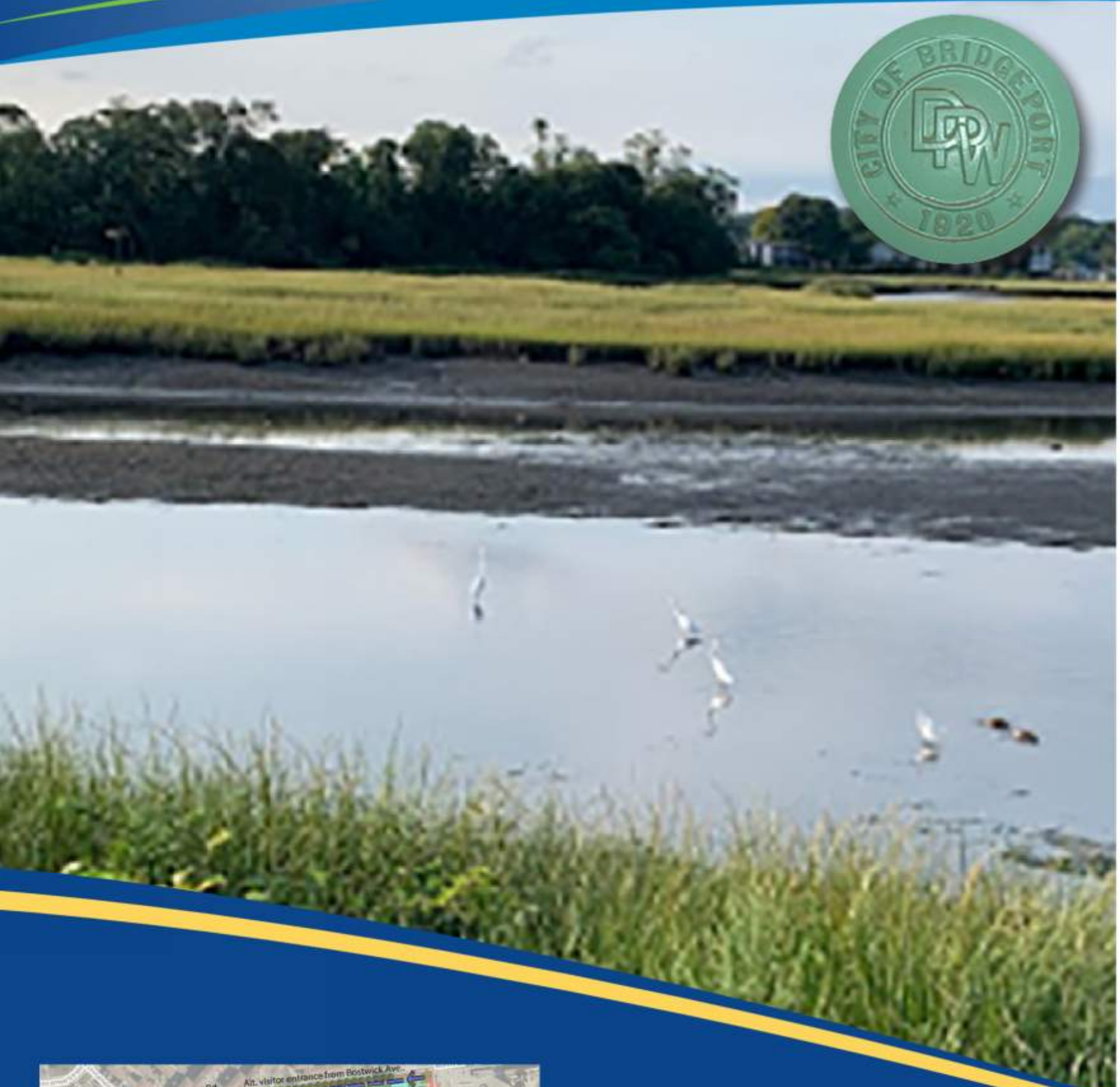
DRAFT

Water Pollution Control Authority (WPCA)

City of Bridgeport, CT

Facilities Plan for the West and East Side Wastewater Treatment Plants



APPENDICES

November 2020

CDM Smith

Appendix A

Administrative Orders

CDM Smith

CSO Administrative Order (WRMU18002) – June 2018

CDM Smith

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

fyi DEEP CSO LTCP 5900

June 14, 201~~7~~8

RECEIVED
JUN 19 2018
CITY OF BRIDGEPORT
MAYOR'S OFFICE

Mayor Joseph P. Ganim,
City of Bridgeport
999 Broad Street
Bridgeport, CT 06604

Re: Administrative Order #WRMU18002

Honorable Mayor Ganim:

In line with recent discussions with City of Bridgeport staff, please find attached one original of Administrative Order #WRMU18002 for your use to finalize this enforcement action.

The Department of Energy and Environmental Protection ("DEEP") appreciates your cooperation in settling this matter.

If you have any questions, please contact Catharine Chu at (860) 424-3342 or catharine.chu@ct.gov.

Sincerely,

Denise Ruzicka

Denise Ruzicka
Director
Water Planning and Management Division
Bureau of Water Protection and Land Reuse

E-Copies w/Attachment: William Robinson, Consultant
Steven Walker, Interim Acting General Manager
Rob Klee, DEEP Commissioner
Bob Kaliszewski, DEEP Deputy Commissioner
Betsey Wingfield, WPLR Bureau Chief

Attachment: Administrative Order #WRMU18002

STATE OF CONNECTICUT :
V. :
CITY OF BRIDGEPORT :

ORDER

A. The Commissioner of Energy and Environmental Protection ("the Commissioner") finds:

1. The City of Bridgeport ("the Respondent") owns and operates a sanitary sewerage system, including sewage treatment facilities and discharges treated sanitary sewage under the terms and conditions of National Pollutant Discharge Elimination System (NPDES) Permit No. CT0101010 (East Side) and NPDES Permit No. CT0100056 (West Side).

2. The Respondent maintains a sewerage system, which includes sewers that convey both stormwater and sanitary sewage ("combined sewers"). During increased flow conditions associated with wet weather events, such combined sewers discharge untreated or partially treated sewage to the waters of the state at certain locations ("combined sewer overflows" or "CSOs"). Currently the Respondent has 30 active combined sewer overflow outfall locations within its collection system.

3. The United States Environmental Protection Agency ("EPA") has published the *Combined Sewer Overflow Control Policy, April 1994*, which requires compliance with the implementation of the "Nine Minimum Controls" and development of a "Long-Term Combined Sewer Overflow Control Plan".

4. On May 30, 2001, the Commissioner issued Order No. WC5320 to address the uncontrolled combined sewer overflows to Island Brook and the Pequonnock River.

5. On January 23, 2001, the Respondent submitted for the Commissioner's review and approval the Report entitled *Facility Plan 2000 Report, Water Pollution Control Authority of Bridgeport, Connecticut*, prepared by the Kasper Group Inc. The Commissioner found that the Respondent's report did not adequately address the requirements of a Long-Term Combined Sewer Overflow Control Plan and that the Respondent had not fully implemented all of the Nine Minimum Controls.

6. On August 18, 2008, the Commissioner issued Order No. WC5478 requiring a Long-Term Combined Sewer Overflow Control Plan, full compliance with the revised Nine Minimum Controls Plans as required by EPA's 1994 Combined Sewer Overflow Control Policy, a report defining acceptable mixing zones for achieving water quality standards for the Pequonnock River, Bridgeport Harbor, Black Rock Harbor and Cedar

Creek, and a Communication Plan.

7. The Connecticut Department of Environmental Protection has subsequently been renamed the Connecticut Department of Energy and Environmental Protection ("DEEP"). Any and all references within this Order are considered to be DEEP.

8. On April 29, 2009 the Respondent submitted for the Commissioner's review and approval the *Summary of Compliance with the Nine Minimum Controls (NMC) and Compliance Plan of Study* (POS) dated April 2009, prepared by Malcolm Pirnie. The NMC and POS were approved with three additions on June 24, 2009.

9. On June 1, 2009 the Respondent submitted for the Commissioner's review and approval a draft of the *Bridgeport WPCA CSO and Receiving Water Field Sampling and Quality Assurance Plan* (QAP) dated July 2009 prepared by Malcolm Pirnie. After DEEP comment, the final report was received July 27, 2009. The QAP was approved on August 12, 2009 with three additions.

10. The Communication Plan submitted on August 28, 2009 for the Commissioner's review and approval by the Respondent was approved on October 14, 2009.

11. On July 22, 2011, the Respondent submitted for the Commissioner's review and approval the *Bridgeport CSO Long Term Control Plan (*LTCP*)* prepared by Malcolm Pirnie. The plan outlines removal of CSOs to the 1 year, 24 hour storm.

12. On January 5, 2018, the Commissioner approved the LTCP report referenced in paragraph A.11 above. The project was approved upon an updated schedule submitted December 20, 2017 as Figure 9-2D.

13. The LTCP referenced in paragraphs A.11 and A.12 above recommends Combined Sewer Overflow control to the 1 year, 24-hour storm. The methods include an illicit connection elimination program, sewer separation, static weir control, Combined Sewer Overflow storage tanks, a continuous water quality monitoring and modeling program, Combined Sewer Overflow relief sewers, and the Tunnel Storage System.

14. This order supersedes orders WC5320 and WC5478.

15. By virtue of the above, the Respondent is causing pollution of the waters of the state and is maintaining facilities or conditions that can reasonably be expected to create a source of pollution to the waters of the state.

B. The Commissioner, acting under §22a-6, §22a-424, §22a-425, §22a-427, §22a-428, §22a-430, and §22a-431 of the Connecticut General Statutes, orders the Respondent as follows:

1. The Respondent has retained Arcadis, formerly known as Malcolm Pirnie, to complete documents and implement actions in regards to the approved LTCP. A qualified consultant is required until this order is fully complied with, and, within ten days after

retaining any consultant other than the one identified in this paragraph, the Respondent shall notify the Commissioner in writing of the identity of such other consultant. The consultant(s) retained shall be a qualified professional engineer licensed to practice in Connecticut and shall be acceptable to the Commissioner. The Respondent shall submit to the Commissioner a description of a consultant's education, experience and training which is relevant to the work required by this order within ten days after a request for such a description. Nothing in this paragraph shall preclude the Commissioner from finding a previously acceptable consultant unacceptable.

2. On or before January 31, 2021, the Respondent shall complete the Phase I and II Construction as indicated in the LTCP Schedule some of which is completed or underway. Included is:

   a. Storm water pump station H2 shall be substantially completed by the end of June 2018.

   b. Approximately 11 contract lining and sewer separation projects shall be completed by January 2021.

3. On or before January 31, 2021, the Respondent shall submit for the Commissioner's review and approval the design plans and specifications of the Phase III Ash Creek Storage Tank including any green components. Following approval by the Commissioner, the Respondent shall have 730 days to complete construction of the approved design.

4. On or before December 31, 2022, the Respondent shall submit for the Commissioner's review and approval the design plans and specifications of the SEAB Storage tank including any green components. Following approval by the Commissioner, the Respondent shall have 1095 days to complete construction of the approved design.

5. On or before December 31, 2021, and on a 5 year recurring schedule thereafter, the Respondent shall submit for the Commissioner's review and approval a LTCP Update to demonstrate the Respondent's progress to date and a plan for meeting the approved CSO control level until such CSO control has been achieved. The Respondent shall make appropriate revisions to such LTCP Update to address comments made by DEEP as necessary to obtain DEEP approval. Each LTCP Update shall at a minimum comply with the following:

   a. Each LTCP Update shall be a stand-alone document that builds upon its predecessor.

   b. Each LTCP Update shall include a public information process and provide an opportunity for receiving and responding to public comment.

   c. Each LTCP Update shall demonstrate to the Commissioner's satisfaction the Respondent's plans for meeting a 1 year, 24-hour storm of CSO control (zero discharges) by December 31, 2039.

d. Each LTCP Update shall include a new five year CSO abatement construction schedule which shall be incorporated into this Order upon approval by DEEP.

6. Water quality monitoring shall be performed continuously with increased monitoring following the completion of each phase of construction. The results of the water quality program shall be incorporated into the LTCP update following construction of the storage tanks referenced in B.3 and B.4 but prior to the design of Combined Sewer Overflow Relief Sewers and determination of the necessity of the final phase and design of the Tunnel Storage System.

7. On or before December 31, 2039, the Respondent shall have constructed all of the improvements necessary to comply with the level of control as referenced in Paragraph A.13.

8. Progress reports: On or before the last day of June and December of each year after issuance of this order, and continuing until all actions required by this order have been completed as approved and to the Commissioner's satisfaction, the Respondent shall submit a progress report to the Commissioner describing the actions which Respondent has taken to date to comply with this order.

9. Full compliance. The Respondent shall not be considered in full compliance with this order until all actions required by this order have been completed as approved and to the Commissioner's satisfaction.

10. Approvals. The Respondent shall use best efforts to submit to the Commissioner all documents required by this order in a complete and approvable form. If the Commissioner notifies Respondent that any document or other action is deficient, and does not approve it with conditions or modifications, it is deemed disapproved, and the Respondent shall correct the deficiencies and resubmit it within the time specified by the Commissioner or, if no time is specified by the Commissioner, within 30 days of the Commissioner's notice of deficiencies. In approving any document or other action under this order, the Commissioner may approve the document or other action as submitted or performed or with such conditions or modifications as the Commissioner deems necessary to carry out the purposes of this order. Nothing in this paragraph shall excuse noncompliance or delay.

11. Definitions. As used in this order, "Commissioner" means the Commissioner or a representative of the Commissioner.

12. Dates. The date of "issuance" of this order is the date the order is deposited in the U.S. mail or personally delivered, whichever is earlier. The date of submission to the Commissioner of any document required by this order shall be the date such document is received by the Commissioner. The date of any notice by the Commissioner under this order, including but not limited to notice of approval or disapproval of any

this order, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is deposited in the U.S. mail or is personally delivered, whichever is earlier. Except as otherwise specified in this order, the word "day" as used in this order means calendar day. Any document or action which is required by this order to be submitted or performed by a date which falls on a Saturday, Sunday or a Connecticut or federal holiday shall be submitted or performed by the next day which is not a Saturday, Sunday or Connecticut or federal holiday.

13. Certification of documents. Any document, including but not limited to any notice, which is required to be submitted to the Commissioner under this order shall be signed by a principal executive officer or ranking elected official or duly authorized representative of such person, as those terms are defined in §22a-430-3(b)(2) of the Regulations of Connecticut State Agencies, and by the individual(s) responsible for actually preparing such document, and each such individual shall certify in writing as follows:

   "I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, that the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under §53a-157b of the Connecticut General Statutes and any other applicable law."

14. Noncompliance. This order is a final order of the Commissioner with respect to the matters addressed herein, and is nonappealable and immediately enforceable. Failure to comply with this order may subject the Respondent to an injunction and penalties under Chapters 439, and 445 or 446k of the Connecticut General Statutes.

15. False statements. Any false statement in any information submitted pursuant to this order may be punishable as a criminal offense under §22a-438 or 22a-131a of the Connecticut General Statutes or, in accordance with §22a-6, under Section 53a-157 of the Connecticut General Statutes and any other applicable law.

16. Notice of transfer; liability of the Respondent and others. Until the Respondent has fully complied with this order, the Respondent shall notify the Commissioner in writing no later than 15 days after transferring all or any portion of the facility, the operations, the site or the business which is the subject of this order or after obtaining a new mailing or location address. The Respondent's obligations under this order shall not be affected by the passage of title to any property to any other person or Respondent.

17. Commissioner's powers. Nothing in this order shall affect the Commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for past, present, or future violations of law,

including but not limited to violations of any permit issued by the Commissioner. If at any time the Commissioner determines that the actions taken by the Respondent pursuant to this order have not successfully corrected all violations, fully characterized the extent or degree of any pollution, or successfully abated or prevented pollution, the Commissioner may institute any proceeding to require Respondent to undertake further investigation or further action to prevent or abate violations or pollution.

18. The Respondent's obligations under law. Nothing in this order shall relieve Respondent of other obligations under applicable federal, state and local law.

19. No assurance by Commissioner. No provision of this order and no action or inaction by the Commissioner shall be construed to constitute an assurance by the Commissioner that the actions taken by Respondent pursuant to this order will result in compliance or prevent or abate pollution.

20. Access to site. Any representative of the Department of Energy and Environmental Protection may enter any CSO facility without prior notice for the purposes of monitoring and enforcing the actions required or allowed by this order.

21. No effect on rights of other persons. This order neither creates nor affects any rights of persons or municipalities that are not parties to this order.

22. Notice to Commissioner of changes. Within 15 days of the date Respondent becomes aware of a change in any information submitted to the Commissioner under this order, or that any such information was inaccurate or misleading or that any relevant information was omitted, Respondent shall submit the correct or omitted information to the Commissioner.

23. Notification of noncompliance. In the event that Respondent becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this order or of any document required hereunder, Respondent shall immediately notify by telephone the individual identified in the next paragraph and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. Within five (5) days of the initial notice, Respondent shall submit in writing the date, time, and duration of the noncompliance and the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and Respondent shall comply with any dates which may be approved in writing by the Commissioner. Notification by Respondent shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.

24. Submission of documents. Any document required to be submitted to the Commissioner under this order shall, unless otherwise specified in this order or in writing by the Commissioner, be directed to:

Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning & Management Division
79 Elm Street
Hartford, Connecticut 06106-5127

Issued as a final order of the Commissioner of Energy and Environmental Protection.

Robert J. Klee
Commissioner

6/14/2018
Date

ADMINISTRATIVE ORDER NO. WRMU18002

WWTP Administrative Order – March 2019

CDM Smith

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

STATE OF CONNECTICUT :
V. :
CITY OF BRIDGEPORT :

ORDER

A. The Commissioner of Energy and Environmental Protection ("the Commissioner") finds:

1. The City of Bridgeport ("the Municipality") owns and operates a sanitary sewerage system, including a sewage treatment facility and discharges treated sanitary sewage under the terms and conditions of National Pollutant Discharge Elimination System (NPDES) Permit No. CT0101010 (East Side) and NPDES Wastewater Discharge Permit No. CT0100056 (West Side).

2. The Municipality maintains a sewerage system, which includes two activated sludge wastewater treatment plants. The East Side Plant has an annual average design flow capacity of 10 million gallons per day (mgd) and the West Side Plant has an annual average design flow capacity of 30 mgd. Both treatment plants serve a sewerage system which includes sewer that convey both stormwater and sanitary sewage ("combined sewers"). All wet weather flows in excess of secondary treatment capacity receive primary treatment before being blended with secondary effluent followed by disinfection with chlorine. The peak secondary treatment capacity of the East Side Plant is 24 mgd and the West Side Plant is 58 mgd.

3. The East Side and West Side plants completed nitrogen removal upgrades in the early 1990s and partial mechanical refurbishments between 1993 and 2001. These upgrades have exceed their design life leading to increased risk of equipment failure and effluent violations.

