69%	1.66	21,162	21,162	**6,500**
2-May-16	23.85	310.67	3.37	307.30	56.87	74.08	17.03	6.13	0.74	2.86	69%	1.98	16,692	16,692	**8,415**
3-May-16	21.29	609.83	4.68	605.15	460.95	76.20	19.51	7.02	0.80	3.11	69%	2.15	86,913	86,913	**20,570**
4-May-16	22.87	294.83	6.18	288.65	907.73	52.28	19.61	7.06	3.49	2.84	69%	1.96	177,787	177,787	**45,692**
5-May-16	21.36	203.50	5.85	197.65	432.98	52.02	21.95	7.90	1.12	2.68	69%	1.85	81,142	81,142	**56,838**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	12,908	**Peaking Factor**	5.41
	Max 7 Day Avg.	69,816		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
6-May-16	20.41	138.33	5.07	133.27	296.48	49.24	17.57	6.33	1.87	2.45	69%	1.69	54,078	54,078	**63,906**
7-May-16	20.10	106.33	4.95	101.38	199.90	60.23	3.25	1.17	1.00	2.13	69%	1.47	36,824	36,824	**67,800**
8-May-16	20.29	72.33	5.15	67.18	152.08	53.78	0.00	0.00	2.20	2.13	69%	1.47	28,848	28,848	**68,898**
9-May-16	23.87	59.00	5.92	53.08	100.78	48.14	0.00	0.00	0.83	1.97	69%	1.36	23,118	23,118	**69,816**
10-May-16	22.76	46.17	5.58	40.58	79.63	39.58	0.00	0.00	1.08	1.86	69%	1.28	17,623	17,623	**59,917**
11-May-16	23.18	60.33	6.22	54.11	60.88	36.01	0.00	0.00	1.43	2.11	69%	1.46	14,231	14,231	**36,552**
12-May-16	24.72	186.00	4.88	181.12	81.17	76.38	13.12	4.72	1.89	2.89	69%	1.99	22,489	22,489	**28,173**
13-May-16	22.37	216.17	4.30	211.87	271.68	75.65	17.99	6.47	0.93	3.53	69%	2.43	55,985	55,985	**28,445**
14-May-16	18.44	168.33	5.08	163.25	317.80	79.80	20.65	7.43	1.70	3.43	69%	2.37	53,624	53,624	**30,845**
15-May-16	16.83	123.83	3.40	120.43	244.88	58.89	16.89	6.08	1.76	3.11	69%	2.15	37,754	37,754	**32,118**
16-May-16	21.91	77.17	5.22	71.95	180.65	59.03	3.62	1.30	1.14	2.32	69%	1.60	36,622	36,622	**34,047**
17-May-16	19.10	44.83	5.08	39.75	107.93	9.58	0.00	0.00	1.76	1.97	69%	1.36	18,105	18,105	**34,116**
18-May-16	23.36	40.33	6.42	33.92	59.63	34.41	0.00	0.00	1.68	1.86	69%	1.28	14,027	14,027	**34,086**
19-May-16	24.60	34.17	5.60	28.57	50.88	33.98	0.00	0.00	1.49	2.11	69%	1.46	12,949	12,949	**32,724**
20-May-16	23.81	36.00	4.68	31.32	42.85	32.44	0.00	0.00	1.17	2.20	69%	1.52	10,806	10,806	**26,269**
21-May-16	22.06	108.67	3.35	105.32	46.98	78.33	0.00	0.00	0.85	2.75	69%	1.90	13,097	13,097	**20,480**
22-May-16	26.41	199.50	3.78	195.72	157.98	81.23	22.73	8.18	1.73	3.66	69%	2.53	41,814	41,814	**21,060**
23-May-16	32.19	62.50	3.40	59.10	293.58	54.93	18.69	6.73	1.83	2.43	69%	1.68	84,974	84,974	**27,967**
24-May-16	28.04	39.50	4.42	35.08	88.65	35.91	8.99	3.24	0.70	2.43	69%	1.68	24,089	24,089	**28,822**
25-May-16	22.77	30.33	3.97	26.37	52.63	31.48	0.00	0.00	3.01	2.00	69%	1.38	12,463	12,463	**28,599**
26-May-16	23.48	28.33	4.22	24.12	39.55	24.81	0.00	0.00	1.27	1.75	69%	1.21	9,560	9,560	**28,115**
27-May-16	19.98	26.17	4.00	22.17	36.18	30.95	0.00	0.00	1.81	1.95	69%	1.35	7,965	7,965	**27,709**
28-May-16	16.10	33.83	4.30	29.53	33.25	45.20	0.00	0.00	2.17	2.48	69%	1.71	6,647	6,647	**26,787**
29-May-16	13.28	46.17	4.47	41.70	44.30	50.48	0.00	0.00	0.86	2.29	69%	1.58	6,707	6,707	**21,772**
30-May-16	16.09	33.83	3.82	30.01	62.55	41.12	0.00	0.00	1.17	2.09	69%	1.44	10,253	10,253	**11,098**
31-May-16	23.77	24.00	5.15	18.85	45.02	22.29	0.00	0.00	1.55	2.16	69%	1.49	10,739	10,739	**9,191**
1-Jun-16	21.98	22.83	5.20	17.63	28.28	25.73	0.00	0.00	1.97	2.09	69%	1.44	7,098	7,098	**8,424**
2-Jun-16	23.37	19.50	5.55	13.95	26.45	13.01	0.00	0.00	1.45	1.61	69%	1.11	6,349	6,349	**7,965**
3-Jun-16	22.27	14.67	4.42	10.25	20.93	20.15	0.00	0.00	1.54	1.95	69%	1.35	5,447	5,447	**7,606**
4-Jun-16	17.62	28.00	4.78	23.22	15.38	36.11	20.76	7.47	1.30	2.18	69%	1.50	4,851	4,851	**7,349**
5-Jun-16	19.97	17.50	4.22	13.28	34.83	22.95	6.74	2.43	1.25	2.25	69%	1.55	7,581	7,581	**7,474**
6-Jun-16	18.33	20.50	5.28	15.22	19.93	30.62	0.00	0.00	1.40	2.41	69%	1.66	4,796	4,796	**6,694**
7-Jun-16	24.68	14.17	4.75	9.42	22.83	28.03	2.56	0.92	1.70	2.02	69%	1.39	7,038	7,038	**6,166**
8-Jun-16	23.65	11.83	4.67	7.17	14.13	27.64	3.54	1.27	1.19	2.04	69%	1.41	4,958	4,958	**5,860**
9-Jun-16	20.60	13.17	3.97	9.20	10.75	27.36	5.10	1.84	1.99	2.16	69%	1.49	3,940	3,940	**5,516**
10-Jun-16	22.37	15.50	4.05	11.45	13.80	27.55	4.72	1.70	1.35	2.36	69%	1.63	4,747	4,747	**5,416**
11-Jun-16	26.22	16.17	4.45	11.72	17.18	27.16	2.02	0.73	1.32	2.09	69%	1.44	6,091	6,091	**5,593**
12-Jun-16	22.92	11.67	3.73	7.93	17.58	25.89	4.79	1.72	1.51	1.91	69%	1.32	5,472	5,472	**5,292**
13-Jun-16	25.90	10.33	4.75	5.58	11.90	17.23	1.80	0.65	1.81	2.04	69%	1.41	4,377	4,377	**5,232**
14-Jun-16	24.43	8.83	4.05	4.78	8.38	27.38	2.68	0.96	1.30	2.04	69%	1.41	3,916	3,916	**4,786**
15-Jun-16	21.20	6.83	3.30	3.53	7.18	28.75	4.40	1.58	1.20	1.91	69%	1.32	3,290	3,290	**4,548**
16-Jun-16	24.78	9.17	3.55	5.62	5.30	25.28	9.42	3.39	1.89	1.79	69%	1.24	3,636	3,636	**4,504**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.** **Max 7 Day Avg.**	**12,908** **69,816**	**Peaking Factor**	**5.41**

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**7 Day Ave**
17-Jun-16	30.17	9.67	3.82	5.85	8.43	35.70	19.62	7.06	1.32	1.77	69%	1.22	6,392	6,392	**4,739**
18-Jun-16	29.83	7.67	4.42	3.25	8.78	23.78	17.41	6.27	1.42	1.91	69%	1.32	5,511	5,511	**4,656**
19-Jun-16	29.71	9.33	4.45	4.88	4.88	27.17	20.22	7.28	1.65	2.02	69%	1.39	4,995	4,995	**4,588**
20-Jun-16	27.48	9.17	4.55	4.62	7.33	26.41	19.86	7.15	1.15	2.16	69%	1.49	5,021	5,021	**4,680**
21-Jun-16	27.57	11.17	4.32	6.85	6.93	33.38	17.79	6.40	2.03	2.25	69%	1.55	5,491	5,491	**4,905**
22-Jun-16	18.46	13.67	3.33	10.33	10.28	39.71	25.31	9.11	1.35	2.16	69%	1.49	4,619	4,619	**5,095**
23-Jun-16	27.49	18.33	3.18	15.15	15.50	23.88	22.17	7.98	1.70	2.41	69%	1.66	7,031	7,031	**5,580**
24-Jun-16	26.03	28.83	4.38	24.45	22.73	32.86	27.36	9.85	1.37	2.70	69%	1.87	8,999	8,999	**5,953**
25-Jun-16	25.24	40.00	3.90	36.10	36.68	38.10	27.12	9.76	1.28	3.21	69%	2.21	12,006	12,006	**6,880**
26-Jun-16	26.27	34.17	3.70	30.47	54.15	39.64	27.94	10.06	1.40	3.18	69%	2.20	16,486	16,486	**8,522**
27-Jun-16	22.51	43.17	3.73	39.43	45.70	43.20	37.13	13.37	1.31	3.16	69%	2.18	13,111	13,111	**9,678**
28-Jun-16	29.01	28.17	3.87	24.30	59.15	39.98	42.36	15.25	1.35	2.75	69%	1.90	20,177	20,177	**11,776**
29-Jun-16	23.56	18.33	3.62	14.72	36.45	29.45	29.96	10.79	1.88	2.59	69%	1.79	10,865	10,865	**12,668**
30-Jun-16	28.49	16.83	3.37	13.47	22.08	38.35	30.05	10.82	1.80	2.34	69%	1.61	10,246	10,246	**13,127**
1-Jul-16	26.14	12.33	3.37	8.97	20.20	39.10	28.23	10.16	1.68	2.20	69%	1.52	8,898	8,898	**13,113**
2-Jul-16	28.35	11.17	3.98	7.18	13.45	36.83	22.97	8.27	1.00	2.29	69%	1.58	7,466	7,466	**12,464**
3-Jul-16	19.69	9.00	3.18	5.82	10.78	37.56	33.60	12.10	1.89	2.25	69%	1.55	5,334	5,334	**10,871**
4-Jul-16	14.05	10.17	2.87	7.30	8.73	25.50	35.42	12.75	1.36	2.54	69%	1.76	3,191	3,191	**9,454**
5-Jul-16	19.64	16.83	2.98	13.85	10.95	17.03	44.87	16.15	1.55	2.84	69%	1.96	4,880	4,880	**7,269**
6-Jul-16	20.00	14.00	3.06	10.94	20.78	27.32	40.29	14.50	1.56	2.57	69%	1.77	6,865	6,865	**6,697**
7-Jul-16	20.66	17.33	3.52	13.82	16.41	26.00	40.30	14.51	1.28	2.82	69%	1.94	6,261	6,261	**6,128**
8-Jul-16	23.95	25.33	3.37	21.97	20.73	34.82	41.10	14.80	1.67	2.57	69%	1.77	8,680	8,680	**6,097**
9-Jul-16	29.56	110.33	4.90	105.43	32.95	52.16	41.98	15.11	1.51	3.25	69%	2.24	15,030	15,030	**7,177**
10-Jul-16	28.94	164.17	5.15	159.02	158.15	50.89	48.25	17.37	1.76	3.87	69%	2.67	45,365	45,365	**12,896**
11-Jul-16	30.40	96.17	4.33	91.83	238.53	46.92	43.65	15.71	1.19	2.93	69%	2.02	67,172	67,172	**22,036**
12-Jul-16	30.81	119.17	3.93	115.23	137.75	42.73	45.00	16.20	1.77	2.96	69%	2.04	42,128	42,128	**27,357**
13-Jul-16	22.70	195.83	3.58	192.25	172.85	42.43	59.76	21.51	2.16	3.41	69%	2.35	38,472	38,472	**31,872**
14-Jul-16	29.41	157.00	4.92	152.08	288.38	36.80	39.55	14.24	1.79	3.64	69%	2.51	76,563	76,563	**41,916**
15-Jul-16	22.30	100.17	5.33	94.83	228.13	28.81	36.49	13.14	1.50	3.55	69%	2.45	46,245	46,245	**47,282**
16-Jul-16	25.56	66.67	5.68	60.98	142.25	45.60	2.72	0.98	1.74	3.00	69%	2.07	33,933	33,933	**49,983**
17-Jul-16	24.75	55.67	4.52	51.15	91.48	49.17	2.32	0.84	1.05	2.57	69%	1.77	22,358	22,358	**46,696**
18-Jul-16	28.60	49.00	5.08	43.92	76.73	44.67	2.83	1.02	1.34	2.75	69%	1.90	22,153	22,153	**40,265**
19-Jul-16	26.78	37.67	4.38	33.28	65.88	41.35	2.44	0.88	1.44	2.64	69%	1.82	18,103	18,103	**36,833**
20-Jul-16	27.67	28.67	4.30	24.37	49.93	43.22	15.31	5.51	1.40	2.80	69%	1.93	15,859	15,859	**33,602**
21-Jul-16	25.76	20.67	3.43	17.23	36.55	43.49	16.22	5.84	2.68	2.61	69%	1.80	12,203	12,203	**24,408**
22-Jul-16	32.67	13.33	4.08	9.25	25.85	22.39	23.40	8.42	0.98	2.61	69%	1.80	10,986	10,986	**19,371**
23-Jul-16	33.73	8.00	4.37	3.63	13.88	29.88	22.94	8.26	1.24	2.52	69%	1.74	8,577	8,577	**15,748**
24-Jul-16	28.85	6.83	3.27	3.57	5.45	27.99	24.09	8.67	1.83	2.48	69%	1.71	5,383	5,383	**13,323**
25-Jul-16	29.28	6.38	3.72	2.67	5.35	26.56	26.66	9.60	1.16	2.50	69%	1.72	5,335	5,335	**10,921**
26-Jul-16	26.37	4.00	3.45	0.55	4.00	27.03	28.98	10.43	2.59	2.39	69%	1.65	4,952	4,952	**9,042**
27-Jul-16	33.34	4.50	3.63	0.87	0.82	24.82	21.90	7.89	1.12	2.29	69%	1.58	4,318	4,318	**7,394**
28-Jul-16	22.64	10.33	3.92	6.42	1.30	33.82	17.68	6.36	2.02	2.34	69%	1.61	3,474	3,474	**6,147**

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg.	12,908	Peaking Factor	5.41
	Max 7 Day Avg.	69,816		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
29-Jul-16	26.54	30.83	3.22	27.62	9.63	42.95	32.99	11.88	1.11	3.27	69%	2.26	7,214	7,214	**5,608**
30-Jul-16	26.61	44.83	3.48	41.35	41.43	56.72	35.33	12.72	0.93	3.91	69%	2.70	15,308	15,308	**6,569**
31-Jul-16	26.54	39.33	2.93	36.40	62.03	75.21	50.96	18.35	2.08	3.48	69%	2.40	21,958	21,958	**8,937**
1-Aug-16	27.76	33.33	3.15	30.18	54.60	51.68	49.91	17.97	2.24	2.75	69%	1.90	19,623	19,623	**10,978**
2-Aug-16	22.73	57.83	2.45	55.38	45.28	50.30	67.11	24.16	1.91	3.64	69%	2.51	15,054	15,054	**12,421**
3-Aug-16	27.30	28.50	3.57	24.93	83.08	41.54	53.35	19.20	1.01	2.96	69%	2.04	25,083	25,083	**15,388**
4-Aug-16	29.86	22.83	4.25	18.58	37.40	27.57	38.65	13.91	1.57	2.43	69%	1.68	14,287	14,287	**16,933**
5-Aug-16	25.72	28.50	3.47	25.03	27.88	49.00	5.42	1.95	2.01	2.82	69%	1.94	9,984	9,984	**17,328**
6-Aug-16	26.60	48.00	3.78	44.22	37.55	55.28	0.00	0.00	1.42	2.82	69%	1.94	12,432	12,432	**16,917**
7-Aug-16	27.26	50.00	3.60	46.40	66.33	64.09	0.00	0.00	1.11	3.16	69%	2.18	19,818	19,818	**16,612**
8-Aug-16	23.87	51.33	4.45	46.88	69.60	61.46	0.00	0.00	0.74	3.09	69%	2.13	17,782	17,782	**16,349**
9-Aug-16	27.70	40.83	3.98	36.85	70.33	37.38	0.00	0.00	2.17	2.75	69%	1.90	19,549	19,549	**16,991**
10-Aug-16	30.28	65.17	4.20	60.97	55.28	61.37	0.00	0.00	2.03	2.66	69%	1.83	19,180	19,180	**16,147**
11-Aug-16	30.22	88.00	4.60	83.40	91.45	63.01	0.00	0.00	1.35	3.32	69%	2.29	28,311	28,311	**18,151**
12-Aug-16	33.09	67.17	4.23	62.93	125.10	61.75	0.00	0.00	1.92	3.16	69%	2.18	40,325	40,325	**22,485**
13-Aug-16	28.54	46.17	4.50	41.67	94.40	65.79	0.00	0.00	1.66	3.07	69%	2.12	27,657	27,657	**24,660**
14-Aug-16	19.98	37.67	5.13	32.53	62.50	50.71	0.00	0.00	1.83	3.21	69%	2.21	13,399	13,399	**23,743**
15-Aug-16	27.68	39.00	5.42	33.58	48.80	50.76	0.00	0.00	1.13	3.21	69%	2.21	15,244	15,244	**23,381**
16-Aug-16	25.29	34.83	4.83	30.00	50.38	37.03	12.46	4.49	1.38	2.96	69%	2.04	14,110	14,110	**22,604**
17-Aug-16	22.90	34.33	4.27	30.07	45.00	42.45	0.00	0.00	1.52	2.84	69%	1.96	11,476	11,476	**21,503**
18-Aug-16	20.70	29.50	3.22	26.28	45.10	43.72	0.00	0.00	2.10	3.62	69%	2.50	10,645	10,645	**18,980**
19-Aug-16	24.50	25.17	3.54	21.63	39.43	40.79	0.00	0.00	1.30	2.80	69%	1.93	10,998	10,998	**14,790**
20-Aug-16	24.65	25.00	3.87	21.13	32.44	37.26	0.00	0.00	1.62	2.68	69%	1.85	9,480	9,480	**12,193**
21-Aug-16	18.63	24.17	3.27	20.90	31.70	40.61	0.00	0.00	1.44	3.05	69%	2.10	7,203	7,203	**11,308**
22-Aug-16	25.14	29.33	3.37	25.97	31.35	44.06	0.00	0.00	1.51	2.86	69%	1.98	9,834	9,834	**10,535**
23-Aug-16	23.72	26.50	2.95	23.55	38.95	30.22	0.00	0.00	1.58	2.82	69%	1.94	10,040	10,040	**9,954**
24-Aug-16	27.39	27.67	3.47	24.20	35.33	34.69	0.00	0.00	2.21	2.93	69%	2.02	11,204	11,204	**9,915**
25-Aug-16	26.44	23.83	3.52	20.31	36.30	38.92	0.00	0.00	1.97	2.59	69%	1.79	11,184	11,184	**9,992**
26-Aug-16	29.28	22.67	3.35	19.32	30.47	34.49	0.00	0.00	1.58	2.48	69%	1.71	10,550	10,550	**9,928**
27-Aug-16	28.37	22.00	3.90	18.10	28.98	42.50	0.00	0.00	1.01	2.89	69%	1.99	10,319	10,319	**10,048**
28-Aug-16	28.79	25.50	4.70	20.80	27.15	35.28	0.00	0.00	1.65	2.82	69%	1.94	9,703	9,703	**10,405**
29-Aug-16	20.92	20.83	3.57	17.27	31.20	40.20	0.00	0.00	1.10	2.68	69%	1.85	7,879	7,879	**10,126**
30-Aug-16	25.74	22.00	4.00	18.00	25.90	22.94	0.00	0.00	1.13	3.02	69%	2.09	7,600	7,600	**9,777**
31-Aug-16	28.20	18.50	3.75	14.75	27.00	33.01	0.00	0.00	2.07	3.02	69%	2.09	9,453	9,453	**9,527**
1-Sep-16	25.89	15.17	4.38	10.78	22.13	27.77	0.00	0.00	1.18	2.52	69%	1.74	7,050	7,050	**8,936**
2-Sep-16	26.44	15.67	4.08	11.58	16.18	38.05	0.00	0.00	1.59	3.00	69%	2.07	6,672	6,672	**8,382**
3-Sep-16	25.66	15.83	4.10	11.73	17.38	34.65	0.00	0.00	1.55	2.70	69%	1.87	6,480	6,480	**7,834**
4-Sep-16	25.34	15.00	4.08	10.92	17.60	33.44	0.00	0.00	1.03	2.73	69%	1.88	6,270	6,270	**7,343**
5-Sep-16	28.43	13.00	3.70	9.30	16.38	31.78	0.00	0.00	1.72	2.93	69%	2.02	6,834	6,834	**7,194**
6-Sep-16	29.00	13.50	3.65	9.85	13.95	27.17	0.00	0.00	1.09	2.86	69%	1.98	5,914	5,914	**6,953**
7-Sep-16	33.26	7.33	4.85	2.48	14.78	40.69	0.00	0.00	1.39	2.82	69%	1.94	8,115	8,115	**6,762**
8-Sep-16	32.23	7.50	2.87	4.63	3.73	40.82	0.00	0.00	1.58	2.61	69%	1.80	4,914	4,914	**6,457**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg. Max 7 Day Avg.	12,908 69,816	Peaking Factor	5.41

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
9-Sep-16	31.10	8.33	2.53	5.80	6.95	43.74	0.00	0.00	1.37	2.89	69%	1.99	5,782	5,782	**6,330**
10-Sep-16	28.61	8.83	2.60	6.23	8.70	35.34	0.00	0.00	0.91	2.77	69%	1.91	5,060	5,060	**6,127**
11-Sep-16	27.24	9.67	3.02	6.65	9.35	27.79	0.00	0.00	1.46	2.86	69%	1.98	4,633	4,633	**5,893**
12-Sep-16	30.75	11.17	3.07	8.10	9.98	34.26	0.00	0.00	2.26	2.89	69%	1.99	6,055	6,055	**5,782**
13-Sep-16	29.07	10.83	2.47	8.37	12.15	30.51	0.00	0.00	2.08	2.89	69%	1.99	5,959	5,959	**5,788**
14-Sep-16	35.13	10.50	4.13	6.37	12.55	33.20	0.00	0.00	1.43	2.93	69%	2.02	7,351	7,351	**5,679**
15-Sep-16	27.59	10.17	3.15	7.02	9.55	42.94	0.00	0.00	1.25	2.68	69%	1.85	5,615	5,615	**5,779**
16-Sep-16	32.34	8.00	3.60	4.40	10.53	44.91	0.00	0.00	1.28	2.34	69%	1.61	6,938	6,938	**5,944**
17-Sep-16	22.97	7.50	2.32	5.18	6.60	48.23	0.00	0.00	0.55	2.66	69%	1.83	4,251	4,251	**5,829**
18-Sep-16	29.08	9.33	2.18	7.15	7.78	35.67	0.00	0.00	1.45	2.75	69%	1.90	5,066	5,066	**5,891**
19-Sep-16	32.69	19.33	2.52	16.82	10.73	28.74	0.00	0.00	1.48	2.52	69%	1.74	5,949	5,949	**5,876**
20-Sep-16	30.94	18.33	3.43	14.90	25.23	36.53	0.00	0.00	2.23	2.39	69%	1.65	10,089	10,089	**6,466**
21-Sep-16	26.85	21.67	2.67	19.00	22.35	38.00	0.00	0.00	1.12	2.54	69%	1.76	7,980	7,980	**6,555**
22-Sep-16	26.59	36.83	2.50	34.33	28.50	58.50	0.00	0.00	2.95	3.59	69%	2.48	11,079	11,079	**7,336**
23-Sep-16	30.24	77.50	3.23	74.27	51.50	57.79	0.00	0.00	1.26	4.21	69%	2.90	18,031	18,031	**8,921**
24-Sep-16	27.88	109.00	4.57	104.43	111.40	84.71	0.00	0.00	0.42	4.98	69%	3.44	32,194	32,194	**12,912**
25-Sep-16	24.78	80.00	4.08	75.92	156.65	86.97	0.00	0.00	2.73	4.23	69%	2.92	38,455	38,455	**17,682**
26-Sep-16	27.49	53.83	4.25	49.58	113.88	68.19	0.00	0.00	1.68	4.19	69%	2.89	31,435	31,435	**21,323**
27-Sep-16	26.55	45.33	4.48	40.85	74.38	66.09	0.00	0.00	1.48	3.71	69%	2.56	21,371	21,371	**22,935**
28-Sep-16	25.19	37.83	3.72	34.12	61.28	67.24	0.00	0.00	1.62	3.57	69%	2.46	17,601	17,601	**24,309**
29-Sep-16	25.10	33.00	3.67	29.33	51.18	60.54	9.50	3.42	0.65	3.68	69%	2.54	15,325	15,325	**24,916**
30-Sep-16	21.63	32.00	4.22	27.78	44.00	50.11	29.21	10.51	1.52	3.62	69%	2.50	12,386	12,386	**24,110**
1-Oct-16	27.41	27.83	4.68	23.15	41.68	45.60	29.42	10.59	1.33	3.18	69%	2.20	14,785	14,785	**21,623**
2-Oct-16	21.73	26.50	2.68	23.82	34.73	32.36	29.28	10.54	1.65	3.14	69%	2.16	9,849	9,849	**17,536**
3-Oct-16	27.89	23.33	3.82	19.52	35.73	29.03	33.66	12.12	2.02	2.96	69%	2.04	12,966	12,966	**14,898**
4-Oct-16	24.43	20.33	3.68	16.65	29.28	32.97	26.60	9.57	1.66	2.96	69%	2.04	9,847	9,847	**13,251**
5-Oct-16	25.72	20.00	3.93	16.07	24.98	28.89	33.07	11.91	1.35	3.00	69%	2.07	9,475	9,475	**12,091**
6-Oct-16	21.74	18.50	2.95	15.55	24.10	31.56	35.32	12.71	2.08	3.02	69%	2.09	8,212	8,212	**11,074**
7-Oct-16	28.16	19.00	3.65	15.35	23.33	27.62	33.25	11.97	1.46	3.21	69%	2.21	9,973	9,973	**10,730**
8-Oct-16	28.85	16.83	3.55	13.28	23.03	26.95	32.18	11.58	1.63	3.23	69%	2.23	10,083	10,083	**10,058**
9-Oct-16	26.34	18.50	3.70	14.80	19.93	28.94	35.26	12.69	1.62	3.00	69%	2.07	8,769	8,769	**9,903**
10-Oct-16	28.17	17.33	4.13	13.20	22.20	26.81	31.99	11.52	1.74	3.00	69%	2.07	9,623	9,623	**9,426**
11-Oct-16	26.96	15.17	3.65	11.52	19.80	34.53	34.31	12.35	2.04	3.14	69%	2.16	9,357	9,357	**9,356**
12-Oct-16	25.64	15.50	3.70	11.80	17.28	39.29	36.17	13.02	1.30	3.18	69%	2.20	8,579	8,579	**9,228**
13-Oct-16	26.34	13.67	2.93	10.73	17.70	14.88	35.28	12.70	1.36	3.11	69%	2.15	7,394	7,394	**9,111**
14-Oct-16	23.08	12.33	3.88	8.45	16.10	23.34	36.68	13.21	1.98	2.98	69%	2.05	6,783	6,783	**8,655**
15-Oct-16	25.33	11.17	3.35	7.82	12.68	20.76	33.27	11.98	1.30	2.96	69%	2.04	6,252	6,252	**8,108**
16-Oct-16	25.17	9.33	3.05	6.28	11.73	16.78	32.33	11.64	1.63	2.80	69%	1.93	5,785	5,785	**7,682**
17-Oct-16	23.89	8.83	3.40	5.43	9.43	19.07	36.28	13.06	1.25	2.80	69%	1.93	5,269	5,269	**7,060**
18-Oct-16	23.51	7.33	2.88	4.45	8.15	20.24	35.11	12.64	1.76	2.61	69%	1.80	5,019	5,019	**6,440**
19-Oct-16	25.10	6.50	2.85	3.65	6.68	17.04	34.89	12.56	1.49	2.61	69%	1.80	4,800	4,800	**5,900**
20-Oct-16	21.77	4.00	2.48	1.52	5.48	18.89	31.91	11.49	1.49	2.75	69%	1.90	3,924	3,924	**5,405**

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	**12,908**	**Peaking Factor**	**5.41**
	Max 7 Day Avg.	**69,816**		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
21-Oct-16	24.46	5.17	2.47	2.70	2.28	7.49	23.44	8.44	1.49	2.80	69%	1.93	2,716	2,716	**4,824**
22-Oct-16	25.83	6.33	3.32	3.02	4.05	25.98	22.57	8.13	0.54	2.77	69%	1.91	4,089	4,089	**4,515**
23-Oct-16	23.26	8.33	3.65	4.68	4.53	10.40	25.63	9.23	1.30	2.75	69%	1.90	3,231	3,231	**4,150**
24-Oct-16	21.16	9.00	2.70	6.30	7.03	17.28	25.28	9.10	1.72	2.73	69%	1.88	3,770	3,770	**3,936**
25-Oct-16	22.77	11.00	3.73	7.27	9.45	17.81	25.68	9.25	1.53	2.70	69%	1.87	4,526	4,526	**3,865**
26-Oct-16	24.61	11.67	3.50	8.17	10.90	18.89	21.38	7.70	1.90	2.57	69%	1.77	5,095	5,095	**3,907**
27-Oct-16	27.22	14.17	3.30	10.87	12.25	17.95	13.93	5.01	1.75	2.73	69%	1.88	5,473	5,473	**4,129**
28-Oct-16	27.32	12.67	4.62	8.05	16.30	22.60	14.78	5.32	1.97	2.50	69%	1.72	6,766	6,766	**4,707**
29-Oct-16	28.18	12.00	3.75	8.25	12.08	20.56	11.77	4.24	0.80	2.82	69%	1.94	5,463	5,463	**4,903**
30-Oct-16	27.49	11.33	3.60	7.73	12.38	18.39	11.90	4.29	1.54	2.54	69%	1.76	5,396	5,396	**5,213**
31-Oct-16	22.05	10.00	2.85	7.15	11.60	20.88	11.84	4.26	2.29	2.70	69%	1.87	4,466	4,466	**5,312**
1-Nov-16	22.10	8.67	2.87	5.80	10.73	20.25	12.25	4.41	1.48	2.73	69%	1.88	4,155	4,155	**5,259**
2-Nov-16	28.17	9.00	3.70	5.30	8.70	22.33	12.16	4.38	2.03	2.39	69%	1.65	5,023	5,023	**5,249**
3-Nov-16	29.30	7.67	3.08	4.58	7.95	13.46	11.02	3.97	1.41	2.68	69%	1.85	4,279	4,279	**5,078**
4-Nov-16	27.19	8.00	3.20	4.80	6.88	21.76	13.96	5.02	1.55	2.54	69%	1.76	4,413	4,413	**4,742**
5-Nov-16	26.35	9.83	3.40	6.43	7.20	23.39	12.90	4.65	1.06	2.50	69%	1.72	4,275	4,275	**4,572**
6-Nov-16	27.03	8.67	3.23	5.43	9.65	19.78	11.73	4.22	1.83	2.45	69%	1.69	4,819	4,819	**4,490**
7-Nov-16	29.74	7.50	3.17	4.33	8.15	21.75	12.20	4.39	1.58	2.32	69%	1.60	5,006	5,006	**4,567**
8-Nov-16	26.22	8.17	3.12	5.05	6.50	20.93	12.08	4.35	1.49	2.43	69%	1.68	3,993	3,993	**4,544**
9-Nov-16	30.09	6.50	3.75	2.75	7.58	26.92	7.68	2.77	1.89	2.45	69%	1.69	5,109	5,109	**4,556**
10-Nov-16	23.02	6.17	2.92	3.25	4.13	36.93	0.00	0.00	1.41	2.45	69%	1.69	3,329	3,329	**4,420**
11-Nov-16	21.30	6.67	2.70	3.97	4.88	38.32	0.00	0.00	1.13	2.20	69%	1.52	3,202	3,202	**4,247**
12-Nov-16	22.11	7.83	2.67	5.17	5.95	38.57	0.00	0.00	1.87	2.27	69%	1.57	3,678	3,678	**4,162**
13-Nov-16	23.67	7.17	2.85	4.32	7.75	42.04	0.00	0.00	1.73	2.45	69%	1.69	4,478	4,478	**4,113**
14-Nov-16	25.54	6.33	2.77	3.57	6.48	34.15	0.00	0.00	1.30	2.34	69%	1.61	3,992	3,992	**3,969**
15-Nov-16	26.57	5.83	3.20	2.63	5.35	34.70	0.00	0.00	1.96	2.43	69%	1.68	4,099	4,099	**3,984**
16-Nov-16	24.58	5.33	3.30	2.03	3.95	30.17	0.00	0.00	1.42	2.43	69%	1.68	3,138	3,138	**3,702**
17-Nov-16	28.91	5.67	2.92	2.75	3.05	35.57	0.00	0.00	1.66	2.32	69%	1.60	3,870	3,870	**3,779**
18-Nov-16	27.03	5.50	2.53	2.97	4.13	37.36	0.00	0.00	1.26	2.48	69%	1.71	3,904	3,904	**3,880**
19-Nov-16	19.06	5.17	2.38	2.78	4.45	36.23	0.00	0.00	1.11	2.32	69%	1.60	2,716	2,716	**3,742**
20-Nov-16	24.81	6.83	3.18	3.65	4.18	41.11	0.00	0.00	2.07	2.34	69%	1.61	3,956	3,956	**3,668**
21-Nov-16	23.75	6.00	2.55	3.45	5.48	24.33	0.00	0.00	2.18	2.25	69%	1.55	3,144	3,144	**3,547**
22-Nov-16	27.32	6.00	3.18	2.82	5.18	37.75	0.00	0.00	2.10	2.32	69%	1.60	4,377	4,377	**3,586**
23-Nov-16	20.92	5.33	2.10	3.23	4.23	40.05	0.00	0.00	1.36	2.20	69%	1.52	3,153	3,153	**3,588**
24-Nov-16	20.42	5.83	2.45	3.38	4.85	40.06	0.00	0.00	1.69	2.34	69%	1.61	3,258	3,258	**3,501**
25-Nov-16	20.76	5.33	2.38	2.95	5.08	35.98	0.00	0.00	1.27	2.23	69%	1.54	3,071	3,071	**3,382**
26-Nov-16	21.24	5.33	2.35	2.98	4.43	33.11	0.00	0.00	1.41	2.34	69%	1.61	2,925	2,925	**3,412**
27-Nov-16	18.04	6.00	2.47	3.53	4.48	34.20	0.00	0.00	1.16	2.20	69%	1.52	2,484	2,484	**3,202**
28-Nov-16	24.54	6.17	3.08	3.08	5.30	19.23	0.00	0.00	0.91	2.36	69%	1.63	2,681	2,681	**3,136**
29-Nov-16	23.73	5.83	2.70	3.13	4.63	29.16	0.00	0.00	0.65	2.36	69%	1.63	2,946	2,946	**2,931**
30-Nov-16	23.40	6.00	2.17	3.83	4.70	29.57	0.00	0.00	0.77	2.27	69%	1.57	2,953	2,953	**2,903**
1-Dec-16	14.17	6.33	3.40	2.93	5.75	36.85	0.00	0.00	0.91	2.36	69%	1.63	2,173	2,173	**2,748**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg.	12,908	Peaking Factor	5.41
	Max 7 Day Avg.	69,816		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
2-Dec-16	11.05	6.25	2.40	3.85	4.40	26.29	0.00	0.00	1.74	2.34	69%	1.61	1,378	1,378	**2,506**
3-Dec-16	18.18	9.00	2.45	6.55	5.78	29.33	0.00	0.00	0.89	2.39	69%	1.65	2,477	2,477	**2,442**
4-Dec-16	21.22	9.67	3.73	5.93	9.83	31.08	0.00	0.00	0.54	2.36	69%	1.63	3,630	3,630	**2,605**
5-Dec-16	10.75	10.75	3.45	7.30	8.90	32.77	0.00	0.00	0.77	2.54	69%	1.76	1,829	1,829	**2,484**
6-Dec-16	12.95	8.40	2.86	5.54	10.95	32.36	0.00	0.00	2.03	2.32	69%	1.60	2,531	2,531	**2,424**
7-Dec-16	7.38	5.50	2.08	3.43	8.31	8.21	0.00	0.00	1.67	2.07	69%	1.43	840	840	**2,123**
8-Dec-16	11.06	4.60	2.18	2.42	5.14	29.69	0.00	0.00	1.67	2.32	69%	1.60	1,524	1,524	**2,030**
9-Dec-16	12.66	4.25	2.15	2.10	3.63	25.96	0.00	0.00	1.60	1.70	69%	1.17	1,427	1,427	**2,037**
10-Dec-16	18.03	4.00	2.73	1.27	3.15	27.52	0.00	0.00	0.98	2.16	69%	1.49	1,979	1,979	**1,966**
11-Dec-16	23.67	4.83	2.62	2.22	1.90	23.34	0.00	0.00	1.55	2.13	69%	1.47	2,234	2,234	**1,766**
12-Dec-16	16.69	4.25	2.75	1.50	3.33	28.64	0.00	0.00	1.98	2.25	69%	1.55	2,046	2,046	**1,797**
13-Dec-16	20.10	5.17	2.27	2.90	2.25	24.89	0.00	0.00	2.28	1.04	69%	0.72	2,022	2,022	**1,725**
14-Dec-16	17.99	9.00	3.42	5.58	4.35	33.22	0.00	0.00	1.40	2.66	69%	1.83	2,502	2,502	**1,962**
15-Dec-16	19.59	9.17	3.87	5.30	8.38	37.35	0.00	0.00	1.36	2.32	69%	1.60	3,522	3,522	**2,247**
16-Dec-16	23.70	18.83	3.93	14.90	7.95	68.69	0.00	0.00	1.68	2.70	69%	1.87	5,990	5,990	**2,899**
17-Dec-16	24.73	15.67	1.82	13.85	22.35	69.26	0.00	0.00	0.53	2.59	69%	1.79	9,000	9,000	**3,902**
18-Dec-16	23.56	22.67	2.32	20.35	20.78	69.82	0.00	0.00	1.87	2.75	69%	1.90	8,580	8,580	**4,809**
19-Dec-16	20.23	112.83	2.85	109.98	30.53	61.63	0.00	0.00	2.04	3.62	69%	2.50	8,763	8,763	**5,768**
20-Dec-16	21.02	162.33	3.55	158.78	164.98	55.68	0.00	0.00	1.76	3.14	69%	2.16	32,282	32,282	**10,091**
21-Dec-16	26.25	113.00	5.37	107.63	238.18	82.56	0.00	0.00	1.76	2.16	69%	1.49	57,796	57,796	**17,990**
22-Dec-16	22.32	145.20	8.14	137.06	161.45	60.36	0.00	0.00	1.77	2.98	69%	2.05	33,849	33,849	**22,323**
23-Dec-16	17.86	130.00	3.63	126.37	205.59	64.46	0.00	0.00	1.89	3.39	69%	2.34	33,889	33,889	**26,309**
24-Dec-16	23.18	114.00	4.40	109.60	189.55	70.92	0.00	0.00	0.95	3.46	69%	2.39	41,050	41,050	**30,887**
25-Dec-16	15.46	85.67	3.00	82.67	164.40	67.11	0.00	0.00	1.59	2.77	69%	1.91	24,011	24,011	**33,091**
26-Dec-16	22.09	89.33	4.65	84.68	124.00	65.90	0.00	0.00	2.27	2.66	69%	1.83	26,921	26,921	**35,685**
27-Dec-16	22.67	82.17	5.02	77.15	127.03	34.14	0.00	0.00	1.69	3.09	69%	2.13	26,507	26,507	**34,860**
28-Dec-16	21.38	137.67	5.43	132.23	115.73	66.23	0.00	0.00	1.67	3.39	69%	2.34	24,585	24,585	**30,116**
29-Dec-16	22.21	176.50	4.18	172.32	198.35	73.41	0.00	0.00	0.81	2.27	69%	1.57	40,902	40,902	**31,123**
30-Dec-16	22.02	184.00	4.45	179.55	258.48	51.55	0.00	0.00	1.74	2.29	69%	1.58	50,661	50,661	**33,519**
31-Dec-16	22.57	121.33	4.13	117.20	269.33	66.65	0.00	0.00	1.12	2.45	69%	1.69	54,655	54,655	**35,463**
1-Jan-17	20.83	91.50	4.25	87.25	175.80	59.09	0.00	0.00	0.93	2.16	69%	1.49	33,775	33,775	**36,858**
2-Jan-17	21.73	77.17	4.57	72.60	130.88	51.63	0.00	0.00	2.59	2.36	69%	1.63	27,043	27,043	**36,875**
3-Jan-17	21.87	58.00	4.60	53.40	108.90	46.39	0.00	0.00	1.72	2.02	69%	1.39	22,746	22,746	**36,338**
4-Jan-17	20.57	50.75	6.40	44.35	80.10	29.13	0.00	0.00	1.61	2.09	69%	1.44	15,636	15,636	**35,060**
5-Jan-17	21.94	47.67	4.48	43.18	66.53	41.26	0.00	0.00	1.51	1.68	69%	1.16	14,728	14,728	**31,320**
6-Jan-17	25.16	39.33	5.07	34.27	64.78	41.60	0.00	0.00	1.54	1.84	69%	1.27	16,570	16,570	**26,450**
7-Jan-17	22.40	28.33	4.17	24.17	51.40	45.04	0.00	0.00	0.88	1.79	69%	1.24	12,302	12,302	**20,400**
8-Jan-17	23.45	20.33	4.08	16.25	36.25	42.18	0.00	0.00	2.81	1.63	69%	1.13	10,120	10,120	**17,021**
9-Jan-17	23.08	19.67	3.93	15.73	24.38	39.88	0.00	0.00	0.58	1.77	69%	1.22	7,141	7,141	**14,177**
10-Jan-17	20.43	19.00	4.06	14.94	23.60	42.64	0.00	0.00	2.22	1.84	69%	1.27	6,605	6,605	**11,871**
11-Jan-17	22.22	19.83	3.43	16.41	22.41	32.51	0.00	0.00	2.24	1.88	69%	1.30	6,459	6,459	**10,561**
12-Jan-17	22.03	19.67	3.15	16.52	24.61	39.24	0.00	0.00	1.17	1.82	69%	1.25	6,940	6,940	**9,448**