4. DEEP Order No. WC5498 issued March 20, 2009, required both plants to automate the chlorination and dechlorination systems. Both plants continue to operate chlorination and dechlorination systems manually.

5. On February 3, 2012, the Respondent submitted for the Commissioner's review and approval the Report entitled *Bridgeport Sludge Processing Systems Evaluation*. The Report was approved on April 3, 2018.

6. On November 21, 2013, the Respondent submitted for the Commissioner's Review and Approval the Report entitled *Bridgeport WPCA Low Level Nitrogen Removal Study.* The Report was approved in March 2, 2018.

7. On October 24, 2017, during a major storm event, the Bridgeport West Side Plant experienced screen failures resulting in floatables and debris not being removed from the influent. The bypass screen was repaired and the main screen was replaced. On January 17, 2018, Bridgeport reported that the West Side Plant main influent bar screen was out of service for scheduled repair/maintenance and not put back online until April 23, 2018.

8. On April 24, 2018, the Bridgeport West Side Plant reported an NPDES permit violation of the maximum daily limit for BOD5. On April 25, 2018, the Bridgeport West Side Plant reported an NPDES permit violation of the maximum daily limit and two times the limit for total suspended solids. The report listed out of service sludge collectors on one of the clarifier tanks, storm events and the main sewer trunks leading to the plant undergoing cleaning during the period as contributing factors.

9. During the June 6 and 8, 2018 inspection of the Bridgeport East Side Plant, it was noted that numerous equipment were out of service awaiting repair.

10. The Reports referenced in paragraphs A.5 and A.6 identify and include recommendations to upgrade the treatment plants to provide added reliability and additional pollutant removal. Action to design and construct such upgrades have not been made. Major long term recommendations include:

    a. West Side recommended improvements include adding computerized SCADA control of the biosolids process, adding odor control units, replacing the existing pumps, adding new sludge storage tanks, adding dewatering units, and anticipates a future additional drying building with dryers and possible energy recovery system. East Side recommended improvements include adding computerized SCADA control of the biosolids process, replacing existing pumps, adding a new scum handling system, replacing the existing sludge handling facility thickening equipment, adding new sludge storage tanks, building a truck bay, and a long term goal of shipping sludge to the West Side for final drying.

    b. The Nitrogen removal study long term plans for both the East and West Side Plants include enhanced nitrogen removal through the use of motor operated sluice gates at step feed points in the aeration basins. The installation of concrete baffles should be used to create an anoxic zone at the head of each pass of the basins with a top mounted mixer for each anoxic zone. In addition, new mixed liquor suspended solids (MLSS) recycle pumps are to be installed. Monitoring and control equipment for the aeration system, blowers, and sluice gates are recommended.

11. By virtue of the above, the Municipality is maintaining facilities or conditions that can reasonably be expected to create a source of pollution to the waters of the state.

B. The Commissioner, acting under §22a-6§22a-424, §22a-425, §22a-427, §22a-428, §22a-430, and §22a-431 of the Connecticut General Statutes, orders the Municipality as follows:

1. a. On or before August 31, 2019, the Municipality shall retain one or more qualified consultants acceptable to the Commissioner until this order is fully complied with, and, within ten days after retaining any consultant other than the one identified in this paragraph, the Municipality shall notify the Commissioner in writing of the identity of such other consultant. The consultant(s) retained shall be a qualified professional engineer licensed to practice in Connecticut and shall be acceptable to the Commissioner. The Municipality shall submit to the Commissioner a description of a consultant's education, experience and training which is relevant to the work required by this order within ten days after a request for such a description. Nothing in this paragraph shall preclude the Commissioner from finding a previously acceptable consultant unacceptable.

   b. On or before November 30, 2020, a Facilities Planning Report shall be submitted for the Commissioner's review and approval. The Facilities report shall contain an assessment of critical components at the treatment plants, and include recommendations including a schedule to complete suggested upgrades to the treatment plants. The Respondent shall incorporate recommendations from the reports referenced in paragraphs A.5 and A.6.

   c. On or before May 31, 2022, 100% design plans and specifications shall be submitted to the Commissioner for review and approval incorporating upgrades recommended by the Reports referenced in A.5 and A.6.

   d. The Municipality shall begin construction of the approved remedial actions in accordance with the approved schedule, but in no event shall the approved remedial actions be begun later than 1644 calendar days from the effective date of this Order.

   e. The Municipality shall complete construction of the approved remedial actions in accordance with the approved schedule, but in no event shall the approved remedial actions be completed later than 2739 calendar days after the effective date of this Order. Within fifteen days after completing such actions, the Municipality shall certify to the Commissioner in writing that the actions have been completed as approved.

2. Progress reports: On or before the last day of June, and December of each year after issuance of this order, and continuing until all actions required by this order have been completed as approved and to the Commissioner's satisfaction, the Municipality shall submit a progress report to the Commissioner describing the actions which Municipality has taken to date to comply with this order.

3. Full compliance. The Municipality shall not be considered in full compliance with this order until all actions required by this order have been completed as approved and to the Commissioner's satisfaction.

4. Approvals. The Respondent shall use best efforts to submit to the Commissioner all documents required by this order in a complete and approvable form. If the Commissioner notifies Respondent that any document or other action is deficient, and does not approve it with conditions or modifications, it is deemed disapproved, and the Respondent shall correct the deficiencies and resubmit it within the time specified by the Commissioner or, if no time is specified by the Commissioner, within 30 days of the Commissioner's notice of deficiencies. In approving any document or other action under this order, the Commissioner may approve the document or other action as submitted or performed or with such conditions or modifications as the Commissioner deems necessary to carry out the purposes of this order. Nothing in this paragraph shall excuse noncompliance or delay.

5. Definitions. As used in this order, "Commissioner" means the Commissioner or a representative of the Commissioner.

6. Dates. The date of "issuance" of this order is the date the order is deposited in the U.S. mail or personally delivered, whichever is earlier. The date of submission to the Commissioner of any document required by this order shall be the date such document is received by the Commissioner. The date of any notice by the Commissioner under this order, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is deposited in the U.S. mail or is personally delivered, whichever is earlier. Except as otherwise specified in this order, the word "day" as used in this order means calendar day. Any document or action which is required by this order to be submitted or performed by a date which falls on a Saturday, Sunday or a Connecticut or federal holiday shall be submitted or performed by the next day which is not a Saturday, Sunday or Connecticut or federal holiday.

7. Certification of documents. Any document, including but not limited to any notice, which is required to be submitted to the Commissioner under this order shall be signed by a principal executive officer or ranking elected official or duly authorized representative of such person, as those terms are defined in §22a-430-3(b)(2) of the Regulations of Connecticut State Agencies, and by the individual(s) responsible for actually preparing such document, and each such individual shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, that the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under §53a-157b of the Connecticut General Statutes and any other applicable law."

8. Noncompliance. This order is a final order of the Commissioner with respect to the matters addressed herein, and is nonappealable and immediately enforceable. Failure to comply with this order may subject the Respondent to an injunction and penalties under Chapters 439, and 445 or 446k of the Connecticut General Statutes.

9. False statements. Any false statement in any information submitted pursuant to this order may be punishable as a criminal offense under §22a-438 or 22a-131a of the Connecticut General Statutes or, in accordance with §22a-6, under Section 53a-157 of the Connecticut General Statutes and any other applicable law.

10. Notice of transfer; liability of the Respondent and others. Until the Respondent has fully complied with this order, the Respondent shall notify the Commissioner in writing no later than 15 days after transferring all or any portion of the facility, the operations, the site or the business which is the subject of this order or after obtaining a new mailing or location address. The Respondent's obligations under this order shall not be affected by the passage of title to any property to any other person or Respondent.

11. Commissioner's powers. Nothing in this order shall affect the Commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for past, present, or future violations of law, including but not limited to violations of any permit issued by the Commissioner. If at any time the Commissioner determines that the actions taken by the Respondent pursuant to this order have not successfully corrected all violations, fully characterized the extent or degree of any pollution, or successfully abated or prevented pollution, the Commissioner may institute any proceeding to require Respondent to undertake further investigation or further action to prevent or abate violations or pollution.

12. The Respondent's obligations under law. Nothing in this order shall relieve Respondent of other obligations under applicable federal, state and local law.

13. No assurance by Commissioner. No provision of this order and no action or inaction by the Commissioner shall be construed to constitute an assurance by the Commissioner that the actions taken by Respondent pursuant to this order will result in compliance or prevent or abate pollution.

14. Access to site. Any representative of the Department of Energy and Environmental Protection may enter any sewage facility without prior notice for the purposes of monitoring and enforcing the actions required or allowed by this order.

15. No effect on rights of other persons. This order neither creates nor affects any rights of persons or municipalities that are not parties to this order.

16. Notice to Commissioner of changes. Within 15 days of the date Respondent becomes aware of a change in any information submitted to the Commissioner under this order,

or that any such information was inaccurate or misleading or that any relevant information was omitted, Respondent shall submit the correct or omitted information to the Commissioner.

17. Notification of noncompliance. In the event that Respondent becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this order or of any document required hereunder, Respondent shall immediately notify by telephone the individual identified in the next paragraph and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. Within five (5) days of the initial notice, Respondent shall submit in writing the date, time, and duration of the noncompliance and the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and Respondent shall comply with any dates which may be approved in writing by the Commissioner. Notification by Respondent shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.

18. Submission of documents. Any document required to be submitted to the Commissioner under this order shall, unless otherwise specified in this order or in writing by the Commissioner, be submitted in an electronic format to:

Catharine Chu, Sanitary Engineer 2
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning & Management Division
79 Elm Street
Hartford, Connecticut 06106-5127
E-mail: catharine.chu@ct.gov

Issued as a final order of the Commissioner of Energy and Environmental Protection.

Katharine S. Dykes
~~Acting~~ Commissioner

Date 3/1/19

AOWRMU19001

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

March 1, 2019

Mayor Joseph P. Ganim,
City of Bridgeport
999 Broad Street
Bridgeport, CT 06604

Re: Administrative Order #WRMU19001

Honorable Mayor Ganim:

In line with recent discussions with City of Bridgeport staff, please find attached one original of Administrative Order #WRMU19001 for your use to finalize this enforcement action.

The Department of Energy and Environmental Protection ("DEEP") appreciates your cooperation in settling this matter.

If you have any questions, please contact Catharine Chu at (860) 424-3342 or catharine.chu@ct.gov.

Sincerely,

for Denise Ruzicka
Director
Water Planning and Management Division
Bureau of Water Protection and Land Reuse

E-Copies w/Attachment: Lauren Mappa, General Manager
Katharine S. Dykes, DEEP Commissioner
Betsey Wingfield, WPLR Bureau Chief

Attachment: Administrative Order #WRMU19001

Appendix B

NPDES Permits

CDM Smith

NPDES Permit No. CT0100056 – West Side WWTP

Connecticut Department of
ENERGY & ENVIRONMENTAL PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

NPDES PERMIT

issued to

Permittee:
City of Bridgeport
999 Broad Street
Bridgeport, Connecticut 06604

Location Address:
Bridgeport West Side WPCF
205 Bostwick Avenue
Bridgeport, Connecticut 06607

Permit ID: CT0100056 **Design Flow Rate:** 30MGD

Effective Date: 07/01/2019

Receiving Stream: Long Island Sound / Cedar Creek

Permit Expires: 06/30/2024

SECTION 1: GENERAL PROVISIONS

(A) This permit is reissued in accordance with Section 22a-430 of Chapter 446k, Connecticut General Statutes ("CGS"), and Regulations of Connecticut State Agencies ("RCSA") adopted thereunder, as amended, and Section 402(b) of the Clean Water Act, as amended, 33 USC 1251, et. seq., and pursuant to an approval dated September 26, 1973, by the Administrator of the United States Environmental Protection Agency for the State of Connecticut to administer a N.P.D.E.S. permit program.

(B) The City of Bridgeport, ("Permittee"), shall comply with all conditions of this permit including the following sections of the RCSA which have been adopted pursuant to Section 22a-430 of the CGS and are hereby incorporated into this permit. **Your attention is especially drawn to the notification requirements of subsection (i)(2), (i)(3), (j)(1), (j)(6), (j)(8), (j)(9)(C), (j)(10)(C), (j)(11)(C), (D), (E), and (F), (k)(3) and (4) and (l)(2) of Section 22a-430-3.** To the extent this permit imposes conditions more stringent than those found in the regulations, this permit shall apply.

Section 22a-430-3 General Conditions
- **(a)** Definitions
- **(b)** General
- **(c)** Inspection and Entry
- **(d)** Effect of a Permit
- **(e)** Duty to Comply
- **(f)** Proper Operation and Maintenance
- **(g)** Sludge Disposal
- **(h)** Duty to Mitigate
- **(i)** Facility Modifications; Notification
- **(j)** Monitoring, Records and Reporting Requirements
- **(k)** Bypass
- **(l)** Conditions Applicable to POTWs
- **(m)** Effluent Limitation Violations
- **(n)** Enforcement
- **(o)** Resource Conservation
- **(p)** Spill Prevention and Control
- **(q)** Instrumentation, Alarms, Flow Recorders
- **(r)** Equalization

Section 22a-430-4 Procedures and Criteria
- **(a)** Duty to Apply
- **(b)** Duty to Reapply
- **(c)** Application Requirements
- **(d)** Preliminary Review
- **(e)** Tentative Determination
- **(f)** Draft Permits, Fact Sheets

(g) Public Notice, Notice of Hearing
(h) Public Comments
(i) Final Determination
(j) Public Hearings
(k) Submission of Plans and Specifications. Approval.
(l) Establishing Effluent Limitations and Conditions
(m) Case-by-Case Determinations
(n) Permit Issuance or Renewal
(o) Permit or Application Transfer
(p) Permit Revocation, Denial or Modification
(q) Variances
(r) Secondary Treatment Requirements
(s) Treatment Requirements
(t) Discharges to POTWs - Prohibitions

(C) Violations of any of the terms, conditions, or limitations contained in this permit may subject the Permittee to enforcement action including, but not limited to, seeking penalties, injunctions and/or forfeitures pursuant to applicable sections of the CGS and RCSA.

(D) Any false statement in any information submitted pursuant to this Section of the permit may be punishable as a criminal offense under Section 22a-438 or 22a-131a of the CGS or in accordance with Section 22a-6, under Section 53a-157b of the CGS.

(E) The Permittee shall comply with Section 22a-416-1 through Section 22a-416-10 of the RCSA concerning operator certification.

(F) No provision of this permit and no action or inaction by the Commissioner shall be construed to constitute an assurance by the Commissioner that the actions taken by the Permittee pursuant to this permit will result in compliance or prevent or abate pollution.

(G) Nothing in this permit shall relieve the Permittee of other obligations under applicable federal, state and local law.

(H) An annual fee shall be paid for each year this permit is in effect as set forth in Section 22a-430-7 of the RCSA. As of October 1, 2009 the annual fee is $3,320.00

(I) The Permittee shall discharge so as not to violate the Interstate Environmental Commission (IEC) Water Quality Regulations promulgated pursuant to the authority conferred upon the IEC by the Tri-State Compact (CGS 22a-294 et seq.) as defined in Attachment 1 Table A.

(J) This permitted discharge is consistent with the applicable goals and policies of the Connecticut Coastal Management Act (Section 22a-92 of the CGS).

SECTION 2: DEFINITIONS

(A) The definitions of the terms used in this permit shall be the same as the definitions contained in Section 22a-423 of the CGS and Section 22a-430-3(a) and 22a-430-6 of the RCSA, except for "Composite" and "No Observable Acute Effect Level (NOAEL)" which are redefined below.

(B) In addition to the above, the following definitions shall apply to this permit:

"------" in the limits column on the monitoring tables in Attachment 1 means a limit is not specified but a value must be reported on the DMR, MOR, and/or the ATMR.

"Annual" in the context of any sampling frequency, shall mean the sample must be collected in the month of June except in the case of Chronic Toxicity when the samples must be collected in the months of July, August or September.

"Average Monthly Limit" means the maximum allowable "Average Monthly Concentration" as defined in Section 22a-430-3(a) of the RCSA when expressed as a concentration (e.g. mg/l); otherwise, it means "Average Monthly Discharge Limitation" as defined in Section 22a-430-3(a) of the RCSA.

"Bi-Monthly" in the context of any sampling frequency, shall mean once every two months including the months of January, March, May, July, September and November.

"Bi-Weekly" in the context of any sampling frequency, shall mean once every two weeks.

"Composite" or **"(C)"** means a sample consisting of a minimum of eight aliquot samples collected at equal intervals of no less than 30 minutes and no more than 60 minutes and combined proportionally to flow over the sampling period provided that during the sampling period the peak hourly flow is experienced.

"Critical Test Concentration" or **"(CTC)"** means the specified effluent dilution at which the Permittee is to conduct a single-concentration Aquatic Toxicity Test.

"Daily Composite" or **"(DC)"** means a composite sample taken over a full operating day consisting of grab samples collected at equal intervals of no more than sixty (60) minutes and combined proportionally to flow; or, a composite sample continuously collected over a full operating day proportionally to flow.

"Daily Concentration" means the concentration of a substance as measured in a daily composite sample, or, arithmetic average of all grab sample results defining a grab sample average.

"Daily Quantity" means the quantity of waste discharged during an operating day.

"Geometric Mean" is the "n"th root of the product of "n" observations.

"Infiltration" means water other than wastewater that enters a sewer system (including sewer system and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow.

"Inflow" means water other than wastewater that enters a sewer system (including sewer service connections) from sources such as, but not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.

"Instantaneous Limit" means the highest allowable concentration of a substance as measured by a grab sample, or the highest allowable measurement of a parameter as obtained through instantaneous monitoring.

"In-stream Waste Concentration" or **"(IWC)"** means the concentration of a discharge in the receiving water after mixing has occurred in the allocated zone of influence.

"MGD" means million gallons per day.

"Maximum Daily Limit" means the maximum allowable "Daily Concentration" (defined above) when expressed as a concentration (e.g. mg/l), otherwise, it means the maximum allowable "Daily Quantity" as defined above, unless it is expressed as a flow quantity. If expressed as a flow quantity it means "Maximum Daily Flow" as defined in Section 22a-430-3(a) of the RCSA.

"Monthly Minimum Removal Efficiency" means the minimum reduction in the pollutant parameter specified when the effluent average monthly concentration for that parameter is compared to the influent average monthly concentration.

"NA" as a Monitoring Table abbreviation means "not applicable".

"NR" as a Monitoring Table abbreviation means "not required".

"No Observable Acute Effect Level" or **"(NOAEL)"** means any concentration equal to or less than the critical test concentration in a single concentration (pass/fail) toxicity test, conducted pursuant to Section 22a-430-3(j)(7)(A)(i) of the RCSA, demonstrating 90% or greater survival of test organisms at the CTC.

"Quarterly" in the context of any sampling frequency, shall mean sampling is required in the months of March, June, September and December.

"Range During Sampling" or **"(RDS)"** as a sample type means the maximum and minimum of all values recorded as a result of analyzing each grab sample of; 1) a Composite Sample, or, 2) a Grab Sample Average. For those Permittee with pH meters that provide continuous monitoring and recording, Range During Sampling means the maximum and minimum readings recorded with the continuous monitoring device during the Composite or Grab Sample Average sample collection.

"Range During Month" or **"(RDM)"** as a sample type means the lowest and the highest values of all of the monitoring data for the reporting month.

"Sanitary Sewage" means wastewaters from residential, commercial and industrial sources introduced by direct connection to the sewerage collection system tributary to the treatment works including non-excessive inflow/infiltration sources.

"Twice per Month" in the context of any sampling frequency, mean two samples per calendar month collected no less than 12 days apart.

"ug/l" means micrograms per liter

"Work Day" in the context of a sampling frequency means, Monday through Friday excluding holidays.

SECTION 3: COMMISSIONER'S DECISION

(A) The Commissioner of Energy and Environmental Protection ("Commissioner") has issued a final decision and found continuance of the existing system to treat the discharge will protect the waters of the state from pollution. The Commissioner's decision is based on application #201710275 for permit reissuance received on November 27, 2017 and the administrative record established in the processing of that application.

(B) The Commissioner hereby authorizes the Permittee to discharge in accordance with the provisions of this permit, the above referenced application, and all approvals issued by the Commissioner or his authorized agent for the discharges and/or activities authorized by, or associated with, this permit.

(C) The Commissioner reserves the right to make appropriate revisions to the permit, if required after Public Notice, in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the Federal Clean Water Act or the CGS or regulations adopted thereunder, as amended. The permit as modified or renewed under this paragraph may also contain any other requirements of the Federal Clean Water Act or CGS or regulations adopted thereunder which are then applicable.

SECTION 4: GENERAL LIMITATIONS AND OTHER CONDITIONS

(A) The Permittee shall not accept any new sources of non-domestic wastewater conveyed to its POTW through its sanitary sewerage system or by any means other than its sanitary sewage system unless the generator of such wastewater; (a) is authorized by a permit issued by the Commissioner under Section 22a-430 CGS (individual permit), or, (b) is authorized under Section 22a-430b (general permit), or, (c) has been issued an emergency or temporary authorization by the Commissioner under Section 22a-6k. All such non-domestic wastewaters shall be processed by the POTW via receiving facilities at a location and in a manner prescribed by the Permittee which are designed to contain and control any unplanned releases.

(B) No new discharge of domestic sewage from a single source to the POTW in excess of 50,000 gallons per day shall be allowed by the Permittee until the Permittee has notified in writing the Connecticut Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater Section, 79 Elm Street, Hartford, CT 06106-5127 of said new discharge.

(C) The Permittee shall maintain a system of user charges based on actual use sufficient to operate and maintain the POTW (including the collection system) and replace critical components.

(D) The Permittee shall maintain a sewer use ordinance that is consistent with the Model Sewer Ordinance for Connecticut Municipalities prepared by the Department of Energy and Environmental Protection. The Commissioner of Energy and Environmental Protection alone may authorize certain discharges which may not conform to the Model Sewer Ordinance.

(E) No sludge deposits-solid refuse-floating solids oils and grease-scum except for small amounts that may result from the discharge from a grease waste treatment facility providing appropriate treatment and none exceeding levels necessary to protect and maintain all designated uses.

(F) No color resulting in obvious discoloration of the surface water outside of any designated zone of influence.

(G) No suspended and settleable solids in concentrations or combinations which would impair the designated uses; none aesthetically objectionable; none which would significantly alter the physical or chemical composition of bottom sediments; none which would adversely impact organisms living in or on the bottom sediment.

(H) No silt or sand deposits other than of natural origin except as may result from normal road maintenance and construction activity provided all reasonable controls or Best Management Practices are used in such activities and all designated uses are protected and maintained.

(I) No turbidity other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity, or discharge from a waste treatment facility providing appropriate treatment, dredging activity or discharge of dredged or fill materials provided all reasonable controls and Best Management Practices are used to control turbidity and none exceeding levels necessary to protect and maintain all designated uses.

(J) Taste and odor as naturally occurs and none that would impair any uses specifically assigned to this Class.

(K) No discharge from the permitted facility shall cause acute or chronic toxicity in the receiving water body beyond any Zone Of Influence (ZOI) specifically allocated to that discharge in this permit.

(L) The Permittee shall maintain an alternate power source adequate to provide full operation of all pump stations in the sewerage collection system and to provide a minimum of primary treatment and disinfection at the water pollution control facility to insure that no discharge of untreated wastewater will occur during a failure of a primary power source.

(M) The average monthly effluent concentration shall not exceed 15% of the average monthly influent concentration for BOD_5 and Total Suspended Solids for all daily composite samples taken in any calendar month.

(N) Any new or increased amount of sanitary sewage discharge to the sewer system is prohibited where it will cause a dry weather overflow or exacerbate an existing dry weather overflow.

(O) Sludge Conditions

(1) The Permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices, including but not limited to 40 CFR Part 503.

(2) If an applicable management practice or numerical limitation for pollutants in sewage sludge more stringent than existing federal and state regulations is promulgated under Section 405(d) of the Clean Water Act (CWA), this permit shall be modified or revoked and reissued to conform to the promulgated regulations.

(3) The Permittee shall give prior notice to the Commissioner of any change(s) planned in the Permittee' sludge use or disposal practice. A change in the Permittee' sludge use or disposal practice may be a cause for modification of the permit.

(4) Testing for inorganic pollutants shall follow "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846 as updated and/or revised.

(P) This permit becomes effective on the 1st day of the month following the date of signature of the Commissioner or designee.

(Q) When the arithmetic mean of the average daily flow from the POTW for the previous 180 days exceeds 90% of the design flow rate, the Permittee shall develop and submit within one year, for the review and approval of the Commissioner, a plan to accommodate future increases in flow to the plant. This plan shall include a schedule for completing any recommended improvements and a plan for financing the improvements.

(R) When the arithmetic mean of the average daily BOD_5 or TSS loading into the POTW for the previous 180 days exceeds 90% of the design load rate, the Permittee shall develop and submit for the review and approval of the Commissioner within one year, a plan to accommodate future increases in load to the plant. This plan shall include a schedule for completing any recommended improvements and a plan for financing the improvements.

(S) On or before July 31st of each calendar year the main flow meter shall be calibrated by an independent contractor in accordance with the manufacturer's specifications. The actual record of the calibration shall be retained onsite and, upon request, the Permittee shall submit to the Commissioner a copy of that record.

(T) The Permittee shall operate and maintain all processes as installed in accordance with the approved plans and specifications and as outlined in the associated operation and maintenance manual. This includes but is not limited to all preliminary treatment processes, primary treatment processes, recycle pumping processes, anaerobic treatment processes, anoxic treatment processes, aerobic treatment processes, flocculation processes, effluent filtration processes or any other processes necessary for the optimal removal of pollutants. The Permittee shall not bypass or fail to operate any of the aforementioned processes without the written approval of the Commissioner.

(U) The Permittee is hereby authorized to accept septage at the treatment facility or other locations as approved by the Commissioner.

(V) The temperature of any discharge shall not increase the temperature of the receiving stream above 83°F, or, in any case, raise the temperature of the receiving stream by more than 4°F beyond the permitted zone of influence. The incremental temperature increase in coastal and marine waters is limited to 1.5°F during the period including July, August and September.

SECTION 5: SPECIFIC EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

(A) The discharge(s) shall not exceed and shall otherwise conform to the specific terms and conditions listed in this permit. The discharge is restricted by, and shall be monitored in accordance with Tables **A** through **G** incorporated in this permit as Attachment 1.

(B) The Permittee shall monitor the performance of the treatment process in accordance with the Monthly Operating Report (MOR) incorporated in this permit as Attachment 2.

SECTION 6: SAMPLE COLLECTION, HANDLING and ANALYTICAL TECHNIQUES

(A) Chemical Analysis

(1) Chemical analyses to determine compliance with effluent limits and conditions established in this permit shall be performed using the methods approved pursuant to the Code of Federal Regulations, Part 136 of Title 40 (40 CFR 136) unless an alternative method has been approved in writing pursuant to 40 CFR 136.4 or as provided in Section 22a-430-3-(j)(7) of the RCSA. Chemicals which do not have methods of analysis defined in 40 CFR 136 or the RCSA shall be analyzed in accordance with methods specified in this permit.

(2) All metals analyses identified in this permit shall refer to analyses for Total Recoverable Metal, as defined in 40 CFR 136 unless otherwise specified.

(3) Grab samples shall be taken during the period of the day when the peak hourly flow is normally experienced.

(4) Samples collected for bacteriological examination shall be collected between the hours of 11 a.m. and 3 p.m. or at that time of day when the peak hourly flow is normally experienced. A chlorine residual sample must be taken at the same time and the results recorded.

(5) The Minimum Levels specified below represent the concentrations at which quantification must be achieved and verified during the chemical analyses for the parameters identified in Attachment 1, Tables A and C. Analyses for these parameters must include check standards within ten percent of the specified Minimum Level or calibration points equal to or less than the specified Minimum Level.

Parameter	Minimum Level
Aluminum	0.050 mg/l
Antimony, Total	0.010 mg/l
Arsenic, Total	0.005 mg/l
Beryllium, Total	0.001 mg/l
Cadmium, Total	0.0005 mg/l
Chlorine, Total Residual	0.050 mg/l
Chromium, Total	0.005 mg/l
Chromium, Total Hexavalent	0.010 mg/l
Copper, Total	0.005 mg/l
Cyanide, Total	0.010 mg/l
Iron, Total	0.040 mg/l
Lead, Total	0.005 mg/l
Mercury, Total	0.0002 mg/l
Nickel, Total	0.005 mg/l
Phosphorus, Total	0.10 mg/l
Selenium, Total	0.005 mg/l
Silver, Total	0.002 mg/l
Thallium, Total	0.005 mg/l
Zinc, Total	0.020 mg/l

(6) The value of each parameter for which monitoring is required under this permit shall be reported to the maximum level of accuracy and precision possible consistent with the requirements of this Section of the permit.

(7) Effluent analyses for which quantification was verified during the analysis at or below the minimum levels specified in this Section and which indicate that a parameter was not detected shall be reported as "less than x" where 'x' is the numerical value equivalent to the analytical method detection limit for that analysis.

(8) Results of effluent analyses which indicate that a parameter was not present at a concentration greater than or equal to the Minimum Level specified for that analysis shall be considered equivalent to zero (0.0) for purposes of determining compliance with effluent limitations or conditions specified in this permit.

(B) Acute Aquatic Toxicity Test

(1) Samples for monitoring of Acute Aquatic Toxicity shall be collected and handled as prescribed in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA-821-R-02-012).

(a) Composite samples shall be chilled as they are collected. Grab samples shall be chilled immediately following collection. Samples shall be held at 0 - 6°C until Acute Aquatic Toxicity testing is initiated.

(b) Effluent samples shall not be dechlorinated, filtered, or, modified in any way, prior to testing for Acute Aquatic Toxicity unless specifically approved in writing by the Commissioner for monitoring at this facility. Facilities with effluent dechlorination and/or filtration designed as part of the treatment process are not required to obtain approval from the Commissioner.

(c) Samples shall be taken after dechlorination for Acute Aquatic Toxicity unless otherwise approved in writing by the Commissioner for monitoring at this facility.

(d) Chemical analyses of the parameters identified in Attachment 1, Table C shall be conducted on an aliquot of the same sample tested for Acute Aquatic Toxicity.

(i) At a minimum, pH, salinity, total alkalinity, total hardness, and total residual chlorine shall be measured in the effluent sample and, during Acute Aquatic Toxicity tests, in the highest concentration of the test and in the dilution (control) water at the beginning of the test and at test termination. If total residual chlorine is not detected at test initiation, it does not need to be measured at test termination. Dissolved oxygen, pH, and temperature shall be measured in the control and all test concentrations at the beginning of the test, daily thereafter, and at test termination. Salinity shall be measured in each test concentration at the beginning of the test and at test termination.

(e) Tests for Acute Aquatic Toxicity shall be initiated within 36 hours of sample collection.

(2) Monitoring for Acute Aquatic Toxicity to determine compliance with the permit condition on Acute Aquatic Toxicity (invertebrate) shall be conducted for 48 hours utilizing neonatal (less than 24 hours old) *Daphnia pulex*.

(3) Monitoring for Acute Aquatic Toxicity to determine compliance with the permit condition on Acute Aquatic Toxicity (vertebrate) shall be conducted for 48 hours utilizing larval (1 to 14-day old with no more than 24 hours range in age) *Pimephales promelas*.

(4) Tests for Acute Aquatic Toxicity shall be conducted as prescribed for static non-renewal acute tests in "Methods for measuring the Acute Aquatic Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA/821-R-02-012), except as specified below.

(a) For Acute Aquatic Toxicity limits, and for monitoring only conditions, expressed as a NOAEL value, Pass/Fail (single concentration) tests shall be conducted at a specified Critical Test Concentration (CTC) equal to the Aquatic Toxicity limit, (100% in the case of monitoring only conditions), as prescribed in Section 22a-430-3(j)(7)(A)(i) of the RCSA.

(b) Organisms shall not be fed during the tests.

(c) Synthetic freshwater prepared with deionized water adjusted to a hardness of 50±5 mg/L as $CaCO_3$ shall be used as dilution water in the tests.

(d) Copper nitrate shall be used as the reference toxicant.

(5) For monitoring only conditions, toxicity shall be demonstrated when the results of a valid pass/fail Acute Aquatic Toxicity indicates less than 90% survival in the effluent at the CTC (100%).

(C) Chronic Aquatic Toxicity Test for Estuarine or Marine Discharges

(1) Chronic Aquatic Toxicity testing of the discharge shall be conducted annually during July, August, or September of each year.

(2) Chronic Aquatic Toxicity testing shall be performed on the discharge in accordance with the test methodology established in "Short-Term Methods for Estimating The Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms" (EPA-821-R-02-014) as referenced in 40 CFR 136 for sheepshead minnow, *Cyprinodon variegates,* survival and growth and mysid, *Mysidopsis bahia,* survival, growth and reproduction.

(a) Chronic Aquatic Toxicity tests shall utilize a minimum of five effluent dilutions prepared using a dilution factor of 0.5 (100% effluent, 50% effluent, 25% effluent, 12.5% effluent, 6.25% effluent).

(b) Cedar Creek water collected immediately upstream of the area influenced by the discharge (with the outgoing tide) shall be used as control (0% effluent) and dilution water in the toxicity tests.

(c) A laboratory water control consisting of synthetic seawater prepared in accordance with EPA-821-R-02-014 shall be used as an additional control (0% effluent) in the toxicity tests.

(d) Daily composite samples of the discharge (final effluent following disinfection) and grab samples of the Cedar Creek, for use as site water control and dilution water, shall be collected on day 0 for test solution renewal on day 1 and day 2 of the test; day 2, for test solution renewal on day 3 and day 4 of the test; and day 4, for test solution renewal for the remainder of the test. Samples shall not be pH or hardness adjusted, or chemically altered in any way.

(3) All samples of the discharge and Cedar Creek water used in the Chronic Aquatic Toxicity test shall, at a minimum, be analyzed and results reported in accordance with the provisions listed in Section 6(A) of this permit for the parameters listed in Attachment 1, Table C included herein, excluding Acute Aquatic Toxicity organism testing.

SECTION 7: RECORDING AND REPORTING REQUIREMENTS

(A) The Permittee and/or the Signatory Authority shall continue to report the results of chemical analyses and any aquatic toxicity test required above in Section 5 and the referenced Attachment 1 by electronic submission of DMRs under this permit to the Department using NetDMR in satisfaction of the DMR submission requirement of this permit. The report shall include a detailed explanation of any violations of the limitations specified. DMRs shall be submitted electronically to the Department no later than the 15th day of the month following the month in which samples are collected.

(1) For composite samples, from other than automatic samplers, the instantaneous flow and the time of each aliquot sample collection shall be recorded and maintained at the POTW.

(B) Complete and accurate test data, including percent survival of test organisms in each replicate test chamber, LC_{50} values and 95% confidence intervals for definitive test protocols, and all supporting chemical/physical measurements performed in association with any aquatic toxicity test, shall be entered on the Aquatic Toxicity Monitoring Report form (ATMR) and sent to the Bureau of Water Protection and Land Reuse at the address specified below by the 15th day of the month following the month in which samples are collected:

ATTN: Municipal Wastewater Monitoring Coordinator
Connecticut Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning and Management Division
79 Elm Street
Hartford, Connecticut 06106-5127

(C) The results of the process monitoring required above in Section 5 shall be entered on the Monthly Operating Report (MOR) form, included herein as Attachment 2, and reported to the Bureau of Water Protection and Land Reuse. The MOR report shall also be accompanied by a detailed explanation of any violations of the limitations specified. The MOR must be received at the address specified above in Section 7 (B) of this permit by the 15th day of the month following the month in which the data and samples are collected.

(D) A complete and thorough report of the results of the chronic toxicity monitoring outlined in Section 6(C) shall be prepared as outlined in Section 10 of EPA-821-R-02-014 and submitted to the Department for review on or before December 31 of each calendar year to the address specified above in Section 7 (B) of this permit.

SECTION 8: RECORDING AND REPORTING OF VIOLATIONS, ADDITIONAL TESTING REQUIREMENTS, BYPASSES, MECHANICAL FAILURES, AND MONITORING EQUIPMENT FAILURES

(A) If any Acute Aquatic Toxicity sample analysis indicates toxicity, or that the test was invalid, an additional sample of the effluent shall be collected and tested for Acute Aquatic Toxicity and associated chemical parameters, as described above in Section 5 and Section 6, and the results reported to the Bureau of Water Protection and Land Reuse (Attn: Aquatic Toxicity) via the ATMR form (see Section 7 (B)) within 30 days of the previous test. These test results shall also be reported on the next month's DMR report pursuant to Section 7 (A). The results of all toxicity tests and associated chemical parameters, valid and invalid, shall be reported.

(B) If any two consecutive Acute Aquatic Toxicity test results or any three Acute Aquatic Toxicity test results in a twelve month period indicates toxicity, the Permittee shall immediately take all reasonable steps to eliminate toxicity wherever possible and shall submit a report, to the

Bureau of Water Protection and Land Reuse (Attn:.Aquatic Toxicity), for the review and written approval of the Commissioner in accordance with Section 22a-430-3(j)(10)(c) of the RCSA describing proposed steps to eliminate the toxic impact of the discharge on the receiving water body. Such a report shall include a proposed time schedule to accomplish toxicity reduction and the Permittee shall comply with any schedule approved by the Commissioner.