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	**12,908**	**Peaking Factor**	**5.41**
	Max 7 Day Avg.	**69,816**		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	**Total**	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**7 Day Ave**
13-Jan-17	22.79	21.17	4.08	17.08	24.78	38.98	0.00	0.00	1.17	1.86	69%	1.28	7,204	7,204	**8,110**
14-Jan-17	22.61	32.00	3.82	28.18	25.63	42.08	0.00	0.00	2.03	1.97	69%	1.36	7,644	7,644	**7,445**
15-Jan-17	17.52	40.83	3.02	37.82	42.28	47.00	0.00	0.00	1.54	2.23	69%	1.54	8,508	8,508	**7,214**
16-Jan-17	21.41	35.83	4.00	31.83	56.73	44.92	0.00	0.00	1.31	1.93	69%	1.33	12,798	12,798	**8,023**
17-Jan-17	22.91	50.33	4.27	46.07	47.75	47.75	0.00	0.00	1.79	2.16	69%	1.49	12,250	12,250	**8,829**
18-Jan-17	16.59	78.80	4.74	74.06	69.10	35.78	0.00	0.00	1.43	2.77	69%	1.91	11,375	11,375	**9,531**
19-Jan-17	17.29	77.17	3.90	73.27	111.09	60.78	0.00	0.00	1.66	2.25	69%	1.55	18,877	18,877	**11,236**
20-Jan-17	16.79	57.50	3.45	54.05	109.90	53.60	0.00	0.00	0.84	2.29	69%	1.58	17,786	17,786	**12,748**
21-Jan-17	20.55	49.00	4.23	44.77	81.08	52.80	0.00	0.00	0.90	2.16	69%	1.49	16,784	16,784	**14,054**
22-Jan-17	18.11	41.00	3.20	37.80	67.15	42.73	0.00	0.00	1.85	1.91	69%	1.32	12,385	12,385	**14,608**
23-Jan-17	20.21	33.17	4.03	29.13	56.70	44.49	0.00	0.00	2.14	1.88	69%	1.30	12,188	12,188	**14,521**
24-Jan-17	22.55	38.50	4.30	34.20	43.70	39.92	0.00	0.00	1.71	1.93	69%	1.33	10,845	10,845	**14,320**
25-Jan-17	18.12	131.33	4.10	127.23	51.30	53.60	0.00	0.00	1.63	1.88	69%	1.30	10,410	10,410	**14,182**
26-Jan-17	18.97	181.00	3.40	177.60	190.85	71.66	0.00	0.00	2.74	2.13	69%	1.47	33,969	33,969	**16,338**
27-Jan-17	22.18	130.83	3.67	127.17	266.40	59.01	0.00	0.00	0.50	2.11	69%	1.46	52,626	52,626	**21,315**
28-Jan-17	20.47	82.17	3.93	78.23	190.75	67.26	0.00	0.00	0.34	1.93	69%	1.33	35,988	35,988	**24,059**
29-Jan-17	21.17	54.33	4.45	49.88	117.35	49.72	0.00	0.00	3.61	2.00	69%	1.38	24,005	24,005	**25,719**
30-Jan-17	23.21	39.83	4.88	34.95	74.83	46.44	0.00	0.00	1.48	1.77	69%	1.22	17,469	17,469	**26,473**
31-Jan-17	16.31	29.60	4.46	25.14	52.43	30.53	0.00	0.00	1.62	1.86	69%	1.28	8,661	8,661	**26,161**
1-Feb-17	15.25	26.17	3.43	22.73	37.71	42.80	0.00	0.00	1.26	1.70	69%	1.17	6,598	6,598	**25,616**
2-Feb-17	14.96	23.00	3.47	19.53	34.10	38.38	0.00	0.00	1.93	1.40	69%	0.97	5,929	5,929	**21,611**
3-Feb-17	20.74	21.83	4.42	17.42	29.30	35.50	0.00	0.00	1.15	1.68	69%	1.16	7,149	7,149	**15,114**
4-Feb-17	24.75	19.17	4.65	14.52	26.13	40.36	0.00	0.00	1.11	1.61	69%	1.11	8,132	8,132	**11,135**
5-Feb-17	17.15	16.33	3.35	12.98	21.78	24.19	0.00	0.00	1.46	1.45	69%	1.00	4,414	4,414	**8,336**
6-Feb-17	21.32	15.17	4.50	10.67	19.48	19.12	0.00	0.00	1.76	1.50	69%	1.03	4,891	4,891	**6,539**
7-Feb-17	21.76	13.17	4.27	8.90	16.00	20.62	0.00	0.00	4.05	1.68	69%	1.16	4,872	4,872	**5,998**
8-Feb-17	22.19	11.50	3.90	7.60	13.35	27.30	0.00	0.00	0.86	1.45	69%	1.00	4,198	4,198	**5,655**
9-Feb-17	19.82	10.83	4.23	6.60	11.40	25.52	0.00	0.00	0.84	1.54	69%	1.06	3,354	3,354	**5,287**
10-Feb-17	20.34	11.33	4.15	7.18	9.90	31.67	0.00	0.00	1.31	1.52	69%	1.05	3,550	3,550	**4,773**
11-Feb-17	19.80	14.83	3.40	11.43	10.78	20.94	0.00	0.00	1.68	1.61	69%	1.11	3,187	3,187	**4,067**
12-Feb-17	20.93	19.17	4.12	15.05	17.15	29.73	0.00	0.00	2.74	1.88	69%	1.30	5,120	5,120	**4,167**
13-Feb-17	26.19	19.50	4.67	14.83	22.58	23.89	0.00	0.00	0.95	2.29	69%	1.58	6,912	6,912	**4,456**
14-Feb-17	14.53	16.33	3.45	12.88	22.25	27.07	0.00	0.00	1.55	1.95	69%	1.35	3,944	3,944	**4,324**
15-Feb-17	15.96	11.80	4.05	7.75	19.33	27.98	0.00	0.00	1.10	1.59	69%	1.10	3,883	3,883	**4,279**
16-Feb-17	17.90	11.17	4.27	6.90	11.63	10.54	0.00	0.00	1.65	1.54	69%	1.06	2,571	2,571	**4,167**
17-Feb-17	19.44	9.83	3.77	6.07	10.35	25.71	0.00	0.00	1.53	1.75	69%	1.21	3,262	3,262	**4,126**
18-Feb-17	25.97	11.17	4.17	7.00	9.10	24.41	0.00	0.00	1.24	1.61	69%	1.11	3,929	3,929	**4,232**
19-Feb-17	16.92	13.00	3.48	9.52	10.50	24.24	0.00	0.00	1.64	1.79	69%	1.24	2,825	2,825	**3,904**
20-Feb-17	24.95	17.17	4.70	12.47	14.28	20.92	0.00	0.00	1.46	1.91	69%	1.32	4,739	4,739	**3,593**
21-Feb-17	21.62	17.00	5.38	11.62	18.70	28.24	0.00	0.00	1.31	2.02	69%	1.39	5,254	5,254	**3,781**
22-Feb-17	16.05	15.33	4.22	11.12	17.43	16.05	0.00	0.00	1.71	2.00	69%	1.38	3,335	3,335	**3,702**
23-Feb-17	20.72	14.17	4.62	9.55	16.68	21.81	0.00	0.00	1.15	1.93	69%	1.33	4,342	4,342	**3,955**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg. Max 7 Day Avg.	12,908 69,816	**Peaking Factor**	5.41

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
24-Feb-17	20.36	12.00	4.58	7.42	14.33	22.62	0.00	0.00	1.30	1.70	69%	1.17	3,903	3,903	**4,047**
25-Feb-17	22.34	9.50	4.75	4.75	11.13	22.73	0.00	0.00	1.51	1.75	69%	1.21	3,737	3,737	**4,019**
26-Feb-17	17.01	10.83	3.70	7.13	7.13	27.45	0.00	0.00	1.46	1.59	69%	1.10	2,440	2,440	**3,964**
27-Feb-17	21.75	12.50	4.13	8.37	10.70	26.45	0.00	0.00	1.39	1.31	69%	0.91	3,672	3,672	**3,812**
28-Feb-17	21.67	22.00	4.08	17.92	12.55	30.72	0.00	0.00	1.60	2.04	69%	1.41	4,332	4,332	**3,680**
1-Mar-17	23.24	48.83	4.45	44.38	26.88	44.00	0.00	0.00	1.83	1.04	69%	0.72	8,040	8,040	**4,352**
2-Mar-17	20.39	117.50	3.53	113.97	66.58	80.94	0.00	0.00	1.88	2.52	69%	1.74	15,702	15,702	**5,975**
3-Mar-17	19.82	115.83	3.83	112.00	170.95	90.41	0.00	0.00	1.73	3.21	69%	2.21	33,004	33,004	**10,133**
4-Mar-17	21.85	74.83	4.02	70.82	168.00	62.95	0.00	0.00	1.54	2.96	69%	2.04	34,406	34,406	**14,514**
5-Mar-17	21.59	55.83	4.03	51.80	106.23	59.24	0.00	0.00	1.40	2.43	69%	1.68	22,603	22,603	**17,394**
6-Mar-17	20.43	40.50	3.63	36.87	77.70	52.90	0.00	0.00	2.20	2.11	69%	1.46	16,331	16,331	**19,203**
7-Mar-17	19.75	28.17	3.13	25.03	55.30	34.02	0.00	0.00	2.71	2.07	69%	1.43	11,324	11,324	**20,201**
8-Mar-17	19.63	28.33	3.67	24.67	37.55	39.87	0.00	0.00	1.44	2.04	69%	1.41	8,402	8,402	**20,253**
9-Mar-17	18.67	27.17	3.65	23.52	37.00	25.83	0.00	0.00	1.46	1.93	69%	1.33	7,295	7,295	**19,052**
10-Mar-17	18.22	27.83	3.97	23.87	35.28	24.43	0.00	0.00	1.64	1.86	69%	1.28	6,822	6,822	**15,312**
11-Mar-17	15.92	23.17	3.35	19.82	35.80	31.70	0.00	0.00	1.91	1.93	69%	1.33	6,336	6,336	**11,302**
12-Mar-17	15.17	19.50	2.85	16.65	29.73	29.08	0.00	0.00	1.34	1.79	69%	1.24	5,095	5,095	**8,800**
13-Mar-17	18.93	19.33	3.32	16.02	24.98	32.35	0.00	0.00	2.43	1.56	69%	1.08	5,894	5,894	**7,310**
14-Mar-17	17.60	18.33	3.23	15.10	24.03	32.00	0.00	0.00	0.85	1.52	69%	1.05	5,090	5,090	**6,419**
15-Mar-17	15.45	15.50	2.82	12.68	22.65	28.78	0.00	0.00	2.19	1.72	69%	1.19	4,369	4,369	**5,843**
16-Mar-17	20.34	15.50	3.68	11.82	19.03	24.87	0.00	0.00	1.16	1.88	69%	1.30	4,798	4,798	**5,486**
17-Mar-17	15.60	13.50	3.15	10.35	17.73	28.12	0.00	0.00	0.71	1.63	69%	1.13	3,547	3,547	**5,018**
18-Mar-17	16.39	11.50	2.97	8.53	15.53	26.49	0.00	0.00	2.60	1.61	69%	1.11	3,621	3,621	**4,631**
19-Mar-17	16.95	10.17	2.68	7.48	12.80	27.01	0.00	0.00	1.98	1.50	69%	1.03	3,281	3,281	**4,371**
20-Mar-17	18.11	9.67	3.68	5.98	11.23	25.04	0.00	0.00	1.78	1.54	69%	1.06	3,161	3,161	**3,981**
21-Mar-17	19.75	9.00	3.33	5.67	8.98	25.07	0.00	0.00	0.87	1.68	69%	1.16	2,943	2,943	**3,674**
22-Mar-17	16.91	8.00	2.98	5.02	8.50	23.93	0.00	0.00	1.55	1.68	69%	1.16	2,506	2,506	**3,408**
23-Mar-17	19.22	8.67	2.87	5.80	7.53	28.94	0.00	0.00	1.88	1.31	69%	0.91	2,923	2,923	**3,140**
24-Mar-17	22.13	8.83	3.53	5.30	8.70	15.04	0.00	0.00	2.06	1.29	69%	0.89	2,910	2,910	**3,049**
25-Mar-17	14.82	8.33	2.35	5.98	7.95	23.76	0.00	0.00	1.47	1.70	69%	1.17	2,114	2,114	**2,834**
26-Mar-17	12.81	9.00	2.93	6.07	8.98	32.43	0.00	0.00	1.97	1.54	69%	1.06	2,231	2,231	**2,684**
27-Mar-17	13.90	9.25	4.20	5.05	9.10	16.08	0.00	0.00	2.07	1.47	69%	1.02	1,922	1,922	**2,507**
28-Mar-17	16.80	32.83	3.13	29.70	7.58	35.03	0.00	0.00	0.39	2.11	69%	1.46	2,663	2,663	**2,467**
29-Mar-17	16.85	174.17	2.90	171.27	44.55	69.32	5.70	2.05	3.00	3.68	69%	2.54	9,897	9,897	**3,523**
30-Mar-17	20.37	61.50	3.68	57.82	256.90	65.91	0.00	0.00	1.75	2.91	69%	2.01	47,353	47,353	**9,870**
31-Mar-17	17.41	108.33	2.15	106.18	86.73	75.73	0.00	0.00	0.60	3.37	69%	2.32	16,032	16,032	**11,745**
1-Apr-17	15.26	122.33	3.25	119.08	159.28	81.62	0.00	0.00	2.68	3.87	69%	2.67	23,796	23,796	**14,842**
2-Apr-17	12.65	65.50	2.25	63.25	178.63	94.60	0.00	0.00	1.79	3.21	69%	2.21	21,995	21,995	**17,665**
3-Apr-17	14.66	37.33	1.93	35.40	94.88	68.73	0.00	0.00	1.41	2.50	69%	1.72	14,281	14,281	**19,431**
4-Apr-17	16.82	23.67	2.67	21.00	53.10	42.54	0.00	0.00	1.64	1.88	69%	1.30	9,497	9,497	**20,407**
5-Apr-17	12.98	22.17	2.82	19.35	31.50	36.18	0.00	0.00	2.40	1.84	69%	1.27	4,880	4,880	**19,691**
6-Apr-17	13.57	58.00	2.53	55.47	29.03	78.45	0.00	0.00	1.30	2.39	69%	1.65	6,048	6,048	**13,790**

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/20/2017
CHECKED BY:

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg.	12,908	Peaking Factor	5.41
	Max 7 Day Avg.	69,816		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
7-Apr-17	13.35	60.00	2.17	57.83	83.20	56.44	0.00	0.00	0.49	2.73	69%	1.88	11,250	11,250	**13,107**
8-Apr-17	13.72	28.33	2.72	25.62	86.75	51.54	0.00	0.00	1.42	2.16	69%	1.49	11,871	11,871	**11,403**
9-Apr-17	16.40	20.83	2.58	18.25	38.43	37.98	0.00	0.00	1.76	2.43	69%	1.68	7,149	7,149	**9,282**
10-Apr-17	17.19	18.17	2.63	15.53	27.38	38.54	0.00	0.00	2.74	1.88	69%	1.30	6,016	6,016	**8,102**
11-Apr-17	16.86	14.17	2.72	11.45	23.30	36.52	0.00	0.00	1.28	2.02	69%	1.39	5,057	5,057	**7,467**
12-Apr-17	12.16	13.60	2.26	11.34	17.18	46.02	0.00	0.00	0.62	1.68	69%	1.16	3,200	3,200	**7,227**
13-Apr-17	17.91	14.33	2.32	12.02	17.01	35.81	0.00	0.00	2.81	2.09	69%	1.44	4,640	4,640	**7,026**
14-Apr-17	17.34	15.00	2.50	12.50	18.03	35.75	0.00	0.00	1.75	1.72	69%	1.19	4,449	4,449	**6,055**
15-Apr-17	17.72	12.67	1.95	10.72	18.75	28.23	0.00	0.00	1.26	2.00	69%	1.38	4,302	4,302	**4,973**
16-Apr-17	16.81	11.33	2.65	8.68	16.08	24.04	0.00	0.00	1.48	1.63	69%	1.13	3,541	3,541	**4,458**
17-Apr-17	20.47	11.67	3.43	8.23	13.03	13.29	0.00	0.00	1.68	1.36	69%	0.94	3,292	3,292	**4,069**
18-Apr-17	27.08	12.00	3.53	8.47	12.35	26.90	0.00	0.00	1.03	1.82	69%	1.25	4,968	4,968	**4,056**
19-Apr-17	24.41	10.67	3.33	7.33	12.70	25.79	0.00	0.00	1.64	1.97	69%	1.36	4,634	4,634	**4,261**
20-Apr-17	25.53	17.00	3.45	13.55	11.00	29.41	0.00	0.00	1.03	2.18	69%	1.50	4,596	4,596	**4,254**
21-Apr-17	23.65	25.50	3.20	22.30	20.33	44.08	0.00	0.00	2.12	2.66	69%	1.83	7,170	7,170	**4,643**
22-Apr-17	15.10	15.67	2.60	13.07	33.45	36.67	0.00	0.00	2.37	1.91	69%	1.32	5,940	5,940	**4,877**
23-Apr-17	15.37	12.67	2.42	10.25	19.60	34.03	0.00	0.00	0.77	1.86	69%	1.28	3,971	3,971	**4,938**
24-Apr-17	19.21	100.83	3.00	97.83	15.38	51.53	0.00	0.00	1.76	1.82	69%	1.25	5,208	5,208	**5,212**
25-Apr-17	20.43	384.17	2.32	381.85	146.75	84.26	0.00	0.00	1.61	2.02	69%	1.39	29,444	29,444	**8,709**
26-Apr-17	22.89	295.33	5.52	289.82	572.78	81.94	0.00	0.00	1.22	2.43	69%	1.68	114,180	114,180	**24,358**
27-Apr-17	21.39	192.33	4.43	187.90	434.73	48.27	0.00	0.00	1.51	2.39	69%	1.65	80,461	80,461	**35,196**
28-Apr-17	19.60	129.83	5.22	124.62	281.85	59.97	0.00	0.00	1.18	2.39	69%	1.65	49,206	49,206	**41,201**
29-Apr-17	22.15	79.67	4.75	74.92	186.93	56.24	0.00	0.00	2.02	2.02	69%	1.39	38,011	38,011	**45,783**
30-Apr-17	21.64	54.17	3.53	50.63	112.38	53.03	0.00	0.00	1.49	2.09	69%	1.44	23,432	23,432	**48,563**
1-May-17	23.98	45.33	3.78	41.55	75.95	31.47	0.00	0.00	2.02	1.97	69%	1.36	17,592	17,592	**50,332**
2-May-17	21.86	35.00	4.00	31.00	62.33	42.01	0.00	0.00	0.96	1.22	69%	0.84	13,790	13,790	**48,096**
3-May-17	22.36	37.33	4.50	32.83	46.50	34.37	0.00	0.00	2.14	2.00	69%	1.38	11,082	11,082	**33,368**
4-May-17	14.55	35.33	4.75	30.58	49.25	33.66	0.00	0.00	1.00	2.39	69%	1.65	7,416	7,416	**22,933**
5-May-17	21.03	33.67	3.97	29.70	45.88	30.41	0.00	0.00	1.06	2.20	69%	1.52	9,957	9,957	**17,326**
6-May-17	13.03	26.17	3.15	23.02	44.55	40.62	0.00	0.00	2.48	2.09	69%	1.44	6,474	6,474	**12,820**
7-May-17	18.78	28.17	4.02	24.15	34.53	46.32	0.00	0.00	2.09	2.50	69%	1.72	7,991	7,991	**10,615**
8-May-17	19.64	26.33	3.50	22.83	36.23	34.00	0.00	0.00	1.84	2.41	69%	1.66	8,031	8,031	**9,249**
9-May-17	18.57	25.17	2.83	22.33	34.25	49.79	0.00	0.00	2.54	2.61	69%	1.80	8,086	8,086	**8,434**
10-May-17	20.65	21.50	2.45	19.05	33.50	48.67	0.00	0.00	1.38	2.68	69%	1.85	8,620	8,620	**8,082**
11-May-17	13.31	21.80	1.74	20.06	28.58	84.67	0.00	0.00	1.93	2.23	69%	1.54	6,132	6,132	**7,899**
12-May-17	19.22	23.67	2.52	21.15	30.09	53.34	0.00	0.00	2.24	2.07	69%	1.43	7,751	7,751	**7,584**
13-May-17	14.12	60.50	3.13	57.37	31.73	89.45	0.00	0.00	1.15	3.50	69%	2.42	7,040	7,040	**7,665**
14-May-17	23.22	67.50	2.25	65.25	86.05	94.93	0.00	0.00	1.89	4.10	69%	2.83	22,615	22,615	**9,754**
15-May-17	16.97	35.83	1.93	33.90	97.88	77.96	0.00	0.00	1.39	3.09	69%	2.13	17,375	17,375	**11,089**
16-May-17	20.56	27.33	2.43	24.90	50.85	75.51	19.68	7.08	1.94	2.96	69%	2.04	13,747	13,747	**11,897**
17-May-17	15.77	37.50	2.38	35.12	37.35	61.10	19.98	7.19	0.95	2.50	69%	1.72	8,090	8,090	**11,822**
18-May-17	21.80	29.67	2.70	26.97	52.68	32.20	17.14	6.17	1.10	2.04	69%	1.41	12,378	12,378	**12,714**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	**12,908**	**Peaking Factor**	**5.41**
	Max 7 Day Avg.	**69,816**		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	**Total**	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**7 Day Ave**
19-May-17	21.19	25.33	2.35	22.98	40.45	36.82	18.92	6.81	1.37	2.00	69%	1.38	10,211	10,211	**13,065**
20-May-17	22.23	22.33	2.12	20.22	34.48	35.12	10.01	3.60	2.13	1.88	69%	1.30	9,252	9,252	**13,381**
21-May-17	19.76	42.33	2.25	40.08	30.33	39.74	15.55	5.60	1.52	2.29	69%	1.58	7,910	7,910	**11,280**
22-May-17	23.91	187.83	3.58	184.25	60.13	80.67	20.33	7.32	1.67	3.27	69%	2.26	18,140	18,140	**11,390**
23-May-17	21.72	191.67	3.30	188.37	276.38	85.09	30.18	10.86	1.87	3.78	69%	2.61	56,403	56,403	**17,483**
24-May-17	20.73	87.50	3.45	84.05	282.55	74.30	26.35	9.48	1.55	3.32	69%	2.29	54,122	54,122	**24,059**
25-May-17	19.48	77.17	3.10	74.07	126.08	44.14	21.83	7.86	1.47	3.30	69%	2.28	23,896	23,896	**25,705**
26-May-17	17.57	81.83	2.75	79.08	111.10	57.80	13.88	5.00	0.88	3.05	69%	2.10	19,520	19,520	**27,035**
27-May-17	23.86	108.17	3.08	105.08	118.63	68.96	20.10	7.23	1.92	3.07	69%	2.12	29,116	29,116	**29,872**
28-May-17	13.72	95.00	2.53	92.47	157.63	61.70	17.78	6.40	2.21	2.52	69%	1.74	20,911	20,911	**31,730**
29-May-17	21.16	164.67	3.20	161.47	138.70	71.02	19.04	6.85	1.70	2.89	69%	1.99	29,362	29,362	**33,333**
30-May-17	23.04	81.67	2.97	78.70	242.20	47.20	14.37	5.17	1.77	2.39	69%	1.65	50,340	50,340	**32,467**
31-May-17	20.02	76.00	4.77	71.23	118.05	54.43	18.47	6.65	0.61	2.32	69%	1.60	23,304	23,304	**28,064**
1-Jun-17	21.56	80.67	4.07	76.60	106.85	66.80	12.12	4.36	1.59	1.04	69%	0.72	23,431	23,431	**27,998**
2-Jun-17	25.02	71.50	3.52	67.98	114.90	89.80	8.18	2.95	1.13	2.73	69%	1.88	30,138	30,138	**29,515**
3-Jun-17	24.52	42.00	3.35	38.65	101.98	4.05	0.00	0.00	2.41	2.34	69%	1.61	21,900	21,900	**28,484**
4-Jun-17	25.97	39.83	4.17	35.67	57.98	26.10	0.00	0.00	2.05	1.97	69%	1.36	14,844	14,844	**27,617**
5-Jun-17	28.05	31.00	3.57	27.43	53.50	34.98	0.00	0.00	1.85	2.07	69%	1.43	15,520	15,520	**25,640**
6-Jun-17	23.37	29.50	2.93	26.57	41.15	32.99	0.00	0.00	1.89	1.88	69%	1.30	10,403	10,403	**19,934**
7-Jun-17	21.52	26.83	2.45	24.38	39.85	33.41	0.00	0.00	1.55	2.13	69%	1.47	9,335	9,335	**17,939**
8-Jun-17	21.41	25.33	2.68	22.65	36.58	36.03	0.00	0.00	1.04	2.02	69%	1.39	8,726	8,726	**15,838**
9-Jun-17	25.42	32.33	3.30	29.03	33.98	34.93	0.00	0.00	1.15	1.79	69%	1.24	9,736	9,736	**12,923**
10-Jun-17	28.33	39.17	3.65	35.52	43.55	36.52	0.00	0.00	2.09	2.04	69%	1.41	13,477	13,477	**11,720**
11-Jun-17	21.11	33.17	2.55	30.62	53.28	45.44	0.00	0.00	1.47	2.59	69%	1.79	12,146	12,146	**11,335**
12-Jun-17	33.24	35.17	2.67	32.50	45.93	46.44	0.00	0.00	2.36	2.59	69%	1.79	17,408	17,408	**11,605**
13-Jun-17	26.33	19.33	2.40	16.93	48.75	41.36	0.00	0.00	1.50	2.32	69%	1.60	13,871	13,871	**12,100**
14-Jun-17	29.14	17.50	2.88	14.62	25.40	29.50	0.00	0.00	1.05	2.16	69%	1.49	8,752	8,752	**12,017**
15-Jun-17	21.84	21.33	2.18	19.15	21.93	33.64	0.00	0.00	1.85	2.20	69%	1.52	6,286	6,286	**11,668**
16-Jun-17	26.22	44.50	2.87	41.63	28.73	58.39	4.15	1.49	1.94	2.34	69%	1.61	10,769	10,769	**11,816**
17-Jun-17	25.35	42.33	2.38	39.95	62.45	51.77	11.62	4.18	1.63	2.93	69%	2.02	17,556	17,556	**12,398**
18-Jun-17	18.67	30.83	2.46	28.37	59.93	53.86	12.21	4.39	0.49	3.18	69%	2.20	12,495	12,495	**12,448**
19-Jun-17	21.60	34.50	2.80	31.70	42.56	41.68	10.20	3.67	1.49	2.54	69%	1.76	10,742	10,742	**11,496**
20-Jun-17	21.41	25.00	2.38	22.62	47.55	23.24	12.02	4.33	1.60	2.26	69%	1.56	10,699	10,699	**11,043**
21-Jun-17	27.47	25.17	3.05	22.12	33.93	34.92	6.35	2.28	2.68	2.41	69%	1.66	11,303	11,303	**11,407**
22-Jun-17	24.46	20.67	3.18	17.48	33.18	30.60	0.00	0.00	0.72	2.27	69%	1.57	8,945	8,945	**11,787**
23-Jun-17	21.50	17.17	3.17	14.00	26.23	48.66	0.00	0.00	1.06	2.23	69%	1.54	7,557	7,557	**11,328**
24-Jun-17	15.06	58.50	3.22	55.28	21.00	23.54	13.85	4.99	2.87	2.13	69%	1.47	4,406	4,406	**9,449**
25-Jun-17	14.15	67.67	2.40	65.27	82.93	75.12	40.58	14.61	1.57	3.32	69%	2.29	13,808	13,808	**9,637**
26-Jun-17	14.23	66.67	2.77	63.90	97.90	99.74	38.38	13.82	1.77	4.25	69%	2.94	16,498	16,498	**10,459**
27-Jun-17	20.69	49.00	3.23	45.77	95.85	48.26	37.26	13.41	1.16	3.66	69%	2.53	20,988	20,988	**11,929**
28-Jun-17	22.68	33.50	3.80	29.70	68.65	44.49	35.84	12.90	1.22	3.25	69%	2.24	17,558	17,558	**12,823**
29-Jun-17	31.34	39.33	4.25	35.08	44.55	38.35	30.89	11.12	0.99	3.09	69%	2.13	17,126	17,126	**13,991**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	**12,908**	**Peaking Factor**	**5.41**
	Max 7 Day Avg.	**69,816**		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
30-Jun-17	24.71	28.50	3.22	25.28	52.63	29.17	36.05	12.98	0.87	3.14	69%	2.16	14,884	14,884	**15,038**
1-Jul-17	28.77	28.83	3.67	25.17	37.93	42.12	35.10	12.64	2.60	2.82	69%	1.94	14,958	14,958	**16,546**
2-Jul-17	26.88	23.83	2.70	21.13	37.75	35.15	35.15	12.65	1.97	2.73	69%	1.88	13,357	13,357	**16,481**
3-Jul-17	29.57	20.50	2.65	17.85	31.70	39.63	35.95	12.94	2.14	2.89	69%	1.99	13,621	13,621	**16,070**
4-Jul-17	24.98	14.67	1.88	12.78	26.78	31.27	33.52	12.07	1.44	2.91	69%	2.01	9,740	9,740	**14,463**
5-Jul-17	20.13	13.67	2.13	11.53	19.18	34.85	47.23	17.00	1.49	2.91	69%	2.01	7,294	7,294	**12,997**
6-Jul-17	28.59	13.33	3.02	10.32	17.30	25.37	43.52	15.67	0.75	3.05	69%	2.10	8,927	8,927	**11,826**
7-Jul-17	29.21	19.83	2.57	17.27	15.48	24.30	48.63	17.51	1.53	2.77	69%	1.91	9,044	9,044	**10,992**
8-Jul-17	29.06	15.83	2.43	13.40	25.90	33.16	46.28	16.66	2.42	2.84	69%	1.96	12,203	12,203	**10,598**
9-Jul-17	24.95	13.67	2.73	10.93	20.10	30.60	47.38	17.06	1.69	2.57	69%	1.77	8,990	8,990	**9,974**
10-Jul-17	29.02	15.17	2.62	12.55	16.40	33.74	45.41	16.35	1.36	2.52	69%	1.74	9,566	9,566	**9,395**
11-Jul-17	31.47	15.67	2.53	13.13	18.83	31.41	32.19	11.59	1.49	2.43	69%	1.68	10,039	10,039	**9,438**
12-Jul-17	28.59	16.50	2.42	14.08	19.70	33.57	48.09	17.31	1.78	2.29	69%	1.58	10,415	10,415	**9,883**
13-Jul-17	30.09	12.00	2.15	9.85	21.13	25.99	27.69	9.97	0.90	2.36	69%	1.63	9,374	9,374	**9,947**
14-Jul-17	29.60	7.50	2.18	5.32	14.78	35.63	10.81	3.89	0.88	2.29	69%	1.58	7,298	7,298	**9,698**
15-Jul-17	32.01	6.17	2.35	3.82	7.98	36.83	0.07	0.03	2.32	2.36	69%	1.63	5,882	5,882	**8,795**
16-Jul-17	27.85	5.33	2.57	2.77	5.73	34.97	20.45	7.36	1.26	2.32	69%	1.60	5,347	5,347	**8,274**
17-Jul-17	30.74	4.00	2.27	1.73	4.15	27.35	20.31	7.31	1.69	2.34	69%	1.61	5,068	5,068	**7,632**
18-Jul-17	27.06	3.50	2.17	1.33	2.60	41.33	16.97	6.11	1.68	2.27	69%	1.57	4,784	4,784	**6,881**
19-Jul-17	30.16	3.83	2.23	1.60	2.00	32.87	16.82	6.05	1.35	2.36	69%	1.63	4,523	4,523	**6,040**
20-Jul-17	29.82	3.83	2.47	1.37	2.40	21.86	16.81	6.05	0.66	2.27	69%	1.57	3,632	3,632	**5,219**
21-Jul-17	29.09	4.50	2.50	2.00	2.05	30.73	21.02	7.57	1.79	2.32	69%	1.60	4,574	4,574	**4,830**
22-Jul-17	29.03	5.00	2.52	2.48	3.00	16.53	31.45	11.32	1.42	2.07	69%	1.43	4,322	4,322	**4,607**
23-Jul-17	28.13	4.67	2.16	2.51	3.73	24.63	27.52	9.91	2.17	2.32	69%	1.60	4,876	4,876	**4,540**
24-Jul-17	28.89	6.67	2.25	4.42	3.76	33.94	17.86	6.43	1.15	2.45	69%	1.69	4,854	4,854	**4,509**
25-Jul-17	27.94	9.17	1.90	7.27	6.63	37.92	13.13	4.73	1.86	2.23	69%	1.54	5,481	5,481	**4,609**
26-Jul-17	29.20	8.50	2.10	6.40	10.90	30.11	11.95	4.30	1.78	2.32	69%	1.60	6,175	6,175	**4,845**
27-Jul-17	28.23	9.17	2.08	7.08	9.60	40.39	13.56	4.88	1.39	2.13	69%	1.47	6,297	6,297	**5,226**
28-Jul-17	28.57	10.00	2.15	7.85	10.63	36.42	12.06	4.34	1.35	2.27	69%	1.57	6,288	6,288	**5,470**
29-Jul-17	27.86	11.00	2.32	8.68	11.78	42.63	13.58	4.89	1.06	2.20	69%	1.52	6,798	6,798	**5,824**
30-Jul-17	27.90	13.00	2.40	10.60	13.03	38.12	13.17	4.74	0.62	2.07	69%	1.43	6,665	6,665	**6,080**
31-Jul-17	29.80	16.17	2.68	13.48	15.90	36.85	11.72	4.22	0.72	1.97	69%	1.36	7,669	7,669	**6,482**
1-Aug-17	29.20	22.50	2.65	19.85	20.23	31.85	13.37	4.81	0.99	2.43	69%	1.68	8,473	8,473	**6,909**
2-Aug-17	27.10	20.83	2.92	17.92	29.78	34.09	12.01	4.32	1.74	2.36	69%	1.63	10,246	10,246	**7,491**
3-Aug-17	27.65	15.17	2.93	12.23	26.88	35.40	13.46	4.84	0.69	2.13	69%	1.47	9,669	9,669	**7,973**
4-Aug-17	30.40	15.67	3.30	12.37	18.35	26.90	10.40	3.74	1.65	2.34	69%	1.61	7,973	7,973	**8,213**
5-Aug-17	23.40	15.17	3.15	12.02	18.55	31.12	17.16	6.18	2.77	2.27	69%	1.57	6,927	6,927	**8,232**
6-Aug-17	26.22	13.50	2.65	10.85	18.03	36.51	12.00	4.32	1.10	2.36	69%	1.63	7,347	7,347	**8,329**
7-Aug-17	29.68	11.00	2.75	8.25	16.28	15.74	11.79	4.24	1.66	2.09	69%	1.44	6,556	6,556	**8,170**
8-Aug-17	29.89	9.50	2.92	6.58	12.38	24.09	12.01	4.32	1.42	2.59	69%	1.79	6,239	6,239	**7,851**
9-Aug-17	30.67	15.00	3.55	11.45	9.88	26.54	11.73	4.22	1.69	2.27	69%	1.57	5,929	5,929	**7,234**
10-Aug-17	29.16	16.33	3.63	12.70	17.18	25.82	12.18	4.38	0.87	2.77	69%	1.91	7,275	7,275	**6,892**

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/20/2017
CHECKED BY:

DAILY SETTLED SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	12,908	**Peaking Factor**	5.41
	Max 7 Day Avg.	69,816		

*Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
													Settling Tank*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	7 Day Ave
11-Aug-17	31.43	17.17	3.87	13.30	19.05	25.80	11.59	4.17	0.93	2.52	0.69	1.74	8,267	8,267	**6,934**
12-Aug-17	28.21	21.33	3.43	17.90	19.95	27.86	12.78	4.60	2.29	2.59	0.69	1.79	8,162	8,162	**7,111**
13-Aug-17	31.51	27.00	3.63	23.37	26.85	37.34	11.34	4.08	1.73	2.93	0.69	2.02	11,437	11,437	**7,695**
14-Aug-17	24.07	31.50	3.82	27.68	35.05	31.01	19.94	7.18	1.75	3.00	0.69	2.07	10,457	10,457	**8,252**
15-Aug-17	27.77	35.17	3.30	31.87	41.52	30.04	23.70	8.53	1.44	3.30	0.69	2.28	13,687	13,687	**9,316**
16-Aug-17	30.41	30.50	3.58	26.92	47.80	40.59	20.03	7.21	1.36	3.09	0.69	2.13	17,037	17,037	**10,903**
17-Aug-17	29.53	25.83	3.02	22.82	40.38	39.40	20.30	7.31	1.24	2.80	0.69	1.93	14,568	14,568	**11,945**
18-Aug-17	29.22	29.00	3.55	25.45	34.23	24.63	23.88	8.60	1.61	2.70	0.69	1.87	12,214	12,214	**12,509**
19-Aug-17	30.11	42.83	3.25	39.58	38.18	64.92	29.88	10.76	1.85	2.96	0.69	2.04	16,811	16,811	**13,744**
20-Aug-17	29.94	55.33	3.97	51.37	59.38	54.65	29.87	10.75	1.86	4.03	0.69	2.78	21,495	21,495	**15,181**
21-Aug-17	28.35	44.17	3.27	40.90	77.05	34.60	31.37	11.29	1.79	3.25	0.69	2.24	23,172	23,172	**16,998**
22-Aug-17	27.16	58.17	3.17	55.00	61.35	63.82	30.04	10.82	1.58	3.73	0.69	2.57	20,412	20,412	**17,958**
23-Aug-17	28.39	55.50	3.37	52.13	82.50	60.04	28.11	10.12	1.80	3.94	0.69	2.72	26,077	26,077	**19,250**
24-Aug-17	28.70	44.83	3.07	41.77	78.20	41.98	26.49	9.54	1.86	3.25	0.69	2.24	23,957	23,957	**20,591**
25-Aug-17	29.94	42.00	3.80	38.20	62.65	37.31	27.27	9.82	1.79	3.05	0.69	2.10	20,782	20,782	**21,815**
26-Aug-17	27.99	38.17	3.62	34.55	57.30	54.18	23.82	8.57	1.58	2.59	0.69	1.79	18,945	18,945	**22,120**
27-Aug-17	28.81	34.33	3.53	30.80	51.83	46.03	15.87	5.71	1.80	2.89	0.69	1.99	17,300	17,300	**21,521**

APPENDIX H
LONG-TERM SOLIDS CALCULATIONS

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/26/2017
CHECKED BY: AS

MINIMUM DAY PROJECTIONS

Solids Removed in Settling Tank

	Scenario 1		Scenario 2	
Assumptions	**DelPac**	**FeCl3**	**DelPac + FeCl3**	
Raw water flow, mgd	7.4	7.4	7.4	
Raw water TSS, mg/L	3.00	3.00	3.00	
PACl, mg/L	0.99		0.99	
Ferric Chloride, mg/L		0.03	0.03	= Reported Ferric Chloride Dose x 0.36
Settled water TSS, mg/L	0.71	0.71	0.71	
Polymer, mg/l	0.34	0.34	0.34	
Raw Water TOC, mg/l	3.42	3.42	3.42	
Max TOC Removal, %	69%	69%	69%	

Calculations	**DelPac**	**FeCl3**	**DelPac + FeCl3**	
TSS removed in settling tank, mg/L	2.3	2.3	2.3	= Raw water TSS - Settled water TSS
TOC Removed, mg/l	2.4	2.4	2.4	
Solids removed in settling tank, lbs/MG	44	42	44	= (Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+ (Polymer X 8.34) + (TOC removed x 8.34)
Solids removed in settling tank, lbs/day	**324**	**309**	**325**	= Solids production rate (lbs/MG) x Raw water flow (mgd)

Solids Removed in Filter

Assumptions	**DelPac**	**FeCl3**	**DelPac + FeCl3**
Settled water TSS, mg/L	0.71	0.71	0.71
Filter vessel diameter, ft	9.67	9.67	9.67
Filter vessel surface area, sq ft	718	718	718
Number of filter vessels	10	10	10
Total filter surface area, sq ft	6,462	6,462	6,462
Filter loading rate, gpm/sf*	0.8	0.8	0.8

*Assumes 1 unit out for backwashing

Calculations	**DelPac**	**FeCl3**	**DelPac + FeCl3**	
Solids removed in filters, lbs/day*	44	44	44	= Filter loading rate x Filter vessel area x Settled water TSS x 8.34

*Assumes all solids retained on the filters are removed during backwash

Total Solids Removed

Calculations	**DelPac**	**FeCl3**	**DelPac + FeCl3**	
Total solids removed, lbs/day	**368**	**352**	**369**	= Solids removed by settling tank and filters

* This calculation assumes that the new filter building will provide a minimum filter area equal to the existing Aldrich Units.
* 2010-2017 plant data used in these projections.