(C) Sewage Right-to-Know Electronic Bypass Reporting

(1) Section 22a-430-3(k) of the RCSA shall apply in all instances of bypass including a bypass of the treatment plant or a component of the sewage collection system planned during required maintenance. The Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater, the Department of Public Health, Water Supply Section and Recreation Section, and the local Director of Health shall be notified within 2 hours of the Permittee learning of the event via online reporting in a format approved by the Commissioner. A final incident report shall be submitted to the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater within five days of the Permittee learning of each occurrence of a discharge or bypass of untreated or partially treated sewage via online reporting in a format approved by the Commissioner.

If the online reporting system is nonfunctional, then the Permittee shall notify DEEP via telephone during normal business hours (8:00 a.m. to 4:30 p.m. Monday through Friday) at (860) 424-3704 or after hours to the DEEP Emergency Response Unit at (860) 424-3338 and the Department of Public Health at (860) 509-8000 with the final incident report being submitted online.

(D) Section 22a-430-3(j) 11 (D) of the RCSA shall apply in the event of any noncompliance with a maximum daily limit and/or any noncompliance that is greater than two times any permit limit. The Permittee shall notify in the same manner as in paragraph C (1) of this Section, the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater Section except, if the online reporting system is nonfunctional and the noncompliance occurs outside normal working hours (8:30 a.m. to 4:30 p.m. Monday through Friday) the Permittee may wait to make the verbal report until 10:30 am of the next business day after learning of the noncompliance.

(E) Section 22a-430-3(j) 8 of the RCSA shall apply in all instances of monitoring equipment failures that prevent meeting the requirements in this permit. In the event of any such failure of the monitoring equipment including, but not limited to, loss of refrigeration for an auto-sampler or lab refrigerator or loss of flow proportion sampling ability, the Permittee shall notify in the same manner as in paragraph C (1) of this Section, the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater Section except, if the online reporting system is nonfunctional and the failure occurs outside normal working hours (8:30 a.m. to 4:30 p.m. Monday through Friday) the Permittee may wait to make the verbal report until 10:30 am of the next business day after learning of the failure.

(F) In addition to the reporting requirements contained in Section 22a-430-3(i), (j), and (k) of the Regulations of Connecticut State Agencies, the Permittee shall notify in the same manner as in paragraph C (1) of this Section, the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater concerning the failure of any major component of the treatment facilities which the Permittee may have reason to believe would result in an effluent violation.

SECTION 9: COMBINED SEWER OVERFLOWS

(A) The Permittee shall continue to maintain Best Management Practices (BMPs) to reduce the impact of existing CSO's on the receiving waters. Detailed records of BMP activities shall be kept.

(1) The Permittee has identified **Stephen Walker** as operations and maintenance manager to be in responsible charge of the wastewater collection system and serve as the contact person for department personnel regarding combined sewer discharges. Within ten days after retaining anyone other than the one originally identified, the Permittee shall notify the Commissioner in writing of the identity of such other operations and maintenance manager.

(2) The Permittee shall use, to the maximum extent practicable, available sewerage system transportation capabilities for the conveyance of combined sewage to treatment facilities.

(3) The Permittee is authorized to discharge combined sewage flows from combined sewer overflow outfalls listed in Attachment 3 in response to wet weather flow, i.e. rainfall or snowmelt conditions, when total available transportation, treatment and storage capabilities are exceeded. Dry weather overflows are prohibited. Any other discharge from the outfalls listed in Attachment 3 constitutes a bypass and is subject to the requirements of Section 8 of this permit.

(4) The locations of outfalls and regulators listed in Attachment 3 are taken from Department records. Any information on the locations of any outfalls and regulators in addition to or in conflict with the information in Attachment 3 shall be submitted to the Commissioner within 30 days of the effective date of this permit or the date the Permittee becomes aware of such information, whichever is earlier.

(5) When the WWTF influent flows exceed **58** MGD, in response to wet weather flow, i.e. rainfall or snowmelt conditions, the Permittee is authorized to discharge from outfall serial number 001-1 only those flows above **58** MGD, chlorine disinfected primary treated combined sewer wastewater.

(6) The discharge from CSO's, including outfall serial number 001-1, shall not contain septage or holding tank waste.

(7) Discharges from CSO's, including outfall serial number 001-1, shall not cause violations of State Water Quality Standards.

(8) Every calendar year, **on or before February 15th**, the Permittee shall submit a report on a form and in a manner prescribed by the Commissioner including the results of all monitoring from the previous calendar year for outfall serial number 001-1, and the following information:

(a) the date, time, and duration of each precipitation event;

(b) the date, time, duration, quality and volume for each discharge event for outfall serial number 001-1;

(9) On or before **December 31, 2019**, the Permittee shall submit an updated list of all historical CSO structures in the system that were sealed including name/designation, location, size of structure, their receiving waters, and date of sealing;

(10) The sewage system shall be inspected and maintained such that deposition of solids and/or other obstructions do not cause restrictions in flow resulting in unnecessary wet weather overflows and to ensure that dry weather discharges are not occurring.

(11) The Permittee shall reduce excessive infiltration/inflow to the sewer system.

(12) The Permittee shall review its existing Sewer Use Ordinance, to ensure the language required under Section 4 of this permit has been incorporated. A copy of ordinance shall be submitted to the Department for verification. If the ordinance is revised, a copy of the ordinance must be submitted to the Department within **60** days from the effective date of the change for verification, review and approval. The Sewer Use Ordinance shall:

(a) prohibit the construction of new combined sewers except in cases where repair or replacement of the existing system is approved in writing by the Commissioner, and

(b) prohibit the introduction of new inflow sources to the existing system.

(13) Monthly CSO inspection forms for all CSO structures/regulators, pumping stations and tidegates, which also verify the existence of identification signs for all combined sewer outfall structures as required by the Commissioner.

The signs shall be located at or near the combined sewer outfall structures so that they are easily readable by the public. These signs shall be a minimum of 12 x 18 inches in size, with white lettering against a green background, and shall contain the following information and image:

(PERMITTEE NAME)

WET WEATHER SEWAGE
DISCHARGE OUTFALL (discharge serial number)

Anyone observing a discharge from this outfall during dry weather conditions should call and report it to the Permittee at [______], and to the Department of Energy and Environmental Protection at (860) 424-3704 or 424-3338.

(B) In the event that the Permittee becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this Section of the permit or of any document required hereunder, the Permittee shall immediately notify the Commissioner and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. In so notifying the Commissioner, the Permittee shall state in writing the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and the Permittee shall comply with any dates which may be approved in writing by the Commissioner. Notification by the Permittee shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.

(C) Any document, other than a DMR, ATMR or MOR required to be submitted to the Commissioner under this Section of the permit shall, unless otherwise specified in writing by the Commissioner, be directed to:

CSO Coordinator
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning and Management Division
Municipal Wastewater
79 Elm Street
Hartford, Connecticut 06106-5127

(D) Right-to-know Untreated CSO Discharge Reporting

(1) Initial CSO Discharge Report

(a) The Permittee shall notify the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater (DEEP) **within 2 hours** of the Permittee learning of an untreated combined sewer overflow via the online reporting system in a format approved by the Commissioner. If the online reporting system is unavailable, then the Permittee shall notify DEEP and via telephone during normal business hours (8:30 a.m. to 4:30 p.m. Monday through Friday) at (860) 424-3704 or after hours to DEEP Emergency Response Unit at (860) 424-3338.

(b) The Permittee shall notify the Department of Agriculture/Aquaculture Division (DoAg) per their Memorandum of Understanding within 2 hours of the Permittee leaning of an untreated combined sewer overflow. DoAg's contact information is (203) 874-0696 during regular hours and (203) 874-0696 after hours.

(2) Follow-Up Untreated CSO Discharge Written Report

A final incident report shall be submitted to the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Water Planning and Management Division, Municipal Wastewater via the online reporting system in a format approved by the Commissioner **within five days** of the Permittee learning of each occurrence of a combined sewer overflow of untreated sewage.

SECTION 10: COMPLIANCE SCHEDULES

(A) CSO Monitoring Plan

Within **180 days** of the effective date of this permit, the Permittee shall submit to the Commissioner in writing an updated plan to strategically monitor combined sewer discharge(s) at all combined sewer outfalls within the permitted system with a schedule to implement the monitoring plan within one year of DEEP approval.

(B) Annual CSO Monitoring Report

After approval of a CSO Monitoring Plan, annually, on or before February 15th, the Permittee shall submit an Annual CSO Monitoring Report on a form and in a manner prescribed by the Commissioner, including the results of all monitoring from the previous calendar year for each combined sewer outfall.

The Annual CSO Monitoring Report shall include the following information:

(1) a list of open CSO structures in the system including name/designation, location, size of structure and their receiving waters;

(2) a list of CSO structures in the system that were sealed including name/designation, location, size of structure, their receiving waters, and the physical method used to seal that CSO which has been approved by the Commissioner;

(3) the date, time, and duration of each precipitation event;

(4) the date, time, duration, and estimation of volume for each discharge event for each CSO structure;

(5) monthly CSO inspection forms for all CSO structures/regulators, pumping stations and tidegates, which also verify the existence of identification signs for all combined sewer outfall structures as required by the Commissioner.

(6) a list of Best Management Practices (BMPs) that have been used to reduce the impact of existing CSO's on the receiving waters; and

(7) a summary of upcoming mitigation efforts for the next 5 years.

(C) The Permittee shall use best efforts to submit to the Commissioner all documents required by this Section of the permit in a complete and approvable form. If the Commissioner notified the Permittee that any document or other action is deficient, and does not approve it with conditions or modifications, it is deemed disapproved, and the Permittee shall correct the deficiencies and resubmit it within the time specified by the Commissioner or, if no time is specified by the Commissioner, within thirty days of the Commissioner's notice of deficiencies. In approving any document or other action under this Compliance Schedule, the Commissioner may approve the document or other action as submitted or performed or with such conditions or modifications as the Commissioner deems necessary to carry out the purposes of this Section of the permit. Nothing in this paragraph shall excuse noncompliance or delay.

(D) Dates. The date of submission to the Commissioner of any document required by this section of the permit shall be the date such document is received by the Commissioner. The date of any notice by the Commissioner under this section of the permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the Commissioner, whichever is earlier. Except as otherwise specified in this permit, the word "day" as used in this Section of the permit means calendar day. Any document or action which is required by this Section only of the permit, to be submitted, or performed, by a date which falls on, Saturday, Sunday, or, a Connecticut or federal holiday, shall be submitted or performed on or before the next day which is not a Saturday, Sunday, or Connecticut or federal holiday.

(E) Notification of noncompliance. In the event that the Permittee becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this Section of the permit or of any document required hereunder, the Permittee shall immediately notify the Commissioner and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. In so notifying the Commissioner, the Permittee shall state in writing the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and the Permittee shall comply with any dates which may be approved in writing by the Commissioner. Notification by the Permittee shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.

(F) Notice to Commissioner of changes. Within fifteen days of the date the Permittee becomes aware of a change in any information submitted to the Commissioner under this Section of the permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, the Permittee shall submit the correct or omitted information to the Commissioner.

(G) Submission of documents. Any document, other than a DMR, ATMR or MOR required to be submitted to the Commissioner under this Section of the permit shall, unless otherwise specified in writing by the Commissioner, be directed to:

Ann A. Straut, Sanitary Engineer 3
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning and Management Division
Municipal Wastewater Section
79 Elm Street
Hartford, Connecticut 06106-5127

This permit is hereby issued on 6/3/19

Brian Thompson
Acting Bureau Chief
Bureau of Water Protection and Land Reuse

ATTACHMENT 1

Tables A through G

TABLE A

Discharge Serial Number (DSN): **001-1**						Monitoring Location: **1**				
Wastewater Description: **Sanitary Sewage**										
Monitoring Location Description: **Final Effluent**										
Allocated Zone of Influence (ZOI): **4575 cfs**					In-stream Waste Concentration (IWC): **1% (allocated)**					
PARAMETER	**Units**	**FLOW/TIME BASED MONITORING**				**INSTANTANEOUS MONITORING**			**REPORT FORM**	**Minimum Level Analysis See Section 6**
		Average Monthly Limit	**Maximum Daily Limit**	**Sample Freq.**	**Sample type**	**Instantaneous Limit or Required Range[3]**	**Sample Freq.**	**Sample Type**		
Alkalinity	mg/l	NA	NA	NR	NA	------	Monthly	Grab	MOR	
Biochemical Oxygen Demand (5 day) [1,5] See remarks C and D	mg/l	30	50	3/week	Daily Composite	NA	NR	NA	DMR/MOR	
Chlorine, Total Residual [5]	mg/l	0.05[4]	0.10[4]	4/ Work Day	Grab	0.20	4/ Work Day	Grab	DMR/MOR	*
Copper, Total	kg/d	NA	------	Monthly	Daily Composite	NA	NA	NA	DMR/MOR	*
Fecal coliform [5]	Colonies per100 ml	NA	NA	NR	NA	see remark (A) below	3/week	Grab	DMR/MOR	
Fecal coliform [5]	Percent of samples exceeding 260 colonies per100 ml	NA	NA	NR	NA	≤10	3/week	Grab	DMR/MOR	
Enterococci [5] see remark B below	Colonies per100 ml	NA	NA	NR	NA	500	3/week	Grab	DMR/MOR	
Flow	MGD	------	------	Continuous[2]	Average Daily Flow	NA	NR	NA	DMR/MOR	
Lead, Total	kg/d	NA	------	Monthly	Daily Composite	NA	NA	NA	DMR/MOR	*
Nickel, Total	kg/d	NA	------	Monthly	Daily Composite	NA	NA	NA	DMR/MOR	*
Nitrogen, Ammonia (total as N)	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Nitrate (total as N)	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Nitrite (total as N)	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Total Kjeldahl	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Total	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Total	lbs/day	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	

Oxygen, Dissolved	mg/l	NA	NA	NR	NA	------	Work Day	Grab	MOR	
pH	S.U.	NA	NA	NR	NA	6 - 9	Work Day	Grab	DMR/MOR	
Phosphate, Ortho	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Phosphorus, Total	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	DMR/MOR	*
Silver, Total	kg/d	NA	------	Monthly	Daily Composite	NA	NA	NA	DMR/MOR	*
Solids, Settleable	ml/l	NA	NA	NR	NA	------	Work Day	Grab	MOR	
Solids, Total Suspended[1, 5] See remarks C and D	mg/l	30	50	3/week	Daily Composite	NA	NA	NA	DMR/MOR	
Temperature	°F	NA	NA	NR	NA	------	Work Day	Grab	MOR	
Turbidity	NTU	NA	NA	NR	NA	------	Work Day	Grab	MOR	

TABLE A – CONDITIONS

Footnotes:

[1] The discharge shall not exceed an average monthly 30 mg/l or a maximum daily 50 mg/l. The Maximum Daily Limit of 50.0 mg/l BOD_5 and 50.0 mg/l Total Suspended Solids are waived during periods when the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to exceed 58 MGD. The Permittee shall state on the monthly Discharge Monitoring Reports and MOR's when exceedance is due to storm induced flows.

[2] The Permittee shall record and report on the monthly operating report the minimum, maximum and total flow for each day of discharge and the average daily flow for each sampling month. The Permittee shall report, on the discharge monitoring report, the average daily flow and maximum daily flow for each sampling month.

[3] The instantaneous limits in this column are maximum limits.

[4] The Maximum Daily Concentration to be reported shall be determined by mathematically averaging the results of the four grab samples required above. The Average Monthly Concentration shall be determined by mathematically averaging the results of the Maximum Daily Concentrations required above.

[5] When the influent flows exceed 58 MGD due to storm events the Permittee may bypass secondary biological treatment only with those flows over 58 MGD. Those bypassed flows over 58 MGD shall be treated to a minimum of primary treatment and disinfection. In addition to Table A requirements, during bypass events these parameters shall be sampled daily during the event in accordance with Table A-I below.

Remarks:

(A) The geometric mean of the Fecal coliform bacteria values for the effluent samples collected in a period of a calendar month shall not exceed 88 per 100 milliliters.

(B) The geometric mean of the Enterococci bacteria values for the effluent samples collected in a period of a calendar month shall not exceed 35 per 100 milliliters.

(C) The Average Weekly discharge Limitation for BOD_5 and Total Suspended Solids shall be 1.5 times the Average Monthly Limit listed above.

(D) In addition to the discharge limits included herein, the following conditions shall apply with the exception of during bypass events due to storm-induced flows exceeding **58** MGD:

- **(i)** Biochemical Oxygen Demand shall not exceed 50 mg/l on a 6 consecutive hour average.
- **(ii)** Total Suspended Solids content shall not exceed 50 mg/l on a 6 consecutive hour average.
- **(iii)** Fecal Coliform content shall not exceed:
  - **(a)** 800 per 100 ml on a 6 consecutive hour geometric mean.
  - **(b)** No sample may contain more than 2,400 per 100 ml.

TABLE A-1

Discharge Serial Number: **001-1**				Monitoring Location: **8**		
Wastewater Description: **Final effluent during secondary treatment bypass events**						
Monitoring Location Description: **Final Effluent**						
PARAMETER	**Units**	**FLOW/TIME BASED MONITORING**		**INSTANTANEOUS MONITORING**		
		Sample Frequency	**Sample Type**	**Sample Frequency**	**Sample Type**	**Reporting form**
BOD (5 day)	mg/l	Daily/event[1,3]	Daily Composite	NA	NA	DMR/MOR
Chlorine Residual (TRC) (May 1st through Sept. 30th)	mg/l	NA	NA	Daily/event[1,3]	Grab	DMR/MOR
Event Duration	Days, hours, minutes	Continuous[2]	Time	NA	NA	DMR/MOR
Fecal Coliform	per 100 ml	NA	NA	Daily/event[1,3]	Grab	DMR/MOR
Enterococci	per 100 ml	NA	NA	Daily/event[1,3]	Grab	DMR/MOR
Flow	MGD	Continuous[2]	Daily Flow	NA	NA	DMR/MOR
Solids, Total Suspended	mg/l	Daily/event[1,3]	Daily Composite	NA	NA	DMR/MOR

TABLE A-1 - CONDITIONS

Footnotes:

[1] For overflow events exceeding one calendar day in duration, sampling shall be performed each day of the event according to the measurement frequency specified. For example, for overflow events exceeding one hour and less than 24 hours in duration, sampling shall be initiated at the start of the overflow event and terminated at the end of the overflow event and analyzed according to the measurement frequency specified. If an overflow event exceeds 24 hours, the Permittee shall take daily composite samples for BOD_5 and TSS, initiating samples at the start of the overflow event and each subsequent 24-hour period and terminating samples at the end of the overflow event. For example, on an overflow event that lasts for 54 hours, sampling would consist of 2, 24 hour samples and 1, 6 hour sample over the course of 3 days. Samples shall be flow proportional.

[2] When the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to the wastewater treatment plant to exceed **58** MGD, the Permittee is authorized to allow only those flows above 58 MGD to bypass secondary treatment facilities and be discharged as disinfected primary treated combined sewer wastewater.

[3] During short duration overflow events (less than one hour in duration) or during intermittent overflow events (with no one overflow exceeding one hour), this sampling requirement is waived.

Remarks - Apply to all of Table A-1:

(a)Sampling data during permitted bypass events shall be excluded from the DMRs and shall be recorded on the MORs.

(b) The Permittee shall make reasonable efforts to maximize the amount of flow receiving final secondary treatment consistent with achieving NPDES effluent limits at the final secondary effluent discharge as described in the Permit.

(c) There is no reporting required under Section 8(C) of this permit for discharges during these events.

TABLE B

Discharge Serial Number (DSN): **001-1**					Monitoring Location: **K**
Wastewater Description: **Sanitary Sewage**					
Monitoring Location Description: **Final Effluent**					
Allocated Zone of Influence (ZOI): **4575 cfs**		In-stream Waste Concentration (IWC): **1%** (allocated)			
PARAMETER	**Units**	**FLOW/TIME BASED MONITORING**			**REPORT FORM**
		Average Monthly Minimum	**Sample Freq.**	**Sample type**	
Biochemical Oxygen Demand (5 day) Percent Removal[1, 3]	% of Influent	85	3/week	Calculated[2]	DMR
Solids, Total Suspended Percent Removal[1, 3]	% of Influent	85	3/week	Calculated[2]	DMR

TABLE B – CONDITIONS

Footnotes:

[1] The discharge shall be less than or equal to 15% of the average monthly influent BOD_5 and total suspended solids (Table E, Monitoring Location G). The 15% provision is waived during periods when the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to exceed 58 MGD. The Permittee shall state on the monthly Discharge Monitoring Reports and MOR's when exceedance of the 15% provision is due to storm induced flows.

[2] Calculated based on the average monthly results described in Table A. Removal efficiency $= \frac{\text{Inf.BOD or TSS} - \text{Effluent BOD or TSS}}{\text{Inf.BOD or TSS}} \text{ X } 100$

[3] When the influent flows exceed 58 MGD due to storm events the Permittee may bypass secondary biological treatment. During bypass events these parameters shall be sampled daily during the event. During short duration bypass events (less than one hour in duration) or during intermittent bypass events (with no one bypass exceeding one hour), this sampling requirement is waived. For bypass events exceeding one hour and less than 24 hours in duration, sampling shall be performed each day of the event according to the measurement frequency specified. If a bypass event covers all or part of three calendar days, the Permittee shall take three daily composite samples for BOD_5 and TSS, initiating samples at the start of the bypass event and each subsequent calendar day and terminating samples at the end of the calendar day or at the end of the bypass event. Samples shall be flow proportional.

TABLE C

Discharge Serial Number (DSN): **001-1**				Monitoring Location: **T**		
Wastewater Description: **Sanitary Sewage**						
Monitoring Location Description: **Final Effluent**						
Allocated Zone of Influence (ZOI): **4575 cfs**			In-stream Waste Concentration (IWC): **1% (allocated)**			
PARAMETER	**Units**	**Maximum Daily Limit**	**Sampling Frequency**	**Sample Type**	**Reporting form**	**Minimum Level Analysis See Section 6**
Aluminum, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Antimony, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
NOAEL Static 48Hr Acute D. Pulex[1]	% survival	≥90%	Quarterly	Daily Composite	ATMR/DMR	
NOAEL Static 48Hr Acute Pimephales[1]	% survival	≥90%	Quarterly	Daily Composite	ATMR/DMR	
Arsenic, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Beryllium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
BOD_5	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Cadmium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Chromium, Hexavalent	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Chromium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Chlorine, Total Residual	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Copper, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Cyanide, Amenable	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Cyanide, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Iron, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Lead, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Mercury, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Nickel, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Nitrogen, Ammonia (total as N)	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Nitrogen, Nitrate, (total as N)	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Nitrogen, Nitrite, (total as N)	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Phenols, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Phosphorus, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Selenium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Silver, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Suspended Solids, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Thallium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Zinc, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*

TABLE C - CONDITIONS

Remarks: [1]The results of the Toxicity Tests are recorded in % survival. The Permittee shall report <u>% survival</u> on the DMR based on criteria in Section 6(B) of this permit.

ATMR – Aquatic Toxicity Monitoring Report

TABLE D

Discharge Serial Number: **001-1**		Monitoring Location: **N**		
Wastewater Description: **Activated Sludge**				
Monitoring Location Description: **Each Aeration Unit**				
PARAMETER	**REPORTING FORMAT**	**INSTANTANEOUS MONITORING**		**REPORTING FORM**
		Sample Frequency	Sample Type	
Oxygen, Dissolved	High & low for each WorkDay	4/WorkDay	Grab	MOR
Sludge Volume Index	WorkDay	WorkDay	Grab	MOR
Mixed Liquor Suspended Solids	WorkDay	WorkDay	Grab	MOR

TABLE E

Discharge Serial Number: **001-1**			Monitoring Location: **G**				
Wastewater Description: **Sanitary Sewage**							
Monitoring Location Description: **Influent**							
PARAMETER	**Units**	**DMR REPORTING FORMAT**	**FLOW/TIME BASED MONITORING**		**INSTANTANEOUS MONITORING**		**REPORTING FORM**
			Sample Frequency	**Sample Type**	**Sample Frequency**	**Sample Type**	
Biochemical Oxygen Demand (5 day)	mg/l	Monthly average	3/week	Daily Composite	NA	NA	DMR/MOR
Nitrogen, Ammonia (total as N)	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Nitrate (total as N)	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Nitrite (total as N)	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Total Kjeldahl	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Total	mg/l		Monthly	Daily Composite	NA	NA	MOR
Phosphate, Ortho	mg/l		Monthly	Daily Composite	NA	NA	MOR
Phosphorus, Total	mg/l		Monthly	Daily Composite	NA	NA	MOR
pH	S.U.		NA	NA	Work Day	Grab	MOR
Solids, Total Suspended	mg/l	Monthly average	3/week	Daily Composite	NA	NA	DMR/MOR
Temperature	°F		NA	NA	Work Day	Grab	MOR

TABLE F

Discharge Serial Number: **001-1**					Monitoring Location: **P**		
Wastewater Description: **Primary Effluent**							
Monitoring Location Description: **Primary Sedimentation Basin Effluent**							
PARAMETER	**Units**	**REPORTING FORMAT**	**TIME/FLOW BASED MONITORING**		**INSTANTANEOUS MONITORING**		**REPORTING FORM**
			Sample Frequency	**Sample Type**	**Sample Frequency**	**Sample type**	
Alkalinity, Total	mg/l		NA	NA	Monthly	Grab	MOR
Biochemical Oxygen Demand (5 day)	mg/l	Monthly average	Weekly	Composite	NA	NA	MOR
Nitrogen, Ammonia (total as N)	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Nitrate (total as N)	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Nitrite (total as N)	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Total Kjeldahl	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Total	mg/l		Monthly	Composite	NA	NA	MOR
pH	S.U.		NA	NA	Monthly	Grab	MOR
Solids, Total Suspended	mg/l	Monthly average	Weekly	Composite	NA	NA	MOR

TABLE G

Discharge Serial Number: **001-1**	Monitoring Location: **SL**		
Wastewater Description: **Thickened/Dewatered Sludge**			
Monitoring Location Description: **At sludge draw off**			
PARAMETER	**INSTANTANEOUS MONITORING**		**REPORTING FORM**
	Units	**Grab Sample Freq.**	
Arsenic, Total	mg/kg	Bi-Monthly	DMR
Beryllium, Total	mg/kg	Bi-Monthly	DMR
Cadmium, Total	mg/kg	Bi-Monthly	DMR
Chromium, Total	mg/kg	Bi-Monthly	DMR
Copper, Total	mg/kg	Bi-Monthly	DMR
Lead, Total	mg/kg	Bi-Monthly	DMR
Mercury, Total	mg/kg	Bi-Monthly	DMR
Nickel, Total	mg/kg	Bi-Monthly	DMR
Nitrogen, Ammonia *	mg/kg	Bi-Monthly	DMR*
Nitrogen, Nitrate (total as N) *	mg/kg	Bi-Monthly	DMR*
Nitrogen, Organic *	mg/kg	Bi-Monthly	DMR*
Nitrogen, Nitrite (total as N) *	mg/kg	Bi-Monthly	DMR*
Nitrogen, Total *	mg/kg	Bi-Monthly	DMR*
pH *	S.U.	Bi-Monthly	DMR*
Polychlorinated Biphenyls	mg/kg	Bi-Monthly	DMR
Solids, Fixed	%	Bi-Monthly	DMR
Solids, Total	%	Bi-Monthly	DMR
Solids, Volatile	%	Bi-Monthly	DMR
Zinc, Total	mg/kg	Bi-Monthly	DMR
(*) required for composting or land application only Testing for inorganic pollutants shall follow "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846 as updated and/or revised.			

ATTACHMENT 2

MONTHLY OPERATING REPORT FORM

ATTACHMENT 3

CSO REGULATORS AND DISCHARGE POINTS

City of Bridgeport West Side NPDES Permitted Regulators as of October 2018
Permit ID: CT0100056

NPDES #	MNEUMONIC	LOCATION	RECEIVING WATER
91	DEW	State St. & Dewey St.	Ash Creek
38	SEAB	Brewster St & Seabright Ave	Black Rock Harbor
87	ANTH	St Stephens Rd & Anthony St	Burr Creek
40	WORD	Howard Ave & Wordin Ave	Cedar Creek
84	ARBOR	Admiral St & Harbor St	Cedar Creek
145	TIC	Henry St & Atlantic St	Bridgeport Harbor
207	STATE A&B	State St & Water St	Pequonnock River
49	WALL	John St - west of Water St	Pequonnock River
50	FAIR	Water St & Fairfield Ave	Pequonnock River
51	HILL	Water St & Golden Hill St	Pequonnock River
195	OVER	Congress St @ foot of Crescent St	Pequonnock River
80	CON	Congress St & Main St	Pequonnock River
79	EWAC	East Washington Ave & Housatonic Ave	Pequonnock River
78	YARD	Housatonic Ave & City Yard	Pequonnock River
77	GRAND	Housatonic Ave & Grand St	Pequonnock River
75	COND	Housatonic between Commercial & Grand	Pequonnock River
76	HOUS	Housatonic Ave & N. Washington Ave	Pequonnock River
33	HUNT	Huntington Rd & Vernon St	Pequonnock River
67 66	CREP/CREW	Pulaski St, Congress St & Crescent Ave	Pequonnock River
101	CAP	Main Street & Capitol Ave	Island Brook
196	FAIM	Main Street & Fairview Ave	Island Brook
48 47	TER N&S	Water St & Union Square	Pequonnock River
192	RAIL	Broad St & Railroad Ave	Bridgeport Harbor
93	CEM	Mt. Grove Cemetery & Dewey St.	Ash Creek

Bridgeport West Permit expiration date: Chief Plant Operator: Date received: (stamped)

Sample month/year: Page 1 of MOR for permit # CT0100056 Phone:

	Daily Flow			Primary Sludge			Anoxic Zone #1		Nitrate	Aeration Tank #1				Internal	Anoxic Zone #2		Nitrate	Aeration Tank #2				Internal	Anoxic Zone #3		Nitrate	Aeration Tank #3			
	Max.	Min.	Total	Vol.	%	wt.	Hi DO	Lo DO	Pre-Anoxic Effluent	MLSS	SVI	high D.O.	low D.O.	recycle	Hi DO	Lo DO	Pre-Anoxic Effluent	MLSS	SVI	high D.O.	low D.O	recycle	Hi DO	Lo DO	Pre-Anoxic Effluent	MLSS	SVI	high D.O.	low D.O.
Units	mgd			gal.	solids	lbs.	mg/l		mg/l			mg/l		%	mg/l		mg/l			mg/l		%	mg/l		mg/l			mg/l	
Freq	daily			work day			4/work day		weekly	Work day		4/work day		work day	4/work day		weekly	Work day		4/work day		work day	4/work day		weekly	Work day		4/work day	
1																													
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Page 2 of MOR for permit #

Internal recycle	Anoxic Zone #4		Nitrate Pre-Anoxic Effluent	Aeration Tank #4				Internal recycle	Anoxic Zone #5		Nitrate Pre-Anoxic Effluent	Aeration Tank #5				Internal recycle	Anoxic Zone #6		Nitrate Pre-Anoxic Effluent	Aeration Tank #6				Internal recycle	Return sludge		Waste sludge	Waste accepted	
	Hi DO	Lo DO		MLSS	SVI	high D.O.	low D.O.		Hi DO	Lo DO		MLSS	SVI	high D.O.	low D.O.		Hi DO	Lo DO		MLSS	SVI	high D.O.	low D.O.		%flow	%solids		septic	indust
%	mg/l		mg/l			mg/l		%	mg/l		mg/l			mg/l		%	mg/l		mg/l			mg/l		%			lbs	gal	gal
work day	4/work day		weekly	Work day		4/work day		work day	4/work day		weekly	Work day		4/work day		work day	4/work day		weekly	Work day		4/work day		work day	work day		work day	work day	

BOD (5-day)			Suspended Solids			Settleable Solids	Turbidity	Chlorine Dose		Chlorine Residual		Chlorine Residual average	Fecal Coliform	Enterococci	Ammonia			Nitrite			Nitrate			TKN		
Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.	Eff.	Eff.			high	low				Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.
mg/l			mg/l			ml/l	NTU	lbs	mg/l	mg/l		mg/l	#/100 ml	#/100 ml	mg/l			mg/l			mg/l			mg/l		
3 per week	weekly	3 per week	3 per week	weekly	3 per week	work day	work day	Daily		4/work day		4/work day	3/week	3/week	Monthly			Monthly			Monthly			Monthly		

Total N			Total N	D.O.	pH		Total P	Total P	OrthoP	Temp.		Copper	Lead	Nickel	Silver	Bypass Flow	Bypass Hours	Rain	Alkalinity		
Inf.	Prim. Eff.	Final Eff.	Eff.	Eff.	Inf.	Eff.	Inf.	Eff.	Eff.	Inf.	Eff.	Eff.	Eff.	Eff.	Eff.	Eff.	Eff.		Inf.	Aer. Eff.	Eff.
mg/l			lb/d	mg/l	S.U.		mg/l	mg/l	mg\l	°F		kg/d	kg/d	kg/d	kg/d	MGD	mg/l	Inches	mg/l		
Monthly			monthly	workday	work day		monthly		monthly	work day						Per event	Per event	Per day	monthly		

Sludge Disposal Location:

Please return forms to:
DEEP - Water Bureau
ATTN: Municipal Wastewater Monitoring Coordinator
Municipal Facilities
79 Elm Street
Hartford, CT 06106-5127

Statement of Acknowledgement

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

Authorized Official:

Title:

Signature: ______________________

Date: __________

DATA TRACKING AND TECHNICAL FACT SHEET

Permittee: City of Bridgeport

PERMIT, ADDRESS, AND FACILITY DATA

PERMIT #: CT0100056 **APPLICATION #:** 201710275 **FACILITY ID.** 015-001

Mailing Address:	Location Address:
Street: 695 Seaview Avenue	Street: 205 Bostwick Avenue
City: Bridgeport ST: CT Zip: 06607	City: Bridgeport ST: CT Zip: 06607
Contact Name: Stephen Walker Interim Acting General Manager	Contact Name: Stephen Walker
Phone No.: (203) 332-5604	Phone No.: (203) 332-5604
	DMR Contact email address: stephen.walker@bridgeportct.gov

PERMIT INFORMATION

DURATION 5 YEAR X 10 YEAR ___ 30 YEAR ___

TYPE New ___ Reissuance X Modification ___

CATEGORIZATION POINT (X) NON-POINT ( ) GIS #

NPDES (X) PRETREAT () GROUND WATER(UIC) ( ) GROUND WATER (OTHER) ( )

NPDES MAJOR**(MA)** X
NPDES SIGNIFICANT MINOR or PRETREAT SIU **(SI)** ___
NPDES or PRETREATMENT MINOR **(MI)** ___

COMPLIANCE SCHEDULE YES___ NO X
POLLUTION PREVENTION ___ TREATMENT REQUIREMENT___
WATER QUALITY REQUIREMENT ___ OTHER ___

OWNERSHIP CODE
Private ___ Federal ___ State ___ Municipal (town only) X Other public___

DEP STAFF ENGINEER Ann Straut **DATE DRAFTED:** March 12, 2018

PERMIT FEES

Discharge Code	DSN Number	Annual Fee
111000f	001-1	$3,320.00

APPLICATION FEE PAID: Paid on 11/27/2017
PROCESSING FEE PAID: Paid on 1/18/2018
ANNUAL FEE PAID: Paid on 6/14/2018

PUBLIC NOTICE
Date of Public Notice: 1/25/19
Date Permit Cleared Public Notice: 2/25/19
Date Public Notice Fees Paid: 2/14/19

FOR NPDES DISCHARGES
Drainage Basin Code: 7003 Water Quality Classification Goal: SB
Segment: Cedar Creek (Black Rock Harbor) 01

NATURE OF BUSINESS GENERATING DISCHARGE
Municipal Sanitary Sewage Treatment

PROCESS AND TREATMENT DESCRIPTION (by DSN)
001-1 Activated sludge treatment with denitrification, chlorine disinfection and dechlorination

RESOURCES USED TO DRAFT PERMIT

_X_ *Federal Effluent Limitation Guideline 40CFR 133 Secondary Treatment Category*

__ *Performance Standards*

__ *Federal Development Document*
name of category

_X_ *Department File Information*

_X_ *Connecticut Water Quality Standards*

_X_ *Anti-degradation Policy*

_X_ *Coastal Management Consistency Review Form*

__ *Other - Explain*

BASIS FOR LIMITATIONS, STANDARDS OR CONDITIONS

_X_ *Secondary Treatment (Section 22a-430-4(r) of the Regulations of Connecticut State Agencies)*

__ *Case-by-Case Determination (See Other Comments)*

_X_ *In order to meet in-stream water quality (See General Comments)*

__ *Anti-degradation policy*

GENERAL COMMENTS
The City of Bridgeport ("Permittee") operates a municipal water pollution control facility ("the facility") located at 205 Bostwick Avenue, Bridgeport. The facility is designed to treat and discharge up to 30 million gallons a day of effluent into Cedar Creek / Long Island Sound. The facility currently uses secondary treatment with denitrification and chlorine disinfection to treat effluent before being discharged. Pursuant to Conn. Gen. Stat. § 22a-430, the Department of Energy and Environmental Protection has issued the City of Bridgeport a permit for the discharge from this facility. The City of Bridgeport has submitted an application to renew its permit. The Department has made a tentative determination to approve the City of Bridgeport's application and has prepared a draft permit consistent with that determination.

The most significant changes from the current permit are the removal of the limits for and the addition of monitoring for copper, lead, nickel, and silver based on review of 5years of water quality data. Aluminum monitoring has been continued to be consistent with the most recent CT Water Quality Standards and Iron monitoring has been continued to be consistent with EPA's National Recommended Water Quality Criteria.