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/26/2017
CHECKED BY: AS

AVERAGE DAY PROJECTIONS

Solids Removed in Settling Tank

	Scenario 1		Scenario 2	
Assumptions	**DelPac**	**FeCl3**	**DelPac + FeCl3**	
Raw water flow, mgd	22.3	22.3	22.3	
Raw water TSS, mg/L	58.83	58.83	58.83	
PACl, mg/L	36.78		36.78	
Ferric Chloride, mg/L		18.54	18.54	= Reported Ferric Chloride Dose x 0.36
Settled water TSS, mg/L	5.87	5.87	5.87	
Polymer, mg/l	1.52	1.52	1.52	
Raw Water TOC, mg/l	3.42	3.42	3.42	
Max TOC Removal, %	69%	69%	69%	

Calculations	DelPac	FeCl3	DelPac + FeCl3	
TSS removed in settling tank, mg/L	53.0	53.0	53.0	= Raw water TSS - Settled water TSS
TOC Removed, mg/l	2.4	2.4	2.4	
Solids removed in settling tank, lbs/MG	558	576	660	= (Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+ (Polymer X 8.34) + (TOC removed x 8.34)
Solids removed in settling tank, lbs/day	**12,462**	**12,866**	**14,741**	= Solids production rate (lbs/MG) x Raw water flow (mgd)

Solids Removed in Filter

Assumptions	DelPac	FeCl3	DelPac + FeCl3
Settled water TSS, mg/L	5.87	5.87	5.87
Filter vessel diameter, ft	9.67	9.67	9.67
Filter vessel surface area, sq ft	718	718	718
Number of filter vessels	10	10	10
Total filter surface area, sq ft	6,462	6,462	6,462
Filter loading rate, gpm/sf*	2.4	2.4	2.4

*Assumes 1 unit out for backwashing

Calculations	DelPac	FeCl3	DelPac + FeCl3	
Solids removed in filters, lbs/day*	1093	1093	1093	= Filter loading rate x Filter vessel area x Settled water TSS x 8.34

*Assumes all solids retained on the filters are removed during backwash

Total Solids Removed

Calculations	DelPac	FeCl3	DelPac + FeCl3	
Total solids removed, lbs/day	**13,555**	**13,958**	**15,834**	= Solids removed by settling tank and filters

* This calculation assumes that the new filter building will provide a minimum filter area equal to the existing Aldrich Units.
* 2010-2017 plant data used in these projections.

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/26/2017
CHECKED BY: AS

95% DAY PROJECTIONS

Solids Removed in Settling Tank

	Scenario 1		Scenario 2	
Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Raw water flow, mgd	34.1	34.1	34.1	95% Flow
Raw water TSS, mg/L	230	230	230	
PACl, mg/L	78.34		78.34	
Ferric Chloride, mg/L		48.69	48.69	= Reported Ferric Chloride Dose x 0.36
Settled water TSS, mg/L	9.00	9.00	9.00	
Polymer, mg/l	2.37	2.37	2.37	
Raw Water TOC, mg/l	3.42	3.42	3.42	
Max TOC Removal, %	69%	69%	69%	

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
TSS removed in settling tank, mg/L	221.2	221.2	221.2	= Raw water TSS - Settled water TSS
TOC Removed, mg/l	2.4	2.4	2.4	
Solids removed in settling tank, lbs/MG	2064	2153	2332	= (Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+ (Polymer X 8.34) + (TOC removed x 8.34)
Solids removed in settling tank, lbs/day	**70,328**	**73,366**	**79,463**	= Solids production rate (lbs/MG) x Raw water flow (mgd)

Solids Removed in Filter

Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**
Settled water TSS, mg/L	9.00	9.00	9.00
Filter vessel diameter, ft	9.67	9.67	9.67
Filter vessel surface area, sq ft	718	718	718
Number of filter vessels	10	10	10
Total filter surface area, sq ft	6,462	6,462	6,462
Filter loading rate, gpm/sf*	3.7	3.7	3.7

*Assumes 1 unit out for backwashing

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Solids removed in filters, lbs/day*	2558	2558	2558	= Filter loading rate x Filter vessel area x Settled water TSS x 8.34

*Assumes all solids retained on the filters are removed during backwash

Total Solids Removed

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Total solids removed, lbs/day	72,886	75,924	82,021	= Solids removed by settling tank and filters

* This calculation assumes that the new filter building will provide a minimum filter area equal to the existing Aldrich Units.
* 2010-2017 plant data used in these projections.

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/26/2017
CHECKED BY: AS

95% DAY PROJECTIONS @ PLANT DESIGN FLOW RATE

Solids Removed in Settling Tank

	Scenario 1		Scenario 2	
Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Raw water flow, mgd	45.0	45.0	45.0	Plant Design Flow Rate
Raw water TSS, mg/L	230	230	230	
PACl, mg/L	78.34		78.34	
Ferric Chloride, mg/L		48.69	48.69	= Reported Ferric Chloride Dose x 0.36
Settled water TSS, mg/L	9.00	9.00	9.00	
Polymer, mg/l	2.37	2.37	2.37	
Raw Water TOC, mg/l	3.42	3.42	3.42	
Max TOC Removal, %	69%	69%	69%	

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
TSS removed in settling tank, mg/L	221.2	221.2	221.2	= Raw water TSS - Settled water TSS
TOC Removed, mg/l	2.4	2.4	2.4	
Solids removed in settling tank, lbs/MG	2064	2153	2332	= (Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+ (Polymer X 8.34) + (TOC removed x 8.34)
Solids removed in settling tank, lbs/day	**92,858**	**96,869**	**104,919**	= Solids production rate (lbs/MG) x Raw water flow (mgd)

Solids Removed in Filter

Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**
Settled water TSS, mg/L	9.00	9.00	9.00
Filter vessel diameter, ft	9.67	9.67	9.67
Filter vessel surface area, sq ft	718	718	718
Number of filter vessels	10	10	10
Total filter surface area, sq ft	6,462	6,462	6,462
Filter loading rate, gpm/sf*	4.8	4.8	4.8

*Assumes 1 unit out for backwashing

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Solids removed in filters, lbs/day*	3378	3378	3378	= Filter loading rate x Filter vessel area x Settled water TSS x 8.34

*Assumes all solids retained on the filters are removed during backwash

Total Solids Removed

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Total solids removed, lbs/day	**96,236**	**100,246**	**108,297**	= Solids removed by settling tank and filters

* This calculation assumes that the new filter building will provide a minimum filter area equal to the existing Aldrich Units.
* 2010-2017 plant data used in these projections.

Stantec

Project No.: 175667010
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BY: SDC
DATE: 9/26/2017
CHECKED BY: AS

MAX DAY PROJECTIONS

Solids Removed in Settling Tank

	Scenario 1		Scenario 2	
Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Raw water flow, mgd	42.2	42.2	42.2	Max Recorded Plant Flow
Raw water TSS, mg/L	392	392	392	= 98th Percentile
PACl, mg/L	154.97		78.34	
Ferric Chloride, mg/L		69.72	48.69	= Reported Ferric Chloride Dose x 0.36
Settled water TSS, mg/L	14.70	14.70	14.70	
Polymer, mg/l	4.05	4.05	4.05	
Raw Water TOC, mg/l	4.80	4.80	4.80	
Max TOC Removal, %	69%	69%	69%	

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
TSS removed in settling tank, mg/L	377.6	377.6	377.6	= Raw water TSS - Settled water TSS
TOC Removed, mg/l	3.3	3.3	3.3	
Solids removed in settling tank, lbs/MG	3564	3594	3657	= (Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+ (Polymer X 8.34) + (TOC removed x 8.34)
Solids removed in settling tank, lbs/day	**150,275**	**151,533**	**154,197**	= Solids production rate (lbs/MG) x Raw water flow (mgd)

Solids Removed in Filter

Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**
Settled water TSS, mg/L	14.70	14.70	14.70
Filter vessel diameter, ft	9.67	9.67	9.67
Filter vessel surface area, sq ft	718	718	718
Number of filter vessels	10	10	10
Total filter surface area, sq ft	6,462	6,462	6,462
Filter loading rate, gpm/sf*	4.5	4.5	4.5

*Assumes 1 unit out for backwashing

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Solids removed in filters, lbs/day*	5169	5169	5169	= Filter loading rate x Filter vessel area x Settled water TSS x 8.34

*Assumes all solids retained on the filters are removed during backwash

Total Solids Removed

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Total solids removed, lbs/day	155,444	156,703	159,366	= Solids removed by settling tank and filters

* This calculation assumes that the new filter building will provide a minimum filter area equal to the existing Aldrich Units.
* 2010-2017 plant data used in these projections.

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/26/2017
CHECKED BY: AS

MAX DAY PROJECTIONS @ PLANT DESIGN FLOW RATE

Solids Removed in Settling Tank

	Scenario 1		Scenario 2	
Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Raw water flow, mgd	45.0	45.0	45.0	Plant Design Flow Rate
Raw water TSS, mg/L	392	392	392	= 98th Percentile
PACl, mg/L	154.97		78.34	
Ferric Chloride, mg/L		69.72	48.69	= Reported Ferric Chloride Dose x 0.36
Settled water TSS, mg/L	14.70	14.70	14.70	
Polymer, mg/l	4.05	4.05	4.05	
Raw Water TOC, mg/l	4.80	4.80	4.80	
Max TOC Removal, %	69%	69%	69%	

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
TSS removed in settling tank, mg/L	377.6	377.6	377.6	= Raw water TSS - Settled water TSS
TOC Removed, mg/l	3.3	3.3	3.3	
Solids removed in settling tank, lbs/MG	3564	3594	3657	= (Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+ (Polymer X 8.34) + (TOC removed x 8.34)
Solids removed in settling tank, lbs/day	**160,383**	**161,726**	**164,568**	= Solids production rate (lbs/MG) x Raw water flow (mgd)

Solids Removed in Filter

Assumptions	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**
Settled water TSS, mg/L	14.70	14.70	14.70
Filter vessel diameter, ft	9.67	9.67	9.67
Filter vessel surface area, sq ft	718	718	718
Number of filter vessels	10	10	10
Total filter surface area, sq ft	6,462	6,462	6,462
Filter loading rate, gpm/sf*	4.8	4.8	4.8

*Assumes 1 unit out for backwashing

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Solids removed in filters, lbs/day*	5517	5517	5517	= Filter loading rate x Filter vessel area x Settled water TSS x 8.34

*Assumes all solids retained on the filters are removed during backwash

Total Solids Removed

Calculations	**DelPAC**	**FeCl3**	**DelPAC + FeCl3**	
Total solids removed, lbs/day	**165,899**	**167,243**	**170,085**	= Solids removed by settling tank and filters

* This calculation assumes that the new filter building will provide a minimum filter area equal to the existing Aldrich Units.
* 2010-2017 plant data used in these projections.

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids
**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
1-Jan-16	19.83	44.67	5.60	39.07	58.60	0.00	62.94	22.66	1.41	1.29	69%	0.89	12,544	932	13,476	
2-Jan-16	15.87	39.67	5.75	33.92	58.60	0.00	55.70	20.05	1.56	1.77	69%	1.22	9,873	1,005	10,878	
3-Jan-16	20.87	39.83	6.35	33.48	50.88	0.00	56.00	20.16	1.34	1.95	69%	1.35	11,637	1,307	12,944	
4-Jan-16	28.58	47.17	9.42	37.75	50.23	0.00	50.63	18.23	1.39	2.23	69%	1.54	15,535	1,990	17,525	
5-Jan-16	18.41	44.17	9.60	34.57	56.63	0.00	46.03	16.57	1.72	1.86	69%	1.28	10,832	1,160	11,992	
6-Jan-16	19.93	41.83	9.60	32.23	51.85	0.00	54.22	19.52	1.58	1.97	69%	1.36	11,248	1,278	12,526	
7-Jan-16	22.64	37.17	6.82	30.35	48.35	9.74	48.62	17.50	1.74	1.91	69%	1.32	12,390	1,359	13,749	**13,299**
8-Jan-16	22.63	35.83	6.75	29.08	45.53	16.07	17.79	6.40	1.27	2.34	69%	1.61	10,766	1,449	12,215	**13,119**
9-Jan-16	18.64	30.50	5.72	24.78	43.63	20.30	44.18	15.90	2.16	2.13	69%	1.47	9,843	1,209	11,052	**13,143**
10-Jan-16	17.24	26.50	4.75	21.75	37.18	16.96	33.53	12.07	0.93	1.82	69%	1.25	7,473	781	8,253	**12,473**
11-Jan-16	19.47	21.50	4.58	16.92	32.63	17.23	39.03	14.05	2.46	1.72	69%	1.19	8,161	810	8,971	**11,251**
12-Jan-16	20.72	19.67	3.90	15.77	25.38	14.19	39.66	14.28	0.88	1.91	69%	1.32	7,063	775	7,838	**10,658**
13-Jan-16	19.80	15.00	3.38	11.62	23.65	16.22	40.10	14.44	1.69	1.77	69%	1.22	6,694	682	7,375	**9,922**
14-Jan-16	21.78	14.67	3.70	10.97	17.43	20.47	48.63	17.51	1.51	1.93	69%	1.33	6,797	755	7,552	**9,037**
15-Jan-16	20.53	14.33	3.30	11.03	16.45	33.42	0.00	0.00	1.09	1.72	69%	1.19	4,772	473	5,246	**8,041**
16-Jan-16	20.76	13.00	4.32	8.68	16.55	32.10	0.00	0.00	1.41	1.77	69%	1.22	4,841	493	5,334	**7,224**
17-Jan-16	22.48	11.83	3.60	8.23	13.03	30.99	0.00	0.00	1.34	1.70	69%	1.17	4,505	441	4,946	**6,752**
18-Jan-16	22.53	9.83	3.25	6.58	12.35	18.12	0.00	0.00	1.10	1.63	69%	1.13	3,671	345	4,016	**6,044**
19-Jan-16	22.50	8.67	3.92	4.75	9.88	33.76	0.00	0.00	1.27	1.50	69%	1.03	4,020	346	4,366	**5,548**
20-Jan-16	23.02	7.50	3.68	3.82	7.13	29.77	0.00	0.00	1.51	1.66	69%	1.14	3,442	328	3,770	**5,033**
21-Jan-16	22.15	6.83	3.67	3.17	5.73	27.79	0.00	0.00	1.96	1.50	69%	1.03	3,016	260	3,276	**4,422**
22-Jan-16	20.93	7.00	4.58	2.42	4.75	21.60	0.00	0.00	1.67	1.61	69%	1.11	2,347	217	2,564	**4,039**
23-Jan-16	19.50	7.17	4.63	2.53	3.63	20.37	0.00	0.00	1.34	1.59	69%	1.10	1,894	173	2,066	**3,572**
24-Jan-16	23.56	7.50	5.53	1.97	3.80	18.02	0.00	0.00	1.39	1.47	69%	1.02	2,190	186	2,375	**3,205**
25-Jan-16	15.11	13.25	5.90	7.35	2.95	2.03	0.00	0.00	1.49	1.75	69%	1.21	781	79	860	**2,754**
26-Jan-16	21.39	11.33	5.47	5.87	11.03	15.77	0.00	0.00	0.46	1.66	69%	1.14	3,022	288	3,310	**2,603**
27-Jan-16	20.24	12.67	4.70	7.97	8.80	25.57	0.00	0.00	2.09	1.82	69%	1.25	3,232	338	3,569	**2,574**
28-Jan-16	22.82	27.50	5.03	22.47	11.95	38.30	0.00	0.00	1.67	1.97	69%	1.36	4,847	551	5,398	**2,878**
29-Jan-16	20.46	39.17	4.15	35.02	33.70	35.25	0.00	0.00	1.58	11.30	69%	7.80	8,998	5,851	14,849	**4,633**
30-Jan-16	24.28	34.33	6.85	27.48	52.53	37.05	0.00	0.00	1.59	1.47	69%	1.02	13,215	1,120	14,336	**6,385**
31-Jan-16	22.64	43.17	6.75	36.42	41.23	36.61	0.00	0.00	1.83	2.09	69%	1.44	10,293	1,237	11,530	**7,693**
1-Feb-16	22.25	52.67	7.03	45.63	54.63	32.16	0.00	0.00	1.14	2.02	69%	1.39	12,240	1,423	13,663	**9,522**
2-Feb-16	22.48	75.50	6.48	69.02	68.45	37.85	0.00	0.00	0.95	1.66	69%	1.14	15,169	1,445	16,615	**11,423**
3-Feb-16	19.60	177.33	5.45	171.88	103.53	55.15	0.00	0.00	1.06	2.64	69%	1.82	19,856	3,012	22,868	**14,180**
4-Feb-16	22.51	330.83	5.52	325.32	257.83	64.66	0.00	0.00	1.52	2.77	69%	1.91	52,378	8,358	60,736	**22,085**
5-Feb-16	19.88	281.50	5.50	276.00	487.98	76.73	0.00	0.00	1.41	2.45	69%	1.69	84,882	11,985	96,867	**33,802**
6-Feb-16	18.07	211.50	4.83	206.67	414.00	64.25	0.00	0.00	1.39	2.34	69%	1.61	65,496	8,818	74,314	**42,370**
7-Feb-16	21.35	110.83	7.10	103.73	310.00	46.18	0.00	0.00	1.37	2.25	69%	1.55	57,982	7,502	65,484	**50,078**
8-Feb-16	24.45	91.83	7.62	84.22	155.60	36.26	0.00	0.00	1.11	1.04	69%	0.72	34,124	2,042	36,167	**53,293**
9-Feb-16	22.63	56.00	7.67	48.33	126.33	23.77	0.00	0.00	0.97	1.84	69%	1.27	25,488	2,696	28,183	**54,946**
10-Feb-16	23.28	40.17	7.33	32.83	72.50	31.48	0.00	0.00	1.27	1.86	69%	1.28	16,243	1,739	17,983	**54,248**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.** **Max 7 Day Avg.**	14,832 80,601	**Peaking Factor**	5.43

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**lbs/day**	**7 Day Ave**
11-Feb-16	21.06	35.00	5.83	29.17	49.25	34.24	0.00	0.00	1.58	1.77	69%	1.22	10,786	1,098	11,884	**47,269**
12-Feb-16	27.61	39.17	6.82	32.35	43.75	33.99	0.00	0.00	1.65	2.13	69%	1.47	12,938	1,589	14,528	**35,506**
13-Feb-16	18.88	39.33	6.80	32.53	48.53	29.74	0.00	0.00	0.92	1.86	69%	1.28	9,272	993	10,264	**26,356**
14-Feb-16	22.49	31.33	7.98	23.35	48.80	27.46	0.00	0.00	1.36	1.72	69%	1.19	11,043	1,096	12,138	**18,735**
15-Feb-16	24.60	26.83	7.13	19.70	35.03	32.50	0.00	0.00	1.46	1.59	69%	1.10	9,534	871	10,405	**15,055**
16-Feb-16	19.43	74.67	5.05	69.62	29.55	43.53	0.00	0.00	1.48	2.20	69%	1.52	7,205	913	8,118	**12,189**
17-Feb-16	24.70	351.17	7.70	343.47	104.43	73.58	0.00	0.00	1.29	1.97	69%	1.36	26,209	2,978	29,188	**13,789**
18-Feb-16	18.31	400.33	6.77	393.57	515.20	82.80	0.00	0.00	1.43	2.77	69%	1.91	82,656	13,189	95,845	**25,784**
19-Feb-16	22.23	179.50	6.55	172.95	590.35	60.51	0.00	0.00	1.49	1.91	69%	1.32	113,037	12,401	125,438	**41,628**
20-Feb-16	20.82	115.50	6.88	108.62	259.43	49.79	0.00	0.00	1.07	1.97	69%	1.36	47,826	5,435	53,261	**47,771**
21-Feb-16	18.68	76.67	5.95	70.72	162.93	41.06	0.00	0.00	1.17	1.56	69%	1.08	27,481	2,474	29,955	**50,316**
22-Feb-16	19.82	98.33	6.13	92.20	106.08	40.61	0.00	0.00	1.34	2.00	69%	1.38	19,818	2,278	22,096	**51,986**
23-Feb-16	19.66	94.83	6.62	88.22	138.30	30.61	0.00	0.00	1.29	1.93	69%	1.33	24,479	2,718	27,197	**54,711**
24-Feb-16	20.27	69.67	6.87	62.80	132.33	42.24	0.00	0.00	1.72	1.72	69%	1.19	24,814	2,462	27,276	**54,438**
25-Feb-16	20.08	71.17	7.30	63.87	94.20	37.30	0.00	0.00	1.37	1.59	69%	1.10	17,902	1,635	19,537	**43,537**
26-Feb-16	19.28	70.67	6.63	64.03	95.80	26.64	0.00	0.00	1.31	1.86	69%	1.28	16,990	1,819	18,810	**28,304**
27-Feb-16	17.99	54.83	5.42	49.42	96.05	31.70	0.00	0.00	1.80	1.79	69%	1.24	16,165	1,667	17,832	**23,243**
28-Feb-16	17.17	42.17	6.17	36.00	74.13	35.59	0.00	0.00	1.40	1.77	69%	1.22	12,384	1,261	13,645	**20,913**
29-Feb-16	18.50	36.67	5.80	30.87	54.00	26.66	0.00	0.00	1.08	1.77	69%	1.22	9,814	999	10,813	**19,301**
1-Mar-16	19.37	32.83	7.43	25.40	46.30	25.29	0.00	0.00	1.40	1.70	69%	1.17	9,013	882	9,896	**16,830**
2-Mar-16	19.22	30.33	7.40	22.93	38.10	26.72	0.00	0.00	1.24	1.59	69%	1.10	7,654	699	8,354	**14,127**
3-Mar-16	19.12	28.50	7.15	21.35	34.40	24.81	0.00	0.00	1.53	1.95	69%	1.35	7,026	789	7,816	**12,452**
4-Mar-16	19.79	28.00	6.45	21.55	32.03	25.68	0.00	0.00	1.46	1.72	69%	1.19	6,882	683	7,564	**10,846**
5-Mar-16	16.51	23.17	5.12	18.05	32.33	25.82	0.00	0.00	1.29	1.68	69%	1.16	5,763	557	6,319	**9,201**
6-Mar-16	17.54	18.00	5.08	12.92	27.08	24.16	0.00	0.00	0.72	1.50	69%	1.03	5,184	446	5,631	**8,056**
7-Mar-16	20.53	19.67	5.58	14.08	19.38	25.87	0.00	0.00	1.77	1.82	69%	1.25	5,047	527	5,574	**7,308**
8-Mar-16	21.06	17.83	5.83	12.00	21.13	24.55	0.00	0.00	1.37	1.86	69%	1.28	5,356	574	5,930	**6,741**
9-Mar-16	20.93	16.50	6.75	9.75	18.00	18.48	0.00	0.00	1.59	1.66	69%	1.14	4,501	429	4,930	**6,252**
10-Mar-16	20.97	15.33	6.82	8.52	14.63	18.59	0.00	0.00	1.89	2.48	69%	1.71	4,078	581	4,659	**5,801**
11-Mar-16	19.55	14.00	6.52	7.48	12.78	17.41	0.00	0.00	1.19	1.47	69%	1.02	3,220	273	3,493	**5,220**
12-Mar-16	17.95	13.33	6.42	6.92	11.23	18.72	0.00	0.00	1.31	1.04	69%	0.72	2,752	165	2,916	**4,733**
13-Mar-16	15.43	14.17	5.83	8.33	10.38	17.96	0.00	0.00	1.12	1.54	69%	1.06	2,249	199	2,448	**4,279**
14-Mar-16	18.70	16.00	6.16	9.84	12.50	20.74	0.00	0.00	1.33	1.66	69%	1.14	3,220	307	3,527	**3,986**
15-Mar-16	19.34	14.67	4.80	9.87	14.76	23.56	0.00	0.00	1.35	1.47	69%	1.02	3,803	322	4,126	**3,728**
16-Mar-16	16.17	14.67	4.93	9.73	14.80	27.66	0.00	0.00	0.97	1.75	69%	1.21	3,310	333	3,643	**3,545**
17-Mar-16	18.32	27.67	5.53	22.13	14.60	32.70	0.00	0.00	1.95	3.14	69%	2.16	4,228	763	4,992	**3,592**
18-Mar-16	20.97	29.00	4.50	24.50	33.20	35.51	0.00	0.00	2.33	1.93	69%	1.33	8,149	905	9,054	**4,387**
19-Mar-16	15.42	29.83	5.05	24.78	36.75	37.17	0.00	0.00	1.19	1.88	69%	1.30	6,355	689	7,044	**4,976**
20-Mar-16	16.46	14.67	4.15	10.52	37.18	26.66	0.00	0.00	0.84	1.70	69%	1.17	6,382	625	7,007	**5,628**
21-Mar-16	19.16	10.50	4.20	6.30	15.78	29.74	0.00	0.00	1.90	1.43	69%	0.99	4,282	352	4,634	**5,786**
22-Mar-16	12.36	9.00	4.75	4.25	9.45	23.61	0.00	0.00	0.73	1.04	69%	0.72	1,790	107	1,897	**5,467**

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
23-Mar-16	18.96	8.33	4.80	3.53	6.38	23.48	0.00	0.00	1.43	1.38	69%	0.95	2,401	191	2,592	**5,317**
24-Mar-16	18.61	9.17	4.23	4.93	5.30	24.91	0.00	0.00	2.00	1.29	69%	0.89	2,330	173	2,503	**4,962**
25-Mar-16	19.11	8.00	3.62	4.38	7.40	20.86	0.00	0.00	0.82	1.63	69%	1.13	2,401	226	2,627	**4,043**
26-Mar-16	20.33	7.50	4.63	2.87	6.58	20.95	0.00	0.00	1.82	1.04	69%	0.72	2,518	151	2,668	**3,418**
27-Mar-16	21.15	7.00	4.88	2.12	4.30	19.54	0.00	0.00	2.22	1.59	69%	1.10	2,287	209	2,496	**2,774**
28-Mar-16	18.44	6.17	4.33	1.83	3.18	19.74	0.00	0.00	1.55	1.72	69%	1.19	1,741	173	1,914	**2,385**
29-Mar-16	19.81	6.67	4.82	1.85	2.75	20.04	0.00	0.00	1.62	1.27	69%	0.87	1,773	129	1,902	**2,386**
30-Mar-16	17.92	8.33	4.50	3.83	2.78	23.82	0.00	0.00	2.06	1.47	69%	1.02	1,849	157	2,006	**2,302**
31-Mar-16	19.73	16.50	4.72	11.78	5.75	18.30	0.00	0.00	1.19	1.54	69%	1.06	2,143	190	2,333	**2,278**
1-Apr-16	19.54	10.17	3.67	6.50	17.68	20.24	0.00	0.00	1.38	1.66	69%	1.14	4,196	400	4,596	**2,559**
2-Apr-16	20.77	9.67	4.05	5.62	9.75	18.51	0.00	0.00	1.35	1.43	69%	0.99	2,970	244	3,214	**2,637**
3-Apr-16	17.37	8.67	3.85	4.82	8.43	21.21	0.00	0.00	1.91	1.43	69%	0.99	2,482	204	2,686	**2,664**
4-Apr-16	19.87	7.50	4.07	3.43	7.23	18.68	0.00	0.00	1.26	1.50	69%	1.03	2,424	209	2,633	**2,767**
5-Apr-16	19.58	7.17	3.83	3.33	5.15	7.56	0.00	0.00	1.23	1.70	69%	1.17	1,572	154	1,726	**2,742**
6-Apr-16	18.87	6.83	4.32	2.52	5.00	20.69	0.00	0.00	1.62	1.47	69%	1.02	2,093	177	2,271	**2,780**
7-Apr-16	17.48	6.50	3.80	2.70	3.78	18.36	0.00	0.00	1.51	1.47	69%	1.02	1,652	140	1,792	**2,702**
8-Apr-16	18.44	7.17	3.98	3.18	4.05	19.46	0.00	0.00	1.83	1.52	69%	1.05	1,884	165	2,049	**2,339**
9-Apr-16	15.70	5.83	3.95	1.88	4.78	18.85	0.00	0.00	1.75	1.45	69%	1.00	1,661	139	1,800	**2,137**
10-Apr-16	20.85	8.17	4.85	3.32	2.83	18.31	0.00	0.00	1.62	1.84	69%	1.27	1,865	197	2,062	**2,047**
11-Apr-16	17.72	9.83	5.45	4.38	4.98	19.80	0.00	0.00	1.30	1.79	69%	1.24	1,911	197	2,108	**1,972**
12-Apr-16	18.63	7.17	3.97	3.20	6.58	16.83	0.00	0.00	1.31	1.50	69%	1.03	2,102	181	2,283	**2,052**
13-Apr-16	20.31	6.17	3.98	2.18	4.80	17.66	0.00	0.00	0.96	1.68	69%	1.16	1,991	192	2,183	**2,040**
14-Apr-16	19.44	7.17	3.75	3.42	3.28	18.18	0.00	0.00	1.64	1.68	69%	1.16	1,791	173	1,964	**2,064**
15-Apr-16	21.38	6.67	4.72	1.95	5.13	18.52	0.00	0.00	1.93	1.61	69%	1.11	2,360	219	2,579	**2,140**
16-Apr-16	22.58	6.00	4.43	1.57	2.93	15.45	0.00	0.00	1.00	1.77	69%	1.22	1,767	180	1,947	**2,161**
17-Apr-16	22.90	5.67	3.90	1.77	2.35	21.83	0.00	0.00	2.12	1.50	69%	1.03	2,192	189	2,381	**2,206**
18-Apr-16	25.37	5.67	4.25	1.42	2.65	16.49	0.00	0.00	0.90	1.52	69%	1.05	1,928	169	2,096	**2,205**
19-Apr-16	24.65	5.33	4.20	1.13	2.13	18.07	0.00	0.00	1.43	1.72	69%	1.19	1,993	198	2,190	**2,191**
20-Apr-16	15.41	6.67	4.30	2.37	1.70	17.54	0.00	0.00	1.08	1.52	69%	1.05	1,109	97	1,206	**2,052**
21-Apr-16	18.59	6.00	3.73	2.27	3.55	19.36	0.00	0.00	0.71	1.68	69%	1.16	1,662	161	1,822	**2,032**
22-Apr-16	17.11	5.50	4.55	0.95	3.40	18.16	0.00	0.00	1.09	1.66	69%	1.14	1,514	144	1,658	**1,900**
23-Apr-16	20.30	5.00	4.43	0.57	1.43	19.94	0.00	0.00	1.05	1.59	69%	1.10	1,528	140	1,668	**1,860**
24-Apr-16	24.76	9.83	4.12	5.72	0.85	15.91	0.00	0.00	1.70	1.70	69%	1.17	1,669	163	1,832	**1,782**
25-Apr-16	25.22	6.67	4.58	2.08	8.58	17.34	0.00	0.00	1.18	1.63	69%	1.13	3,288	309	3,597	**1,996**
26-Apr-16	28.20	6.67	4.23	2.43	3.13	9.45	0.00	0.00	0.97	1.59	69%	1.10	1,828	167	1,995	**1,968**
27-Apr-16	20.98	6.67	4.12	2.55	3.65	18.81	0.00	0.00	1.17	1.59	69%	1.10	1,936	177	2,113	**2,098**
28-Apr-16	29.02	11.33	5.25	6.08	3.83	22.14	0.00	0.00	1.76	1.77	69%	1.22	3,114	317	3,431	**2,328**
29-Apr-16	23.71	26.83	5.43	21.40	9.13	38.34	0.00	0.00	2.04	2.36	69%	1.63	4,605	626	5,231	**2,838**
30-Apr-16	20.27	59.33	4.83	54.50	32.10	77.40	0.00	0.00	1.09	3.21	69%	2.21	9,568	1,765	11,333	**4,219**
1-May-16	22.50	40.33	2.42	37.91	81.75	81.17	24.07	8.67	1.40	2.41	69%	1.66	21,162	2,933	24,095	**7,399**
2-May-16	23.85	310.67	3.37	307.30	56.87	74.08	17.03	6.13	0.74	2.86	69%	1.98	16,692	2,751	19,443	**9,663**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.** **Max 7 Day Avg.**	14,832 80,601	**Peaking Factor**	5.43

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**lbs/day**	**7 Day Ave**
3-May-16	21.29	609.83	4.68	605.15	460.95	76.20	19.51	7.02	0.80	3.11	69%	2.15	86,913	15,579	102,491	**24,020**
4-May-16	22.87	294.83	6.18	288.65	907.73	52.28	19.61	7.06	3.49	2.84	69%	1.96	177,787	29,068	206,855	**53,269**
5-May-16	21.36	203.50	5.85	197.65	432.98	52.02	21.95	7.90	1.12	2.68	69%	1.85	81,142	12,522	93,664	**66,159**
6-May-16	20.41	138.33	5.07	133.27	296.48	49.24	17.57	6.33	1.87	2.45	69%	1.69	54,078	7,635	61,713	**74,228**
7-May-16	20.10	106.33	4.95	101.38	199.90	60.23	3.25	1.17	1.00	2.13	69%	1.47	36,824	4,523	41,347	**78,515**
8-May-16	20.29	72.33	5.15	67.18	152.08	53.78	0.00	0.00	2.20	2.13	69%	1.47	28,848	3,543	32,392	**79,701**
9-May-16	23.87	59.00	5.92	53.08	100.78	48.14	0.00	0.00	0.83	1.97	69%	1.36	23,118	2,627	25,745	**80,601**
10-May-16	22.76	46.17	5.58	40.58	79.63	39.58	0.00	0.00	1.08	1.86	69%	1.28	17,623	1,887	19,511	**68,747**
11-May-16	23.18	60.33	6.22	54.11	60.88	36.01	0.00	0.00	1.43	2.11	69%	1.46	14,231	1,729	15,960	**41,476**
12-May-16	24.72	186.00	4.88	181.12	81.17	76.38	13.12	4.72	1.89	2.89	69%	1.99	22,489	3,736	26,224	**31,842**
13-May-16	22.37	216.17	4.30	211.87	271.68	75.65	17.99	6.47	0.93	3.53	69%	2.43	55,985	11,357	67,342	**32,646**
14-May-16	18.44	168.33	5.08	163.25	317.80	79.80	20.65	7.43	1.70	3.43	69%	2.37	53,624	10,597	64,221	**35,914**
15-May-16	16.83	123.83	3.40	120.43	244.88	58.89	16.89	6.08	1.76	3.11	69%	2.15	37,754	6,767	44,521	**37,646**
16-May-16	21.91	77.17	5.22	71.95	180.65	59.03	3.62	1.30	1.14	2.32	69%	1.60	36,622	4,883	41,505	**39,898**
17-May-16	19.10	44.83	5.08	39.75	107.93	9.58	0.00	0.00	1.76	1.97	69%	1.36	18,105	2,057	20,162	**39,991**
18-May-16	23.36	40.33	6.42	33.92	59.63	34.41	0.00	0.00	1.68	1.86	69%	1.28	14,027	1,502	15,529	**39,929**
19-May-16	24.60	34.17	5.60	28.57	50.88	33.98	0.00	0.00	1.49	2.11	69%	1.46	12,949	1,573	14,522	**38,257**
20-May-16	23.81	36.00	4.68	31.32	42.85	32.44	0.00	0.00	1.17	2.20	69%	1.52	10,806	1,370	12,176	**30,377**
21-May-16	22.06	108.67	3.35	105.32	46.98	78.33	0.00	0.00	0.85	2.75	69%	1.90	13,097	2,073	15,169	**23,369**
22-May-16	26.41	199.50	3.78	195.72	157.98	81.23	22.73	8.18	1.73	3.66	69%	2.53	41,814	8,812	50,626	**24,241**
23-May-16	32.19	62.50	3.40	59.10	293.58	54.93	18.69	6.73	1.83	2.43	69%	1.68	84,974	11,886	96,860	**32,149**
24-May-16	28.04	39.50	4.42	35.08	88.65	35.91	8.99	3.24	0.70	2.43	69%	1.68	24,089	3,370	27,459	**33,191**
25-May-16	22.77	30.33	3.97	26.37	52.63	31.48	0.00	0.00	3.01	2.00	69%	1.38	12,463	1,433	13,896	**32,958**
26-May-16	23.48	28.33	4.22	24.12	39.55	24.81	0.00	0.00	1.27	1.75	69%	1.21	9,560	961	10,521	**32,387**
27-May-16	19.98	26.17	4.00	22.17	36.18	30.95	0.00	0.00	1.81	1.95	69%	1.35	7,965	895	8,859	**31,913**
28-May-16	16.10	33.83	4.30	29.53	33.25	45.20	0.00	0.00	2.17	2.48	69%	1.71	6,647	947	7,595	**30,831**
29-May-16	13.28	46.17	4.47	41.70	44.30	50.48	0.00	0.00	0.86	2.29	69%	1.58	6,707	885	7,593	**24,683**
30-May-16	16.09	33.83	3.82	30.01	62.55	41.12	0.00	0.00	1.17	2.09	69%	1.44	10,253	1,232	11,485	**12,487**
31-May-16	23.77	24.00	5.15	18.85	45.02	22.29	0.00	0.00	1.55	2.16	69%	1.49	10,739	1,333	12,072	**10,289**
1-Jun-16	21.98	22.83	5.20	17.63	28.28	25.73	0.00	0.00	1.97	2.09	69%	1.44	7,098	853	7,951	**9,439**
2-Jun-16	23.37	19.50	5.55	13.95	26.45	13.01	0.00	0.00	1.45	1.61	69%	1.11	6,349	588	6,937	**8,927**
3-Jun-16	22.27	14.67	4.42	10.25	20.93	20.15	0.00	0.00	1.54	1.95	69%	1.35	5,447	612	6,059	**8,527**
4-Jun-16	17.62	28.00	4.78	23.22	15.38	36.11	20.76	7.47	1.30	2.18	69%	1.50	4,851	609	5,460	**8,222**
5-Jun-16	19.97	17.50	4.22	13.28	34.83	22.95	6.74	2.43	1.25	2.25	69%	1.55	7,581	981	8,561	**8,361**
6-Jun-16	18.33	20.50	5.28	15.22	19.93	30.62	0.00	0.00	1.40	2.41	69%	1.66	4,796	665	5,461	**7,500**
7-Jun-16	24.68	14.17	4.75	9.42	22.83	28.03	2.56	0.92	1.70	2.02	69%	1.39	7,038	818	7,856	**6,898**
8-Jun-16	23.65	11.83	4.67	7.17	14.13	27.64	3.54	1.27	1.19	2.04	69%	1.41	4,958	583	5,541	**6,554**
9-Jun-16	20.60	13.17	3.97	9.20	10.75	27.36	5.10	1.84	1.99	2.16	69%	1.49	3,940	489	4,429	**6,195**
10-Jun-16	22.37	15.50	4.05	11.45	13.80	27.55	4.72	1.70	1.35	2.36	69%	1.63	4,747	645	5,392	**6,100**
11-Jun-16	26.22	16.17	4.45	11.72	17.18	27.16	2.02	0.73	1.32	2.09	69%	1.44	6,091	732	6,823	**6,295**
12-Jun-16	22.92	11.67	3.73	7.93	17.58	25.89	4.79	1.72	1.51	1.91	69%	1.32	5,472	600	6,072	**5,939**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
13-Jun-16	25.90	10.33	4.75	5.58	11.90	17.23	1.80	0.65	1.81	2.04	69%	1.41	4,377	515	4,892	**5,858**
14-Jun-16	24.43	8.83	4.05	4.78	8.38	27.38	2.68	0.96	1.30	2.04	69%	1.41	3,916	460	4,376	**5,361**
15-Jun-16	21.20	6.83	3.30	3.53	7.18	28.75	4.40	1.58	1.20	1.91	69%	1.32	3,290	361	3,651	**5,091**
16-Jun-16	24.78	9.17	3.55	5.62	5.30	25.28	9.42	3.39	1.89	1.79	69%	1.24	3,636	375	4,010	**5,031**
17-Jun-16	30.17	9.67	3.82	5.85	8.43	35.70	19.62	7.06	1.32	1.77	69%	1.22	6,392	651	7,043	**5,267**
18-Jun-16	29.83	7.67	4.42	3.25	8.78	23.78	17.41	6.27	1.42	1.91	69%	1.32	5,511	605	6,116	**5,166**
19-Jun-16	29.71	9.33	4.45	4.88	4.88	27.17	20.22	7.28	1.65	2.02	69%	1.39	4,995	581	5,576	**5,095**
20-Jun-16	27.48	9.17	4.55	4.62	7.33	26.41	19.86	7.15	1.15	2.16	69%	1.49	5,021	623	5,644	**5,202**
21-Jun-16	27.57	11.17	4.32	6.85	6.93	33.38	17.79	6.40	2.03	2.25	69%	1.55	5,491	710	6,202	**5,463**
22-Jun-16	18.46	13.67	3.33	10.33	10.28	39.71	25.31	9.11	1.35	2.16	69%	1.49	4,619	573	5,193	**5,683**
23-Jun-16	27.49	18.33	3.18	15.15	15.50	23.88	22.17	7.98	1.70	2.41	69%	1.66	7,031	974	8,006	**6,254**
24-Jun-16	26.03	28.83	4.38	24.45	22.73	32.86	27.36	9.85	1.37	2.70	69%	1.87	8,999	1,400	10,399	**6,734**
25-Jun-16	25.24	40.00	3.90	36.10	36.68	38.10	27.12	9.76	1.28	3.21	69%	2.21	12,006	2,215	14,221	**7,892**
26-Jun-16	26.27	34.17	3.70	30.47	54.15	39.64	27.94	10.06	1.40	3.18	69%	2.20	16,486	3,020	19,505	**9,881**
27-Jun-16	22.51	43.17	3.73	39.43	45.70	43.20	37.13	13.37	1.31	3.16	69%	2.18	13,111	2,384	15,495	**11,289**
28-Jun-16	29.01	28.17	3.87	24.30	59.15	39.98	42.36	15.25	1.35	2.75	69%	1.90	20,177	3,193	23,370	**13,741**
29-Jun-16	23.56	18.33	3.62	14.72	36.45	29.45	29.96	10.79	1.88	2.59	69%	1.79	10,865	1,620	12,484	**14,783**
30-Jun-16	28.49	16.83	3.37	13.47	22.08	38.35	30.05	10.82	1.80	2.34	69%	1.61	10,246	1,379	11,626	**15,300**
1-Jul-16	26.14	12.33	3.37	8.97	20.20	39.10	28.23	10.16	1.68	2.20	69%	1.52	8,898	1,128	10,025	**15,247**
2-Jul-16	28.35	11.17	3.98	7.18	13.45	36.83	22.97	8.27	1.00	2.29	69%	1.58	7,466	986	8,452	**14,423**
3-Jul-16	19.69	9.00	3.18	5.82	10.78	37.56	33.60	12.10	1.89	2.25	69%	1.55	5,334	690	6,025	**12,497**
4-Jul-16	14.05	10.17	2.87	7.30	8.73	25.50	35.42	12.75	1.36	2.54	69%	1.76	3,191	467	3,658	**10,806**
5-Jul-16	19.64	16.83	2.98	13.85	10.95	17.03	44.87	16.15	1.55	2.84	69%	1.96	4,880	798	5,678	**8,278**
6-Jul-16	20.00	14.00	3.06	10.94	20.78	27.32	40.29	14.50	1.56	2.57	69%	1.77	6,865	1,014	7,879	**7,620**
7-Jul-16	20.66	17.33	3.52	13.82	16.41	26.00	40.30	14.51	1.28	2.82	69%	1.94	6,261	1,015	7,276	**6,999**
8-Jul-16	23.95	25.33	3.37	21.97	20.73	34.82	41.10	14.80	1.67	2.57	69%	1.77	8,680	1,283	9,963	**6,990**
9-Jul-16	29.56	110.33	4.90	105.43	32.95	52.16	41.98	15.11	1.51	3.25	69%	2.24	15,030	2,812	17,842	**8,332**
10-Jul-16	28.94	164.17	5.15	159.02	158.15	50.89	48.25	17.37	1.76	3.87	69%	2.67	45,365	10,096	55,460	**15,394**
11-Jul-16	30.40	96.17	4.33	91.83	238.53	46.92	43.65	15.71	1.19	2.93	69%	2.02	67,172	11,335	78,507	**26,087**
12-Jul-16	30.81	119.17	3.93	115.23	137.75	42.73	45.00	16.20	1.77	2.96	69%	2.04	42,128	7,164	49,292	**32,317**
13-Jul-16	22.70	195.83	3.58	192.25	172.85	42.43	59.76	21.51	2.16	3.41	69%	2.35	38,472	7,552	46,024	**37,766**
14-Jul-16	29.41	157.00	4.92	152.08	288.38	36.80	39.55	14.24	1.79	3.64	69%	2.51	76,563	16,034	92,597	**49,955**
15-Jul-16	22.30	100.17	5.33	94.83	228.13	28.81	36.49	13.14	1.50	3.55	69%	2.45	46,245	9,442	55,687	**56,487**
16-Jul-16	25.56	66.67	5.68	60.98	142.25	45.60	2.72	0.98	1.74	3.00	69%	2.07	33,933	5,860	39,793	**59,623**
17-Jul-16	24.75	55.67	4.52	51.15	91.48	49.17	2.32	0.84	1.05	2.57	69%	1.77	22,358	3,304	25,662	**55,366**
18-Jul-16	28.60	49.00	5.08	43.92	76.73	44.67	2.83	1.02	1.34	2.75	69%	1.90	22,153	3,506	25,659	**47,816**
19-Jul-16	26.78	37.67	4.38	33.28	65.88	41.35	2.44	0.88	1.44	2.64	69%	1.82	18,103	2,746	20,849	**43,753**
20-Jul-16	27.67	28.67	4.30	24.37	49.93	43.22	15.31	5.51	1.40	2.80	69%	1.93	15,859	2,551	18,410	**39,808**
21-Jul-16	25.76	20.67	3.43	17.23	36.55	43.49	16.22	5.84	2.68	2.61	69%	1.80	12,203	1,835	14,038	**28,585**
22-Jul-16	32.67	13.33	4.08	9.25	25.85	22.39	23.40	8.42	0.98	2.61	69%	1.80	10,986	1,652	12,638	**22,436**
23-Jul-16	33.73	8.00	4.37	3.63	13.88	29.88	22.94	8.26	1.24	2.52	69%	1.74	8,577	1,245	9,821	**18,154**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
24-Jul-16	28.85	6.83	3.27	3.57	5.45	27.99	24.09	8.67	1.83	2.48	69%	1.71	5,383	767	6,150	**15,367**
25-Jul-16	29.28	6.38	3.72	2.67	5.35	26.56	26.66	9.60	1.16	2.50	69%	1.72	5,335	767	6,103	**12,573**
26-Jul-16	26.37	4.00	3.45	0.55	4.00	27.03	28.98	10.43	2.59	2.39	69%	1.65	4,952	680	5,632	**10,399**
27-Jul-16	33.34	4.50	3.63	0.87	0.82	24.82	21.90	7.89	1.12	2.29	69%	1.58	4,318	570	4,888	**8,467**
28-Jul-16	22.64	10.33	3.92	6.42	1.30	33.82	17.68	6.36	2.02	2.34	69%	1.61	3,474	468	3,942	**7,025**
29-Jul-16	26.54	30.83	3.22	27.62	9.63	42.95	32.99	11.88	1.11	3.27	69%	2.26	7,214	1,359	8,574	**6,444**
30-Jul-16	26.61	44.83	3.48	41.35	41.43	56.72	35.33	12.72	0.93	3.91	69%	2.70	15,308	3,447	18,755	**7,721**
31-Jul-16	26.54	39.33	2.93	36.40	62.03	75.21	50.96	18.35	2.08	3.48	69%	2.40	21,958	4,397	26,354	**10,607**
1-Aug-16	27.76	33.33	3.15	30.18	54.60	51.68	49.91	17.97	2.24	2.75	69%	1.90	19,623	3,105	22,729	**12,982**
2-Aug-16	22.73	57.83	2.45	55.38	45.28	50.30	67.11	24.16	1.91	3.64	69%	2.51	15,054	3,153	18,207	**14,778**
3-Aug-16	27.30	28.50	3.57	24.93	83.08	41.54	53.35	19.20	1.01	2.96	69%	2.04	25,083	4,266	29,348	**18,273**
4-Aug-16	29.86	22.83	4.25	18.58	37.40	27.57	38.65	13.91	1.57	2.43	69%	1.68	14,287	1,999	16,286	**20,036**
5-Aug-16	25.72	28.50	3.47	25.03	27.88	49.00	5.42	1.95	2.01	2.82	69%	1.94	9,984	1,619	11,603	**20,469**
6-Aug-16	26.60	48.00	3.78	44.22	37.55	55.28	0.00	0.00	1.42	2.82	69%	1.94	12,432	2,016	14,448	**19,854**
7-Aug-16	27.26	50.00	3.60	46.40	66.33	64.09	0.00	0.00	1.11	3.16	69%	2.18	19,818	3,604	23,423	**19,435**
8-Aug-16	23.87	51.33	4.45	46.88	69.60	61.46	0.00	0.00	0.74	3.09	69%	2.13	17,782	3,164	20,946	**19,180**
9-Aug-16	27.70	40.83	3.98	36.85	70.33	37.38	0.00	0.00	2.17	2.75	69%	1.90	19,549	3,094	22,642	**19,814**
10-Aug-16	30.28	65.17	4.20	60.97	55.28	61.37	0.00	0.00	2.03	2.66	69%	1.83	19,180	2,935	22,114	**18,780**
11-Aug-16	30.22	88.00	4.60	83.40	91.45	63.01	0.00	0.00	1.35	3.32	69%	2.29	28,311	5,409	33,720	**21,271**
12-Aug-16	33.09	67.17	4.23	62.93	125.10	61.75	0.00	0.00	1.92	3.16	69%	2.18	40,325	7,334	47,659	**26,422**
13-Aug-16	28.54	46.17	4.50	41.67	94.40	65.79	0.00	0.00	1.66	3.07	69%	2.12	27,657	4,885	32,542	**29,007**
14-Aug-16	19.98	37.67	5.13	32.53	62.50	50.71	0.00	0.00	1.83	3.21	69%	2.21	13,399	2,472	15,872	**27,928**
15-Aug-16	27.68	39.00	5.42	33.58	48.80	50.76	0.00	0.00	1.13	3.21	69%	2.21	15,244	2,812	18,056	**27,515**
16-Aug-16	25.29	34.83	4.83	30.00	50.38	37.03	12.46	4.49	1.38	2.96	69%	2.04	14,110	2,400	16,509	**26,639**
17-Aug-16	22.90	34.33	4.27	30.07	45.00	42.45	0.00	0.00	1.52	2.84	69%	1.96	11,476	1,876	13,353	**25,387**
18-Aug-16	20.70	29.50	3.22	26.28	45.10	43.72	0.00	0.00	2.10	3.62	69%	2.50	10,645	2,215	12,860	**22,407**
19-Aug-16	24.50	25.17	3.54	21.63	39.43	40.79	0.00	0.00	1.30	2.80	69%	1.93	10,998	1,769	12,768	**17,423**
20-Aug-16	24.65	25.00	3.87	21.13	32.44	37.26	0.00	0.00	1.62	2.68	69%	1.85	9,480	1,463	10,942	**14,337**
21-Aug-16	18.63	24.17	3.27	20.90	31.70	40.61	0.00	0.00	1.44	3.05	69%	2.10	7,203	1,263	8,466	**13,279**
22-Aug-16	25.14	29.33	3.37	25.97	31.35	44.06	0.00	0.00	1.51	2.86	69%	1.98	9,834	1,621	11,455	**12,336**
23-Aug-16	23.72	26.50	2.95	23.55	38.95	30.22	0.00	0.00	1.58	2.82	69%	1.94	10,040	1,628	11,669	**11,645**
24-Aug-16	27.39	27.67	3.47	24.20	35.33	34.69	0.00	0.00	2.21	2.93	69%	2.02	11,204	1,891	13,094	**11,608**
25-Aug-16	26.44	23.83	3.52	20.31	36.30	38.92	0.00	0.00	1.97	2.59	69%	1.79	11,184	1,667	12,851	**11,606**
26-Aug-16	29.28	22.67	3.35	19.32	30.47	34.49	0.00	0.00	1.58	2.48	69%	1.71	10,550	1,503	12,054	**11,504**
27-Aug-16	28.37	22.00	3.90	18.10	28.98	42.50	0.00	0.00	1.01	2.89	69%	1.99	10,319	1,714	12,033	**11,660**
28-Aug-16	28.79	25.50	4.70	20.80	27.15	35.28	0.00	0.00	1.65	2.82	69%	1.94	9,703	1,574	11,277	**12,062**
29-Aug-16	20.92	20.83	3.57	17.27	31.20	40.20	0.00	0.00	1.10	2.68	69%	1.85	7,879	1,216	9,095	**11,725**
30-Aug-16	25.74	22.00	4.00	18.00	25.90	22.94	0.00	0.00	1.13	3.02	69%	2.09	7,600	1,322	8,922	**11,332**
31-Aug-16	28.20	18.50	3.75	14.75	27.00	33.01	0.00	0.00	2.07	3.02	69%	2.09	9,453	1,645	11,098	**11,047**
1-Sep-16	25.89	15.17	4.38	10.78	22.13	27.77	0.00	0.00	1.18	2.52	69%	1.74	7,050	1,023	8,073	**10,365**
2-Sep-16	26.44	15.67	4.08	11.58	16.18	38.05	0.00	0.00	1.59	3.00	69%	2.07	6,672	1,152	7,825	**9,761**

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/20/2017
CHECKED BY:

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.** **Max 7 Day Avg.**	14,832 80,601	**Peaking Factor**	5.43

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	**Filters***	**Total**	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**lbs/day**	**7 Day Ave**
3-Sep-16	25.66	15.83	4.10	11.73	17.38	34.65	0.00	0.00	1.55	2.70	69%	1.87	6,480	1,008	7,489	**9,111**
4-Sep-16	25.34	15.00	4.08	10.92	17.60	33.44	0.00	0.00	1.03	2.73	69%	1.88	6,270	984	7,254	**8,536**
5-Sep-16	28.43	13.00	3.70	9.30	16.38	31.78	0.00	0.00	1.72	2.93	69%	2.02	6,834	1,153	7,987	**8,378**
6-Sep-16	29.00	13.50	3.65	9.85	13.95	27.17	0.00	0.00	1.09	2.86	69%	1.98	5,914	975	6,889	**8,088**
7-Sep-16	33.26	7.33	4.85	2.48	14.78	40.69	0.00	0.00	1.39	2.82	69%	1.94	8,115	1,316	9,431	**7,849**
8-Sep-16	32.23	7.50	2.87	4.63	3.73	40.82	0.00	0.00	1.58	2.61	69%	1.80	4,914	739	5,653	**7,504**
9-Sep-16	31.10	8.33	2.53	5.80	6.95	43.74	0.00	0.00	1.37	2.89	69%	1.99	5,782	960	6,742	**7,349**
10-Sep-16	28.61	8.83	2.60	6.23	8.70	35.34	0.00	0.00	0.91	2.77	69%	1.91	5,060	807	5,867	**7,118**
11-Sep-16	27.24	9.67	3.02	6.65	9.35	27.79	0.00	0.00	1.46	2.86	69%	1.98	4,633	764	5,397	**6,852**
12-Sep-16	30.75	11.17	3.07	8.10	9.98	34.26	0.00	0.00	2.26	2.89	69%	1.99	6,055	1,006	7,060	**6,720**
13-Sep-16	29.07	10.83	2.47	8.37	12.15	30.51	0.00	0.00	2.08	2.89	69%	1.99	5,959	990	6,948	**6,729**
14-Sep-16	35.13	10.50	4.13	6.37	12.55	33.20	0.00	0.00	1.43	2.93	69%	2.02	7,351	1,240	8,591	**6,609**
15-Sep-16	27.59	10.17	3.15	7.02	9.55	42.94	0.00	0.00	1.25	2.68	69%	1.85	5,615	867	6,482	**6,727**
16-Sep-16	32.34	8.00	3.60	4.40	10.53	44.91	0.00	0.00	1.28	2.34	69%	1.61	6,938	934	7,872	**6,888**
17-Sep-16	22.97	7.50	2.32	5.18	6.60	48.23	0.00	0.00	0.55	2.66	69%	1.83	4,251	650	4,902	**6,750**
18-Sep-16	29.08	9.33	2.18	7.15	7.78	35.67	0.00	0.00	1.45	2.75	69%	1.90	5,066	802	5,868	**6,818**
19-Sep-16	32.69	19.33	2.52	16.82	10.73	28.74	0.00	0.00	1.48	2.52	69%	1.74	5,949	863	6,812	**6,782**
20-Sep-16	30.94	18.33	3.43	14.90	25.23	36.53	0.00	0.00	2.23	2.39	69%	1.65	10,089	1,385	11,473	**7,429**
21-Sep-16	26.85	21.67	2.67	19.00	22.35	38.00	0.00	0.00	1.12	2.54	69%	1.76	7,980	1,169	9,149	**7,508**
22-Sep-16	26.59	36.83	2.50	34.33	28.50	58.50	0.00	0.00	2.95	3.59	69%	2.48	11,079	2,291	13,370	**8,492**
23-Sep-16	30.24	77.50	3.23	74.27	51.50	57.79	0.00	0.00	1.26	4.21	69%	2.90	18,031	4,367	22,398	**10,567**
24-Sep-16	27.88	109.00	4.57	104.43	111.40	84.71	0.00	0.00	0.42	4.98	69%	3.44	32,194	9,234	41,428	**15,785**
25-Sep-16	24.78	80.00	4.08	75.92	156.65	86.97	0.00	0.00	2.73	4.23	69%	2.92	38,455	9,365	47,820	**21,779**
26-Sep-16	27.49	53.83	4.25	49.58	113.88	68.19	0.00	0.00	1.68	4.19	69%	2.89	31,435	7,573	39,009	**26,378**
27-Sep-16	26.55	45.33	4.48	40.85	74.38	66.09	0.00	0.00	1.48	3.71	69%	2.56	21,371	4,560	25,931	**28,444**
28-Sep-16	25.19	37.83	3.72	34.12	61.28	67.24	0.00	0.00	1.62	3.57	69%	2.46	17,601	3,617	21,218	**30,168**
29-Sep-16	25.10	33.00	3.67	29.33	51.18	60.54	9.50	3.42	0.65	3.68	69%	2.54	15,325	3,250	18,575	**30,911**
30-Sep-16	21.63	32.00	4.22	27.78	44.00	50.11	29.21	10.51	1.52	3.62	69%	2.50	12,386	2,578	14,964	**29,849**
1-Oct-16	27.41	27.83	4.68	23.15	41.68	45.60	29.42	10.59	1.33	3.18	69%	2.20	14,785	2,708	17,493	**26,430**
2-Oct-16	21.73	26.50	2.68	23.82	34.73	32.36	29.28	10.54	1.65	3.14	69%	2.16	9,849	1,778	11,628	**21,260**
3-Oct-16	27.89	23.33	3.82	19.52	35.73	29.03	33.66	12.12	2.02	2.96	69%	2.04	12,966	2,205	15,171	**17,854**
4-Oct-16	24.43	20.33	3.68	16.65	29.28	32.97	26.60	9.57	1.66	2.96	69%	2.04	9,847	1,675	11,522	**15,796**
5-Oct-16	25.72	20.00	3.93	16.07	24.98	28.89	33.07	11.91	1.35	3.00	69%	2.07	9,475	1,636	11,111	**14,352**
6-Oct-16	21.74	18.50	2.95	15.55	24.10	31.56	35.32	12.71	2.08	3.02	69%	2.09	8,212	1,429	9,641	**13,076**
7-Oct-16	28.16	19.00	3.65	15.35	23.33	27.62	33.25	11.97	1.46	3.21	69%	2.21	9,973	1,840	11,813	**12,625**
8-Oct-16	28.85	16.83	3.55	13.28	23.03	26.95	32.18	11.58	1.63	3.23	69%	2.23	10,083	1,873	11,956	**11,834**
9-Oct-16	26.34	18.50	3.70	14.80	19.93	28.94	35.26	12.69	1.62	3.00	69%	2.07	8,769	1,514	10,283	**11,642**
10-Oct-16	28.17	17.33	4.13	13.20	22.20	26.81	31.99	11.52	1.74	3.00	69%	2.07	9,623	1,662	11,284	**11,087**
11-Oct-16	26.96	15.17	3.65	11.52	19.80	34.53	34.31	12.35	2.04	3.14	69%	2.16	9,357	1,690	11,047	**11,019**
12-Oct-16	25.64	15.50	3.70	11.80	17.28	39.29	36.17	13.02	1.30	3.18	69%	2.20	8,579	1,571	10,150	**10,882**
13-Oct-16	26.34	13.67	2.93	10.73	17.70	14.88	35.28	12.70	1.36	3.11	69%	2.15	7,394	1,325	8,720	**10,750**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids
**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
14-Oct-16	23.08	12.33	3.88	8.45	16.10	23.34	36.68	13.21	1.98	2.98	69%	2.05	6,783	1,162	7,945	**10,198**
15-Oct-16	25.33	11.17	3.35	7.82	12.68	20.76	33.27	11.98	1.30	2.96	69%	2.04	6,252	1,063	7,316	**9,535**
16-Oct-16	25.17	9.33	3.05	6.28	11.73	16.78	32.33	11.64	1.63	2.80	69%	1.93	5,785	931	6,716	**9,025**
17-Oct-16	23.89	8.83	3.40	5.43	9.43	19.07	36.28	13.06	1.25	2.80	69%	1.93	5,269	848	6,117	**8,287**
18-Oct-16	23.51	7.33	2.88	4.45	8.15	20.24	35.11	12.64	1.76	2.61	69%	1.80	5,019	755	5,773	**7,534**
19-Oct-16	25.10	6.50	2.85	3.65	6.68	17.04	34.89	12.56	1.49	2.61	69%	1.80	4,800	722	5,522	**6,873**
20-Oct-16	21.77	4.00	2.48	1.52	5.48	18.89	31.91	11.49	1.49	2.75	69%	1.90	3,924	621	4,545	**6,276**
21-Oct-16	24.46	5.17	2.47	2.70	2.28	7.49	23.44	8.44	1.49	2.80	69%	1.93	2,716	437	3,153	**5,592**
22-Oct-16	25.83	6.33	3.32	3.02	4.05	25.98	22.57	8.13	0.54	2.77	69%	1.91	4,089	652	4,741	**5,224**
23-Oct-16	23.26	8.33	3.65	4.68	4.53	10.40	25.63	9.23	1.30	2.75	69%	1.90	3,231	511	3,742	**4,799**
24-Oct-16	21.16	9.00	2.70	6.30	7.03	17.28	25.28	9.10	1.72	2.73	69%	1.88	3,770	592	4,362	**4,548**
25-Oct-16	22.77	11.00	3.73	7.27	9.45	17.81	25.68	9.25	1.53	2.70	69%	1.87	4,526	704	5,230	**4,471**
26-Oct-16	24.61	11.67	3.50	8.17	10.90	18.89	21.38	7.70	1.90	2.57	69%	1.77	5,095	753	5,848	**4,517**
27-Oct-16	27.22	14.17	3.30	10.87	12.25	17.95	13.93	5.01	1.75	2.73	69%	1.88	5,473	859	6,332	**4,773**
28-Oct-16	27.32	12.67	4.62	8.05	16.30	22.60	14.78	5.32	1.97	2.50	69%	1.72	6,766	973	7,739	**5,428**
29-Oct-16	28.18	12.00	3.75	8.25	12.08	20.56	11.77	4.24	0.80	2.82	69%	1.94	5,463	886	6,349	**5,657**
30-Oct-16	27.49	11.33	3.60	7.73	12.38	18.39	11.90	4.29	1.54	2.54	69%	1.76	5,396	790	6,186	**6,006**
31-Oct-16	22.05	10.00	2.85	7.15	11.60	20.88	11.84	4.26	2.29	2.70	69%	1.87	4,466	695	5,161	**6,121**
1-Nov-16	22.10	8.67	2.87	5.80	10.73	20.25	12.25	4.41	1.48	2.73	69%	1.88	4,155	652	4,807	**6,060**
2-Nov-16	28.17	9.00	3.70	5.30	8.70	22.33	12.16	4.38	2.03	2.39	69%	1.65	5,023	690	5,713	**6,041**
3-Nov-16	29.30	7.67	3.08	4.58	7.95	13.46	11.02	3.97	1.41	2.68	69%	1.85	4,279	660	4,940	**5,842**
4-Nov-16	27.19	8.00	3.20	4.80	6.88	21.76	13.96	5.02	1.55	2.54	69%	1.76	4,413	646	5,059	**5,459**
5-Nov-16	26.35	9.83	3.40	6.43	7.20	23.39	12.90	4.65	1.06	2.50	69%	1.72	4,275	615	4,890	**5,251**
6-Nov-16	27.03	8.67	3.23	5.43	9.65	19.78	11.73	4.22	1.83	2.45	69%	1.69	4,819	680	5,499	**5,153**
7-Nov-16	29.74	7.50	3.17	4.33	8.15	21.75	12.20	4.39	1.58	2.32	69%	1.60	5,006	667	5,673	**5,226**
8-Nov-16	26.22	8.17	3.12	5.05	6.50	20.93	12.08	4.35	1.49	2.43	69%	1.68	3,993	559	4,552	**5,189**
9-Nov-16	30.09	6.50	3.75	2.75	7.58	26.92	7.68	2.77	1.89	2.45	69%	1.69	5,109	721	5,830	**5,206**
10-Nov-16	23.02	6.17	2.92	3.25	4.13	36.93	0.00	0.00	1.41	2.45	69%	1.69	3,329	470	3,799	**5,043**
11-Nov-16	21.30	6.67	2.70	3.97	4.88	38.32	0.00	0.00	1.13	2.20	69%	1.52	3,202	406	3,608	**4,836**
12-Nov-16	22.11	7.83	2.67	5.17	5.95	38.57	0.00	0.00	1.87	2.27	69%	1.57	3,678	481	4,158	**4,731**
13-Nov-16	23.67	7.17	2.85	4.32	7.75	42.04	0.00	0.00	1.73	2.45	69%	1.69	4,478	632	5,110	**4,676**
14-Nov-16	25.54	6.33	2.77	3.57	6.48	34.15	0.00	0.00	1.30	2.34	69%	1.61	3,992	537	4,530	**4,512**
15-Nov-16	26.57	5.83	3.20	2.63	5.35	34.70	0.00	0.00	1.96	2.43	69%	1.68	4,099	573	4,672	**4,529**
16-Nov-16	24.58	5.33	3.30	2.03	3.95	30.17	0.00	0.00	1.42	2.43	69%	1.68	3,138	439	3,578	**4,208**
17-Nov-16	28.91	5.67	2.92	2.75	3.05	35.57	0.00	0.00	1.66	2.32	69%	1.60	3,870	516	4,386	**4,291**
18-Nov-16	27.03	5.50	2.53	2.97	4.13	37.36	0.00	0.00	1.26	2.48	69%	1.71	3,904	556	4,460	**4,413**
19-Nov-16	19.06	5.17	2.38	2.78	4.45	36.23	0.00	0.00	1.11	2.32	69%	1.60	2,716	362	3,078	**4,259**
20-Nov-16	24.81	6.83	3.18	3.65	4.18	41.11	0.00	0.00	2.07	2.34	69%	1.61	3,956	533	4,489	**4,170**
21-Nov-16	23.75	6.00	2.55	3.45	5.48	24.33	0.00	0.00	2.18	2.25	69%	1.55	3,144	407	3,550	**4,030**
22-Nov-16	27.32	6.00	3.18	2.82	5.18	37.75	0.00	0.00	2.10	2.32	69%	1.60	4,377	584	4,961	**4,072**
23-Nov-16	20.92	5.33	2.10	3.23	4.23	40.05	0.00	0.00	1.36	2.20	69%	1.52	3,153	400	3,553	**4,068**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**lbs/day**	**7 Day Ave**
24-Nov-16	20.42	5.83	2.45	3.38	4.85	40.06	0.00	0.00	1.69	2.34	69%	1.61	3,258	439	3,697	**3,970**
25-Nov-16	20.76	5.33	2.38	2.95	5.08	35.98	0.00	0.00	1.27	2.23	69%	1.54	3,071	393	3,464	**3,827**
26-Nov-16	21.24	5.33	2.35	2.98	4.43	33.11	0.00	0.00	1.41	2.34	69%	1.61	2,925	394	3,319	**3,862**
27-Nov-16	18.04	6.00	2.47	3.53	4.48	34.20	0.00	0.00	1.16	2.20	69%	1.52	2,484	315	2,799	**3,621**
28-Nov-16	24.54	6.17	3.08	3.08	5.30	19.23	0.00	0.00	0.91	2.36	69%	1.63	2,681	365	3,046	**3,548**
29-Nov-16	23.73	5.83	2.70	3.13	4.63	29.16	0.00	0.00	0.65	2.36	69%	1.63	2,946	401	3,347	**3,318**
30-Nov-16	23.40	6.00	2.17	3.83	4.70	29.57	0.00	0.00	0.77	2.27	69%	1.57	2,953	386	3,339	**3,287**
1-Dec-16	14.17	6.33	3.40	2.93	5.75	36.85	0.00	0.00	0.91	2.36	69%	1.63	2,173	295	2,468	**3,112**
2-Dec-16	11.05	6.25	2.40	3.85	4.40	26.29	0.00	0.00	1.74	2.34	69%	1.61	1,378	185	1,563	**2,840**
3-Dec-16	18.18	9.00	2.45	6.55	5.78	29.33	0.00	0.00	0.89	2.39	69%	1.65	2,477	340	2,817	**2,768**
4-Dec-16	21.22	9.67	3.73	5.93	9.83	31.08	0.00	0.00	0.54	2.36	69%	1.63	3,630	493	4,124	**2,958**
5-Dec-16	10.75	10.75	3.45	7.30	8.90	32.77	0.00	0.00	0.77	2.54	69%	1.76	1,829	268	2,097	**2,822**
6-Dec-16	12.95	8.40	2.86	5.54	10.95	32.36	0.00	0.00	2.03	2.32	69%	1.60	2,531	337	2,868	**2,754**
7-Dec-16	7.38	5.50	2.08	3.43	8.31	8.21	0.00	0.00	1.67	2.07	69%	1.43	840	100	940	**2,411**
8-Dec-16	11.06	4.60	2.18	2.42	5.14	29.69	0.00	0.00	1.67	2.32	69%	1.60	1,524	203	1,728	**2,305**
9-Dec-16	12.66	4.25	2.15	2.10	3.63	25.96	0.00	0.00	1.60	1.70	69%	1.17	1,427	140	1,567	**2,306**
10-Dec-16	18.03	4.00	2.73	1.27	3.15	27.52	0.00	0.00	0.98	2.16	69%	1.49	1,979	246	2,224	**2,221**
11-Dec-16	23.67	4.83	2.62	2.22	1.90	23.34	0.00	0.00	1.55	2.13	69%	1.47	2,234	274	2,509	**1,990**
12-Dec-16	16.69	4.25	2.75	1.50	3.33	28.64	0.00	0.00	1.98	2.25	69%	1.55	2,046	265	2,311	**2,021**
13-Dec-16	20.10	5.17	2.27	2.90	2.25	24.89	0.00	0.00	2.28	1.04	69%	0.72	2,022	121	2,143	**1,917**
14-Dec-16	17.99	9.00	3.42	5.58	4.35	33.22	0.00	0.00	1.40	2.66	69%	1.83	2,502	383	2,885	**2,195**
15-Dec-16	19.59	9.17	3.87	5.30	8.38	37.35	0.00	0.00	1.36	2.32	69%	1.60	3,522	470	3,992	**2,519**
16-Dec-16	23.70	18.83	3.93	14.90	7.95	68.69	0.00	0.00	1.68	2.70	69%	1.87	5,990	932	6,922	**3,284**
17-Dec-16	24.73	15.67	1.82	13.85	22.35	69.26	0.00	0.00	0.53	2.59	69%	1.79	9,000	1,342	10,341	**4,443**
18-Dec-16	23.56	22.67	2.32	20.35	20.78	69.82	0.00	0.00	1.87	2.75	69%	1.90	8,580	1,358	9,938	**5,505**
19-Dec-16	20.23	112.83	2.85	109.98	30.53	61.63	0.00	0.00	2.04	3.62	69%	2.50	8,763	1,824	10,587	**6,687**
20-Dec-16	21.02	162.33	3.55	158.78	164.98	55.68	0.00	0.00	1.76	3.14	69%	2.16	32,282	5,829	38,111	**11,825**
21-Dec-16	26.25	113.00	5.37	107.63	238.18	82.56	0.00	0.00	1.76	2.16	69%	1.49	57,796	7,175	64,970	**20,695**
22-Dec-16	22.32	145.20	8.14	137.06	161.45	60.36	0.00	0.00	1.77	2.98	69%	2.05	33,849	5,801	39,650	**25,789**
23-Dec-16	17.86	130.00	3.63	126.37	205.59	64.46	0.00	0.00	1.89	3.39	69%	2.34	33,889	6,608	40,498	**30,585**
24-Dec-16	23.18	114.00	4.40	109.60	189.55	70.92	0.00	0.00	0.95	3.46	69%	2.39	41,050	8,166	49,216	**36,138**
25-Dec-16	15.46	85.67	3.00	82.67	164.40	67.11	0.00	0.00	1.59	2.77	69%	1.91	24,011	3,831	27,842	**38,696**
26-Dec-16	22.09	89.33	4.65	84.68	124.00	65.90	0.00	0.00	2.27	2.66	69%	1.83	26,921	4,119	31,040	**41,618**
27-Dec-16	22.67	82.17	5.02	77.15	127.03	34.14	0.00	0.00	1.69	3.09	69%	2.13	26,507	4,716	31,223	**40,634**
28-Dec-16	21.38	137.67	5.43	132.23	115.73	66.23	0.00	0.00	1.67	3.39	69%	2.34	24,585	4,794	29,378	**35,550**
29-Dec-16	22.21	176.50	4.18	172.32	198.35	73.41	0.00	0.00	0.81	2.27	69%	1.57	40,902	5,346	46,248	**36,492**
30-Dec-16	22.02	184.00	4.45	179.55	258.48	51.55	0.00	0.00	1.74	2.29	69%	1.58	50,661	6,688	57,348	**38,899**
31-Dec-16	22.57	121.33	4.13	117.20	269.33	66.65	0.00	0.00	1.12	2.45	69%	1.69	54,655	7,717	62,372	**40,779**
1-Jan-17	20.83	91.50	4.25	87.25	175.80	59.09	0.00	0.00	0.93	2.16	69%	1.49	33,775	4,193	37,968	**42,225**
2-Jan-17	21.73	77.17	4.57	72.60	130.88	51.63	0.00	0.00	2.59	2.36	69%	1.63	27,043	3,676	30,719	**42,179**
3-Jan-17	21.87	58.00	4.60	53.40	108.90	46.39	0.00	0.00	1.72	2.02	69%	1.39	22,746	2,645	25,391	**41,346**

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg. Max 7 Day Avg.	14,832 80,601	Peaking Factor	5.43