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC NOTICE PERIOD AND THE DEPARTMENT'S RESPONSES

☐ *The Department has received no written comments on the proposed action. (REVIEW BY MANAGEMENT ONLY)*

X *Staff reviewed written comments and responded to the comments during a public informational meeting and a number of conference calls. The majority of the comments were concerning the zone of influence, a dye study and inclusion of the Long Term Control Plan into the permit even though it is already in an order. No significant changes have been made to the permit. (REVIEW BY SUPERVISOR AND MANAGEMENT ONLY)*

☐ *The Department has received and Staff has reviewed written comments on the proposed action and made significant changes as follows: (ADD COMMENTS, RESPONSES AND PERMIT CHANGES) (REVIEW BY PERMIT STAFF, SUPERVISOR AND MANAGEMENT)*

SPECIFIC REQUIREMENTS OR REVISIONS

The Department reviewed the application for consistency with Connecticut's Water Quality Standards and determined that with the limits in the draft permit, including those discussed below, that the draft permit is consistent with maintenance and protection of water quality in accordance with the Tier I Anti-degradation Evaluation and Implementation Review provisions of such Standards.

The need for inclusion of water quality based discharge limitations in this permit was evaluated consistent with Connecticut Water Quality Standards and criteria, pursuant to 40 CFR 122.44(d). Discharge monitoring data was evaluated for consistency with the available aquatic life criteria (acute and chronic) and human health (fish consumption only) criteria, considering the zone of influence allocated to the facility where appropriate. In addition to this review, the statistical procedures outlined in the EPA <u>Technical Support Document for Water Quality-based Toxics Control</u> (EPA/505/2-90-001) were employed to calculate the need for such limits. Comparison of the attached monitoring data and its inherent variability with the calculated water quality based limits indicates a low statistical probability of exceeding such limits. Therefore, no water quality based limits were included in the permit at this time.

WATER QUALITY LIMIT CALCULATIONS

See attached

Effluent Chemistry: BRIDGEPORT WEST WPCF

as of Monday, December 04, 2017 | Design Flow 30 MGD | Avg. Monthly Flow : MGD | Max. Monthly Flow : MGD

Receiving Waterbody: LIS via Cedar Creek
Allocated ZOI: 100:1 cfs
Database IWC: 1% (allocated)

Date	BOD	TSS	NH3	NO2	NO3	CNt	CNa	Be	As	Cd	Cr6	Cr3	Cu	Pb	Th	Ni	Ag	Zn	Sb	Se	Phen	Hg	Al	P	Fe
12/6/2012	< 5.00	4.00	0.48	0.060	5.80	< 5.0	< 5.0	< 2.0	< 2.0	< 0.5	< 5.0	< 2.0	8.0	1.0	< 1.0	4.0	< 1.0	55.0	< 2.0	< 2.0	60.0	< 0.0			
3/6/2013	29.00	12.00	2.20	< 0.050	2.40	< 5.0	< 5.0	< 2.0	< 2.0	< 0.5	5.0	< 2.0	18.0	2.0	< 1.0	5.0	13.0	60.0	< 2.0	< 2.0	< 30.0	< 0.0			
6/18/2013	7.00	9.70	0.98	< 0.050	3.60	< 5.0	< 5.0	< 2.0	< 2.0	< 0.5	< 5.0	< 2.0	22.0	2.0	< 1.0	6.0	5.0	49.0	2.0	< 2.0	< 30.0	< 0.0			
9/22/2013	9.40	15.00	1.50	0.060	4.20	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	2.0	8.0	2.0	< 1.0	11.0	9.0	63.0	< 2.0	< 2.0	< 30.0	< 0.0	95.0	2.5	290.0
12/5/2013	< 5.00	4.60	0.79	0.080	7.20	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	11.0	9.0	3.0	< 1.0	8.0	20.0	10.0	< 2.0	< 2.0	< 30.0	< 0.0			
3/6/2014	6.50	7.50	0.32	0.150	1.00	6.0	< 7.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	9.0	6.0	< 1.0	5.0	< 1.0	82.0	< 2.0	< 2.0	< 30.0	< 0.0			
6/5/2014	6.30	5.80	1.40	0.090	5.20	< 5.0	< 5.0	< 2.0	< 2.0	< 0.5	< 5.0	< 2.0	7.0	2.0	< 1.0	7.0	1.0	47.0	< 2.0	< 2.0	< 30.0	< 0.0			
9/8/2014	< 5.00	5.00	1.40	0.140	2.70	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	4.0	0.7	< 1.0	8.0	< 1.0	43.0	< 2.0	< 2.0	< 30.0	< 0.0	24.0	2.0	150.0
9/17/2014	< 5.00	4.00	0.61	< 0.050	4.50	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	5.0	0.7	< 1.0	8.0	< 1.0	61.0	< 2.0	< 2.0	< 30.0	< 0.0	< 20.0		140.0
12/3/2014	6.00	3.60	2.70	0.170	4.60	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	5.0	0.6	< 1.0	9.0	< 1.0	63.0	< 2.0	< 2.0	< 30.0	< 0.0			
3/12/2015	6.00	6.90	0.74	< 0.050	4.90	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	9.0	1.0	< 1.0	3.0	2.0	75.0	< 2.0	< 2.0	< 30.0	< 0.0			
6/4/2015	40.00	17.00	8.80	0.060	0.71	< 5.0	< 5.0	< 1.0	< 2.0	0.6	< 5.0	15.0	110.0	18.0	< 1.0	9.0	7.0	230.0	2.0	< 2.0	30.0	<160.0			
9/2/2015	< 5.00		< 0.10	0.060	6.30	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	5.0	1.0	< 1.0	6.0	< 1.0	81.0	< 2.0	< 2.0	< 30.0	< 0.0			
9/4/2015	< 5.00	2.10	0.15	< 0.050	1.10	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	2.0	< 0.5	< 1.0	5.0	6.0	13.0	< 2.0	< 2.0	< 30.0	< 0.0	< 20.0		70.0
12/10/2015	< 5.00	2.80	0.98	< 0.050	4.60	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	8.0	0.9	< 1.0	4.0	< 1.0	84.0	< 2.0	< 2.0	< 30.0	< 0.0			

Date	BOD	TSS	NH3	NO2	NO3	CNt	CNa	Be	As	Cd	Cr6	Cr3	Cu	Pb	Th	Ni	Ag	Zn	Sb	Se	Phen	Hg	Al	P	Fe
3/10/2016	< 5.00	1.80	4.40	< 0.050	1.20	6.0	6.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	3.0	0.6	< 1.0	15.0	< 1.0	46.0	< 2.0	< 2.0	< 30.0	< 0.0			
6/2/2016	6.00	13.00	5.10	< 0.050	0.77	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	6.0	3.0	< 1.0	7.0	< 1.0	40.0	< 2.0	< 2.0	< 30.0	< 0.0			
9/7/2016	< 5.00	7.60	0.49	0.180	3.30	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	2.0	4.1	2.6	< 1.0	3.0	< 1.0	63.0	< 2.0	< 2.0	< 30.0	< 0.0			
12/8/2016	5.20	3.30	0.67	0.090	4.00	< 5.0	< 5.0	< 0.2	< 1.0	< 0.1	< 5.0	< 1.0	3.4	0.7	< 1.0	1.4	< 0.3	63.0	< 1.0	< 2.0	< 30.0	< 0.0	23.0	0.7	120.0
4/28/2017	4.80	< 5.00	3.73	0.118	0.32	< 10.0	< 10.0	< 1.0	< 2.0	< 0.1	< 10.0	2.0	5.0	< 0.3	< 1.0	3.0	< 1.0	38.0	< 3.0	< 5.0	< 15.0	< 0.2	68.0	0.5	255.0
9/6/2017	< 4.00	< 5.00	3.43	0.146	1.31	< 10.0	< 10.0	< 1.0	< 2.0	< 0.1	< 10.0	< 1.0	4.0	< 0.3	< 1.0	2.0	< 1.0	59.0	< 3.0	< 5.0	< 15.0	< 0.2	24.0	1.9	272.0

Text334:

	BOD	TSS	NH3	NO2	NO3	CNt	CNa	Be	As	Cd	Cr6	Cr3	Cu	Pb	Th	Ni	Ag	Zn	Sb	Se	Phen	Hg	Al	P	Fe
Count	21	20	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	7	5	7
# Detected	11	18	20	13	21	2	1	0	0	1	1	5	21	18	0	21	8	21	2	0	2	0	5	5	7
Average	8.34	6.79	1.95	0.086	3.32	5.6	5.6	1.2	2.0	0.4	5.5	3.0	12.1	2.3	1.0	6.2	3.6	63.1	2.0	2.3	30.0	7.6	39.1	1.5	185.3
Maximum	40.00	17.00	8.80	0.180	7.20	10.0	10.0	2.0	2.0	0.6	10.0	15.0	110.0	18.0	1.0	15.0	20.0	230.0	3.0	5.0	60.0	160.0	95.0	2.5	290.0
CV	1.1	0.6	1.1	0.5	0.6	0.3	0.3	0.4	0.1	0.3	0.3	1.2	1.9	1.6	0.0	0.5	1.4	0.7	0.2	0.4	0.3	4.6	0.8	0.6	0.5

Bold => mg/L Normal => ug/L

Bridgeport West Side Treatment Plant

Discharger:	Bridgeport West Side Treatment Plant		by: Strauta, 12/4/2017, 13:43
Receiving Water:	Lonf Island Sound, Cedar Cre€ CURRENT CONDITIONS		
Design Flow:	30.000 MGD	Avg. Flow:	18.630 MGD
Allocated ZOI:	4575.00 CFS	Max. Flow:	78.100 MGD
Samples/Month:	4	IWC:	1.00 %

WQB Limits - **Saltwater**

Compound	C.V.	AML ug/l	MDL ug/l	AML kg/d	MDL kg/d	LIMIT? ML?
Aluminum	0.8	6.66E+03	1.53E+04	7.57E+02	1.73E+03	
Ammonia	1.1	5.26E+04	1.38E+05	5.98E+03	1.56E+04	
Antimony	0.2	2.79E+04	3.70E+04	3.17E+03	4.20E+03	
Arsenic	0.1	2.10E-02	2.43E-02	2.39E-03	2.76E-03	ML
Beryllium	0.4	1.29E+01	2.17E+01	1.47E+00	2.46E+00	
Cadmium	0.3	7.92E+02	1.19E+03	8.99E+01	1.35E+02	
Chlorine	0.6	6.11E+02	1.23E+03	6.95E+01	1.39E+02	
Chromium (hex)	0.3	4.50E+03	6.75E+03	5.11E+02	7.67E+02	
Chromium (tri)	1.2	1.01E+08	2.71E+08	1.14E+07	3.08E+07	
Copper	1.9	2.77E+02	8.43E+02	3.15E+01	9.58E+01	
Cyanide (amen)	0.3	6.64E+01	9.96E+01	7.54E+00	1.13E+01	
Lead	1.6	5.00E+02	1.47E+03	5.68E+01	1.67E+02	
Mercury	4.6	5.08E+00	1.74E+01	5.77E-01	1.98E+00	ML
Nickel	0.5	6.90E+02	1.27E+03	7.85E+01	1.45E+02	
Phenol	0.3	8.56E+07	1.28E+08	9.73E+06	1.46E+07	
Selenium	0.4	6.18E+03	1.03E+04	7.02E+02	1.18E+03	
Silver	1.4	6.68E+01	1.89E+02	7.59E+00	2.15E+01	
Thallium	0.0	4.68E+01	4.68E+01	5.32E+00	5.32E+00	
Zinc	0.7	7.11E+03	1.53E+04	8.08E+02	1.74E+03	

Current Conditions

Compound	# DETECTS	AMC ug/l	MMC ug/l	AMM kg/d	MMM kg/d
Aluminum	5	3.91E+01	9.50E+01	2.76E+00	2.81E+01
Ammonia	20	1.95E+03	8.80E+03	1.38E+02	2.60E+03
Antimony	2	2.00E+00	3.00E+00	1.41E-01	8.88E-01
Arsenic	0	2.00E+00	2.00E+00	1.41E-01	5.92E-01
Beryllium	0	1.20E+00	2.00E+00	8.47E-02	5.92E-01
Cadmium	1	4.00E-01	6.00E-01	2.82E-02	1.78E-01
Chlorine					
Chromium (hex)	1	5.50E+00	1.00E+01	3.88E-01	2.96E+00
Chromium (tri)	5	3.00E+00	1.50E+01	2.12E-01	4.44E+00
Copper	21	1.21E+01	1.10E+02	8.54E-01	3.25E+01
Cyanide (amen)	1	5.60E+00	1.00E+01	3.95E-01	2.96E+00
Lead	18	2.30E+00	1.80E+01	1.62E-01	5.33E+00
Mercury	0	7.60E+00	1.60E+02	5.36E-01	4.73E+01
Nickel	21	6.20E+00	1.50E+01	4.38E-01	4.44E+00
Phenol	2	3.00E+01	6.00E+01	2.12E+00	1.78E+01
Selenium	0	2.30E+00	5.00E+00	1.62E-01	1.48E+00
Silver	8	3.60E+00	2.00E+01	2.54E-01	5.92E+00
Thallium	0	1.00E+00	1.00E+00	7.06E-02	2.96E-01
Zinc	21	6.31E+01	2.30E+02	4.45E+00	6.80E+01

Final WQB Limits

	AML (kg/d)	MDL (kg/d)

Interim WQB Limits

	AML (kg/d)	MDL (kg/d)

Minimum Levels

Arsenic	0.005 mg/L
Mercury	0.0002 mg/L

NPDES Permit No. CT0101010 – East Side WWTP

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

MUNICIPAL NPDES PERMIT
issued to

Permittee:
Water Pollution Control Authority
City of Bridgeport
695 Seaview Avenue
Bridgeport, Connecticut 06607

Location Address:

Bridgeport East Side WPCF
695 Seaview Avenue
Bridgeport, Connecticut 06607

Facility ID: 015-002 **Permit ID:** CT0101010

Permit Expires: **October 28, 2020**

Receiving Stream: Bridgeport Harbor

Design Flow Rate: 10.0 MGD

SECTION 1: GENERAL PROVISIONS

(A) This permit is reissued in accordance with Section 22a-430 of Chapter 446k, Connecticut General Statutes ("CGS"), and Regulations of Connecticut State Agencies ("RCSA") adopted thereunder, as amended, and Section 402(b) of the Clean Water Act, as amended, 33 USC 1251, et. seq., and pursuant to an approval dated September 26, 1973, by the Administrator of the United States Environmental Protection Agency for the State of Connecticut to administer a N.P.D.E.S. permit program.

(B) The City of Bridgeport, ("Permittee"), shall comply with all conditions of this permit including the following sections of the RCSA which have been adopted pursuant to Section 22a-430 of the CGS and are hereby incorporated into this permit. **Your attention is especially drawn to the notification requirements of subsection (i)(2), (i)(3), (j)(1), (j)(6), (j)(8), (j)(9)(C), (j)(10)(C), (j)(11)(C), (D), (E), and (F), (k)(3) and (4) and (l)(2) of Section 22a-430-3.** To the extent this permit imposes conditions more stringent than those found in the regulations, this permit shall apply.

Section 22a-430-3 General Conditions
- **(a)** Definitions
- **(b)** General
- **(c)** Inspection and Entry
- **(d)** Effect of a Permit
- **(e)** Duty to Comply
- **(f)** Proper Operation and Maintenance
- **(g)** Sludge Disposal
- **(h)** Duty to Mitigate
- **(i)** Facility Modifications; Notification
- **(j)** Monitoring, Records and Reporting Requirements
- **(k)** Bypass
- **(l)** Conditions Applicable to POTWs
- **(m)** Effluent Limitation Violations
- **(n)** Enforcement
- **(o)** Resource Conservation
- **(p)** Spill Prevention and Control
- **(q)** Instrumentation, Alarms, Flow Recorders
- **(r)** Equalization

Section 22a-430-4 Procedures and Criteria
- **(a)** Duty to Apply
- **(b)** Duty to Reapply
- **(c)** Application Requirements
- **(d)** Preliminary Review
- **(e)** Tentative Determination

(f) Draft Permits, Fact Sheets
(g) Public Notice, Notice of Hearing
(h) Public Comments
(i) Final Determination
(j) Public Hearings
(k) Submission of Plans and Specifications. Approval.
(l) Establishing Effluent Limitations and Conditions
(m) Case-by-Case Determinations
(n) Permit Issuance or Renewal
(o) Permit or Application Transfer
(p) Permit Revocation, Denial or Modification
(q) Variances
(r) Secondary Treatment Requirements
(s) Treatment Requirements
(t) Discharges to POTWs - Prohibitions

(C) Violations of any of the terms, conditions, or limitations contained in this permit may subject the Permittee to enforcement action including, but not limited to, seeking penalties, injunctions and/or forfeitures pursuant to applicable sections of the CGS and RCSA.

(D) Any false statement in any information submitted pursuant to this Section of the permit may be punishable as a criminal offense under Section 22a-438 or 22a-131a of the CGS or in accordance with Section 22a-6, under Section 53a-157b of the CGS.

(E) The Permittee shall comply with Section 22a-416-1 through Section 22a-416-10 of the RCSA concerning operator certification.

(F) No provision of this permit and no action or inaction by the Commissioner shall be construed to constitute an assurance by the Commissioner that the actions taken by the Permittee pursuant to this permit will result in compliance or prevent or abate pollution.

(G) Nothing in this permit shall relieve the Permittee of other obligations under applicable federal, state and local law.

(H) An annual fee shall be paid for each year this permit is in effect as set forth in Section 22a-430-7 of the RCSA. As of October 1, 2009 the annual fee is $3,005.00.

(I) The Permittee shall discharge so as not to violate the Interstate Environmental Commission (IEC) Water Quality Regulations promulgated pursuant to the authority conferred upon the IEC by the Tri-State Compact (CGS 22a-294 et seq.) as defined in Attachment 1 Table A.

(J) This permitted discharge is consistent with the applicable goals and policies of the Connecticut Coastal Management Act (Section 22a-92 of the CGS).

SECTION 2: DEFINITIONS

(A) The definitions of the terms used in this permit shall be the same as the definitions contained in Section 22a-423 of the CGS and Section 22a-430-3(a) and 22a-430-6 of the RCSA, except for "Composite" and "No Observable Acute Effect Level (NOAEL)" which are redefined below.

(B) In addition to the above, the following definitions shall apply to this permit:

"------" in the limits column on the monitoring tables in Attachment 1 means a limit is not specified but a value must be reported on the DMR, MOR, and/or the ATMR.

"Annual" in the context of any sampling frequency, shall mean the sample must be collected in the month of June.

"Average Monthly Limit" means the maximum allowable "Average Monthly Concentration" as defined in Section 22a-430-3(a) of the RCSA when expressed as a concentration (e.g. mg/l); otherwise, it means "Average Monthly Discharge Limitation" as defined in Section 22a-430-3(a) of the RCSA.

"Bi-Monthly" in the context of any sampling frequency, shall mean once every two months including the months of January, March, May, July, September and November.