*2016-2017 Daily Backwash Waste data at 0.1% solids
**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
4-Jan-17	20.57	50.75	6.40	44.35	80.10	29.13	0.00	0.00	1.61	2.09	69%	1.44	15,636	1,879	17,515	**39,652**
5-Jan-17	21.94	47.67	4.48	43.18	66.53	41.26	0.00	0.00	1.51	1.68	69%	1.16	14,728	1,423	16,151	**35,352**
6-Jan-17	25.16	39.33	5.07	34.27	64.78	41.60	0.00	0.00	1.54	1.84	69%	1.27	16,570	1,753	18,322	**29,777**
7-Jan-17	22.40	28.33	4.17	24.17	51.40	45.04	0.00	0.00	0.88	1.79	69%	1.24	12,302	1,269	13,571	**22,805**
8-Jan-17	23.45	20.33	4.08	16.25	36.25	42.18	0.00	0.00	2.81	1.63	69%	1.13	10,120	951	11,071	**18,963**
9-Jan-17	23.08	19.67	3.93	15.73	24.38	39.88	0.00	0.00	0.58	1.77	69%	1.22	7,141	727	7,868	**15,698**
10-Jan-17	20.43	19.00	4.06	14.94	23.60	42.64	0.00	0.00	2.22	1.84	69%	1.27	6,605	699	7,303	**13,114**
11-Jan-17	22.22	19.83	3.43	16.41	22.41	32.51	0.00	0.00	2.24	1.88	69%	1.30	6,459	700	7,160	**11,635**
12-Jan-17	22.03	19.67	3.15	16.52	24.61	39.24	0.00	0.00	1.17	1.82	69%	1.25	6,940	725	7,665	**10,423**
13-Jan-17	22.79	21.17	4.08	17.08	24.78	38.98	0.00	0.00	1.17	1.86	69%	1.28	7,204	771	7,975	**8,945**
14-Jan-17	22.61	32.00	3.82	28.18	25.63	42.08	0.00	0.00	2.03	1.97	69%	1.36	7,644	869	8,513	**8,222**
15-Jan-17	17.52	40.83	3.02	37.82	42.28	47.00	0.00	0.00	1.54	2.23	69%	1.54	8,508	1,090	9,598	**8,012**
16-Jan-17	21.41	35.83	4.00	31.83	56.73	44.92	0.00	0.00	1.31	1.93	69%	1.33	12,798	1,421	14,218	**8,919**
17-Jan-17	22.91	50.33	4.27	46.07	47.75	47.75	0.00	0.00	1.79	2.16	69%	1.49	12,250	1,521	13,771	**9,843**
18-Jan-17	16.59	78.80	4.74	74.06	69.10	35.78	0.00	0.00	1.43	2.77	69%	1.91	11,375	1,815	13,190	**10,704**
19-Jan-17	17.29	77.17	3.90	73.27	111.09	60.78	0.00	0.00	1.66	2.25	69%	1.55	18,877	2,442	21,319	**12,655**
20-Jan-17	16.79	57.50	3.45	54.05	109.90	53.60	0.00	0.00	0.84	2.29	69%	1.58	17,786	2,348	20,133	**14,392**
21-Jan-17	20.55	49.00	4.23	44.77	81.08	52.80	0.00	0.00	0.90	2.16	69%	1.49	16,784	2,084	18,868	**15,871**
22-Jan-17	18.11	41.00	3.20	37.80	67.15	42.73	0.00	0.00	1.85	1.91	69%	1.32	12,385	1,359	13,744	**16,463**
23-Jan-17	20.21	33.17	4.03	29.13	56.70	44.49	0.00	0.00	2.14	1.88	69%	1.30	12,188	1,321	13,509	**16,362**
24-Jan-17	22.55	38.50	4.30	34.20	43.70	39.92	0.00	0.00	1.71	1.93	69%	1.33	10,845	1,204	12,049	**16,116**
25-Jan-17	18.12	131.33	4.10	127.23	51.30	53.60	0.00	0.00	1.63	1.88	69%	1.30	10,410	1,128	11,539	**15,880**
26-Jan-17	18.97	181.00	3.40	177.60	190.85	71.66	0.00	0.00	2.74	2.13	69%	1.47	33,969	4,172	38,141	**18,283**
27-Jan-17	22.18	130.83	3.67	127.17	266.40	59.01	0.00	0.00	0.50	2.11	69%	1.46	52,626	6,395	59,021	**23,839**
28-Jan-17	20.47	82.17	3.93	78.23	190.75	67.26	0.00	0.00	0.34	1.93	69%	1.33	35,988	3,995	39,983	**26,855**
29-Jan-17	21.17	54.33	4.45	49.88	117.35	49.72	0.00	0.00	3.61	2.00	69%	1.38	24,005	2,759	26,764	**28,715**
30-Jan-17	23.21	39.83	4.88	34.95	74.83	46.44	0.00	0.00	1.48	1.77	69%	1.22	17,469	1,779	19,248	**29,535**
31-Jan-17	16.31	29.60	4.46	25.14	52.43	30.53	0.00	0.00	1.62	1.86	69%	1.28	8,661	927	9,589	**29,183**
1-Feb-17	15.25	26.17	3.43	22.73	37.71	42.80	0.00	0.00	1.26	1.70	69%	1.17	6,598	646	7,243	**28,570**
2-Feb-17	14.96	23.00	3.47	19.53	34.10	38.38	0.00	0.00	1.93	1.40	69%	0.97	5,929	479	6,408	**24,037**
3-Feb-17	20.74	21.83	4.42	17.42	29.30	35.50	0.00	0.00	1.15	1.68	69%	1.16	7,149	690	7,840	**16,725**
4-Feb-17	24.75	19.17	4.65	14.52	26.13	40.36	0.00	0.00	1.11	1.61	69%	1.11	8,132	753	8,885	**12,282**
5-Feb-17	17.15	16.33	3.35	12.98	21.78	24.19	0.00	0.00	1.46	1.45	69%	1.00	4,414	368	4,782	**9,142**
6-Feb-17	21.32	15.17	4.50	10.67	19.48	19.12	0.00	0.00	1.76	1.50	69%	1.03	4,891	421	5,312	**7,151**
7-Feb-17	21.76	13.17	4.27	8.90	16.00	20.62	0.00	0.00	4.05	1.68	69%	1.16	4,872	471	5,342	**6,545**
8-Feb-17	22.19	11.50	3.90	7.60	13.35	27.30	0.00	0.00	0.86	1.45	69%	1.00	4,198	350	4,549	**6,160**
9-Feb-17	19.82	10.83	4.23	6.60	11.40	25.52	0.00	0.00	0.84	1.54	69%	1.06	3,354	298	3,651	**5,766**
10-Feb-17	20.34	11.33	4.15	7.18	9.90	31.67	0.00	0.00	1.31	1.52	69%	1.05	3,550	310	3,861	**5,197**
11-Feb-17	19.80	14.83	3.40	11.43	10.78	20.94	0.00	0.00	1.68	1.61	69%	1.11	3,187	295	3,482	**4,426**
12-Feb-17	20.93	19.17	4.12	15.05	17.15	29.73	0.00	0.00	2.74	1.88	69%	1.30	5,120	555	5,675	**4,553**
13-Feb-17	26.19	19.50	4.67	14.83	22.58	23.89	0.00	0.00	0.95	2.29	69%	1.58	6,912	912	7,824	**4,912**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
14-Feb-17	14.53	16.33	3.45	12.88	22.25	27.07	0.00	0.00	1.55	1.95	69%	1.35	3,944	443	4,387	**4,776**
15-Feb-17	15.96	11.80	4.05	7.75	19.33	27.98	0.00	0.00	1.10	1.59	69%	1.10	3,883	355	4,238	**4,731**
16-Feb-17	17.90	11.17	4.27	6.90	11.63	10.54	0.00	0.00	1.65	1.54	69%	1.06	2,571	228	2,799	**4,609**
17-Feb-17	19.44	9.83	3.77	6.07	10.35	25.71	0.00	0.00	1.53	1.75	69%	1.21	3,262	328	3,590	**4,571**
18-Feb-17	25.97	11.17	4.17	7.00	9.10	24.41	0.00	0.00	1.24	1.61	69%	1.11	3,929	364	4,293	**4,687**
19-Feb-17	16.92	13.00	3.48	9.52	10.50	24.24	0.00	0.00	1.64	1.79	69%	1.24	2,825	291	3,117	**4,321**
20-Feb-17	24.95	17.17	4.70	12.47	14.28	20.92	0.00	0.00	1.46	1.91	69%	1.32	4,739	520	5,259	**3,955**
21-Feb-17	21.62	17.00	5.38	11.62	18.70	28.24	0.00	0.00	1.31	2.02	69%	1.39	5,254	611	5,865	**4,166**
22-Feb-17	16.05	15.33	4.22	11.12	17.43	16.05	0.00	0.00	1.71	2.00	69%	1.38	3,335	383	3,718	**4,092**
23-Feb-17	20.72	14.17	4.62	9.55	16.68	21.81	0.00	0.00	1.15	1.93	69%	1.33	4,342	482	4,824	**4,381**
24-Feb-17	20.36	12.00	4.58	7.42	14.33	22.62	0.00	0.00	1.30	1.70	69%	1.17	3,903	382	4,285	**4,480**
25-Feb-17	22.34	9.50	4.75	4.75	11.13	22.73	0.00	0.00	1.51	1.75	69%	1.21	3,737	376	4,113	**4,454**
26-Feb-17	17.01	10.83	3.70	7.13	7.13	27.45	0.00	0.00	1.46	1.59	69%	1.10	2,440	223	2,663	**4,390**
27-Feb-17	21.75	12.50	4.13	8.37	10.70	26.45	0.00	0.00	1.39	1.31	69%	0.91	3,672	278	3,949	**4,203**
28-Feb-17	21.67	22.00	4.08	17.92	12.55	30.72	0.00	0.00	1.60	2.04	69%	1.41	4,332	509	4,842	**4,056**
1-Mar-17	23.24	48.83	4.45	44.38	26.88	44.00	0.00	0.00	1.83	1.04	69%	0.72	8,040	481	8,521	**4,743**
2-Mar-17	20.39	117.50	3.53	113.97	66.58	80.94	0.00	0.00	1.88	2.52	69%	1.74	15,702	2,279	17,981	**6,622**
3-Mar-17	19.82	115.83	3.83	112.00	170.95	90.41	0.00	0.00	1.73	3.21	69%	2.21	33,004	6,089	39,093	**11,595**
4-Mar-17	21.85	74.83	4.02	70.82	168.00	62.95	0.00	0.00	1.54	2.96	69%	2.04	34,406	5,851	40,257	**16,758**
5-Mar-17	21.59	55.83	4.03	51.80	106.23	59.24	0.00	0.00	1.40	2.43	69%	1.68	22,603	3,162	25,765	**20,058**
6-Mar-17	20.43	40.50	3.63	36.87	77.70	52.90	0.00	0.00	2.20	2.11	69%	1.46	16,331	1,984	18,315	**22,111**
7-Mar-17	19.75	28.17	3.13	25.03	55.30	34.02	0.00	0.00	2.71	2.07	69%	1.43	11,324	1,346	12,670	**23,229**
8-Mar-17	19.63	28.33	3.67	24.67	37.55	39.87	0.00	0.00	1.44	2.04	69%	1.41	8,402	988	9,389	**23,353**
9-Mar-17	18.67	27.17	3.65	23.52	37.00	25.83	0.00	0.00	1.46	1.93	69%	1.33	7,295	810	8,105	**21,942**
10-Mar-17	18.22	27.83	3.97	23.87	35.28	24.43	0.00	0.00	1.64	1.86	69%	1.28	6,822	731	7,553	**17,436**
11-Mar-17	15.92	23.17	3.35	19.82	35.80	31.70	0.00	0.00	1.91	1.93	69%	1.33	6,336	703	7,039	**12,691**
12-Mar-17	15.17	19.50	2.85	16.65	29.73	29.08	0.00	0.00	1.34	1.79	69%	1.24	5,095	525	5,620	**9,813**
13-Mar-17	18.93	19.33	3.32	16.02	24.98	32.35	0.00	0.00	2.43	1.56	69%	1.08	5,894	531	6,425	**8,114**
14-Mar-17	17.60	18.33	3.23	15.10	24.03	32.00	0.00	0.00	0.85	1.52	69%	1.05	5,090	445	5,535	**7,095**
15-Mar-17	15.45	15.50	2.82	12.68	22.65	28.78	0.00	0.00	2.19	1.72	69%	1.19	4,369	433	4,803	**6,440**
16-Mar-17	20.34	15.50	3.68	11.82	19.03	24.87	0.00	0.00	1.16	1.88	69%	1.30	4,798	520	5,318	**6,042**
17-Mar-17	15.60	13.50	3.15	10.35	17.73	28.12	0.00	0.00	0.71	1.63	69%	1.13	3,547	333	3,880	**5,517**
18-Mar-17	16.39	11.50	2.97	8.53	15.53	26.49	0.00	0.00	2.60	1.61	69%	1.11	3,621	335	3,956	**5,077**
19-Mar-17	16.95	10.17	2.68	7.48	12.80	27.01	0.00	0.00	1.98	1.50	69%	1.03	3,281	282	3,563	**4,783**
20-Mar-17	18.11	9.67	3.68	5.98	11.23	25.04	0.00	0.00	1.78	1.54	69%	1.06	3,161	280	3,442	**4,357**
21-Mar-17	19.75	9.00	3.33	5.67	8.98	25.07	0.00	0.00	0.87	1.68	69%	1.16	2,943	284	3,228	**4,027**
22-Mar-17	16.91	8.00	2.98	5.02	8.50	23.93	0.00	0.00	1.55	1.68	69%	1.16	2,506	242	2,748	**3,734**
23-Mar-17	19.22	8.67	2.87	5.80	7.53	28.94	0.00	0.00	1.88	1.31	69%	0.91	2,923	221	3,144	**3,423**
24-Mar-17	22.13	8.83	3.53	5.30	8.70	15.04	0.00	0.00	2.06	1.29	69%	0.89	2,910	216	3,127	**3,315**
25-Mar-17	14.82	8.33	2.35	5.98	7.95	23.76	0.00	0.00	1.47	1.70	69%	1.17	2,114	207	2,321	**3,082**
26-Mar-17	12.81	9.00	2.93	6.07	8.98	32.43	0.00	0.00	1.97	1.54	69%	1.06	2,231	198	2,429	**2,920**

Stantec

Project No.: 175667010
Project: KRS1 Residuals Management Master Plan
Title: Long Term - Solids Production

BY: SDC
DATE: 9/20/2017
CHECKED BY:

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)				
	Daily Avg.	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed		
												Settling Tank**	**Filters***	**Total**	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**lbs/day**	**7 Day Ave**
27-Mar-17	13.90	9.25	4.20	5.05	9.10	16.08	0.00	0.00	2.07	1.47	69%	1.02	1,922	163	2,085	**2,726**
28-Mar-17	16.80	32.83	3.13	29.70	7.58	35.03	0.00	0.00	0.39	2.11	69%	1.46	2,663	324	2,987	**2,692**
29-Mar-17	16.85	174.17	2.90	171.27	44.55	69.32	5.70	2.05	3.00	3.68	69%	2.54	9,897	2,099	11,996	**4,013**
30-Mar-17	20.37	61.50	3.68	57.82	256.90	65.91	0.00	0.00	1.75	2.91	69%	2.01	47,353	7,929	55,282	**11,461**
31-Mar-17	17.41	108.33	2.15	106.18	86.73	75.73	0.00	0.00	0.60	3.37	69%	2.32	16,032	3,105	19,137	**13,748**
1-Apr-17	15.26	122.33	3.25	119.08	159.28	81.62	0.00	0.00	2.68	3.87	69%	2.67	23,796	5,296	29,091	**17,572**
2-Apr-17	12.65	65.50	2.25	63.25	178.63	94.60	0.00	0.00	1.79	3.21	69%	2.21	21,995	4,058	26,053	**20,947**
3-Apr-17	14.66	37.33	1.93	35.40	94.88	68.73	0.00	0.00	1.41	2.50	69%	1.72	14,281	2,054	16,335	**22,983**
4-Apr-17	16.82	23.67	2.67	21.00	53.10	42.54	0.00	0.00	1.64	1.88	69%	1.30	9,497	1,029	10,527	**24,060**
5-Apr-17	12.98	22.17	2.82	19.35	31.50	36.18	0.00	0.00	2.40	1.84	69%	1.27	4,880	516	5,396	**23,117**
6-Apr-17	13.57	58.00	2.53	55.47	29.03	78.45	0.00	0.00	1.30	2.39	69%	1.65	6,048	830	6,878	**16,203**
7-Apr-17	13.35	60.00	2.17	57.83	83.20	56.44	0.00	0.00	0.49	2.73	69%	1.88	11,250	1,766	13,016	**15,328**
8-Apr-17	13.72	28.33	2.72	25.62	86.75	51.54	0.00	0.00	1.42	2.16	69%	1.49	11,871	1,474	13,345	**13,079**
9-Apr-17	16.40	20.83	2.58	18.25	38.43	37.98	0.00	0.00	1.76	2.43	69%	1.68	7,149	1,000	8,149	**10,521**
10-Apr-17	17.19	18.17	2.63	15.53	27.38	38.54	0.00	0.00	2.74	1.88	69%	1.30	6,016	652	6,668	**9,140**
11-Apr-17	16.86	14.17	2.72	11.45	23.30	36.52	0.00	0.00	1.28	2.02	69%	1.39	5,057	588	5,645	**8,442**
12-Apr-17	12.16	13.60	2.26	11.34	17.18	46.02	0.00	0.00	0.62	1.68	69%	1.16	3,200	309	3,509	**8,173**
13-Apr-17	17.91	14.33	2.32	12.02	17.01	35.81	0.00	0.00	2.81	2.09	69%	1.44	4,640	558	5,198	**7,933**
14-Apr-17	17.34	15.00	2.50	12.50	18.03	35.75	0.00	0.00	1.75	1.72	69%	1.19	4,449	441	4,891	**6,772**
15-Apr-17	17.72	12.67	1.95	10.72	18.75	28.23	0.00	0.00	1.26	2.00	69%	1.38	4,302	494	4,796	**5,551**
16-Apr-17	16.81	11.33	2.65	8.68	16.08	24.04	0.00	0.00	1.48	1.63	69%	1.13	3,541	333	3,874	**4,940**
17-Apr-17	20.47	11.67	3.43	8.23	13.03	13.29	0.00	0.00	1.68	1.36	69%	0.94	3,292	257	3,549	**4,495**
18-Apr-17	27.08	12.00	3.53	8.47	12.35	26.90	0.00	0.00	1.03	1.82	69%	1.25	4,968	519	5,486	**4,472**
19-Apr-17	24.41	10.67	3.33	7.33	12.70	25.79	0.00	0.00	1.64	1.97	69%	1.36	4,634	527	5,161	**4,708**
20-Apr-17	25.53	17.00	3.45	13.55	11.00	29.41	0.00	0.00	1.03	2.18	69%	1.50	4,596	577	5,172	**4,704**
21-Apr-17	23.65	25.50	3.20	22.30	20.33	44.08	0.00	0.00	2.12	2.66	69%	1.83	7,170	1,097	8,267	**5,186**
22-Apr-17	15.10	15.67	2.60	13.07	33.45	36.67	0.00	0.00	2.37	1.91	69%	1.32	5,940	652	6,592	**5,443**
23-Apr-17	15.37	12.67	2.42	10.25	19.60	34.03	0.00	0.00	0.77	1.86	69%	1.28	3,971	425	4,396	**5,518**
24-Apr-17	19.21	100.83	3.00	97.83	15.38	51.53	0.00	0.00	1.76	1.82	69%	1.25	5,208	544	5,752	**5,832**
25-Apr-17	20.43	384.17	2.32	381.85	146.75	84.26	0.00	0.00	1.61	2.02	69%	1.39	29,444	3,423	32,867	**9,744**
26-Apr-17	22.89	295.33	5.52	289.82	572.78	81.94	0.00	0.00	1.22	2.43	69%	1.68	114,180	15,972	130,152	**27,600**
27-Apr-17	21.39	192.33	4.43	187.90	434.73	48.27	0.00	0.00	1.51	2.39	69%	1.65	80,461	11,044	91,505	**39,933**
28-Apr-17	19.60	129.83	5.22	124.62	281.85	59.97	0.00	0.00	1.18	2.39	69%	1.65	49,206	6,754	55,960	**46,746**
29-Apr-17	22.15	79.67	4.75	74.92	186.93	56.24	0.00	0.00	2.02	2.02	69%	1.39	38,011	4,419	42,430	**51,866**
30-Apr-17	21.64	54.17	3.53	50.63	112.38	53.03	0.00	0.00	1.49	2.09	69%	1.44	23,432	2,817	26,249	**54,988**
1-May-17	23.98	45.33	3.78	41.55	75.95	31.47	0.00	0.00	2.02	1.97	69%	1.36	17,592	1,999	19,592	**56,965**
2-May-17	21.86	35.00	4.00	31.00	62.33	42.01	0.00	0.00	0.96	1.22	69%	0.84	13,790	970	14,760	**54,378**
3-May-17	22.36	37.33	4.50	32.83	46.50	34.37	0.00	0.00	2.14	2.00	69%	1.38	11,082	1,274	12,356	**37,550**
4-May-17	14.55	35.33	4.75	30.58	49.25	33.66	0.00	0.00	1.00	2.39	69%	1.65	7,416	1,018	8,434	**25,683**
5-May-17	21.03	33.67	3.97	29.70	45.88	30.41	0.00	0.00	1.06	2.20	69%	1.52	9,957	1,262	11,219	**19,291**
6-May-17	13.03	26.17	3.15	23.02	44.55	40.62	0.00	0.00	2.48	2.09	69%	1.44	6,474	778	7,252	**14,266**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	Daily Avg.	14,832	Peaking Factor	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids

**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
7-May-17	18.78	28.17	4.02	24.15	34.53	46.32	0.00	0.00	2.09	2.50	69%	1.72	7,991	1,149	9,140	**11,822**
8-May-17	19.64	26.33	3.50	22.83	36.23	34.00	0.00	0.00	1.84	2.41	69%	1.66	8,031	1,113	9,144	**10,329**
9-May-17	18.57	25.17	2.83	22.33	34.25	49.79	0.00	0.00	2.54	2.61	69%	1.80	8,086	1,216	9,303	**9,550**
10-May-17	20.65	21.50	2.45	19.05	33.50	48.67	0.00	0.00	1.38	2.68	69%	1.85	8,620	1,330	9,951	**9,206**
11-May-17	13.31	21.80	1.74	20.06	28.58	84.67	0.00	0.00	1.93	2.23	69%	1.54	6,132	785	6,917	**8,989**
12-May-17	19.22	23.67	2.52	21.15	30.09	53.34	0.00	0.00	2.24	2.07	69%	1.43	7,751	922	8,673	**8,626**
13-May-17	14.12	60.50	3.13	57.37	31.73	89.45	0.00	0.00	1.15	3.50	69%	2.42	7,040	1,419	8,459	**8,798**
14-May-17	23.22	67.50	2.25	65.25	86.05	94.93	0.00	0.00	1.89	4.10	69%	2.83	22,615	5,330	27,945	**11,484**
15-May-17	16.97	35.83	1.93	33.90	97.88	77.96	0.00	0.00	1.39	3.09	69%	2.13	17,375	3,092	20,467	**13,102**
16-May-17	20.56	27.33	2.43	24.90	50.85	75.51	19.68	7.08	1.94	2.96	69%	2.04	13,747	2,338	16,084	**14,071**
17-May-17	15.77	37.50	2.38	35.12	37.35	61.10	19.98	7.19	0.95	2.50	69%	1.72	8,090	1,164	9,254	**13,971**
18-May-17	21.80	29.67	2.70	26.97	52.68	32.20	17.14	6.17	1.10	2.04	69%	1.41	12,378	1,455	13,833	**14,959**
19-May-17	21.19	25.33	2.35	22.98	40.45	36.82	18.92	6.81	1.37	2.00	69%	1.38	10,211	1,174	11,385	**15,347**
20-May-17	22.23	22.33	2.12	20.22	34.48	35.12	10.01	3.60	2.13	1.88	69%	1.30	9,252	1,003	10,255	**15,603**
21-May-17	19.76	42.33	2.25	40.08	30.33	39.74	15.55	5.60	1.52	2.29	69%	1.58	7,910	1,044	8,954	**12,890**
22-May-17	23.91	187.83	3.58	184.25	60.13	80.67	20.33	7.32	1.67	3.27	69%	2.26	18,140	3,418	21,558	**13,046**
23-May-17	21.72	191.67	3.30	188.37	276.38	85.09	30.18	10.86	1.87	3.78	69%	2.61	56,403	12,256	68,659	**20,557**
24-May-17	20.73	87.50	3.45	84.05	282.55	74.30	26.35	9.48	1.55	3.32	69%	2.29	54,122	10,340	64,462	**28,444**
25-May-17	19.48	77.17	3.10	74.07	126.08	44.14	21.83	7.86	1.47	3.30	69%	2.28	23,896	4,534	28,430	**30,529**
26-May-17	17.57	81.83	2.75	79.08	111.10	57.80	13.88	5.00	0.88	3.05	69%	2.10	19,520	3,422	22,942	**32,180**
27-May-17	23.86	108.17	3.08	105.08	118.63	68.96	20.10	7.23	1.92	3.07	69%	2.12	29,116	5,142	34,258	**35,609**
28-May-17	13.72	95.00	2.53	92.47	157.63	61.70	17.78	6.40	2.21	2.52	69%	1.74	20,911	3,035	23,946	**37,751**
29-May-17	21.16	164.67	3.20	161.47	138.70	71.02	19.04	6.85	1.70	2.89	69%	1.99	29,362	4,878	34,240	**39,562**
30-May-17	23.04	81.67	2.97	78.70	242.20	47.20	14.37	5.17	1.77	2.39	69%	1.65	50,340	6,910	57,250	**37,933**
31-May-17	20.02	76.00	4.77	71.23	118.05	54.43	18.47	6.65	0.61	2.32	69%	1.60	23,304	3,107	26,411	**32,497**
1-Jun-17	21.56	80.67	4.07	76.60	106.85	66.80	12.12	4.36	1.59	1.04	69%	0.72	23,431	1,402	24,833	**31,983**
2-Jun-17	25.02	71.50	3.52	67.98	114.90	89.80	8.18	2.95	1.13	2.73	69%	1.88	30,138	4,730	34,868	**33,687**
3-Jun-17	24.52	42.00	3.35	38.65	101.98	4.05	0.00	0.00	2.41	2.34	69%	1.61	21,900	2,948	24,848	**32,342**
4-Jun-17	25.97	39.83	4.17	35.67	57.98	26.10	0.00	0.00	2.05	1.97	69%	1.36	14,844	1,687	16,531	**31,283**
5-Jun-17	28.05	31.00	3.57	27.43	53.50	34.98	0.00	0.00	1.85	2.07	69%	1.43	15,520	1,845	17,365	**28,872**
6-Jun-17	23.37	29.50	2.93	26.57	41.15	32.99	0.00	0.00	1.89	1.88	69%	1.30	10,403	1,128	11,531	**22,341**
7-Jun-17	21.52	26.83	2.45	24.38	39.85	33.41	0.00	0.00	1.55	2.13	69%	1.47	9,335	1,147	10,482	**20,065**
8-Jun-17	21.41	25.33	2.68	22.65	36.58	36.03	0.00	0.00	1.04	2.02	69%	1.39	8,726	1,015	9,741	**17,909**
9-Jun-17	25.42	32.33	3.30	29.03	33.98	34.93	0.00	0.00	1.15	1.79	69%	1.24	9,736	1,004	10,740	**14,462**
10-Jun-17	28.33	39.17	3.65	35.52	43.55	36.52	0.00	0.00	2.09	2.04	69%	1.41	13,477	1,585	15,062	**13,064**
11-Jun-17	21.11	33.17	2.55	30.62	53.28	45.44	0.00	0.00	1.47	2.59	69%	1.79	12,146	1,811	13,956	**12,697**
12-Jun-17	33.24	35.17	2.67	32.50	45.93	46.44	0.00	0.00	2.36	2.59	69%	1.79	17,408	2,595	20,003	**13,074**
13-Jun-17	26.33	19.33	2.40	16.93	48.75	41.36	0.00	0.00	1.50	2.32	69%	1.60	13,871	1,849	15,720	**13,672**
14-Jun-17	29.14	17.50	2.88	14.62	25.40	29.50	0.00	0.00	1.05	2.16	69%	1.49	8,752	1,086	9,839	**13,580**
15-Jun-17	21.84	21.33	2.18	19.15	21.93	33.64	0.00	0.00	1.85	2.20	69%	1.52	6,286	797	7,083	**13,200**
16-Jun-17	26.22	44.50	2.87	41.63	28.73	58.39	4.15	1.49	1.94	2.34	69%	1.61	10,769	1,450	12,219	**13,412**

Stantec

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids
**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	RAW MGD	RAW NTU	Settled NTU	NTU Removed	TSS Removed	DelPAC 2020, mg/l	Ferric Chloride, mg/l	Net Ferric Chloride, mg/l	Polymer (mg/L)	RW TOC	% TOC Removal	TOC Removed	lbs/day	lbs/day	lbs/day	7 Day Ave
17-Jun-17	25.35	42.33	2.38	39.95	62.45	51.77	11.62	4.18	1.63	2.93	69%	2.02	17,556	2,962	20,518	**14,191**
18-Jun-17	18.67	30.83	2.46	28.37	59.93	53.86	12.21	4.39	0.49	3.18	69%	2.20	12,495	2,289	14,784	**14,309**
19-Jun-17	21.60	34.50	2.80	31.70	42.56	41.68	10.20	3.67	1.49	2.54	69%	1.76	10,742	1,573	12,315	**13,211**
20-Jun-17	21.41	25.00	2.38	22.62	47.55	23.24	12.02	4.33	1.60	2.26	69%	1.56	10,699	1,391	12,090	**12,692**
21-Jun-17	27.47	25.17	3.05	22.12	33.93	34.92	6.35	2.28	2.68	2.41	69%	1.66	11,303	1,566	12,869	**13,125**
22-Jun-17	24.46	20.67	3.18	17.48	33.18	30.60	0.00	0.00	0.72	2.27	69%	1.57	8,945	1,169	10,114	**13,558**
23-Jun-17	21.50	17.17	3.17	14.00	26.23	48.66	0.00	0.00	1.06	2.23	69%	1.54	7,557	968	8,524	**13,031**
24-Jun-17	15.06	58.50	3.22	55.28	21.00	23.54	13.85	4.99	2.87	2.13	69%	1.47	4,406	541	4,947	**10,806**
25-Jun-17	14.15	67.67	2.40	65.27	82.93	75.12	40.58	14.61	1.57	3.32	69%	2.29	13,808	2,638	16,446	**11,044**
26-Jun-17	14.23	66.67	2.77	63.90	97.90	99.74	38.38	13.82	1.77	4.25	69%	2.94	16,498	4,039	20,537	**12,218**
27-Jun-17	20.69	49.00	3.23	45.77	95.85	48.26	37.26	13.41	1.16	3.66	69%	2.53	20,988	4,423	25,410	**14,121**
28-Jun-17	22.68	33.50	3.80	29.70	68.65	44.49	35.84	12.90	1.22	3.25	69%	2.24	17,558	3,285	20,843	**15,260**
29-Jun-17	31.34	39.33	4.25	35.08	44.55	38.35	30.89	11.12	0.99	3.09	69%	2.13	17,126	3,047	20,173	**16,697**
30-Jun-17	24.71	28.50	3.22	25.28	52.63	29.17	36.05	12.98	0.87	3.14	69%	2.16	14,884	2,687	17,571	**17,990**
1-Jul-17	28.77	28.83	3.67	25.17	37.93	42.12	35.10	12.64	2.60	2.82	69%	1.94	14,958	2,426	17,384	**19,767**
2-Jul-17	26.88	23.83	2.70	21.13	37.75	35.15	35.15	12.65	1.97	2.73	69%	1.88	13,357	2,096	15,453	**19,625**
3-Jul-17	29.57	20.50	2.65	17.85	31.70	39.63	35.95	12.94	2.14	2.89	69%	1.99	13,621	2,263	15,884	**18,960**
4-Jul-17	24.98	14.67	1.88	12.78	26.78	31.27	33.52	12.07	1.44	2.91	69%	2.01	9,740	1,631	11,371	**16,954**
5-Jul-17	20.13	13.67	2.13	11.53	19.18	34.85	47.23	17.00	1.49	2.91	69%	2.01	7,294	1,221	8,515	**15,193**
6-Jul-17	28.59	13.33	3.02	10.32	17.30	25.37	43.52	15.67	0.75	3.05	69%	2.10	8,927	1,565	10,492	**13,810**
7-Jul-17	29.21	19.83	2.57	17.27	15.48	24.30	48.63	17.51	1.53	2.77	69%	1.91	9,044	1,443	10,487	**12,798**
8-Jul-17	29.06	15.83	2.43	13.40	25.90	33.16	46.28	16.66	2.42	2.84	69%	1.96	12,203	1,995	14,198	**12,343**
9-Jul-17	24.95	13.67	2.73	10.93	20.10	30.60	47.38	17.06	1.69	2.57	69%	1.77	8,990	1,328	10,318	**11,610**
10-Jul-17	29.02	15.17	2.62	12.55	16.40	33.74	45.41	16.35	1.36	2.52	69%	1.74	9,566	1,388	10,955	**10,905**
11-Jul-17	31.47	15.67	2.53	13.13	18.83	31.41	32.19	11.59	1.49	2.43	69%	1.68	10,039	1,404	11,443	**10,916**
12-Jul-17	28.59	16.50	2.42	14.08	19.70	33.57	48.09	17.31	1.78	2.29	69%	1.58	10,415	1,375	11,790	**11,383**
13-Jul-17	30.09	12.00	2.15	9.85	21.13	25.99	27.69	9.97	0.90	2.36	69%	1.63	9,374	1,274	10,648	**11,406**
14-Jul-17	29.60	7.50	2.18	5.32	14.78	35.63	10.81	3.89	0.88	2.29	69%	1.58	7,298	963	8,262	**11,088**
15-Jul-17	32.01	6.17	2.35	3.82	7.98	36.83	0.07	0.03	2.32	2.36	69%	1.63	5,882	800	6,682	**10,014**
16-Jul-17	27.85	5.33	2.57	2.77	5.73	34.97	20.45	7.36	1.26	2.32	69%	1.60	5,347	713	6,060	**9,406**
17-Jul-17	30.74	4.00	2.27	1.73	4.15	27.35	20.31	7.31	1.69	2.34	69%	1.61	5,068	682	5,750	**8,662**
18-Jul-17	27.06	3.50	2.17	1.33	2.60	41.33	16.97	6.11	1.68	2.27	69%	1.57	4,784	625	5,409	**7,800**
19-Jul-17	30.16	3.83	2.23	1.60	2.00	32.87	16.82	6.05	1.35	2.36	69%	1.63	4,523	615	5,138	**6,850**
20-Jul-17	29.82	3.83	2.47	1.37	2.40	21.86	16.81	6.05	0.66	2.27	69%	1.57	3,632	475	4,107	**5,915**
21-Jul-17	29.09	4.50	2.50	2.00	2.05	30.73	21.02	7.57	1.79	2.32	69%	1.60	4,574	610	5,184	**5,476**
22-Jul-17	29.03	5.00	2.52	2.48	3.00	16.53	31.45	11.32	1.42	2.07	69%	1.43	4,322	514	4,836	**5,212**
23-Jul-17	28.13	4.67	2.16	2.51	3.73	24.63	27.52	9.91	2.17	2.32	69%	1.60	4,876	650	5,526	**5,136**
24-Jul-17	28.89	6.67	2.25	4.42	3.76	33.94	17.86	6.43	1.15	2.45	69%	1.69	4,854	685	5,540	**5,106**
25-Jul-17	27.94	9.17	1.90	7.27	6.63	37.92	13.13	4.73	1.86	2.23	69%	1.54	5,481	702	6,183	**5,216**
26-Jul-17	29.20	8.50	2.10	6.40	10.90	30.11	11.95	4.30	1.78	2.32	69%	1.60	6,175	823	6,998	**5,482**
27-Jul-17	28.23	9.17	2.08	7.08	9.60	40.39	13.56	4.88	1.39	2.13	69%	1.47	6,297	773	7,070	**5,905**

Project No.: 175667010 **BY:** SDC
Project: KRS1 Residuals Management Master Plan **DATE:** 9/20/2017
Title: Long Term - Solids Production **CHECKED BY:**

DAILY SOLIDS PROJECTON - ALL SCENARIOS

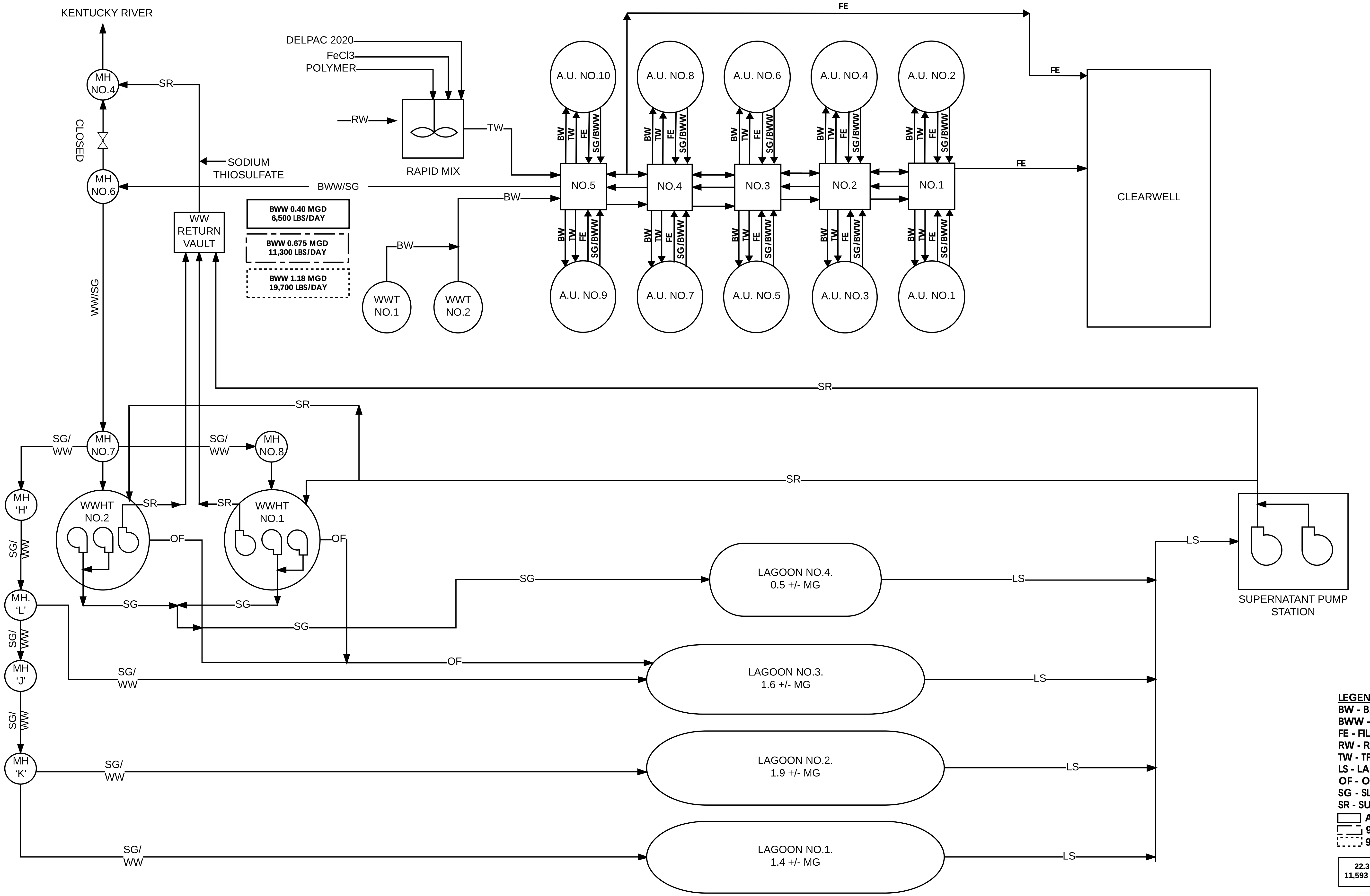
Solids (lbs)	**Daily Avg.**	14,832	**Peaking Factor**	5.43
	Max 7 Day Avg.	80,601		