"Bi-Weekly" in the context of any sampling frequency, shall mean once every two weeks.

"Composite" or **"(C)"** means a sample consisting of a minimum of eight aliquot samples collected at equal intervals of no less than 30 minutes and no more than 60 minutes and combined proportionally to flow over the sampling period provided that during the sampling period the peak hourly flow is experienced.

"Critical Test Concentration" or **"(CTC)"** means the specified effluent dilution at which the Permittee is to conduct a single-concentration Aquatic Toxicity Test.

"Daily Composite" or **"(DC)"** means a composite sample taken over a full operating day consisting of grab samples collected at equal intervals of no more than sixty (60) minutes and combined proportionally to flow; or, a composite sample continuously collected over a full operating day proportionally to flow.

"Daily Concentration" means the concentration of a substance as measured in a daily composite sample, or, arithmetic average of all grab sample results defining a grab sample average.

"Daily Quantity" means the quantity of waste discharged during an operating day.

"Geometric Mean" is the "n"th root of the product of "n" observations.

"Infiltration" means water other than wastewater that enters a sewer system (including sewer system and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow.

"Inflow" means water other than wastewater that enters a sewer system (including sewer service connections) from sources such as, but not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.

"Instantaneous Limit" means the highest allowable concentration of a substance as measured by a grab sample, or the highest allowable measurement of a parameter as obtained through instantaneous monitoring.

"In-stream Waste Concentration" or **"(IWC)"** means the concentration of a discharge in the receiving water after mixing has occurred in the allocated zone of influence.

"MGD" means million gallons per day.

"Maximum Daily Limit" means the maximum allowable "Daily Concentration" (defined above) when expressed as a concentration (e.g. mg/l); otherwise, it means the maximum allowable "Daily Quantity" as defined above, unless it is expressed as a flow quantity. If expressed as a flow quantity it means "Maximum Daily Flow" as defined in Section 22a-430-3(a) of the RCSA.

"Monthly Minimum Removal Efficiency" means the minimum reduction in the pollutant parameter specified when the effluent average monthly concentration for that parameter is compared to the influent average monthly concentration.

"NA" as a Monitoring Table abbreviation means "not applicable".

"NR" as a Monitoring Table abbreviation means "not required".

"No Observable Acute Effect Level" or **"(NOAEL)"** means any concentration equal to or less than the critical test concentration in a single concentration (pass/fail) toxicity test, conducted pursuant to Section 22a-430-3(j)(7)(A)(i) of the RCSA, demonstrating 90% or greater survival of test organisms at the CTC.

"Quarterly" in the context of any sampling frequency, shall mean sampling is required in the months of March, June, September and December.

"Range During Sampling" or **"(RDS)"** as a sample type means the maximum and minimum of all values recorded as a result of analyzing each grab sample of; 1) a Composite Sample, or, 2) a Grab Sample Average. For those Permittee with pH meters that provide continuous monitoring and recording, Range During Sampling means the maximum and minimum readings recorded with the continuous monitoring device during the Composite or Grab Sample Average sample collection.

"Range During Month" or **"(RDM)"** as a sample type means the lowest and the highest values of all of the monitoring data for the reporting month.

"Sanitary Sewage" means wastewaters from residential, commercial and industrial sources introduced by direct connection to the sewerage collection system tributary to the treatment works including non-excessive inflow/infiltration sources.

"Twice per Month" in the context of any sampling frequency, mean two samples per calendar month collected no less than 12 days apart.

"ug/l" means micrograms per liter

"Work Day" in the context of a sampling frequency means, Monday through Friday excluding holidays.

SECTION 3: COMMISSIONER'S DECISION

(A) The Commissioner of Energy and Environmental Protection ("Commissioner") has issued a final decision and found continuance of the existing system to treat the discharge will protect the waters of the state from pollution. The Commissioner's decision is based on application #201300409 for permit reissuance received on January 22, 2013 and the administrative record established in the processing of that application.

(B) The Commissioner hereby authorizes the Permittee to discharge in accordance with the provisions of this permit, the above referenced application, and all approvals issued by the Commissioner or his authorized agent for the discharges and/or activities authorized by, or associated with, this permit.

(C) The Commissioner reserves the right to make appropriate revisions to the permit, if required after Public Notice, in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the Federal Clean Water Act or the CGS or regulations adopted thereunder, as amended. The permit as modified or renewed under this paragraph may also contain any other requirements of the Federal Clean Water Act or CGS or regulations adopted thereunder which are then applicable.

SECTION 4: GENERAL LIMITATIONS AND OTHER CONDITIONS

(A) The Permittee shall not accept any new sources of non-domestic wastewater conveyed to its POTW through its sanitary sewerage system or by any means other than its sanitary sewage system unless the generator of such wastewater; (a) is authorized by a permit issued by the Commissioner under Section 22a-430 CGS (individual permit), or, (b) is authorized under Section 22a-430b (general permit), or, (c) has been issued an emergency or temporary authorization by the Commissioner under Section 22a-6k. All such non-domestic wastewaters shall be processed by the POTW via receiving facilities at a location and in a manner prescribed by the Permittee which are designed to contain and control any unplanned releases.

(B) No new discharge of domestic sewage from a single source to the POTW in excess of 50,000 gallons per day shall be allowed by the Permittee until the Permittee has notified in writing the Municipal Facilities Section of said new discharge. New discharge notifications as described in this section shall be submitted to the staff identified in section 10(H) included herein.

(C) The Permittee shall maintain a system of user charges based on actual use sufficient to operate and maintain the POTW (including the collection system) and replace critical components.

(D) The Permittee shall maintain a sewer use ordinance that is consistent with the Model Sewer Ordinance for Connecticut Municipalities prepared by the Department of Energy and Environmental Protection. The Commissioner of Energy and Environmental Protection alone may authorize certain discharges which may not conform to the Model Sewer Ordinance.

(E) No discharge from the permitted facility beyond any zone of influence shall contain or cause in the receiving stream a visible oil sheen, floating solids, visible discoloration, or foaming beyond that which may result from a discharge from a permitted facility and none exceeding levels necessary to maintain all designated uses.

(F) No discharge from the permitted facility shall cause acute or chronic toxicity in the receiving water body beyond any Zone Of Influence (ZOI) specifically allocated to that discharge in this permit.

(G) The Permittee shall maintain an alternate power source adequate to provide full operation of all pump stations in the sewerage collection system and to provide a minimum of primary treatment and disinfection at the water pollution control facility to insure that no discharge of untreated wastewater will occur during a failure of a primary power source.

(H) The average monthly effluent concentration shall not exceed 15% of the average monthly influent concentration for BOD_5 and Total

Suspended Solids for all daily composite samples taken in any calendar month.

(I) Any new or increased amount of sanitary sewage discharge to the sewer system is prohibited where it will cause a dry weather overflow or exacerbate an existing dry weather overflow.

(J) Sludge Conditions

(1) The Permittee shall comply with all existing federal and state laws and regulations that apply to sewage sludge use and disposal practices, including but not limited to 40 CFR Part 503.

(2) If an applicable management practice or numerical limitation for pollutants in sewage sludge more stringent than existing federal and state regulations is promulgated under Section 405(d) of the Clean Water Act (CWA), this permit shall be modified or revoked and reissued to conform to the promulgated regulations.

(3) The Permittee shall give prior notice to the Commissioner of any change(s) planned in the Permittee' sludge use or disposal practice. A change in the Permittee' sludge use or disposal practice may be a cause for modification of the permit.

(4) Testing for inorganic pollutants shall follow "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846 as updated and/or revised.

(K) This permit becomes effective on the 1st day of the month following the date of signature of the Commissioner or designee.

(L) When the arithmetic mean of the average daily flow from the POTW for the previous 180 days exceeds 90% of the design flow rate, the Permittee shall develop and submit within one year, for the review and approval of the Commissioner, a plan to accommodate future increases in flow to the plant. This plan shall include a schedule for completing any recommended improvements and a plan for financing the improvements.

(M) When the arithmetic mean of the average daily BOD_5 or TSS loading into the POTW for the previous 180 days exceeds 90% of the design load rate, the Permittee shall develop and submit for the review and approval of the Commissioner within one year, a plan to accommodate future increases in load to the plant. This plan shall include a schedule for completing any recommended improvements and a plan for financing the improvements.

(N) On or before July 31st of each calendar year the main flow meter shall be calibrated by an independent contractor in accordance with the manufacturer's specifications. The actual record of the calibration shall be retained onsite and, upon request, the Permittee shall submit to the Commissioner a copy of that record.

(O) The Permittee shall operate and maintain all processes as installed in accordance with the approved plans and specifications and as outlined in the associated operation and maintenance manual. This includes but is not limited to all preliminary treatment processes, primary treatment processes, recycle pumping processes, anaerobic treatment processes, anoxic treatment processes, aerobic treatment processes, flocculation processes, effluent filtration processes or any other processes necessary for the optimal removal of pollutants. The Permittee shall not bypass or fail to operate any of the aforementioned processes without the written approval of the Commissioner.

(P) The Permittee is hereby authorized to accept septage at the treatment facility; or other locations as approved by the Commissioner.

(Q) The temperature of any discharge shall not increase the temperature of the receiving stream above 83°F, or, in any case, raise the temperature of the receiving stream by more than 4°F beyond the permitted zone of influence. The incremental temperature increase in coastal and marine waters is limited to 1.5°F during the period including July, August and September.

SECTION 5: SPECIFIC EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

(A) The discharge(s) shall not exceed and shall otherwise conform to the specific terms and conditions listed in this permit. The discharge is restricted by, and shall be monitored in accordance with Tables **A** through **G** incorporated in this permit as Attachment 1.

(B) The Permittee shall monitor the performance of the treatment process in accordance with the Monthly Operating Report (MOR) incorporated in this permit as Attachment 2.

SECTION 6: SAMPLE COLLECTION, HANDLING and ANALYTICAL TECHNIQUES

(A) Chemical Analysis

(1) Chemical analyses to determine compliance with effluent limits and conditions established in this permit shall be performed using the methods approved pursuant to the Code of Federal Regulations, Part 136 of Title 40 (40 CFR 136) unless an alternative method has been approved in writing pursuant to 40 CFR 136.4 or as provided in Section 22a-430-3-(j)(7) of the RCSA. Chemicals which do not have methods of analysis defined in 40 CFR 136 or the RCSA shall be analyzed in accordance with methods specified in this permit.

(2) All metals analyses identified in this permit shall refer to analyses for Total Recoverable Metal, as defined in 40 CFR 136 unless otherwise specified.

(3) Grab samples shall be taken during the period of the day when the peak hourly flow is normally experienced.

(4) Samples collected for bacteriological examination shall be collected between the hours of 11 a.m. and 3 p.m. or at that time of day when the peak hourly flow is normally experienced. **A chlorine residual sample must be taken at the same time and the results recorded.**

(5) The Minimum Levels specified below represent the concentrations at which quantification must be achieved and verified during the chemical analyses for the parameters identified in Attachment 1, Tables **A and C**. Analyses for these parameters must include check standards within ten percent of the specified Minimum Level or calibration points equal to or less than the specified Minimum Level.

Parameter	Minimum Level
Aluminum	0.050 mg/l
Antimony, Total	0.010 mg/l
Arsenic, Total	0.005 mg/l
Beryllium, Total	0.001 mg/l
Cadmium, Total	0.0005 mg/l
Chlorine, Total Residual	0.050 mg/l
Chromium, Total	0.005 mg/l
Chromium, Total Hexavalent	0.010 mg/l
Copper, Total	0.005 mg/l
Cyanide, Total	0.010 mg/l
Iron, Total	0.040 mg/l
Lead, Total	0.005 mg/l
Mercury, Total	0.0002 mg/l
Nickel, Total	0.005 mg/l
Phosphorus, Total	0.10 mg/l
Selenium, Total	0.005 mg/l
Silver, Total	0.002 mg/l
Thallium, Total	0.005 mg/l
Zinc, Total	0.020 mg/l

(6) The value of each parameter for which monitoring is required under this permit shall be reported to the maximum level of accuracy and precision possible consistent with the requirements of this Section of the permit.

(7) Effluent analyses for which quantification was verified during the analysis at or below the minimum levels specified in this Section and which indicate that a parameter was not detected shall be reported as "less than x" where 'x' is the numerical value equivalent to the analytical method detection limit for that analysis.

(8) Results of effluent analyses which indicate that a parameter was not present at a concentration greater than or equal to the Minimum Level specified for that analysis shall be considered equivalent to zero (0.0) for purposes of determining compliance with effluent limitations or conditions specified in this permit.

(B) Acute Aquatic Toxicity Test

(1) Samples for monitoring of Acute Aquatic Toxicity shall be collected and handled as prescribed in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA-821-R-02-012).

(a) Composite samples shall be chilled as they are collected. Grab samples shall be chilled immediately following collection. Samples shall be held at 0 - 6°C until Acute Aquatic Toxicity testing is initiated.

(b) Effluent samples shall not be dechlorinated, filtered, or, modified in any way, prior to testing for Acute Aquatic Toxicity unless specifically approved in writing by the Commissioner for monitoring at this facility. Facilities with effluent dechlorination and/or filtration designed as part of the treatment process are not required to obtain approval from the Commissioner.

(c) Samples shall be taken after dechlorination for Acute Aquatic Toxicity unless otherwise approved in writing by the Commissioner for monitoring at this facility.

(d) Chemical analyses of the parameters identified in Attachment 1, Table C shall be conducted on an aliquot of the same sample tested for Acute Aquatic Toxicity.

(i) At a minimum, pH, salinity, total alkalinity, total hardness, and total residual chlorine shall be measured in the effluent sample and, during Acute Aquatic Toxicity tests, in the highest concentration of the test and in the dilution (control) water at the beginning of the test and at test termination. If total residual chlorine is not detected at test initiation, it does not need to be measured at test termination. Dissolved oxygen, pH, and temperature shall be measured in the control and all test concentrations at the beginning of the test, daily thereafter, and at test termination. Salinity shall be measured in each test concentration at the beginning of the test and at test termination.

(e) Tests for Acute Aquatic Toxicity shall be initiated within 36 hours of sample collection.

(2) Monitoring for Acute Aquatic Toxicity to determine compliance with the permit condition on Acute Aquatic Toxicity (invertebrate) shall be conducted for 48 hours utilizing neonatal (less than 24 hours old) *Daphnia pulex*.

(3) Monitoring for Acute Aquatic Toxicity to determine compliance with the permit condition on Acute Aquatic Toxicity (vertebrate) shall be conducted for 48 hours utilizing larval (1 to 14-day old with no more than 24 hours range in age) *Pimephales promelas*.

(4) Tests for Acute Aquatic Toxicity shall be conducted as prescribed for static non-renewal acute tests in "Methods for measuring the Acute Aquatic Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (EPA/821-R-02-012), except as specified below.

(a) For Acute Aquatic Toxicity limits, and for monitoring only conditions, expressed as a NOAEL value, Pass/Fail (single concentration) tests shall be conducted at a specified Critical Test Concentration (CTC) equal to the Aquatic Toxicity limit, (100% in the case of monitoring only conditions), as prescribed in Section 22a-430-3(j)(7)(A)(i) of the RCSA.

(b) Organisms shall not be fed during the tests.

(c) Synthetic freshwater prepared with deionized water adjusted to a hardness of 50±5 mg/L as $CaCO_3$ shall be used as dilution water in the tests.

(d) Copper nitrate shall be used as the reference toxicant.

(5) For monitoring only conditions, toxicity shall be demonstrated when the results of a valid pass/fail Acute Aquatic Toxicity indicates less than 90% survival in the effluent at the CTC (100%).

SECTION 7: RECORDING AND REPORTING REQUIREMENTS

(A) The results of chemical analyses and any aquatic toxicity test required above in Section 5 and the referenced Attachment 1 shall be entered on the Discharge Monitoring Report (DMR) and reported to the Bureau of Water Protection and Land Reuse. The report shall also include a detailed explanation of any violations of the limitations specified. The DMR must be received at the following address by the 15th day of the month following the month in which samples are collected.

ATTN: Municipal Wastewater Monitoring Coordinator
Connecticut Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse, Planning and Standards Division
79 Elm Street
Hartford, Connecticut 06106-5127

(1) For composite samples, from other than automatic samplers, the instantaneous flow and the time of each aliquot sample collection shall be recorded and maintained at the POTW.

(B) Complete and accurate test data, including percent survival of test organisms in each replicate test chamber, LC_{50} values and 95% confidence intervals for definitive test protocols, and all supporting chemical/physical measurements performed in association with any aquatic toxicity test, shall be entered on the Aquatic Toxicity Monitoring Report form (ATMR) and sent to the Bureau of Water Protection and Land Reuse at the address specified above in Section 7 (A) of this permit by the 15th day of the month following the month in which samples are collected.

(C) The results of the process monitoring required above in Section 5 shall be entered on the Monthly Operating Report (MOR) form, included herein as Attachment 2, and reported to the Bureau of Water Protection and Land Reuse. The MOR report shall also be accompanied by a detailed explanation of any violations of the limitations specified. The MOR, must be received at the address specified above in Section 7 (A) of this permit by the 15th day of the month following the month in which the data and samples are collected.

(D) NetDMR Reporting Requirements -

(1) Unless otherwise approved in writing by the Commissioner, no later than one-hundred and twenty (120) days after the issuance of this permit, the Permittee shall begin reporting to the Department electronically using NetDMR, a web-based tool that allows Permittee to electronically submit discharge monitoring reports (DMRs) and other required reports through a secure internet connection. Specific requirements regarding subscription to NetDMR and submittal of data and reports in hard copy form and for submittal using NetDMR are described below:

(a) NetDMR Subscriber Agreement

On or before fifteen (15) days after the issuance of this permit, the Permittee and/or the person authorized to sign the Permittee discharge monitoring reports ("Signatory Authority") as described in RCSA Section 22a-430-3(b)(2) shall contact the Department and initiate the subscription process for electronic submission of Discharge Monitoring Report (DMR) information. On or before ninety (90) days after issuance of this permit the Permittee shall submit a signed and notarized copy of the *Connecticut DEP NetDMR Subscriber Agreement* to the Department.

(b) Submittal of Reports Using NetDMR

Unless otherwise approved by the Commissioner, on or before one-hundred and twenty (120) days after issuance of this permit, the Permittee and/or the Signatory Authority shall electronically submit DMRs and reports required under this permit to the Department using NetDMR in satisfaction of the DMR submission requirement of this permit. DMRs shall be submitted electronically to the Department no later than the 15th day of the month following the completed reporting period.

(c) Submittal of NetDMR Opt-Out Requests

If the Permittee is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for electronically submitting DMRs and reports, the Commissioner may approve the submission of DMRs and other required reports in hard copy form ("opt-out request"). Opt-out requests must be submitted in writing to the Department for written approval on or before fifteen (15) days prior to the date a Permittee would be required under this permit to begin filing DMRs and other reports using NetDMR. This demonstration shall be valid for twelve (12) months from the date of the Department's approval and shall thereupon expire. At such time, DMRs and reports shall be submitted electronically to the Department using NetDMR unless the Permittee submits a renewed opt-out request and such request is approved by the Department.