*2016-2017 Daily Backwash Waste data at 0.1% solids
**Solids = Raw MGD *((Net Ferric chloride dose x 0.66 x 8.34) + (TSS removed x 8.34) + (PACl dose X 0.0489 X 5.6% Al x 8.34)+(polymer*8.34)+(TOC Removed*8.34))

													Solids Removed			
													Settling Tank**	Filters*	Total	
Date	**RAW MGD**	**RAW NTU**	**Settled NTU**	**NTU Removed**	**TSS Removed**	**DelPAC 2020, mg/l**	**Ferric Chloride, mg/l**	**Net Ferric Chloride, mg/l**	**Polymer (mg/L)**	**RW TOC**	**% TOC Removal**	**TOC Removed**	**lbs/day**	**lbs/day**	**lbs/day**	**7 Day Ave**
28-Jul-17	28.57	10.00	2.15	7.85	10.63	36.42	12.06	4.34	1.35	2.27	69%	1.57	6,288	822	7,110	**6,180**
29-Jul-17	27.86	11.00	2.32	8.68	11.78	42.63	13.58	4.89	1.06	2.20	69%	1.52	6,798	862	7,660	**6,584**
30-Jul-17	27.90	13.00	2.40	10.60	13.03	38.12	13.17	4.74	0.62	2.07	69%	1.43	6,665	792	7,457	**6,860**
31-Jul-17	29.80	16.17	2.68	13.48	15.90	36.85	11.72	4.22	0.72	1.97	69%	1.36	7,669	872	8,541	**7,288**
1-Aug-17	29.20	22.50	2.65	19.85	20.23	31.85	13.37	4.81	0.99	2.43	69%	1.68	8,473	1,185	9,658	**7,785**
2-Aug-17	27.10	20.83	2.92	17.92	29.78	34.09	12.01	4.32	1.74	2.36	69%	1.63	10,246	1,393	11,639	**8,448**
3-Aug-17	27.65	15.17	2.93	12.23	26.88	35.40	13.46	4.84	0.69	2.13	69%	1.47	9,669	1,188	10,856	**8,989**
4-Aug-17	30.40	15.67	3.30	12.37	18.35	26.90	10.40	3.74	1.65	2.34	69%	1.61	7,973	1,073	9,046	**9,265**
5-Aug-17	23.40	15.17	3.15	12.02	18.55	31.12	17.16	6.18	2.77	2.27	69%	1.57	6,927	905	7,832	**9,290**
6-Aug-17	26.22	13.50	2.65	10.85	18.03	36.51	12.00	4.32	1.10	2.36	69%	1.63	7,347	999	8,346	**9,417**
7-Aug-17	29.68	11.00	2.75	8.25	16.28	15.74	11.79	4.24	1.66	2.09	69%	1.44	6,556	788	7,344	**9,246**
8-Aug-17	29.89	9.50	2.92	6.58	12.38	24.09	12.01	4.32	1.42	2.59	69%	1.79	6,239	930	7,169	**8,890**
9-Aug-17	30.67	15.00	3.55	11.45	9.88	26.54	11.73	4.22	1.69	2.27	69%	1.57	5,929	775	6,704	**8,185**
10-Aug-17	29.16	16.33	3.63	12.70	17.18	25.82	12.18	4.38	0.87	2.77	69%	1.91	7,275	1,161	8,436	**7,840**
11-Aug-17	31.43	17.17	3.87	13.30	19.05	25.80	11.59	4.17	0.93	2.52	0.69	1.74	8,267	1,200	9,467	**7,900**
12-Aug-17	28.21	21.33	3.43	17.90	19.95	27.86	12.78	4.60	2.29	2.59	0.69	1.79	8,162	1,217	9,379	**8,121**
13-Aug-17	31.51	27.00	3.63	23.37	26.85	37.34	11.34	4.08	1.73	2.93	0.69	2.02	11,437	1,930	13,367	**8,838**
14-Aug-17	24.07	31.50	3.82	27.68	35.05	31.01	19.94	7.18	1.75	3.00	0.69	2.07	10,457	1,806	12,263	**9,541**
15-Aug-17	27.77	35.17	3.30	31.87	41.52	30.04	23.70	8.53	1.44	3.30	0.69	2.28	13,687	2,597	16,283	**10,843**
16-Aug-17	30.41	30.50	3.58	26.92	47.80	40.59	20.03	7.21	1.36	3.09	0.69	2.13	17,037	3,031	20,068	**12,752**
17-Aug-17	29.53	25.83	3.02	22.82	40.38	39.40	20.30	7.31	1.24	2.80	0.69	1.93	14,568	2,344	16,912	**13,963**
18-Aug-17	29.22	29.00	3.55	25.45	34.23	24.63	23.88	8.60	1.61	2.70	0.69	1.87	12,214	1,901	14,115	**14,627**
19-Aug-17	30.11	42.83	3.25	39.58	38.18	64.92	29.88	10.76	1.85	2.96	0.69	2.04	16,811	2,859	19,669	**16,097**
20-Aug-17	29.94	55.33	3.97	51.37	59.38	54.65	29.87	10.75	1.86	4.03	0.69	2.78	21,495	4,981	26,476	**17,970**
21-Aug-17	28.35	44.17	3.27	40.90	77.05	34.60	31.37	11.29	1.79	3.25	0.69	2.24	23,172	4,336	27,508	**20,147**
22-Aug-17	27.16	58.17	3.17	55.00	61.35	63.82	30.04	10.82	1.58	3.73	0.69	2.57	20,412	4,382	24,793	**21,363**
23-Aug-17	28.39	55.50	3.37	52.13	82.50	60.04	28.11	10.12	1.80	3.94	0.69	2.72	26,077	5,906	31,983	**23,065**
24-Aug-17	28.70	44.83	3.07	41.77	78.20	41.98	26.49	9.54	1.86	3.25	0.69	2.24	23,957	4,483	28,440	**24,712**
25-Aug-17	29.94	42.00	3.80	38.20	62.65	37.31	27.27	9.82	1.79	3.05	0.69	2.10	20,782	3,643	24,425	**26,185**
26-Aug-17	27.99	38.17	3.62	34.55	57.30	54.18	23.82	8.57	1.58	2.59	0.69	1.79	18,945	2,824	21,770	**26,485**
27-Aug-17	28.81	34.33	3.53	30.80	51.83	46.03	15.87	5.71	1.80	2.89	0.69	1.99	17,300		17,300	**25,174**

APPENDIX I
MASS BALANCE SCHEMATICS

**Reduced Size Print
Not to Scale**

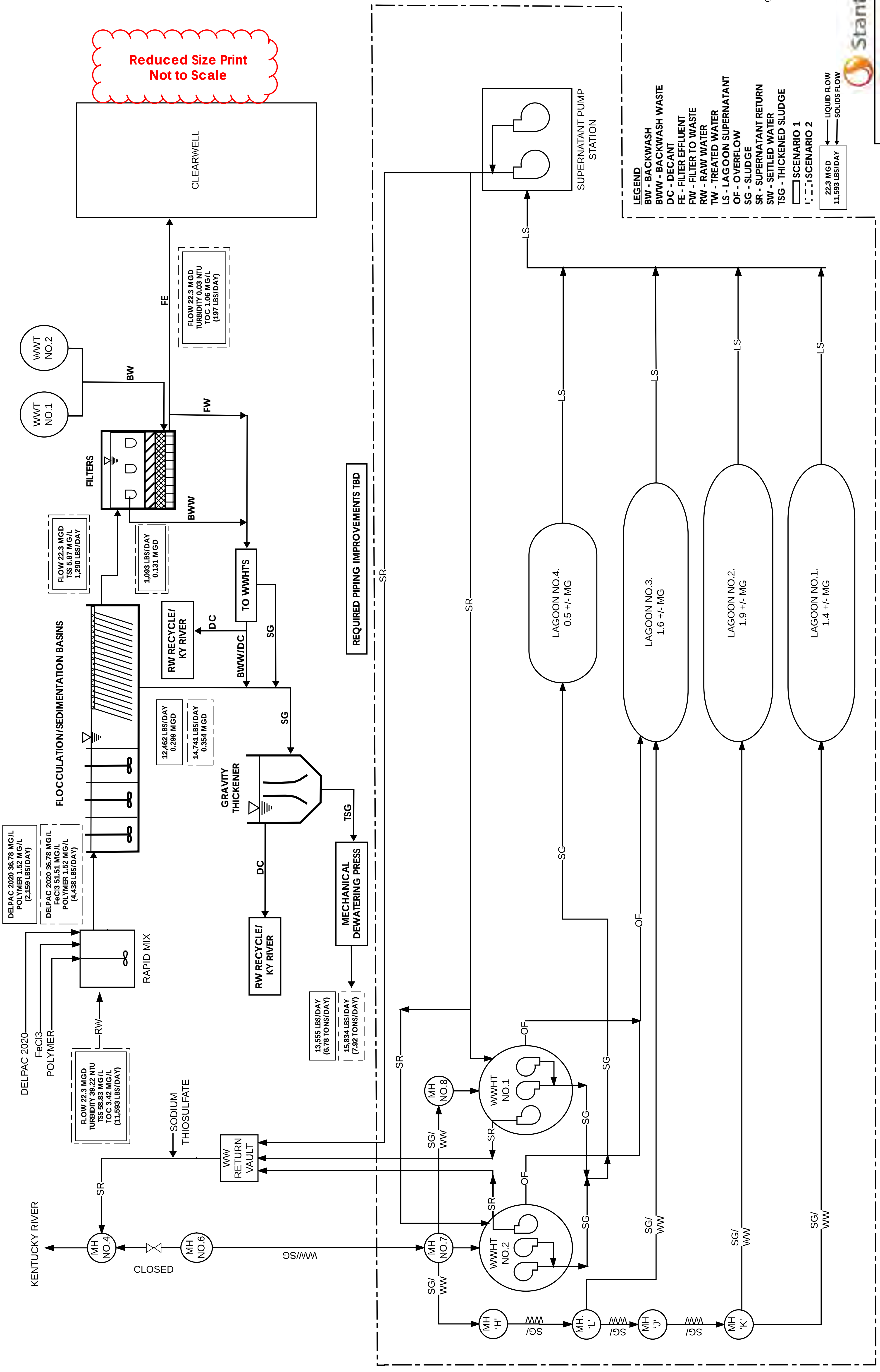


LEGEND
BW - BACKWASH
BWW - BACKWASH WASTE
FE - FILTER EFFLUENT
RW - RAW WATER
TW - TREATED WATER
LS - LAGOON SUPERNATANT
OF - OVERFLOW
SG - SLUDGE
SR - SUPERNATANT RETURN
▭ AVERAGE DAY
▭ 95% DAY
▭ 95% DAY @ 45 MGD

22.3 MGD 11,593 LBS/DAY	← LIQUID FLOW ← SOLIDS FLOW

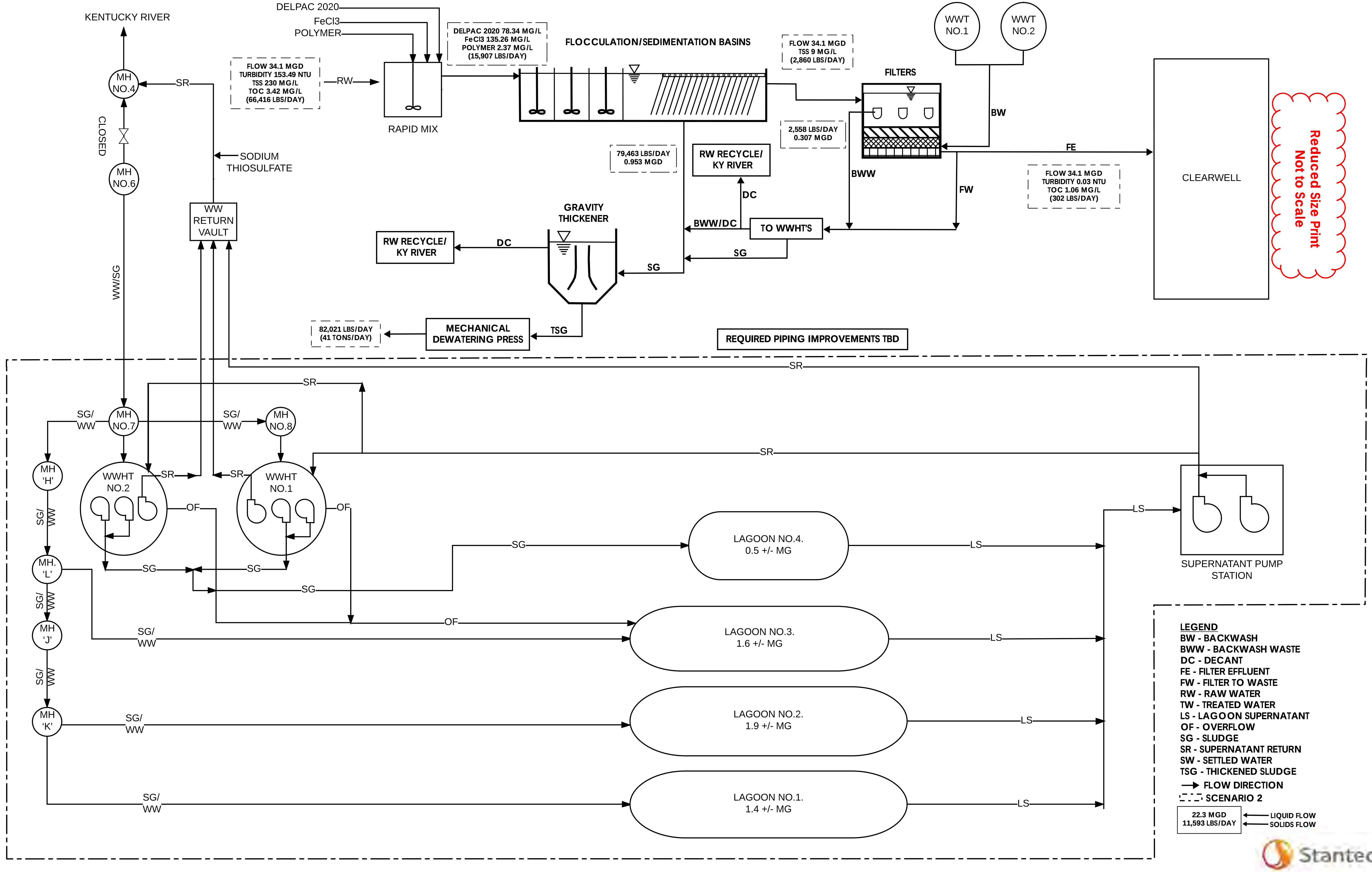
Stantec

KRS1 RESIDUALS MASTER PLAN
PROCESS SCHEMATIC - NEAR TERM
AVERAGE, 95%, & 95% @ 45 MGD DAY



Stantec

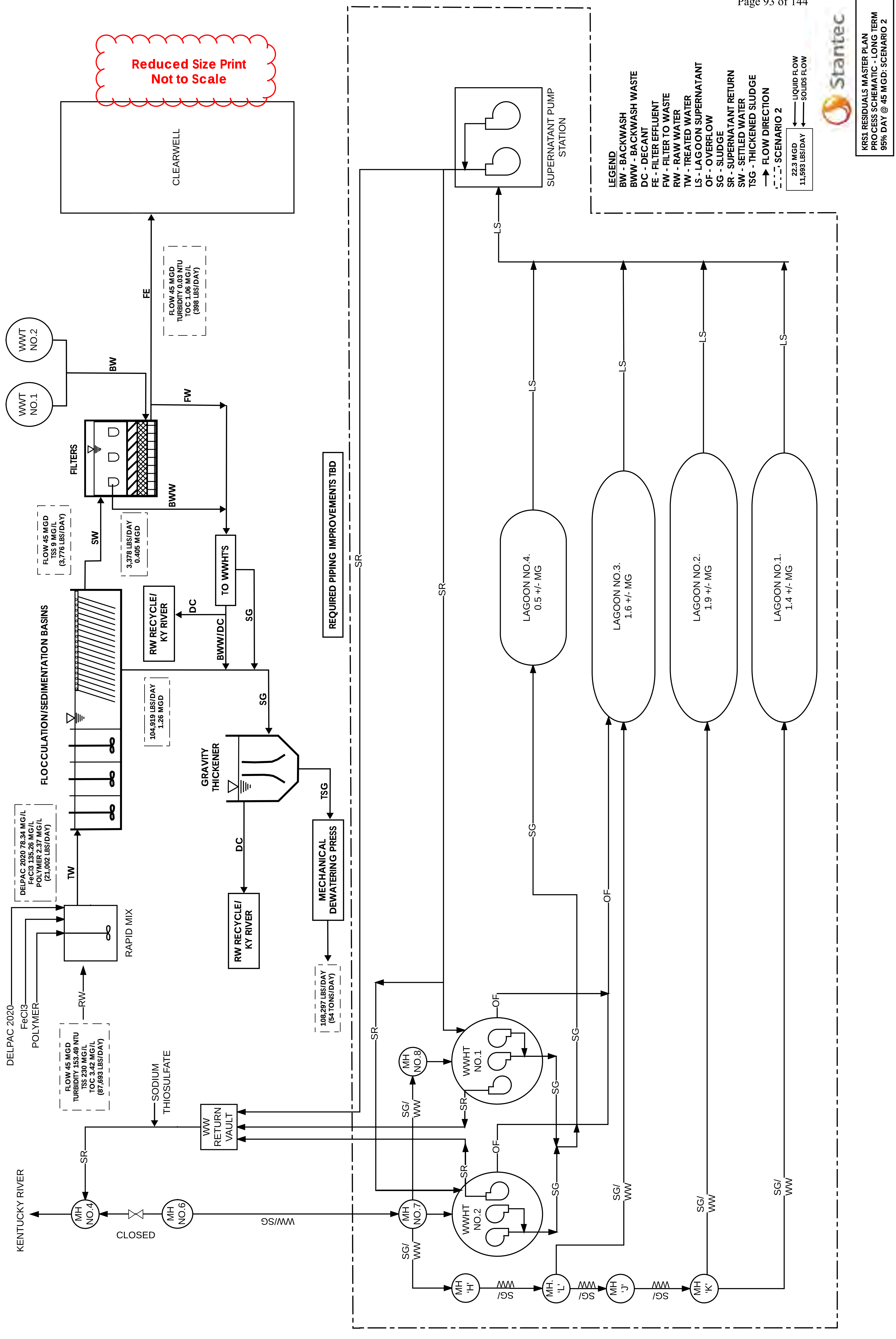
KRS1 RESIDUALS MASTER PLAN
PROCESS SCHEMATIC - LONG TERM
AVERAGE DAY: SCENARIO 1 & 2



Stantec

KRS1 RESIDUALS MASTER PLAN
PROCESS SCHEMATIC - LONG TERM
95% DAY: SCENARIO 2

Reduced Size Print
Not to Scale



KRS1 RESIDUALS MASTER PLAN
PROCESS SCHEMATIC - LONG TERM
95% DAY @ 45 MGD: SCENARIO 2

APPENDIX J
NEAR-TERM AND INTERMEDIATE IMPROVEMENTS PLAN

Stantec

Memo

To: Adam Tilley, PE
Kentucky American Water (KAW)
From: Bret Lavey
Stantec
File: mem_002_175667010.docx
Date: October 6, 2017

Reference: KRS1 Solids Handling Near-Term Improvements and Screw Press Pilot

PROJECT BACKGROUND

SCOPE

Kentucky American Water (KAW) is seeking to develop and implement a solids handling masterplan at the Kentucky River Station I Water Treatment Plant (KRS1). The planned improvements are anticipated to be performed in three phases:

1. Near-term: provide operational improvements in the fall of 2017 to extend the operational capacity of the existing four-lagoon system between dredging.
2. Mid-term: design and construct new gravity thickener(s) and potentially another wash water waste holding tank (WWHT) to accompany the two existing WWHTs at an approximate capacity of 500,000 gallons.
3. Long-term: design and construct a new dewatering facility, anticipated to house a filter press, screw press, or centrifuge.

Stantec Consulting Services Inc. (Stantec) was retained by KAW to prepare the masterplan and provide the near- and mid-term improvements' design.

MEMO PURPOSE

The purpose of this memo is to provide a project update and seek feedback/discussion from KAW on the following two items:

1. Operational concept for the near-term improvements
2. Proposed layout and logistics for a dewatering pilot

SCREW PRESS PILOT

An on-site dewatering pilot project is planned for the week of October 23, 2018 at KRS1. The pilot will be conducted by Schwing America Inc. (Schwing). Schwing will demonstrate the capabilities of their screw press system.

EXISTING CONDITIONS

The existing solids handling process at KRS1 generally consists of:

1. Ten (10) Aldrich Units comprise the sludge collection within the Plant. Each Unit is a combined settlement and filtration unit, with an interior settlement basin and exterior filter

2. Sludge blowdown is extracted from the bottom of the sedimentation basins in the Aldrich Units and conveyed to the wash water holding tanks (WWHTs)
3. Wash water waste from filter backwashes in the Aldrich Units is conveyed to the WWHTs
4. The existing WWHTs often lack capacity for the inflows from the ten Aldrich Units. After minimal settling time, inflows are directed from the WWHTs to the east end of one of three larger lagoons, typically Lagoon 2 or 3 (in some cases, wash water and sludge blowdown is conveyed directly to Lagoon 2 or 3)
5. Sludge pumps in the center of the WWHTs convey the settled sludge to one of the lagoons, typically the smallest lagoon, Lagoon 4
6. Lagoons are decanted via telescoping valves at the west end of each lagoon. Effluent flows north, by gravity, to the supernatant pump station
7. Supernatant is pumped between Lagoon 4 and the Aldrich Units and then along the top of the hill east of the Aldrich Units to a KPDES discharge on the hillside south of the existing tram
8. Lagoons are periodically dredged and the sludge is placed in the beneficial reuse area at the northeast end of the property

An annotated aerial view is presented in **Figure 1**. An existing conditions drawing and a simplified hydraulic profile are included in **Attachment A**.

Figure 1. Aerial View of Solids Handling System

Reference: KRS1 Solids Handling Near-Term Improvements and Screw Press Pilot

PROJECT UPDATE

Upon receiving the Notice to Proceed (NTP) in July, 2017, Stantec has met with KAW plant and engineering personnel and multiple equipment vendors and suppliers to determine the short- and long-term needs for KAW and the products available to meet those needs. Notable milestones for the Project include the following:

- Geotechnical exploration (i.e., soil borings and rock coring) for the design of the gravity thickeners was completed the week September 11, 2017.
- Sampling and solids production calculations are on-going. Sampling to support near-, mid-, and long-term improvements have been collected and analyzed by Stantec, WaterSolve LLC, and Microbac Laboratories. Results of the sampling efforts are provided in **Attachment B**. Calculations to support the design for the mid- and long-term improvements will be presented to KAW under a separate report in **October 2017**.
- Design of the gravity thickeners is anticipated to begin in November 2017 with a target bid date of **March 2018** (for construction in summer 2018).
- The final masterplan with conceptual design calculations and recommended dewatering strategy(ies) is anticipated to be submitted in **January 2018**.

NEAR-TERM IMPROVEMENTS

OVERVIEW

Based on review of the existing system and conversations with TenCate, Stantec and KAW are proposing to implement a Geotube system. Schematic plans for the initial portions of work are provided in **Attachment C**. A picture of a Geotube from TenCate is presented in **Figure 2**.

Figure 2. TenCate Geotube Dewatering Container

The Geotube accepts sludge/water via a pump and flexible hose and the water is then filtered via pressure from the inside of the Geotube through the geotextile, while filtrate is conveyed from the site. The proposed near-term components of the project include:

- Excavating and expanding Lagoon 4 with a generally flat bottom near elevation 880 feet
- Install an impermeable liner in the flat area overlain by 6-inches of gravel
- Construct a drainage swale along the northern edge of the expanded Lagoon 4 and install a new drainage culvert to Lagoon 3 for the filtrate
- Stockpile the excavated clay material and topsoil to the west of the flat area for future reuse as a second stage of Geotubes, access road construction for the neighboring nature preserve, or construction access/lay-down for future heavy construction work at KRS1
    - Existing sludge within the lagoon is to be hauled to the beneficial reuse area
    - As part of this process, KAW has requested Stantec provide a proposal to provide on-site resident project representation to direct the earthwork, observe material changes and where to haul/ stockpile the material
- Install a polymer feed system in a temporary shed near the southeast corner of Lagoon 4 adjacent to a new injection manhole on the existing sludge line
    - The polymer and feed equipment selection process is on-going based on KAW's request to evaluate CedarChem polymers
- Provide electrical power and communications from the existing facilities at WWHT #2 to the polymer feed system
- Install 60-foot diameter Geotubes in three phases for an approximate total length of 559 linear feet based on the estimates provided by WaterSolve LLC (**Figure 3**)
    - Once filled, the 60-foot diameter Geotubes raise to a height of approximately seven (7) feet when pressurized or full of sludge
    - Based on peak sludge production estimates, about 100 linear feet of Geotubes per month would be required to accept 100-percent of the sludge blowdown and filter wash water waste
- Install a new connection on the existing 6-inch diameter sludge force main from the WWHTs and header to split flow into three flexible hoses (to operate three Geotubes simultaneously)

Based on the planned operational concept (see description in the following sub-section), additional motor-operated or automatic valves are not proposed. Automatic valves near the east side of Lagoons 2 and 3 could yield some operational benefit for operating the Lagoons, but would require modifications (including earthwork) in the existing gravel access roads. When electing to pursue the near-term Geotube system, it was deemed not necessary to replace these manual valves based on the limited and temporary level of benefit provided.

Reference: KRS1 Solids Handling Near-Term Improvements and Screw Press Pilot

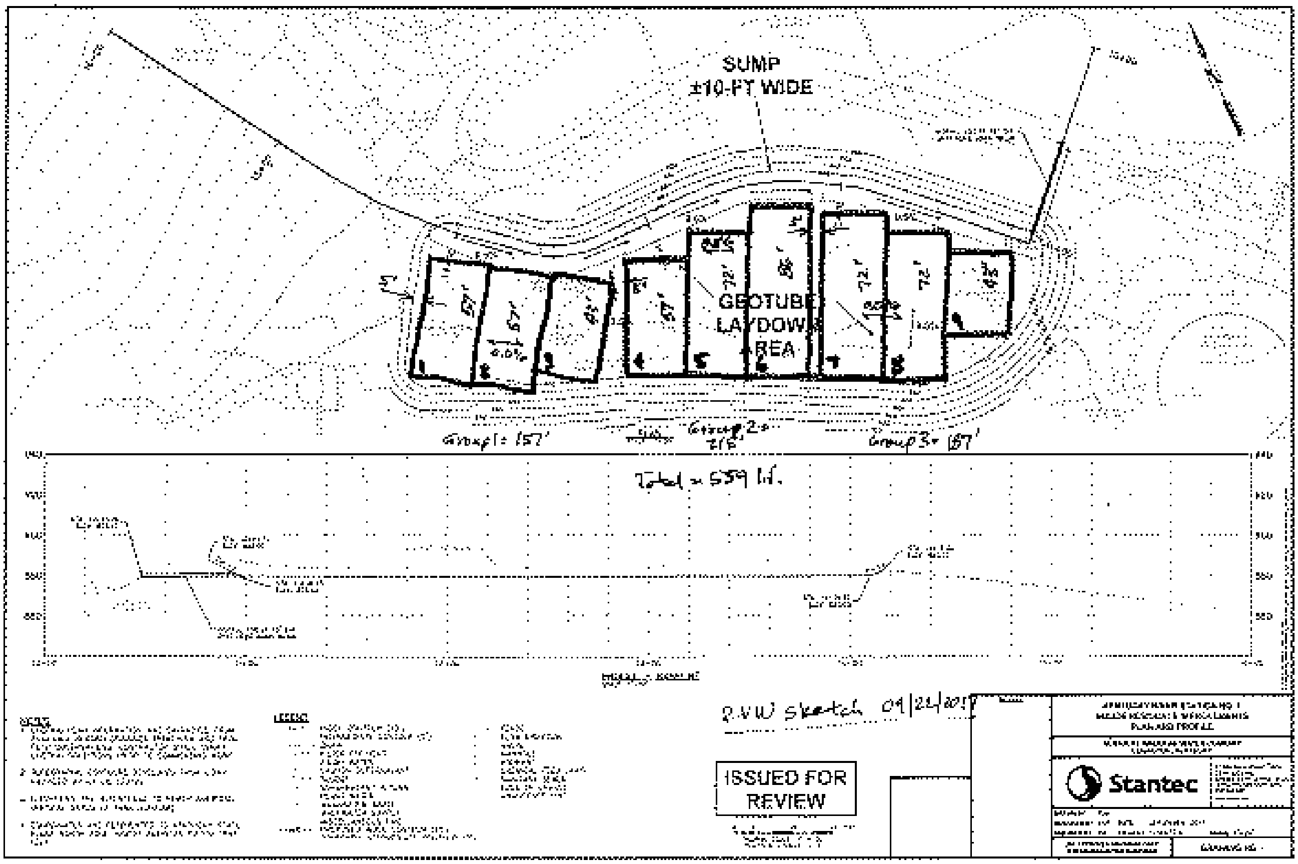


Figure 3. Hand-Sketch for Geotube Layout from Water Solve LLC

The Geotube system is anticipated to be implemented in the Fall of 2017 and maintained in service until the gravity thickener construction is complete and potentially until the long-term dewatering system is implemented; service timeline will depend upon the performance of the Geotube system and the long-term planning schedule by KAW.

GEOTECHNICAL CONSIDERATIONS

Stantec reviewed existing as-builts and was unable to locate any geotechnical information or embankment design criteria for the construction of the lagoons. A preliminary evaluation of the existing cross-section from Lagoon 4 through Lagoon 1 indicates that portions of the embankments are as steep as 1.5 horizontal to 1 vertical, which typically pose increased stability concerns. Additionally, based on repeated dredging of the lagoons, portions of the embankment side slopes may have been modified from their original design.

Geotubes are designed such that they can be stacked on top of one another for future phases. However, Stantec does not recommend stacking the tubes do to the unknown geotechnical stability of the lagoons and embankments heading down the hill to the north. Based on no reported stability concerns or observations from existing operations, Stantec recommends not to increase the soil or hydrostatic loading beyond existing conditions in the Geotube laydown area.

OPERATIONAL CONCEPT

The following describes the planned approach to operating the Geotube system:

- Wash water waste and sludge blowdown will continue to discharge to the WWHTs
- The existing sludge pumps should be operated to the maximum extent practical to fill the Geotubes with the sludge from the WWHTs
- The existing influent/effluent line near the top of the WWHTs will pass any excess wash water waste or sludge blowdown to the waste line on the east side of the lagoons
    - It is recommended this excess waste water be directed to Lagoon 2 by closing the manual valves at the influent to Lagoon 1 and 3 and opening the valve to the influent of Lagoon 2
- Filtrate from the Geotubes is directed through the filtrate ditch at the north end of the laydown area and is conveyed to Lagoon 3 via the new culvert under the access road
- When the first phase of Geotubes are full, the hoses will connect to the second phase of Geotubes , while the phase 1 Geotubes will begin the drying process. The process will be repeated for transitioning between phase 2 and 3 Geotubes.
- When the phase 3 Geotubes are nearly full, the tubes in phase one will be cut open and the material will be hauled away if deemed dry enough to do so; KAW may elect to install new Geotubes into phase 1 based on master planning timelines.
- If the material is not to KAW's desired dryness, a second stage can be constructed as a Geotube laydown area west of Lagoon 3 (just below the scrubber) at an approximate elevation of 872 feet
    - If this tier is used, the system will operate in a similar fashion except that excess waste water from the WWHTs will be directed to Lagoon 3 and the Geotubes filtrate water will be directed to Lagoon 2
- Decant flows from the Lagoons will be maintained through the existing telescoping valves

For all scenarios, Stantec recommends reserving Lagoon 1 for backup redundancy as it is currently.

SCHEDULE

Bidding for the earthwork, liner, gravel, and for the proposed polymer feed shed and the chemical injection manhole is anticipated in October 2017. Construction is estimated to be complete by the end of December 2017.

It is anticipated that upon selection of the polymer and feed equipment, KAW will contract directly with Glenwood Electric to provide the equipment and power the feed system. It is also anticipated that KAW will contract directly with Emerson to provide the controls and perform the SCADA integration. This work is anticipated to be completed by the end of December 2017.

The proposed near-term improvements are anticipated to be completed, and the Geotube system operational, by January 2018.

SCREW PRESS PILOT

As described previously, Schwing will be on-site at KRS1 during the week of October 23, 2017 to conduct a pilot with their screw press dewatering equipment. Schwing's proposal and pilot instructions are provided in **Attachment D**. Schwing will bring their smallest screw press mounted on a 53-foot long trailer and park it on-site for a week. Schwing will select and feed an appropriate polymer for the pilot and has a sludge pump capable of about 8 feet of suction lift with about 100 to 150 linear feet of 2-inch flexible suction hose. Schwing will also provide a 30-amp breaker on the trailer and approximately 150 linear feet of 3-phase, bare end cable. The general layout of the anticipated trailer location is depicted in plan view and in a photograph of the site in **Figures 4** and **5,** respectively. KAW has indicated the existing electrical cabinet between the WWHTs can be utilized to power the trailer, shown in **Figure 6**.

Figure 4. Plan View Schematic of Pilot Layout Area

Reference: KRS1 Solids Handling Near-Term Improvements and Screw Press Pilot

Figure 5. Photograph of Pilot Layout Area

Figure 6. Photograph of WWHTs and Electrical Cabinet (next to staircase)

KAW LOGISTICS

A drawing depicting the required preparations to be performed in advance of the pilot is provided in **Attachment E**. The following summarizes the items that KAW will be responsible for to conduct the pilot:

- Provide bare end cable connection to existing electrical cabinet capable of feeding a 30-amp breaker
- Modify the existing sludge force main valve into Lagoon 4 with a reducer, NPT-flange adapter, 2” camlock male coupler, and 30 feet of 2” camlock hose (See **Figure 7**)
- Front-end loader to contain solids from pilot system, typically needs dumped twice per day, or other disposal equipment

Figure 7. Photograph of 6-inch Sludge Force Main Connection

CLOSING

Stantec appreciates the opportunity to assist KAW in improving their solids handling system and providing greater operational flexibility to plant staff. We look forward to an opportunity to discuss the items presented herein and participating in implementing the near-term improvements and screw press pilot. If you have any questions in the meantime, please contact me.

STANTEC CONSULTING SERVICES INC.

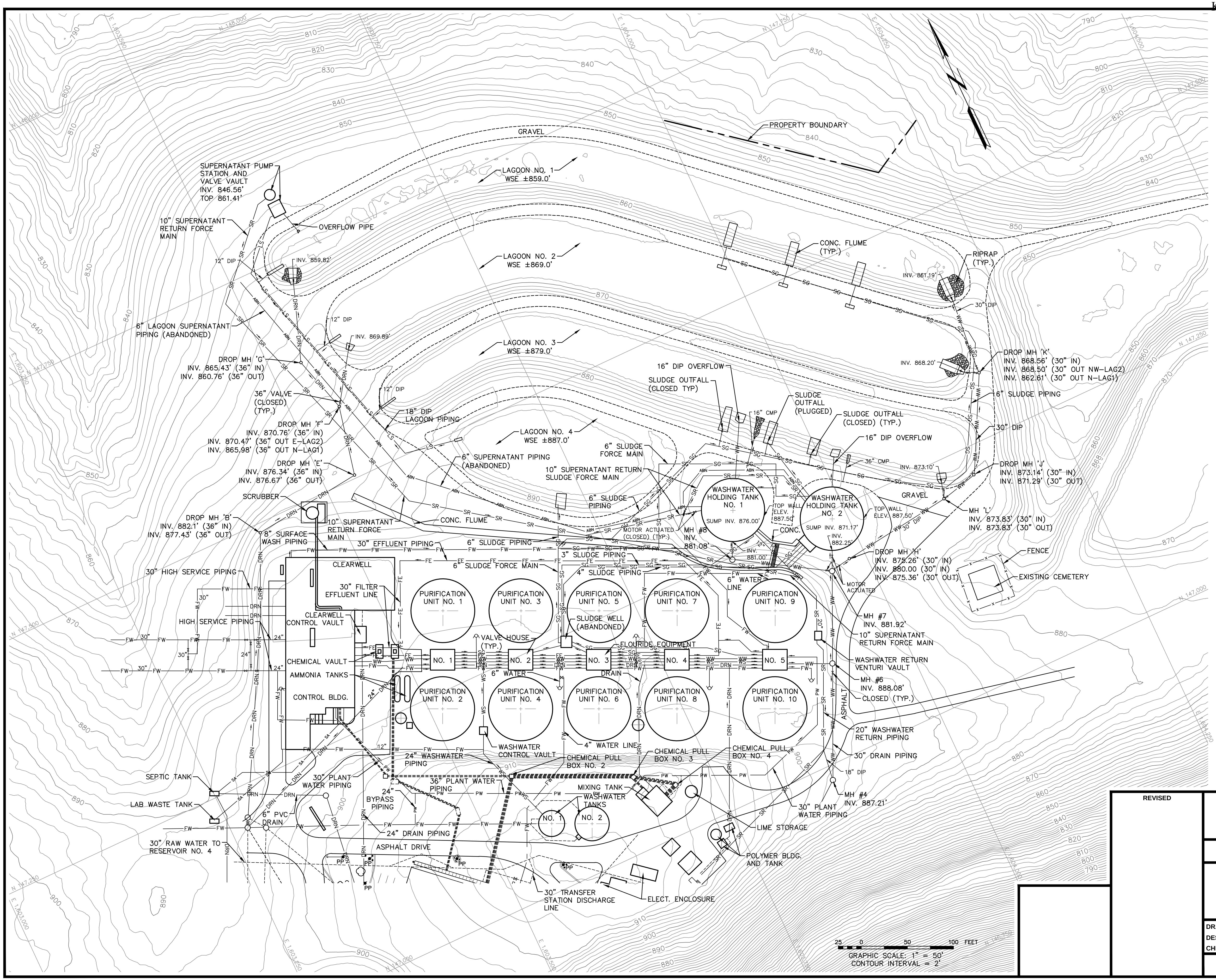
Bret Lavey, PE, ENV SP
Principal
Phone: 859.552.4909
bret.lavey@stantec.com

Attachment: A – Existing Conditions Plan and Hydraulic Profile
B – Sampling Results
C – Near-Term Improvements Plan
D – Schwing Pilot Proposal and Instructions
E – Screw Press Pilot Plans

c. Mitzi Combs, Justin Sensabaugh, Brent O’Neill, and Mike Maggard (KAW)
File, Project Team

Attachment A

Existing Conditions Plan and Hydraulic Profile



NOTES:

1. EXISTING PLAN INFORMATION WAS EXTRACTED FROM AVAILABLE RECORD DRAWINGS FROM KAW AND FROM FIELD OBSERVATIONS. CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO COMMENCING WORK.
2. TOPOGRAPHIC CONTOURS DEVELOPED FROM LIDAR PROVIDED BY KY GIS (2012).
3. ELEVATIONS ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. COORDINATES ARE REFERENCED TO KENTUCKY STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM 1983, FEET.

LEGEND

860	INDEX CONTOUR (10')
	INTERMEDIATE CONTOUR (2')
DRN	DRAIN
FE	FILTER EFFLUENT
FW	FINISH WATER
LS	LAGOON SUPERNATANT
SG	SLUDGE
SR	SUPERNATANT RETURN
PW	PLANT WATER
WW	WASHWATER WASTE
WS	WASHWATER SUPPLY
- - -	MISCELLANEOUS PIPE
X	FENCE
→	FLOW DIRECTION
⋈	VALVE
○	MANHOLE
△	HYDRANT
- - -	CHEMICAL FEED LINES
SA	SANITARY SEWER
- - -	EDGE OF GRAVEL
ABN	ABANDONED LINE

REVISED

KENTUCKY RIVER STATION NO. 1
SOLIDS RESIDUALS IMPROVEMENTS
EXISTING CONDITIONS

KENTUCKY AMERICAN WATER COMPANY
LEXINGTON, KENTUCKY

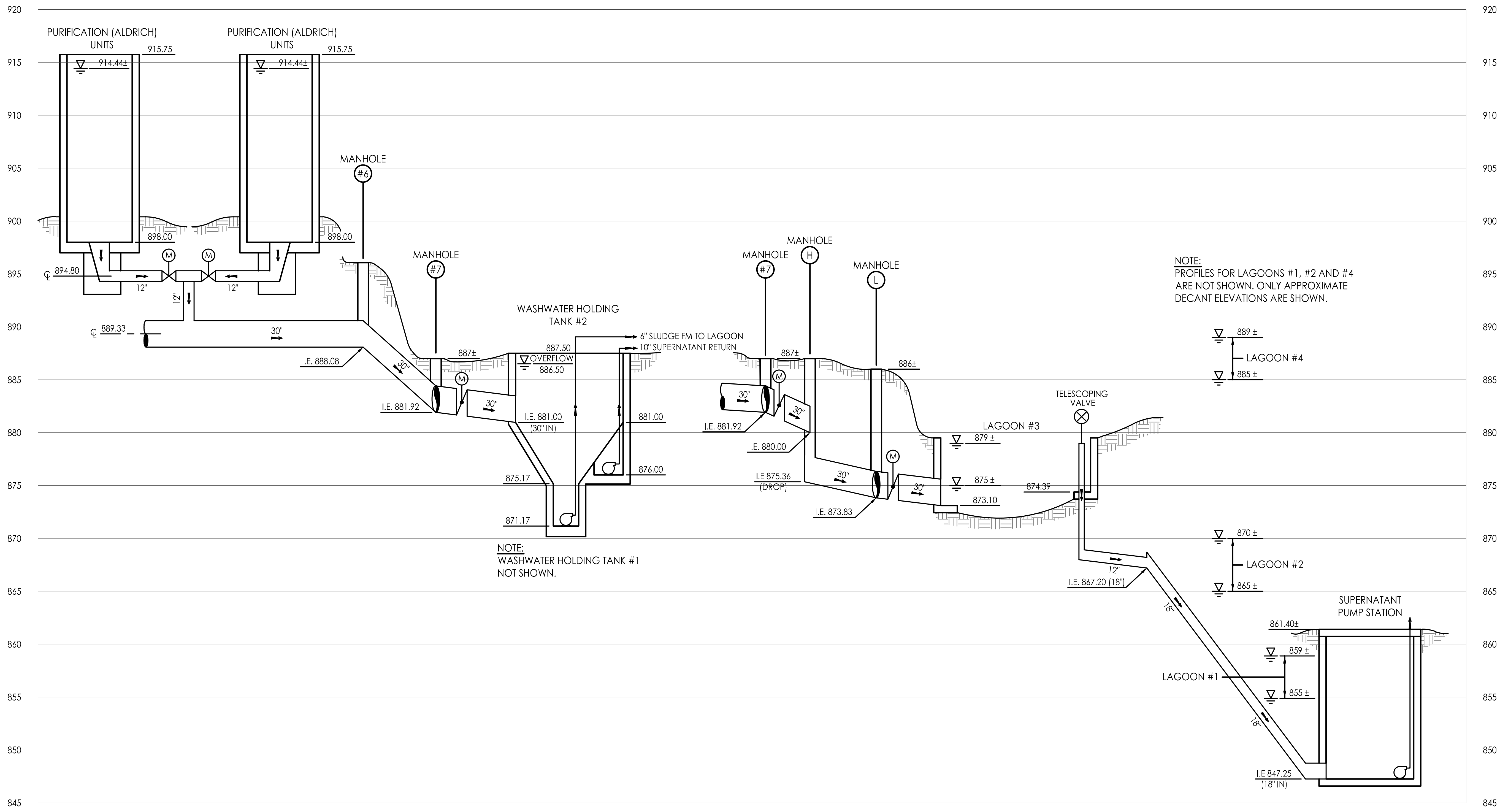
Stantec

STANTEC CONSULTING
SERVICES INC.
3052 BEAUMONT CENTRE CIRCLE
LEXINGTON, KENTUCKY 40513
(859) 422-3000
www.stantec.com

DRAWN BY: ACC
DESIGNED BY: CSP **DATE:** SEPTEMBER, 2017
CHECKED BY: BAL **PROJECT:** 175667010 **SCALE:** 1"=50'

USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES

DRAWING NO. 3



NOTE:
WASHWATER HOLDING TANK #1
NOT SHOWN.

NOTE:
PROFILES FOR LAGOONS #1, #2 AND #4
ARE NOT SHOWN. ONLY APPROXIMATE
DECANT ELEVATIONS ARE SHOWN.

HYDRAULIC PROFILE

0 2.5' 5' 10'
1"=5' VERTICAL
NOT TO SCALE ---------- HORIZONTAL

REVISED

KRS1 RESIDUALS MANAGEMENT MASTER PLAN
AND NEAR-TERM AND INTERMEDIATE IMPROVEMENTS
HYDRAULIC PROFILE

KENTUCKY AMERICAN WATER COMPANY
LEXINGTON, KENTUCKY

Stantec

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DRAWN BY: JFBH
DESIGNED BY: - **DATE:** –
CHECKED BY: - **PROJECT:** 175667010 **SCALE:** N.T.S.

USE APPROVED DRAWINGS ONLY
FOR CONSTRUCTION PURPOSES

00G05

Attachment B

Sampling Results

DEWATERING PERFORMANCE TRIAL
STANTEC CONSULTING SERVICES INC
KRS1 PROJECT

For:
Sam Lee
Stantec Consulting Services Inc.
3052 Beaumont Centre Circle
Lexington, KY 40513

By:
WaterSolve, LLC
5031 68th St., SE
Caledonia, MI 49316
www.gowatersolve.com
616-575-8693

August 31, 2017

1. Scope of Work

WaterSolve, LLC was tasked to perform a Geotube® dewatering performance trial and cone tests on samples provided by Stantec Consulting Services. The objectives of these dewatering trials were to identify chemical conditioning program(s), identify polymer flocculent(s), and dosing rate(s) for a potential Geotube® dewatering application. The objectives of subsequent cone tests were to measure total solids (TS) of the flocculated, contained, and dewatered residual after passage through the GT500D Geotube® fabric.

2. Materials & Methods

3 five gallon samples (x2 sludge samples, x1 dewatered cake sample) collected from the Kentucky River Drinking water treatment plant were received at WaterSolve's Laboratory (Caledonia, MI) on August 29, 2017. Samples of residual were homogenized and 150-mL samples were placed in graduated, glass jars.

Several polymers (emulsions) were "made-down" at a 0.5% concentration for this dewatering trial. Polymer (6.7 to 20-ppm) was added to a sample with a 1-mL plastic syringe and moderately tumbled five to seven times.

Observations of water release rate, water clarity, and flocculent appearance were recorded on appropriate data sheets (Appendix A). Polymer(s) that flocculated and dewatered these residuals most effectively were re-evaluated with lower doses in order to isolate the most efficient dewatering and flocculating polymer(s). A Hach DR 2800 was used to measure TSS (Total Suspended Solids) after the samples were poured through the Geotube® GT500D fabric with a measurable limit of up to 750-mg/L suspended solids.

Percent total solids (dry weight) of the initial residual samples and dewatered cake sample (captured on GT500D Geotube® fabric) were measured.

3. Results

Chemical conditioning with Solve 161 was determined to flocculate and dewater the residual most effectively compared to the other products (Appendix A). Water release volume and flocculent appearance were excellent when a 0.2-mL dose of Solve 161 (6.7-ppm, 5.6-lbs/dry ton) was added to a 150-mL sample.

The provided sludge sample sample was 0.24-percent dry weight solids. When a 1,000-mL test sample was conditioned with Solve 161 and passed through the Geotube® GT500D fabric, percent solids increased to 7.0-percent after sixty minutes of drying time (Appendix C). From this 1,000-mL conditioned sample, 650-mL and 990-mL of water was released in minute and sixty minutes, respectively, after passage though the fabric. The TSS of the filtrate was 6-mg/L.

4. Recommendations

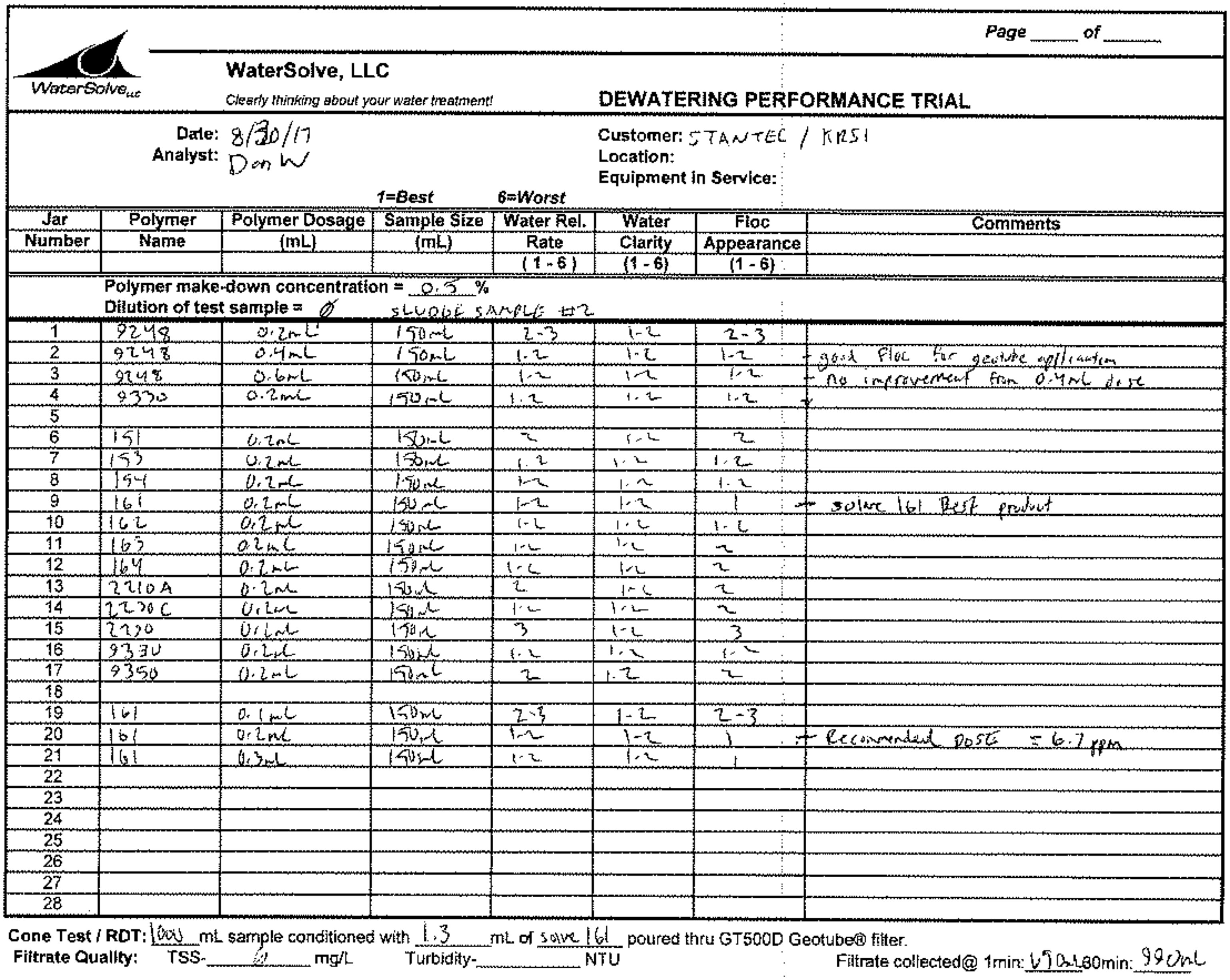
We recommend a product application of Solve 161 (5.6-lbs/dry ton dose) for dewatering the residuals in a Geotube® application in order to pass a paint filter test for subsequent disposal. Solve 161 is required to be made-down at 0.5-percent with a polymer make-down unit or aged in batch/feed tanks prior to injection into the residual line. Moderate to high mixing energy is required between the polymer introduction points and the Geotube® containers (e.g., three to five bends in the discharge line and/or inline static mixers).

Expected time to being able pass a Paint Filter Test is unpredictable in a Geotube® container from these bench-scale experiments. An onsite or laboratory hanging bag or Geotube® dewatering trial (GDT) may be used and is recommended if the timeline for achieving project goals of dry weight solids and if Geotube® filtrate characteristics are in question for this application. Additional dewatering evaluations over time are recommended if project objectives for consolidation are greater than passing a Paint Filter Test.

Due to potential variability of the material, daily on-site testing and chemical conditioning verification are recommended during pumping operations.

WaterSolve LLC does not make any implied warranty of any kind. Customer is solely responsible for determining the means and methods of the Product(s) use and whether or not Product(s) is suitable or desirable for Customer's intended uses. Customer agrees not to make any claim against Watersolve LLC based upon, or arising out of or relating to any advice or any technical information given to the Customer by Watersolve LLC for information purposes only and shall indemnify and hold Watersolve LLC harmless from any and all claims asserted by any third party arising out of or related to the Customer's use of Watersolve LLC's Product(s). Any technical information if given by Watersolve LLC to the Customer is without any consideration and use of such information by Customer be at consumer's own risk and shall not relieve the Customer from ultimate liability to ensure Product(s) are used properly per Project and Product(s) specifications.

Appendix A – Dewatering Sheets



WaterSolve, LLC
Clearly thinking about your water treatment!

Page ____ of ____

DEWATERING PERFORMANCE TRIAL

Date: 8/30/17
Analyst: Don W

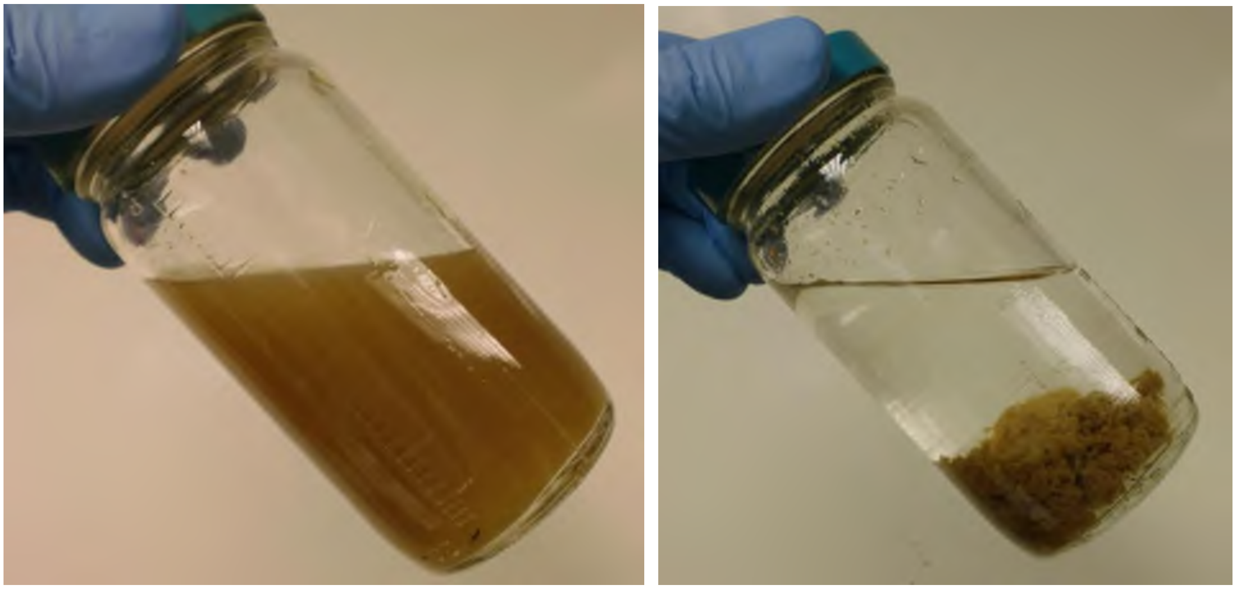
Customer: STANTEC / KRSI
Location:
Equipment in Service:

1=Best *6=Worst*

Jar Number	Polymer Name	Polymer Dosage (mL)	Sample Size (mL)	Water Rel. Rate (1 - 6)	Water Clarity (1 - 6)	Floc Appearance (1 - 6)	Comments
Polymer make-down concentration = 0.5 % Dilution of test sample = 0 SLUDGE SAMPLE #2							
1	9248	0.2mL	150mL	2-3	1-2	2-3	
2	9248	0.4mL	150mL	1-2	1-2	1-2	+ good floc for geotube application
3	9248	0.6mL	150mL	1-2	1-2	1-2	+ no improvement from 0.4mL dose
4	9330	0.2mL	150mL	1-2	1-2	1-2	
5							
6	151	0.2mL	150mL	2	1-2	2	
7	153	0.2mL	150mL	1-2	1-2	1-2	
8	154	0.2mL	150mL	1-2	1-2	1-2	
9	161	0.2mL	150mL	1-2	1-2	1	→ solve 161 Best product
10	162	0.2mL	150mL	1-2	1-2	1-2	
11	163	0.2mL	150mL	1-2	1-2	2	
12	164	0.2mL	150mL	1-2	1-2	2	
13	2210A	0.2mL	150mL	2	1-2	2	
14	2230C	0.2mL	150mL	1-2	1-2	2	
15	2230	0.2mL	150mL	3	1-2	3	
16	9330	0.2mL	150mL	1-2	1-2	1-2	
17	9350	0.2mL	150mL	2	1-2	2	
18							
19	161	0.1mL	150mL	2-3	1-2	2-3	
20	161	0.2mL	150mL	1-2	1-2	1	→ Recommended DOSE = 6.7 ppm
21	161	0.3mL	150mL	1-2	1-2	1	
22							
23							
24							
25							
26							
27							
28							

Cone Test / RDT: 1000 mL sample conditioned with 1.3 mL of solve 161 poured thru GT500D Geotube® filter.
Filtrate Quality: TSS- 0 mg/L Turbidity-_____ NTU Filtrate collected@ 1min: 450mL 60min: 990mL

Appendix B – Photographs



One hundred fifty milliliter sample prior to chemical conditioning (Left). One hundred fifty milliliter sample conditioned with Solve 161 (Right).

A one thousand milliliter sample conditioned with Solve 161 was poured through the GT500D Geotube® fabric. The captured cake (Left) and filtrate (Right) are shown above.

Appendix C – Percent Solids

Total Solids Determination - Percent Dry Weight

Customer Name/Application STANTEC/KRSI

Date 8/29/17 Technician Dan W Oven Temperature 105°C

Sample ID SLUDGE #1 Dish Number 2 Dilution 0

Dish (dry) = 47.337 g Dish, Sample (wet) = 146.089 g Dish, Sample (dry) = 47.574 g

Dish, sample (wet) – Dish (dry) = 98.752 (A) Dish, sample (dry) – Dish (dry) = 0.237 (B)

Total Solids B ÷ A x 100 = 0.24 % Dry Weight Solids

Sample ID SLUDGE #2 Dish Number 3 Dilution 0

Dish (dry) = 47.060 g Dish, Sample (wet) = 156.651 g Dish, Sample (dry) = 47.357 g

Dish, sample (wet) – Dish (dry) = 109.591 (A) Dish, sample (dry) – Dish (dry) = 0.297 (B)

Total Solids B ÷ A x 100 = 0.27 % Dry Weight Solids

Sample ID CAKE SAMPLE Dish Number 4 Dilution 0

Dish (dry) = 48.240 g Dish, Sample (wet) = 144.012 g Dish, Sample (dry) = 85.841 g

Dish, sample (wet) – Dish (dry) = 95.772 (A) Dish, sample (dry) – Dish (dry) = 37.601 (B)

Total Solids B ÷ A x 100 = 39.3 % Dry Weight Solids

Sample ID 60 MIN CONE TEST CAKE Dish Number 1 Dilution 0

Dish (dry) = 48.240 g Dish, Sample (wet) = 68.063 g Dish, Sample (dry) = 49.632 g

Dish, sample (wet) – Dish (dry) = 19.823 (A) Dish, sample (dry) – Dish (dry) = 1.392 (B)

Total Solids B ÷ A x 100 = 7.0 % Dry Weight Solids

Sample ID________ Dish Number ______ Dilution ______

Dish (dry) = ______ g Dish, Sample (wet) = ______ g Dish, Sample (dry) = ______ g

Dish, sample (wet) – Dish (dry) = ______ (A) Dish, sample (dry) – Dish (dry) = ______ (B)

Total Solids B ÷ A x 100 = ______ % Dry Weight Solids

Appendix D – CHAIN OF CUSTODY RECORD <u>SDS - Available upon request.</u>

WaterSolve LLC

5031 68th Street SE
Caledonia, MI 49316 Phone
(616)575-8693
www.gowatersolve.com

Chain of Custody Record

Pg. ____ of ____

Lab COC# ____

For Lab Use Only

Received By
Date Received
Lab Bin #
WS Job #
Project Lab Tech.

Client Name	**Stantec Consulting Services Inc.**
Address	**3052 Beaumont Centre Circle**
City, State Zip	**Lexington, KY 40513**
Phone/Email	**sam.lee@stantec.com**
Project Name	**KRS1**
Client Project No./P.O. No.	**175667010**
Contact/Report To	**Sam Lee (859) 422-3109**
Invoice To	**Sam Lee (859) 422-3109**

Analysis Requested

Please note any known hazardous material contained in the samples or any other helpful information about the samples below.

Schedule	Matrix Code	Sample Number	Field Sample ID	Container ID/Type	Sample Date	Sample Time	Comp	Grab	Matrix	Geotube® Dewatering	Settling Application	Other* (comments)	Total Suspended Solids Limit mg/L	Turbidity Limit NTU	pH Limit range	Other** (comments) Limit Units	Other***(comments) Limit Units	Sample Comments
			1 KRS1 SLUDGE 1	5gal	8/25	10:20	X		H₂O	1								
			2 KRS1 SLUDGE 2	5gal	8/25	10:20	X		H₂O	1								Duplicate
			3 KRS1 ~~SLUDGE~~ Cake	Bag	8/25	11:00		X	SOIL	1		+						
			4															
			5															

Sampled By (print) SAM LEE

Sampler's Signature

Is this sample designated as hazardous waste per RCRA? [✓ No] ( ) Yes (comments) ____

Company STANTEC

Relinquished by Date 8/25/17 Time 12:00 Received by ____ Date ____ Time ____

How Shipped? Hand ____ Carrier ____ Tracking No. ____

Sample Comments
All times EST.
- In-situ sludge sample ~~(aqeos)~~ (aqueous) and duplicate
- Dewatered cake sample (soil)

Project Information Briefly describe the project objectives:
KY RIVER drinking water treatment plant. Sludge dewatering.

Type of Material/Residual X Municipal Wastewater ___ Municipal Water Treatment ___ Lake/Pond/River Sediment (circle one) ___ Industrial/Process ___ Mine Drainage ___ Other ____

Application X Geotube® Dewatering ___ Settling ___ Clarification ___ Mechanical Dewatering ___ Thickening ___ Other ____

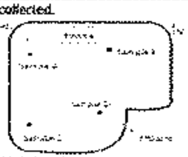
How was the sample obtained? ✓ Individual Core(s) (Best sample collection technique with only solids from core, discard overlying water, overlying water should be sent seperately) ✓ Composite (PLEASE NOTE, while a composite sample may give us an indication of an average treatment scenario, it does not indicate pockets of concern for treatment effectiveness or areas that may require a higher or lower dose of chemistry, or contain higher in-situ solids since the area of concern may be masked by factors of dilution from other areas) ___ Other ____

Are there specific requirement or permit limitations? (i.e. filtrate turbidity, TSS, or other parameters)
Visual Red Limit for $FeCl_3$

Where will the filtrate/treatment effluent be discharged?
KRS1

Solids concentration of sample (% dry weight solids) if known ____ % in-situ ____ %

Please draw a diagram of the body of water and identify where the samples were collected.



Project Comments

Stantec

Memo

To: Project Files
File: 175557133
From: Sam Lee, PE
Lexington, KY
Date: September 7, 2017

Reference: **KAW KRS1 – Field Sampling August 25, 2017**

Stantec Consulting Services Inc. (Stantec) was present at the KY American Water (KAW) KY River Station No. 1 (KRS) Municipal Drinking Water Treatment Plant (WTP) to perform the following scope:

1. Collect water samples from the Wash Water Holding Tanks from the following flow sources:
    a. Aldrich Unit Backwash.
    b. Aldrich Unit Sludge.
2. Deliver samples to Microbac Laboratories in Lexington, KY for analytical testing. The following analyses were performed:
    a. Percent Solids.
    b. Total Solids.
3. Collect a dewatered sludge sample from the KAW KRS1 drying beds. Samples were delivered to the Stantec geotechnical testing laboratory in Lexington, KY for grain size analyses.

A photo log is provided in the following. The following Attachments are appended to this memorandum:

A. Site Overview and Solids Residuals Flow Schematic

B. Microbac Testing Results

C. Stantec Testing Results

STANTEC CONSULTING SERVICES INC.

Sam Lee, PE
Project Engineer
Phone: (859) 422-3109
Fax: (859) 422-3100
Sam.Lee@stantec.com

Reference: KAW KRS1 – Field Sampling August 25, 2017

Photo 1: Washwater Holding Tank No. 1

Photo 2: Discharge to Washwater Holding Tank No. 1

Reference: KAW KRS1 – Field Sampling August 25, 2017

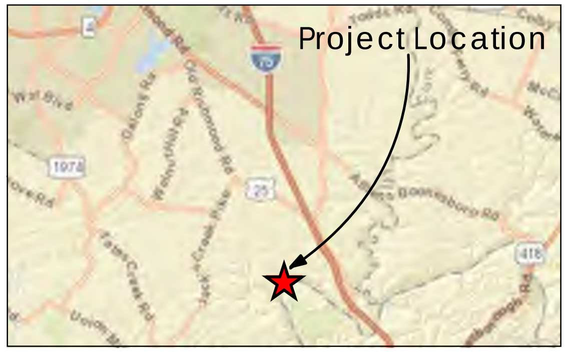
Photo 3: Washwater Discharge to Lagoon No. 2

Photo 4: Sludge Samples. Samples were collected approximately 2-minutes apart (from left to right)

Reference: KAW KRS1 – Field Sampling August 25, 2017

Photo 5: Sludge Samples after approximately 20-minutes of settling.

ATTACHMENT A
SITE OVERVIEW AND SOLIDS RESIDUALS FLOW SCHEMATIC



Notes
1. Coordinate System: NAD 1983 Kentucky North
2. 2016 Aerial Imagery provided by LFUCG

0 200 400 Feet

1:2,400 (At original document size of 11x17)

Project Location
Lexington, Fayette County, KY

123456789
Prepared by SCL on 2017-09-07
Technical Review by BAL on 2017-09-07

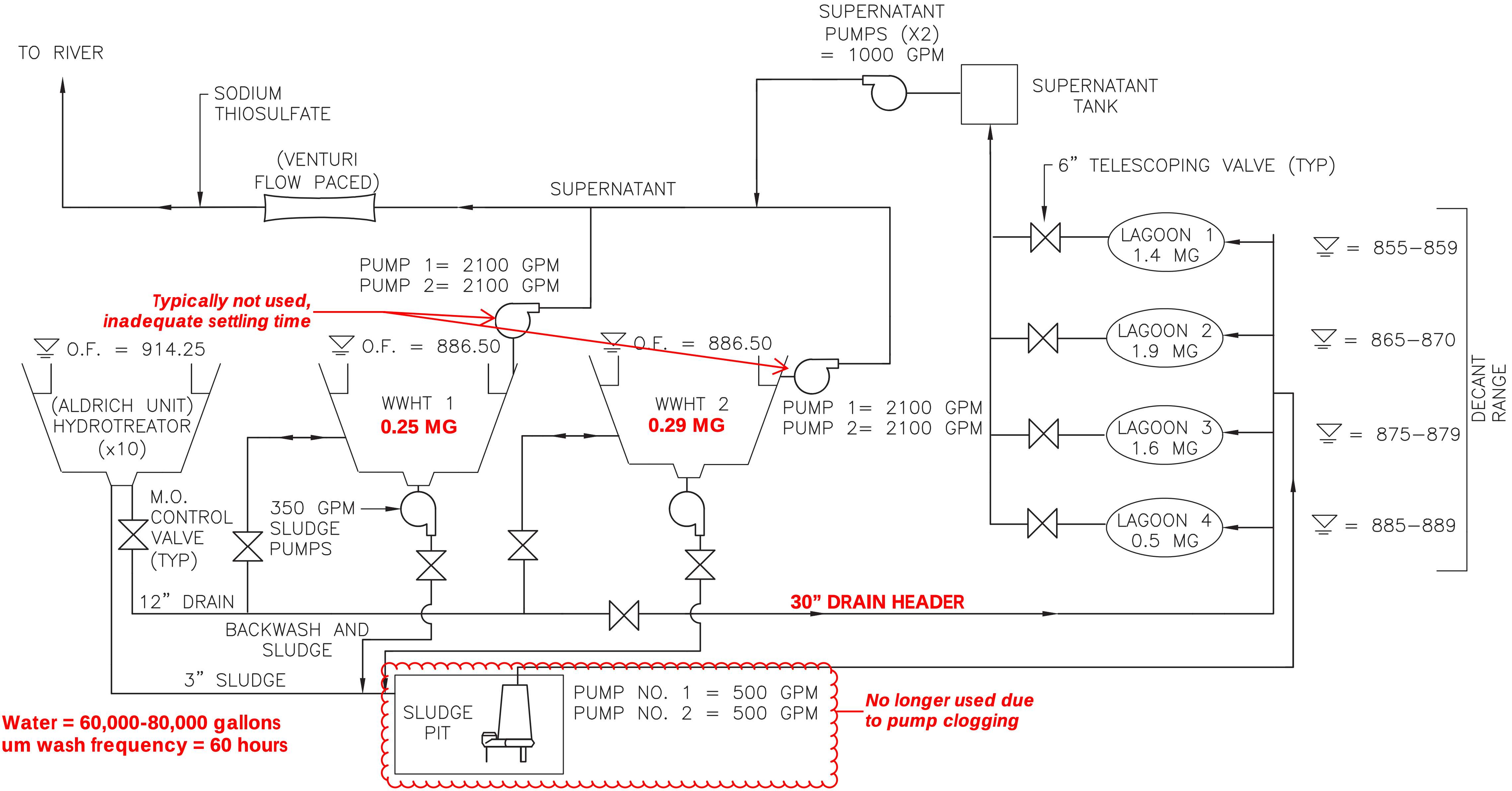
Client/Project
Kentucky American Water
KY River Station No. 1
Solids Residuals Improvements

Figure No.
1

Title
Project Overview

Page 01 of 01

V:\1756\active\175667010\gis\mxds\project_overview.mxd Revised: 2017-09-07 By: samlee



Typically not used, inadequate settling time

Wash Water = 60,000-80,000 gallons
Minimum wash frequency = 60 hours

No longer used due to pump clogging

ATTACHMENT B
MICROBAC TESTING RESULTS

MICROBAC

PRELIMINARY CERTIFICATE OF ANALYSIS

7081757

Stantec Consulting Services - Lexington
Sam Lee
1409 North Forbes Road
Lexington, KY 40511

Date Reported	08/29/2017
Date Due	09/01/2017
Date Received	08/25/2017
Customer #	E4100
Work Purchase Order:	

KRS1

Analysis	OOC	Qualifier	Result	Units	Min	Max	Method	Rpt Limit	Analysis Date	Tech
Sample: 01 **KRS1 Wash 1**									**Sampled** 08/24/2017 @ 15:20	
Sampled By Customer										
Moisture, Percent			99.9	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			880	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 02 **KRS1 Wash 2**									**Sampled** 08/24/2017 @ 15:30	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1900	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 03 **KRS1 Wash 3**									**Sampled** 08/24/2017 @ 15:40	
Sampled By Customer										
Moisture, Percent			99.9	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1000	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 04 **KRS1 Wash 4**									**Sampled** 08/24/2017 @ 15:50	
Sampled By Customer										
Moisture, Percent			99.9	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1200	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 05 **KRS1 002A**									**Sampled** 08/24/2017 @ 16:00	
Sampled By Customer										
Moisture, Percent			100	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			410	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 06 **KRS1 002B**									**Sampled** 08/24/2017 @ 16:05	
Sampled By Customer										
Moisture, Percent			100	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			370	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 07 **KRS1 Sludge 1**									**Sampled** 08/25/2017 @ 10:20	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1800	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL

MICROBAC

PRELIMINARY CERTIFICATE OF ANALYSIS

7081757

Stantec Consulting Services - Lexington
Sam Lee

Date Due 09/01/2017
Date Received 08/25/2017

KRS1

Analysis	OOC	Qualifier	Result	Units	Min	Max	Method	Rpt Limit	Analysis Date	Tech
Sample: 08 **KRS1 Sludge 2**								**Comp Start** 05/25/2017 @ 10:25	**Comp End** 08/25/2017 @ 10:25	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1700	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL
Sample: 09 **KRS1 Sludge 3**								**Comp Start** 05/25/2017 @ 10:30	**Comp End** 08/25/2017 @ 10:30	
Sampled By Customer										
Moisture, Percent			99.8	%			Calculated		08/28/2017 11:02	CJL
Solids, Total			1600	mg/L			USGS I-3750-85	10	08/28/2017 11:02	CJL

Calculations

Analyte results that are indicated to have a “Calculated” method are derived from the calculation of the unrounded, raw analyte concentrations. The final, raw value is then rounded to the correct number of significant figures. Any apparent mathematical discrepancies are the result of the addition of unrounded results.

Qualifier Definitions

THIS REPORT HAS BEEN REVIEWED AND APPROVED FOR RELEASE:

Draft Report A.M.

David Lester, Managing Director

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

For any feedback concerning our services, please contact David Lester, Managing Director at 502.962.6400 or Rob Crookston, President at president@microbac.com.

PERCENT TOTAL, VOLATILE, FIXED SOLIDS

BATCH INFORMATION

Analyst	CJL	**Batch#**	135683&135685		**SM 2540G & USGS I-3753-85**	
Oven IDs	O-10	**In** (104° Oven)	8/28/2017	11:02	NA (550° Muf.)	NA	NA
			Date	Time	Date	Time	Temperature
Balance ID	B-10	**Out**	8/29/2017	8:27	NA	NA	NA

ANALYTICAL DATA

			A	B	C		D		E	F	G
	Sample ID	%Moisture	Tare Wt (g)	Sample Wt. (g)	Tare+Dry Wt (g)	Tare+Dry Wt (g)	Tare+Ash Wt (g)	Tare+Ash Wt (g)	Total %	Volatiles DWB	Ash DWB (%)
1	Blank		**85.6687**		85.6688	85.6692			0.01%		
2	7081757-01 a	99.91	**87.3548**	49.99	87.3989	87.4001			0.09%		
3	7081757-01 a DUP	99.91	**86.93**	49.7271	86.9736	86.974			0.09%		
4	7081757-02 a	99.81	**75.5896**	50.3503	75.6862	75.685			0.19%		
5	7081757-03 a	99.9	**86.3488**	50.2314	86.3993	86.3994			0.10%		
6	7081757-04 a	99.88	**76.0193**	49.8841	76.0794	76.0799			0.12%		
7	7081757-05 a	99.96	**85.4548**	50.5378	85.4752	85.4739			0.04%		
8	7081757-06 a	99.96	**85.1041**	49.4205	85.1228	85.1239			0.04%		
9	7081757-07 a	99.82	**77.9304**	50.106	78.0192	78.0174			0.18%		
10	7081757-08 a	99.83	**75.3167**	49.7934	75.3995	75.4006			0.17%		
11	7081757-09 a	99.84	**86.6998**	50.0665	86.7816	86.7822			0.16%		
12	7081799-01 b	57.55	**86.9349**	26.0157	97.9774	97.9765			42.45%		
13	7081799-01 b	57.83	**88.5575**	29.0323	100.8016	100.802			42.17%		
14	7081802-01 b	78.71	**78.7299**	28.3491	84.7662	84.7637			21.29%		
15											
16											
17											
18											
19											
20											
21											
22											

	Total	Volatiles	Fixed
RPD%	0.61%		

Comments:

Calculations verified 9/2/16 by AMD

Calculations

$$\text{Total \%(E)} = \frac{(C-A)*100}{B}$$

$$\text{Volatiles \% (F)} = 100\%-G$$

$$\text{Fixed (\%) G} = \frac{(D-A)*100}{C-A}$$

MICROBAC LABORATORIES, INC., KTL DIVISION

Solids, Total 170828A

TOTAL, VOLATILE, AND FIXED SOLIDS

Gravimetric - Water & Wastewater USGS I-3750-85 and I-3753-85

BATCH INFORMATION

Analyst	CJL	Batch#	135683	Date	8/28/2017	Time 11:02

		104°Oven	DATE	TIME	TEMPERATURE	550°Muf.	DATE	TIME	TEMPERATURE
IDs	O-10	IN	8/28/2017	11:02	103 °C		NA	NA	NA °C
IDs	B-10	OUT	8/29/2017	8:27	105 °C		NA	NA	NA °C

ANALYTICAL DATA

		A	B	C	D	E	F	G	H
	SAMPLE ID	Pan ID	Sample Vol. (ml)	Tare Wt. (g)	Tare + Dry Wt. (g)	Tare + Ash Wt. (g)	**Total (mg/L)**	**Volatile (mg/L)**	**Fixed (mg/L)**
1	MB	R-1	50	85.6687	85.6688		**2**		
2	LCS	R-2	50	70.5288	70.5539		**502**		
3	7081757-01 a	R-3	50	87.3548	87.3989		**882**		
4	7081757-01 a	R-4	50	86.93	86.9736		**872**		
5	7081757-02 a	R-5	50	75.5896	75.6862		**1932**		
6	7081757-03 a	R-6	50	86.3488	86.3993		**1010**		
7	7081757-04 a	R-7	50	76.0193	76.0794		**1202**		
8	7081757-05 a	R-8	50	85.4548	85.4752		**408**		
9	7081757-06 a	R-9	50	85.1041	85.1228		**374**		
10	7081757-07 a	R-10	50	77.9304	78.0192		**1776**		
11	7081757-08 a	R-11	50	75.3167	75.3995		**1656**		
12	7081757-09 a	R-12	50	86.6998	86.7816		**1636**		
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									

COMMENTS

Verified against manual calculation 2/1/2013 DDL

LCS = 100.4% Total

LCS = Volatile

LCS = Fixed

CALCULATIONS

$$F = \frac{(D-C)*1000000}{B}$$

$$G = \frac{(D-E)*1000000}{B}$$

$$H = \frac{(E-C)*1000000}{B}$$

REAGENTS & STANDARDS

Description	ID#
500MG/L (250mg/L Nacl and 250mg/L starch)	54764
LCS Volatile: 250mg/L	NA

	RPD	Result 1	Result 2
Sample dup 1	1.1%	882	872
Sample dup 2			

MICROBAC®
www.microbac.com

3323 Gilmore Industrial Blvd.
Louisville, KY 40213
502.962.6400 p
502.962.6411 f

2520 Regency Rd.
Lexington, KY 40503
859.276.3506 p
859.278.5665 f

2701 N. Cullen Ave., Ste. A
Evansville, IN 47715
812.464.9000 p
812.424.0667 f

5309 Reidland Rd.
Paducah, KY 42003
270.898.3637 p
270.898.3666 f

100 Grand Vue Plaza, Ste. 22
Hazard, KY 41701
606.487.0511 p
606.910.0086 f

CHAIN OF CUSTODY

Client: STANTEC
Street Address: 3052 BEAUMONT CTR CIR
City / State / Zip: LEXINGTON KY
Phone: (859) 422-3109 Fax: ( )
Email: sam.lee@stantec.com
Attention: SAM LEE PO #:
Sampler: SAM LEE
Site / Project Name: KRS1

Due Date: 9/1/2017

Analyses Requested

Date / Time	Sample ID / Description	Number of Containers	Type of Container Plastic, clear glass, vial, etc.	Preservative in Container None, HNO_3, H_2SO_4, NaOH, etc.	Sample Matrix Soil, Sludge, Water, Oil, etc.	RUSH* (Fill-in desired TAT)	Total Solids (%)	Total Solids (mg/L)
8/24 15:20	KRS1 WASH 1	1	Plastic	N/A	H_2O		1	1
8/24 15:30	KRS1 WASH 2						1	1
8/24 15:40	KRS~~R~~1 WASH 3						1	1
8/24 15:50	KRS1 WASH 4						1	1
8/24 16:00	KRS1 ~~WASH~~ 002A						1	1
8/24 16:05	KRS1 002B						1	1
8/25 10:20	KRS1 SLUDGE 1						1	1
8/25 10:25	KRS1 SLUDGE 2						1	1
8/25 10:30	KRS1 SLUDGE 3						1	1

Relinquished By: Date: 8/25/17 Time: 11:30
Received By: Lisa Martin Date: 8/25/17 Time: 1130
Relinquished By: Date: / / Time:
Received By: Date: / / Time:
Relinquished By: Date: / / Time:
Received By: Date: / / Time:

Notes: 5 DAY TAT

To be filled out by Microbac · Temp. Upon Receipt (°C): 1.9 Thermometer ID: L16 No. Bottles Received: 9
Samples Received on Ice? [✓ Yes] No Custody Seals Intact? Yes No [✓ N/A]

Version 05.19.2015

*Standard RUSH TAT Charges: Same Day x3; Next Day x2; Three Day x1.5. Please contact us for RUSH request arrangements at 502.962.6400

Page 1 of 1

ATTACHMENT C
STANTEC TESTING RESULTS

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name KRS 1 Sludge Improvements
Project Number 175667010
Source Sludge
Lab ID 1

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method ASTM D 422
Prepared using ASTM D 421

Particle Shape Angular
Particle Hardness: Hard and Durable

Tested By CM
Test Date 08-28-2017
Date Received 08-25-2017

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3/4"	100.0
3/8"	91.7
No. 4	83.9
No. 10	73.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on -3 inch fraction only

Specific Gravity 2.66 ASTM D 854

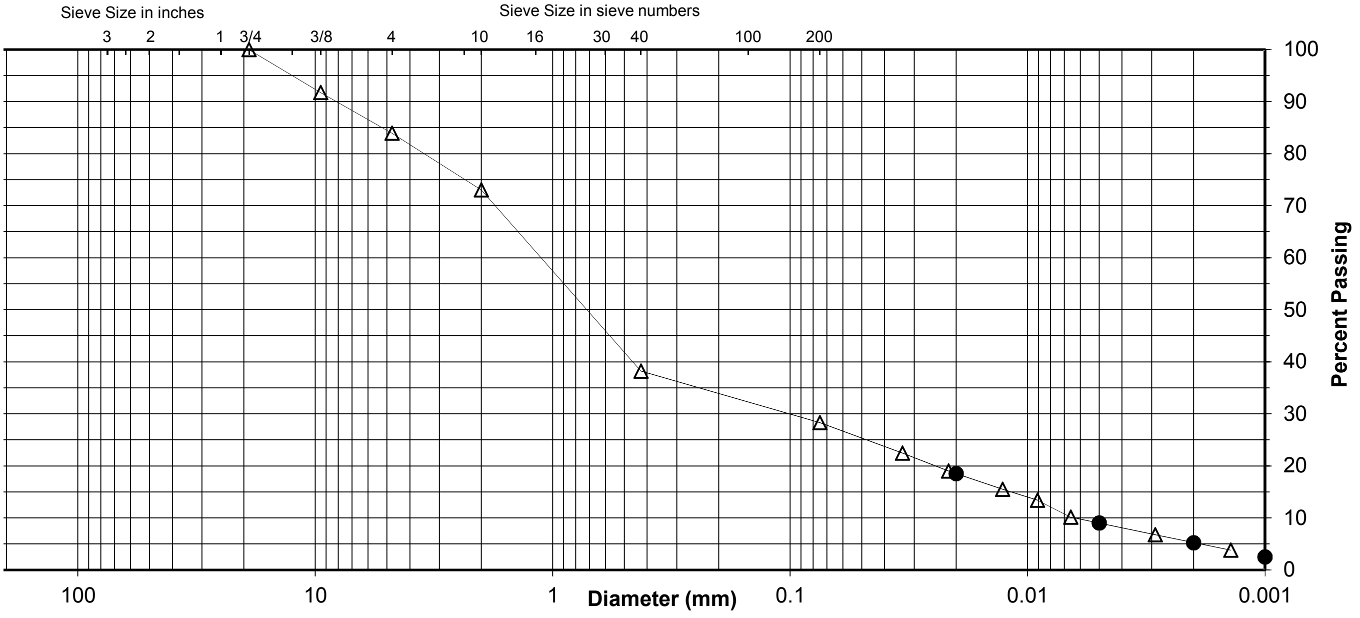
Dispersed using Apparatus A - Mechanical, for 1 minute

No. 40	38.2
No. 200	28.3
0.02 mm	18.5
0.005 mm	9.0
0.002 mm	5.2
0.001 mm	2.5

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	16.1	10.9	34.8	9.9	19.3	9.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	27.0	34.8	9.9	23.1	5.2



Comments

Reviewed By [redacted]

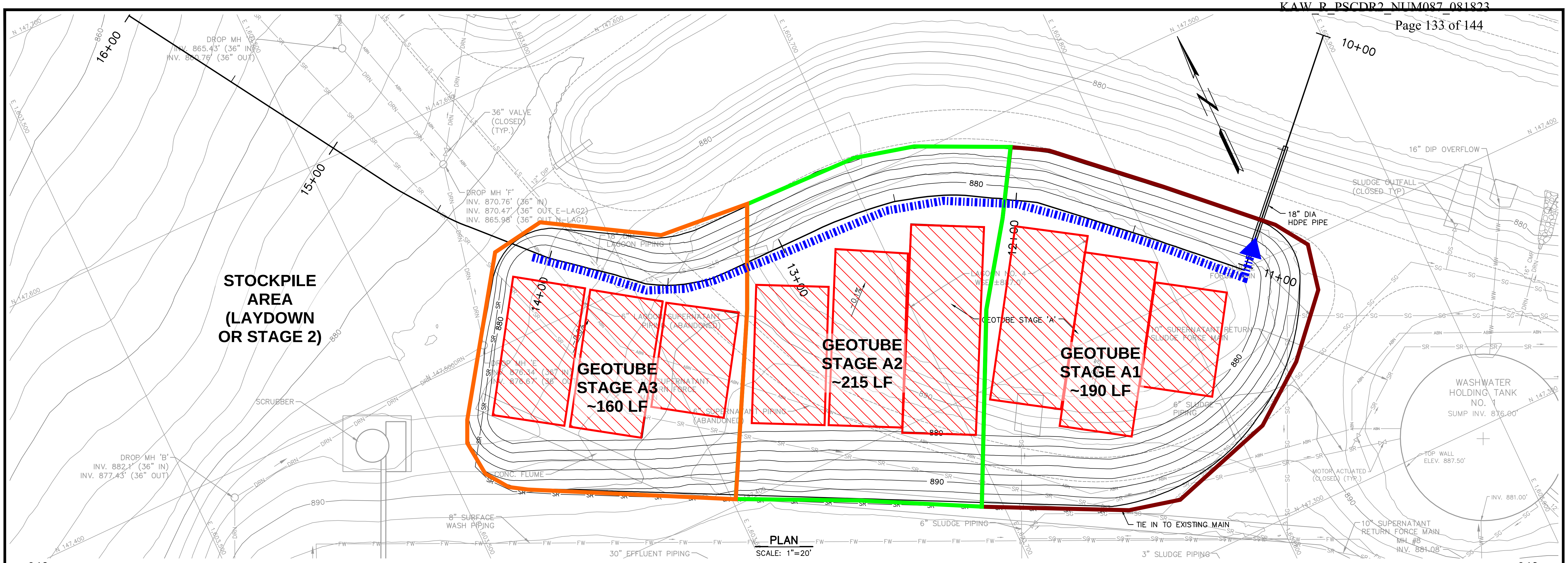
Template: tmp_sum_input.xlsm
Version: 20170217
Approved By: RJ

Stantec Consulting Services Inc.
Lexington, Kentucky

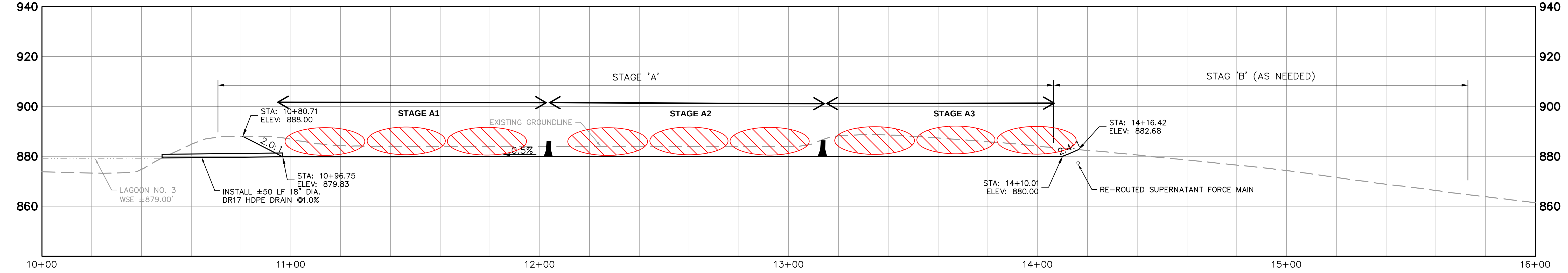
Reported By: RJ
Report Date: 09/06/2017

Attachment C

Near-Term Improvements Plan



PLAN
SCALE: 1"=20'



PROFILE – BASELINE
SCALE: 1"=20'

NOTES:

1. EXISTING PLAN INFORMATION WAS EXTRACTED FROM AVAILABLE RECORD DRAWINGS FROM KAW AND FROM FIELD OBSERVATIONS. CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO COMMENCING WORK.
2. TOPOGRAPHIC CONTOURS DEVELOPED FROM LIDAR PROVIDED BY KY GIS (2012).
3. ELEVATIONS ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. COORDINATES ARE REFERENCED TO KENTUCKY STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM 1983, FEET.

LEGEND

— 860 —	INDEX CONTOUR (10')	— X —	FENCE
———	INTERMEDIATE CONTOUR (2')	→	FLOW DIRECTION
— DRN —	DRAIN	⋈	VALVE
— FE —	FILTER EFFLUENT	○	MANHOLE
— FW —	FINISH WATER		HYDRANT
— LS —	LAGOON SUPERNATANT	— — — —	CHEMICAL FEED LINES
— SG —	SLUDGE	— SA —	SANITARY SEWER
— SR —	SUPERNATANT RETURN	- - - - - -	EDGE OF GRAVEL
— PW —	PLANT WATER	— ABN —	ABANDONED LINE
— WW —	WASHWATER WASTE		
— WS —	WASHWATER SUPPLY		
— — — —	MISCELLANEOUS PIPE		
— 860 —	PROPOSED INDEX CONTOUR (10')		
———	PROPOSED INTERMEDIATE CONTOUR (2')		

10 0 20 40 FEET
GRAPHIC SCALE: 1" = 20'
CONTOUR INTERVAL = 2'

REVISED

KENTUCKY RIVER STATION NO. 1
SOLIDS RESIDUALS IMPROVEMENTS
GRADING PLAN AND PROFILE

KENTUCKY AMERICAN WATER COMPANY
LEXINGTON, KENTUCKY

Stantec

STANTEC CONSULTING SERVICES INC.
3052 BEAUMONT CENTRE CIRCLE
LEXINGTON, KENTUCKY 40513
(859) 422-3000
www.stantec.com

DRAWN BY: PJB
DESIGNED BY: CSP **DATE:** SEPTEMBER, 2017
CHECKED BY: BAL **PROJECT:** 175667010 **SCALE:** 1"=20'

USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES

DRAWING NO. 5

Attachment D

Schwing Pilot Proposal and Instructions

SCHWING
BIOSET

350 SMC Drive
Somerset, WI 54025
Phone: (715) 247-3433
Fax: (715) 247-3438

September 20, 2017

Kentucky American Water
6300 Cedarcreek Ln
Lexington KY 40515

Attention: Mrs. Mitzi Combs

Subject: Kentucky American Water
High Performance Screw Press Dewatering System Demonstration
Schwing Bioset, Inc.

Dear Mrs. Combs,

Schwing Bioset is pleased to present the following proposal for an on-site dewatering screw press pilot.

EQUIPMENT RENTAL

Schwing Bioset is pleased to offer the following equipment for one week pilot test.

- One (1) Schwing Bioset Dewatering Screw press and controls, complete with polymer system, reaction tank, and sludge feed pump.
- One (1) week of service (including travel) plus one day for clean-up and packing assistance.

Mobilization/ Demobilization Fee…….………………………	**~~Not to Exceed $1,000.00~~ Waived**
Equipment Rental Rate……………………………………..	**~~$ 2,000.00 / week~~ Waived**

Clarifications:

1. The "Mobilization Fee" includes freight to and from the Customer's facility. One (1) week, one (1) trip of service by a Schwing Bioset field technician for startup and training of screw press Pilot unit. One (1) day, one (1) trip, shall be provided for take down.

Costs for additional field service time if desired, shall be charged to the Customer's account.

2. Fifteen (15) gallons of vendor recommended polymer is included.
3. Skid has a dedicated control enclosure for the connected equipment. Control enclosure includes control logic, motor starters and variable speed drives; 480 V / 3 phase power.
    a. Screw Press skid has a 30 amp circuit breaker. 150' of power cable will be provided for the rated service.
    b. Electric Service provided & connected by customer.
    c. Actual power consumption will be less depending on processing rate and material properties.
4. Customer shall be responsible to provide sludge feed sludge to the pilot unit. Trailer has a 2" female Camlock connection. Trailer has a feed pump on the unit with roughly 6' of suction head nad a VFD to control sludge feed rate. Sludge Feed to screw press skid shall be: Biological thickened sludge, 0.5 – 5% solids. Stream must be free of debris such has rags, etc. SBI will provide, 100' long 2" hose, with female camlok fitting.
5. Filtrate Return: Host to accept filtrate from 2" hose, possibly at nearby drain. SBI filtrate hose length 50' long.
6. Lab Data: Host to provide lab analysis of subject sludge, including volatile solids content, ash content, fiber content, and pH.
7. Water requirements (SBI shall supply 100' hose with garden hose thread connection):
    a. Screw Press wash cycle: 5 gpm potable @ 45-60psi (once per 8 hrs)
    b. Screw Press polymer dilution: < 2 gpm @ 40 psi
8. Customer is responsible for all wash water and disposal of all sludge and any other residuals, including sludge produced during demonstration.
9. Prices are valid for 30 days.
10. Payment terms offered are subject to final credit approval.

TECHNICAL DATA

Process Material Description:	Sludge
Process Material Solids Content:	0.5 to 5.0% Total Dry Solids
Design Sludge Processing Rate:	Approx 90 dry lbs / hour (12.9 GPM @ 1.4% solids)
Estimated Polymer Consumption:	10-40 active lbs per dry ton sludge

AVAILABILITY

Week of October 23rd, 2017.

FREIGHT

Delivery of equipment to test site and return freight is included in mobilization fee. Currently May timeframe is available.

CONSUMABLES

The rental fee does not include costs for wear parts. Wear parts may be purchased separately from Schwing Bioset as needed.

SBI will perform Jar testing to identify polymer recommendation. SBI will provide recommended polymer for One (1) weeks operation.

TAXES

No taxes are included in this quote. The amount of any applicable present or future state/local sales/use tax or other government charge upon the production, sale, shipment, and/or use of the goods covered by this quotation shall be paid directly to the taxing authorities by purchaser, and paid tax receipts will be furnished to Schwing Bioset, Inc. upon request, unless purchaser provides us with an exemption certificate acceptable to the taxing authorities.

TERMS

Mobilization Fee:

100% with delivery, net 30 days.

Equipment Rental and Service Technician Fee:

100% at conclusion of rental, net 30 days.

OTHER REQUIREMENTS

1. SBI shall provide Labor for installation, cleaning, disassembly, loading, and unloading of the skid and piping.
2. Customer shall be responsible for electrical hook-up and water connections.
3. The equipment must be returned in the same condition as received, normal wear accepted. A Schwing Bioset service technician is required to stay on-site to supervise equipment breakdown and cleaning.
4. Any Schwing Bioset supplied equipment that is cut or modified in any way shall be replaced and charged to the Customer’s account.

5. Customer shall be responsible for all applicable permits and/or licenses.

If you have any further questions, please feel free to contact me at (cell) 203-731-0977, or email ewanstrom@schwingbioset.com.

Yours very truly,
Schwing Bioset, Inc.
Eric M Wanstrom
Eric Wanstrom, PE
Northeast Regional Sales Manager
CC: Jason Beck – The Henry P Thompson Co.

ORDER ACCEPTANCE

Offer for demonstration, including all terms and conditions referenced within, is accepted by:

____
Name

____
Title

____
Company

____
Company Address

____
Date

350 SMC DRIVE
SOMERSET, WI 54025
PH: (715) 247-3433
FAX: (715) 247-3438
www.schwingbioset.com

Schwing Bioset Screw Press

SCREW PRESS PILOT

Schwing Bioset is pleased to offer the following equipment for a one week pilot test:

Schedule

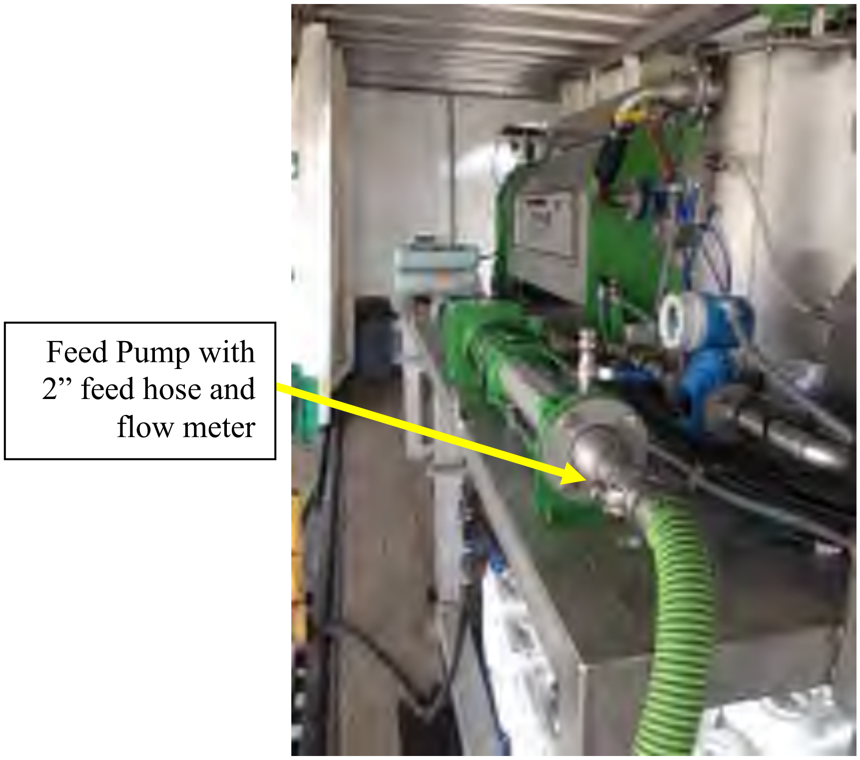
Monday:	Pilot Trailer and technician arrive on site. Setup is performed.
Tuesday-Thursday:	Operate the screw press and collect samples and solids data. Split samples shall be provided to the district for independent verification of results.
Thursday (afternoon):	Clean up and pack up of the pilot trailer.
Friday:	Pilot trailer is picked up.

Clarifications:

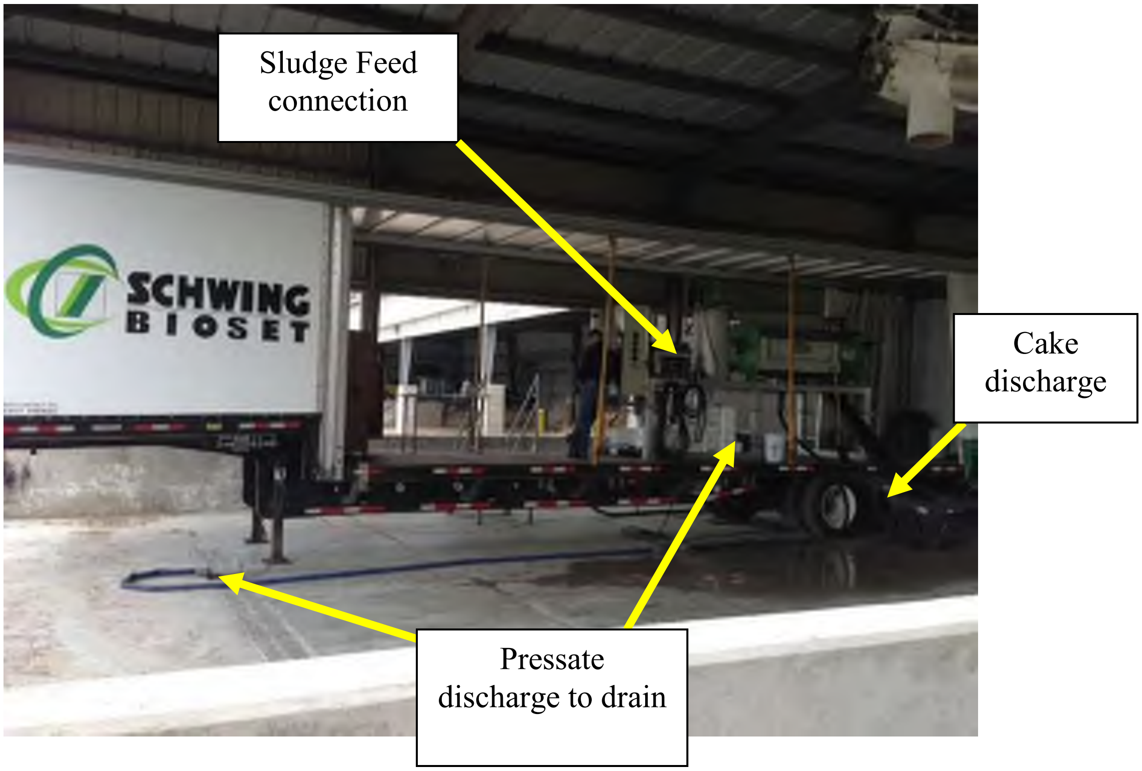
1. Technician shall set up the pilot unit, operate, and collect samples and data of the pilot test.
2. Schwing Bioset shall include 15 gallons of recommended polymer. Schwing Bioset shall work with the district to perform on-site jar testing four (4) weeks prior to the pilot test. The polymer shall be shipped to the site prior to the pilot test. The district shall receive and store the three (3), 5 gallon containers indoors in a temperature controlled space.
3. Pilot unit is a 50’ trailer and will be located on site with access to:
    a. 30 Amps of 480v/ 3phase power
    b. Sludge feed with a 2” male camlock coupling.
    c. Drain for the pressate water which is gravity fed.
    d. Minimum 4gpm of potable water at 20-40psi (3/4”-1” garden hose) for polymer blending and general clean up use.
    e. Cake collection: Unit will process up to 100 dry lbs per hr or roughly 200-500 wet lbs per hr of cake.

4. Skid has a dedicated control enclosure for the connected equipment. Control enclosure includes control logic, motor starters and variable speed drives; 480 V / 3 phase power.
    a. Screw Press skid has a 30 amp circuit breaker. 200' of power cable will be provided for the rated service.
    b. Service provided & connected by customer.
    c. Actual power consumption will be less depending on processing rate and material properties.

5. Customer's Sludge Feed to screw press skid shall be: sludge, 0.5 – 5% solids. Stream must be free of debris such has rags, etc. SBI will provide 2" vac hose, 100' long, with female camlok fitting. Sludge feed shall range from 3-15gpm. A feed pump on the pilot unit shall control the flow to the screw press.



6. Filtrate Return: Host to accept filtrate from 2” hose, possibly at nearby manhole. SBI filtrate hose length 100’ long.
7. Lab Data: Customer to provide lab analysis of subject sludge, including volatile solids content, ash content, fiber content, and pH.
8. Water requirements (SBI shall supply 100’ hose with garden hose thread connection):
    a. Screw Press wash cycle: 5 gpm potable @ 45-60psi (once per 8 hrs)
    b. Screw Press polymer dilution: < 10 gpm @ 40 psi
9. Customer is responsible for cleanup and disposal of all sludge and any other residuals, including sludge produced during rental. Also, location for cleanout of equipment is the responsibility of the customer.



AVAILABILITY

To be determined.

CONSUMABLES

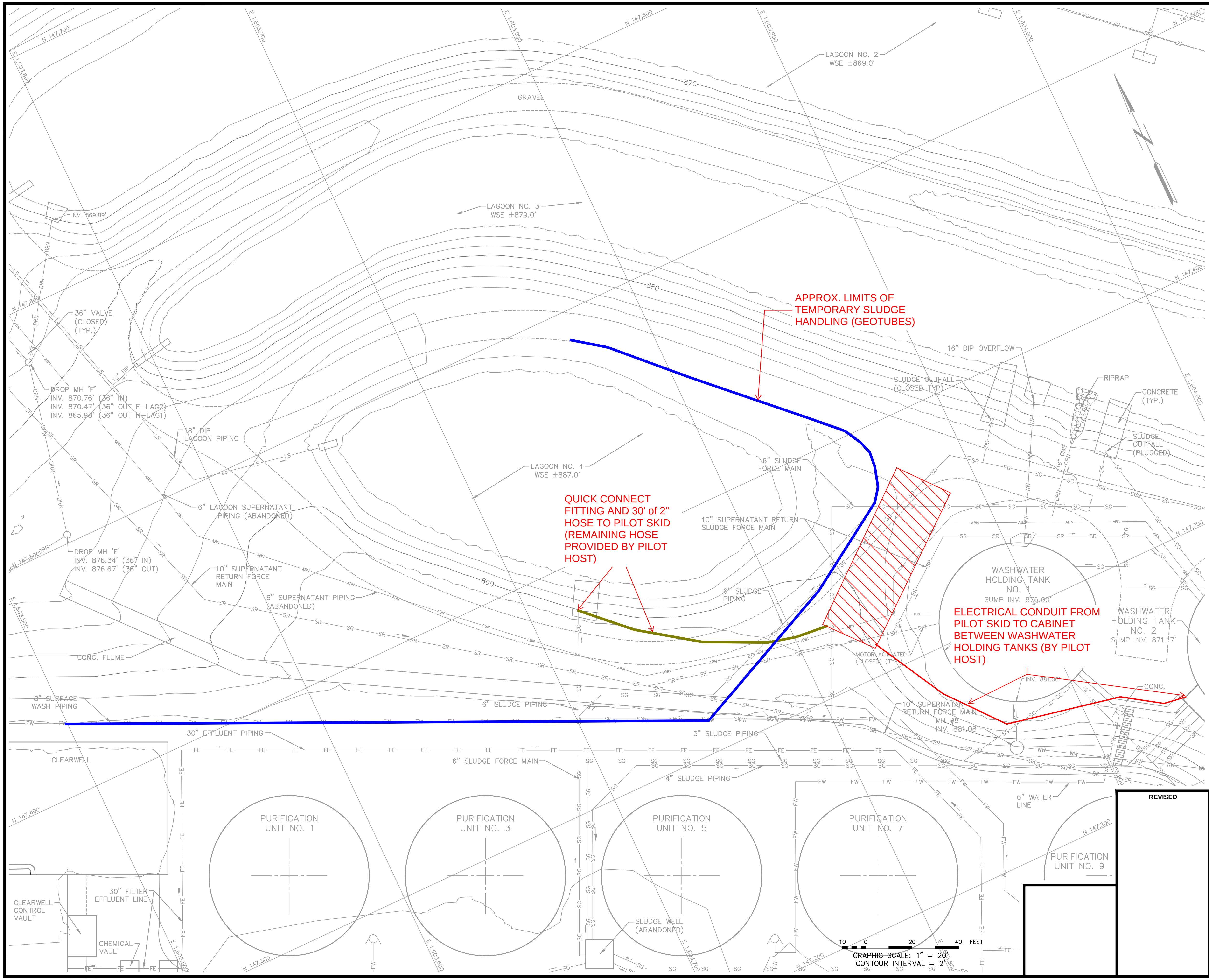
SBI will provide 15 gallons of polymer. Polymer type shall be determined during on site jar testing performed 4 weeks prior to the pilot test.

If you have any further questions, please feel free to contact me at (cell) 203-731-0977, or email EWanstrom@schwingbioset.com.

Yours very truly,
Schwing Bioset, Inc.
Eric M Wanstrom
Eric Wanstrom, P.E.
Northeast Regional Sales Manager

Attachment E

Screw Press Pilot Plans



APPROX. LIMITS OF TEMPORARY SLUDGE HANDLING (GEOTUBES)

QUICK CONNECT FITTING AND 30' of 2" HOSE TO PILOT SKID (REMAINING HOSE PROVIDED BY PILOT HOST)

ELECTRICAL CONDUIT FROM PILOT SKID TO CABINET BETWEEN WASHWATER HOLDING TANKS (BY PILOT HOST)

NOTES:

1. EXISTING PLAN INFORMATION WAS EXTRACTED FROM AVAILABLE RECORD DRAWINGS FROM KAW AND FROM FIELD OBSERVATIONS. CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO COMMENCING WORK.
2. TOPOGRAPHIC CONTOURS DEVELOPED FROM LIDAR PROVIDED BY KY GIS (2012).
3. ELEVATIONS ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. COORDINATES ARE REFERENCED TO KENTUCKY STATE PLANE NORTH ZONE, NORTH AMERICAN DATUM 1983, FEET.

LEGEND

—— 860 ——	INDEX CONTOUR (10')
————	INTERMEDIATE CONTOUR (2')
—— DRN ——	DRAIN
—— FE ——	FILTER EFFLUENT
—— FW ——	FINISH WATER
—— LS ——	LAGOON SUPERNATANT
—— SG ——	SLUDGE
—— SR ——	SUPERNATANT RETURN
—— PW ——	PLANT WATER
—— WW ——	WASHWATER WASTE
—— WS ——	WASHWATER SUPPLY
— — — —	MISCELLANEOUS PIPE
—— X ——	FENCE
→	FLOW DIRECTION
⋈	VALVE
○	MANHOLE
⌓	HYDRANT
— — — —	CHEMICAL FEED LINES
—— SA ——	SANITARY SEWER
- - - - - -	EDGE OF GRAVEL
—— ABN ——	ABANDONED LINE

ELECTRICAL NEEDS:

☐ CONNECTION FOR 480V/ 3 PHASE POWER.

SKID HAS 30 AMP BREAKER. CONNECTION NEEDS TO BE WITHIN 150 FEET OF SKID

SLUDGE FEED NEEDS:

☐ QUICK CONNECT FOR 2" FEMALE CAMLOK FITTING

CONNECTION NEEDS TO BE WITHIN 100 FEET OF SKID

REVISED

**KENTUCKY RIVER STATION NO. 1
SOLIDS RESIDUALS IMPROVEMENTS
SITE PLAN**

**KENTUCKY AMERICAN WATER COMPANY
LEXINGTON, KENTUCKY**

Stantec

STANTEC CONSULTING SERVICES INC.
3052 BEAUMONT CENTRE CIRCLE
LEXINGTON, KENTUCKY 40513
(859) 422-3000
www.stantec.com

DRAWN BY: ACC
DESIGNED BY: CSP **DATE:**
CHECKED BY: BAL **PROJECT:** 175667010 **SCALE:** 1"=20'

USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES

DRAWING NO.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: Harold Walker

88. Refer to the Direct Testimony of Harold Walker, III (Walker Direct Testimony).

    a. Identify all of the noncash items that have been included in the calculation of Working Capital.

    b. Identify the amount of Working Capital that is included for each item.

    c. Identify each American Water affiliate that has been authorized to include non-cash items in Working Capital for rate purposes. For each affiliate, identify which specific noncash items have been authorized.

Response:

a. Please note that Mr. Walker does not discuss "noncash items" in his testimony and the phrase "noncash items" may have different meanings to different people. In the broadest sense, the "noncash items" included in the calculation of Working Capital may include the following line items: amortization; uncollectibles; depreciation and amortization; deferred income taxes; and net income. The term "non-cash expense" is an accounting term only. It is not a term that has significance from a financial, economic, or regulatory perspective, because something categorized as a "non-cash expense" from an accounting perspective still represents a true expense for a company. Working capital is required to fund that portion of the expense which has not been collected from customers despite service having been provided.

b. Please see Schedule HW-1 which lists all the components of the Company's working capital.

c. Mr. Walker did not gather the requested information for his testimony, but has been involved in cases in NJ, VA, IL, and MO and included many of the same items as described in subpart a. above in each based on each jurisdiction's precedent summarized in the table below.

	NJ	VA	IL	MO
Amortization	In	In		
Uncollectibles	In	In		
Depreciation and Amortization	In	In		
Deferred Income Taxes	In	In	In	
Net Income	In *			

* - In NJ, operating income is included and would be considered a noncash item. The Inclusion of operating income requires all interest expense and net income being treated as noncash items and are assigned 0 (zero) lead days.

This approach is consistent with the PSC's determination in Case No. 2018-00358 that "...the Commission has consistently refused to adopt[,] the arguments raised…" against "the inclusion of non-cash items in the calculation of working capital."

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

89. Refer to the Direct Testimony of John M. Watkins (Watkins Direct Testimony), page 4, lines 10-16.

    a. What are the forecasted test period wage increases for the union employees?

    b. Have CBAs been executed that cover the wages for the entire forecasted test period? If not, when does the Company expect for those CBAs to be executed?

    c. What are the average base pay increases for non-union employees for the last five years?

Response:

a. The forecasted test period includes two wage increases for union employees:
   - November 1, 2023: 2.5%
   - November 1, 2024: 2.5%

b. The current collective bargaining agreement, ratified in 2022 is valid through October 31, 2025.

c. The average wage increases for non-union employees over the last five years are as seen below:
   - 2019: 2.76%
   - 2020: 2.72%
   - 2021: 3.02%
   - 2022: 3.11%.
   - 2023: 3.15%

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

90. Refer to Watkins Direct Testimony, page 6, line 8. Identify the changes in the Annual Performance Plan and Long-Term Performance Plan since the last rate case.

Response:

Since Case No. 2018-00358, the Annual Performance Plan has expanded to include union employees, who are now eligible for Annual Performance Plan awards of 3% of their base salary. Annual Performance Plan awards are focused on achieving the overall company's goals. The eligible awards have also changed. Non-exempt employees and employees at salary levels 22 and 25 are now eligible for awards that are 7% of base salary, which was previously 5%. Employees with salary levels of 30 and 35 are now eligible for awards commensurate with 12% of base salary, which was previously 10%. Long-Term Performance Plan ("LTPP") awards have changed for employees with salary level 55, who are now eligible for a LTPP percentage of 15%, which was previously 10%, and employees with salary level 65 who are now eligible for a LTPP percentage of 40%, previously 30%.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

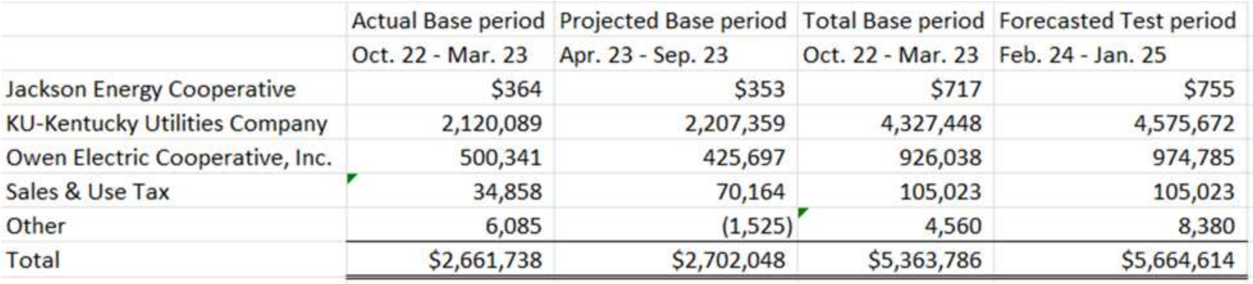
91. Refer to Watkins Direct Testimony, page 11, line 11.

a. Provide the purchased power expense by power provider in the actual base period, the projected base period, and the forecasted test period.

b. Have any purchased power providers indicated to Kentucky-American that they are seeking to increase rates within the forecasted test period?

Response:

a. The purchased power expense by provider for the requested periods is as follows:



	Actual Base period	Projected Base period	Total Base period	Forecasted Test period
	Oct. 22 - Mar. 23	Apr. 23 - Sep. 23	Oct. 22 - Mar. 23	Feb. 24 - Jan. 25
Jackson Energy Cooperative	$364	$353	$717	$755
KU-Kentucky Utilities Company	2,120,089	2,207,359	4,327,448	4,575,672
Owen Electric Cooperative, Inc.	500,341	425,697	926,038	974,785
Sales & Use Tax	34,858	70,164	105,023	105,023
Other	6,085	(1,525)	4,560	8,380
Total	$2,661,738	$2,702,048	$5,363,786	$5,664,614

b. Kentucky-American has not received any notice of our purchased power providers seeking rate changes.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

92. Provide the annual salaries for the past five years for executives for Kentucky-American Water.

Response:

Please refer to the below for the annual salaries of executives for Kentucky-American for the past five years.

Title	**2018**	**2019**	**2020**	**2021**	**2022**
President*					$270,000
VP Operations	$154,884	$155,000	$160,425	$168,446	$216,444

*****Kentucky-American Water President position was a Service Company position prior to 2022.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

93. Provide a list of all proposed new employee positions, and proposed salaries.

Response:

There are no proposed new employee positions as a part of this rate case proceeding, all vacant positions at the time of filing were for backfills. Please note that all 3 vacant positions at the time of filing have been filled.

KENTUCKY-AMERICAN WATER COMPANY
CASE NO. 2023-00191
COMMISSION STAFF'S SECOND REQUEST FOR INFORMATION

Witness: John Watkins

94. Refer to Case No. 2018-00358.[7] Provide the number of part- and full-time positions Kentucky-American Water currently considers appropriate for staffing needs.

    a. Provide the current number of active employees.

    b. Provide a list of all vacant authorized positions and the length of time they have been vacant.

Response:

The Company believes the appropriate level for staffing is 156 full time equivalents (FTEs).

a. There are currently 149 active employees.
b. Please see the list of vacant positions below:

Job	Date Vacated
Crew Leader	06/22/23
Maint Service Specialist	03/19/23
Maintenance Technician II	07/23/23
Mgr. Opns	04/14/23
Supvr. Production	12/11/22
Operations Specialist	06/30/23
GIS Analyst	07/29/23

---

[7] Case No. 2018-00358, *Electronic Application of Kentucky American Water Company for an Adjustment of Rates* (Ky. PSC Jun. 27, 2019), Order at 37–40, Employee Vacancies/Labor Expenses discussion.