All opt-out requests and requests for the NetDMR subscriber form should be sent to the following address:

Attn: NetDMR Coordinator
Connecticut Department of Energy and Environmental Protection
Water Permitting and Enforcement Division – 2nd Floor
79 Elm Street
Hartford, CT 06106-5127

SECTION 8: RECORDING AND REPORTING OF VIOLATIONS, ADDITIONAL TESTING REQUIREMENTS, BYPASSES, MECHANICAL FAILURES, AND MONITORING EQUIPMENT FAILURES

(A) If any Acute Aquatic Toxicity sample analysis indicates toxicity, or that the test was invalid, an additional sample of the effluent shall be collected and tested for Acute Aquatic Toxicity and associated chemical parameters, as described above in Section 5 and Section 6, and the results reported to the Bureau of Water Protection and Land Reuse (Attn: Aquatic Toxicity) via the ATMR form (see Section 7 (B)) within 30 days of the previous test. These test results shall also be reported on the next month's DMR report pursuant to Section 7 (A). The results of all toxicity tests and associated chemical parameters, valid and invalid, shall be reported.

(B) If any two consecutive Acute Aquatic Toxicity test results or any three Acute Aquatic Toxicity test results in a twelve month period indicates toxicity, the Permittee shall immediately take all reasonable steps to eliminate toxicity wherever possible and shall submit a report, to the Bureau of Water Protection and Land Reuse (Attn: Aquatic Toxicity), for the review and written approval of the Commissioner in accordance with Section 22a-430-3(j)(10)(c) of the RCSA describing proposed steps to eliminate the toxic impact of the discharge on the receiving water body. Such a report shall include a proposed time schedule to accomplish toxicity reduction and the Permittee shall comply with any schedule approved by the Commissioner.

(C) Section 22a-430-3(k) of the RCSA shall apply in all instances of bypass including a bypass of the treatment plant or a component of the sewage collection system planned during required maintenance. The Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Municipal Facilities Section (860) 424-3704, the Department of Public Health, Water Supply Section (860) 509-7333 and Recreation Section (860) 509-7297, and the local Director of Health shall be notified within 2 hours of the Permittee learning of the event by telephone during normal business hours. If the discharge or bypass occurs outside normal working hours (8:30 a.m. to 4:30 p.m. Monday through Friday), notification shall be made within 2 hours of the Permittee learning of the event to the Emergency Response Unit at (860) 424-3338 and the Department of Public Health at (860) 509-8000. A written report shall be submitted to the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Municipal Facilities Section within five days of the Permittee learning of each occurrence, or potential occurrence, of a discharge or bypass of untreated or partially treated sewage.

The written report shall contain:

(i) The nature and cause of the bypass, permit violation, treatment component failure, and/or equipment failure,

(ii) the time the incident occurred and the anticipated time which it is expected to continue or, if the condition has been corrected, the duration,

(iii) the estimated volume of the bypass or discharge of partially treated or raw sewage,

(iv) the steps being taken to reduce or minimize the effect on the receiving waters, and

(v) the steps that will be taken to prevent reoccurrence of the condition in the future.

For treatment plants south of Interstate 95 and any other plants which may impact shellfishing areas the Department of Agriculture / Aquaculture Division must also be notified within 2 hours of the Permittee learning of the event by telephone at (203) 874-0696 and in writing within 72 hours of each occurrence of an emergency diversion or by-pass of untreated or partially treated sewage and a copy of the written report should be sent to:

State of Connecticut
Department of Agriculture/Aquaculture Division
P.O. Box 97
Milford, Connecticut 06460]

(D) Section 22a-430-3(j) 11 (D) of the RCSA shall apply in the event of any noncompliance with a maximum daily limit and/or any noncompliance that is greater than two times any permit limit. The Permittee shall notify in the same manner as in paragraph C of this Section, the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse Planning and Standards Division, Municipal Facilities Section except, if the noncompliance occurs outside normal working hours (8:30 a.m. to 4:30 p.m. Monday through Friday) the Permittee may wait to make the verbal report until 10:30 am of the next business day after learning of the noncompliance.

(E) Section 22a-430-3(j) 8 of the RCSA shall apply in all instances of monitoring equipment failures that prevent meeting the requirements in this permit. In the event of any such failure of the monitoring equipment including, but not limited to, loss of refrigeration for an auto-sampler or lab refrigerator or loss of flow proportion sampling ability, the Permittee shall notify in the same manner as in paragraph C of this Section, the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Municipal Facilities Section except, if the failure occurs outside normal working hours (8:30 a.m. to 4:30 p.m. Monday through Friday) the Permittee may wait to make the verbal report until 10:30 am of the next business day after learning of the failure.

(F) In addition to the reporting requirements contained in Section 22a-430-3(i), (j), and (k) of the Regulations of Connecticut State Agencies, the Permittee shall notify in the same manner as in paragraph C of this Section, the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Municipal Facilities Section concerning the failure of any major component of the treatment facilities which the Permittee may have reason to believe would result in an effluent violation.

SECTION 9: COMBINED SEWER OVERFLOWS

(A) The Permittee shall continue to maintain Best Management Practices (BMPs) to reduce the impact of existing CSO's on the receiving waters. Detailed records of BMP activities shall be kept.

(1) The Permittee has identified **William Robinson** as operations and maintenance manager to be in responsible charge of the wastewater collection system and serve as the contact person for department personnel regarding combined sewer discharges. Within ten days after retaining anyone other than the one originally identified, the Permittee shall notify the Commissioner in writing of the identity of such other operations and maintenance manager.

(2) The Permittee shall use, to the maximum extent practicable, available sewerage system transportation capabilities for the conveyance of combined sewage to treatment facilities.

(3) The Permittee is authorized to discharge combined sewage flows from combined sewer overflow outfalls listed in Attachment **3** in response to wet weather flow, i.e. rainfall or snowmelt conditions, when total available transportation, treatment and storage capabilities are exceeded. Dry weather overflows are prohibited. Any other discharge from the outfalls listed in Attachment **3** constitutes a bypass and is subject to the requirements of Section 8 of this permit.

(4) The locations of outfalls and regulators listed in Attachment **3** are taken from Department records. Any information on the locations of any outfalls and regulators in addition to or in conflict with the information in Attachment **3** shall be submitted to the Commissioner within 30 days of the date of issuance of this permit or the date the Permittee becomes aware of such information, whichever is earlier.

(5) When the WWTF influent flows exceed **24** MGD, in response to wet weather flow, i.e. rainfall or snowmelt conditions, the Permittee is authorized to discharge from outfall serial number 001-1 only those flows above **24** MGD, chlorine disinfected primary treated combined sewer wastewater.

(6) The discharge from CSO's, including outfall serial number 001-1, shall not contain septage or holding tank waste.

(7) Discharges from CSO's, including outfall serial number 001-1, shall not cause violations of State Water Quality Standards.

(8) Every calendar year, **on or before September 30th**, the Permittee shall submit a report on a form and in a manner prescribed by the Commissioner including the results of all monitoring from the previous calendar year for outfall serial number 001-1, and the following information:

(a) the date, time, and duration of each precipitation event;

(b) the date, time, duration, quality and volume for each discharge event for outfall serial number 001-1;

(9) On or before **December 31, 2016**, the Permittee shall submit a list of all historical CSO structures in the system that were sealed including name/designation, location, size of structure, their receiving waters, and date of sealing;

(10) The sewage system shall be inspected and maintained such that deposition of solids and/or other obstructions do not cause restrictions in flow resulting in unnecessary wet weather overflows and to ensure that dry weather discharges are not occurring.

(11) The Permittee shall reduce excessive infiltration/inflow to the sewer system.

(12) The Permittee shall review its existing Sewer Use Ordinance, to ensure the language required under Section 4 of this permit has been incorporated. A copy of ordinance shall be submitted to the Department for verification. If the ordinance is revised, a copy of the ordinance must be submitted to the Department within **60** days from the effective date of the change for verification, review and approval. The Sewer Use Ordinance shall:

(a) prohibit the construction of new combined sewers except in cases where repair or replacement of the existing system is approved in writing by the Commissioner, and

(b) prohibit the introduction of new inflow sources to the existing system.

(13) Monthly CSO inspection forms for all CSO structures/regulators, pumping stations and tidegates, which also verify the existence of identification signs for all combined sewer outfall structures as required by the Commissioner shall be maintained.

(a) The signs shall be located at or near the combined sewer outfall structures so that they are easily readable by the public. These signs shall be a minimum of 12 x 18 inches in size, with white lettering against a green background, and shall contain the following information and image:

(PERMITTEE NAME)

WET WEATHER SEWAGE
DISCHARGE OUTFALL (discharge serial number)

Anyone observing a discharge from this outfall during dry weather conditions should call and report it to the Permittee at [______], and to the Department of Energy and Environmental Protection at (860) 424-3704 or 424-3338.

(B) In the event that the Permittee becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this Section of the permit or of any document required hereunder, the Permittee shall immediately notify the Commissioner and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. In so notifying the Commissioner, the Permittee shall state in writing the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and the Permittee shall comply with any dates which may be approved in writing by the Commissioner. Notification by the Permittee shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.

(C) Any document, other than a DMR, ATMR or MOR required to be submitted to the Commissioner under this Section of the permit shall, unless otherwise specified in writing by the Commissioner, be directed to the staff identified in section 10(G) included herein:

(D) Right-to-know Untreated CSO Discharge Reporting

(1) Initial CSO Discharge E-Mail Report

The Permittee shall notify the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Municipal Facilities Section (DEEP) and the Department of Agriculture/Aquaculture Division (DoAg) **within 2 hours** of the Permittee learning of an untreated combined sewer overflow via e-mail to the following e-mails: deep.cso@ct.gov, ivonne.hall@ct.gov, alissa.dragan@snet.net and kristin.dbanick@snet.net utilizing the e-mail format below. If e-mail is unavailable, then the Permittee shall notify DEEP and DoAg via telephone during normal business hours (8:30 a.m. to 4:30 p.m. Monday through Friday) at (860) 424-3704 and (203) 874-0696 respectively or after hours to DEEP Emergency Response Unit at (860) 424-3338 and DoAg at (203) 874-0696.

The initial e-mail report shall contain:

(a) the name or designator of overflow location;

(b) the date and time of initiation;

(c) the size of overflow structure;

(d) the name of the surface water body impacted by the discharge; and

E-mail format:

Report of CSO activation: Regulator (NAME OR DESIGNATION) located in (TOWN/CITY) activated on (DATE) at approximately (TIME). This is a (SIZE) regulator.

(YOUR NAME & PHONE)

(2) Follow-Up Untreated CSO Discharge Written Report

A written report shall be submitted to the Department of Energy and Environmental Protection, Bureau of Water Protection and Land Reuse, Planning and Standards Division, Municipal Facilities Section and the Department of Agriculture/Aquaculture Division at the addresses below **within five days** of the Permittee learning of each occurrence, or potential occurrence, of a combined sewer overflow of untreated sewage.

The follow-up written report shall contain:

() the frequency and duration of the precipitation event and each discharge event;

() an estimation of the volume and quality of the discharges; and

() the names of the impacted receiving waters and any follow up completed by the WPCF.

Contact addresses:

State of Connecticut
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Planning and Standards Division
79 Elm Street
Hartford, Connecticut 06106-5127]

State of Connecticut
Department of Agriculture/
Aquaculture Division
P.O. Box 97
Milford, CT 06460

SECTION 10: COMPLIANCE SCHEDULES

(A) CSO Monitoring Plan

Within **180 days** of the issuance of the permit, the Permittee shall submit to the Commissioner in writing a plan to strategically monitor combined sewer discharge(s) at all combined sewer outfalls within the permitted system with a schedule to implement the monitoring plan within one year of DEEP approval.

(B) Annual CSO Monitoring Report

After approval of a CSO Monitoring Plan, annually, on or before October 31st, the Permittee shall submit an Annual CSO Monitoring Report on a form and in a manner prescribed by the Commissioner, including the results of all monitoring from the previous calendar year for each combined sewer outfall.

The Annual CSO Monitoring Report shall include the following information:

(1) a list of open CSO structures in the system including name/designation, location, size of structure and their receiving waters;

(2) a list of CSO structures in the system that were sealed including name/designation, location, size of structure, their receiving waters, and the physical method used to seal that CSO which has been approved by the Commissioner;

(3) the date, time, and duration of each precipitation event resulting in a discharge;

(4) the date, time, duration, and estimation of volume for each discharge event for each CSO structure;

(5) monthly CSO inspection forms for all CSO structures/regulators, pumping stations and tidegates, which also verify the existence of identification signs for all combined sewer outfall structures as required by the Commissioner.

(6) a list of Best Management Practices (BMPs) that have been used to reduce the impact of existing CSO's on the receiving waters; and

(7) a summary of upcoming mitigation efforts for the next 5 years.

(C) The Permittee shall achieve the final water quality-based effluent limits for **Enterococci** for DSN 001-1 established in Section 5 of this permit, in accordance with the following:

(1) No later than **May 1, 2016,** the Permittee shall comply with the requirements in Table A of this permit for **Enterococci**. Within fifteen days after completing such actions, the Permittee shall certify to the Commissioner in writing that the actions have been completed as approved by the Commissioner.

(D) The Permittee shall use best efforts to submit to the Commissioner all documents required by this Section of the permit in a complete and approvable form. If the Commissioner notified the Permittee that any document or other action is deficient, and does not approve it with conditions or modifications, it is deemed disapproved, and the Permittee shall correct the deficiencies and resubmit it within the time specified by the Commissioner or, if no time is specified by the Commissioner, within thirty days of the Commissioner's notice of deficiencies. In approving any document or other action under this Compliance Schedule, the Commissioner may approve the document or other action as submitted or performed or with such conditions or modifications as the Commissioner deems necessary to carry out the purposes of this Section of the permit. Nothing in this paragraph shall excuse noncompliance or delay.

(E) Dates. The date of submission to the Commissioner of any document required by this section of the permit shall be the date such document is received by the Commissioner. The date of any notice by the Commissioner under this section of the permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the Commissioner, whichever is earlier. Except as otherwise specified in this permit, the word "day" as used in this Section of the permit means calendar day. Any document or action which is required by this Section only of the permit, to be submitted, or performed, by a date which falls on, Saturday, Sunday, or, a Connecticut or federal holiday, shall be submitted or performed on or before the next day which is not a Saturday, Sunday, or Connecticut or federal holiday.

(F) Notification of noncompliance. In the event that the Permittee becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this Section of the permit or of any document required hereunder, the Permittee shall immediately notify the Commissioner and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. In so notifying the Commissioner, the Permittee shall state in writing the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and the Permittee shall comply with any dates which may be approved in writing by the Commissioner. Notification by the Permittee shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.

(G) Notice to Commissioner of changes. Within fifteen days of the date the Permittee becomes aware of a change in any information submitted to the Commissioner under this Section of the permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, the Permittee shall submit the correct or omitted information to the Commissioner.

(H) Submission of documents. Any document, other than a DMR, ATMR or MOR required to be submitted to the Commissioner under this Section of the permit shall, unless otherwise specified in writing by the Commissioner, be directed to:

Ann Straut, Sanitary Engineer 3
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse, Planning and Standards Division
79 Elm Street
Hartford, Connecticut 06106-5127

This permit is hereby issued on October 29, 2015

Betsey Wingfield
Bureau Chief
Bureau of Water Protection and Land Reuse

ATTACHMENT 1

Tables A through G

TABLE A

Discharge Serial Number (DSN): **001-1**	Monitoring Location: **1**
Wastewater Description: **Sanitary Sewage**	
Monitoring Location Description: **Final Effluent**	
Allocated Zone of Influence (ZOI): **293.5cfs**	In-stream Waste Concentration (IWC): **5.95 %**

PARAMETER	Units	FLOW/TIME BASED MONITORING				INSTANTANEOUS MONITORING			REPORT FORM	Minimum Level Analysis See Section 6
		Average Monthly Limit	Maximum Daily Limit	Sample Freq.	Sample type	Instantaneous Limit or Required Range[3]	Sample Freq.	Sample Type		
Alkalinity	mg/l	NA	NA	NR	NA	------	Monthly	Grab	MOR	
Biochemical Oxygen Demand (5 day) [1/5], See remarks D and E below.	mg/l	30 mg/l	50 mg/l	3/week	Daily Composite	NA	NR	NA	DMR/MOR	
Chlorine, Total Residual[5] See remark A below.	mg/l	0.05[4]	0.10[4]	4/ Work Day	Grab	0.20	4/ Work Day	Grab	DMR/MOR	*
Copper, Total	kg/d	2.514	6.781	Weekly	Daily Composite	NA	NA	NA	DMR/MOR	*
Fecal coliform [5] See remark E below.	Colonies per100 ml	NA	NA	NR	NA	see remark (B) below	3/week	Grab	DMR/MOR	
Fecal coliform [5] See remark E below.	Percent of samples exceeding 260 colonies per100 ml	NA	NA	NR	NA	≤10	3/week	Grab	DMR/MOR	
Enterococci [5/6] See remark C below	Colonies per100 ml	NA	NA	NR	NA	500	3/week	Grab	DMR/MOR	
Flow	MGD	------	------	Continuous[2]	Average Daily Flow	NA	NR	NA	DMR/MOR	
Nitrogen, Ammonia (total as N)	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	DMR/MOR	
Nitrogen, Nitrate (total as N)	mg/l	NA	——	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Nitrite (total as N)	mg/l	NA	——	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Total Kjeldahl	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Total	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Nitrogen, Total	lbs/day	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	
Oxygen, Dissolved	mg/l	NA	NA	NR	NA	------	Work Day	Grab	MOR	
pH	S.U.	NA	NA	NR	NA	6 - 9	Work Day	Grab	DMR/MOR	
Phosphate, Ortho	mg/l	NA	------	Monthly	Daily Composite	NA	NR	NA	MOR	

Phosphorus, Total	mg/l	NA	-----	Monthly	Daily Composite	NA	NR	NA	DMR/MOR	
Solids, Settleable	ml/l	NA	NA	NR	NA	------	Work Day	Grab	MOR	
Solids, Total Suspended[1/5], See remarks D and F below	mg/l	30 mg/l	50 mg/l	3/Week	Daily Composite	NA	NA	NA	DMR/MOR	
Temperature	°F	NA	NA	NR	NA	------	Work Day	Grab	MOR	
Turbidity	NTU	NA	NA	NR	NA	------	Work Day	Grab	MOR	

TABLE A – CONDITIONS

Footnotes:

[1] The discharge shall not exceed an average monthly 30 mg/l or a maximum daily 50 mg/l. The Maximum Daily Limit of 50.0 mg/l BOD_5 and 50.0 mg/l Total Suspended Solids are waived during periods when the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to exceed 24 MGD and the permittee shall report the maximum daily discharge concentration for BOD_5 and TSS when the permittee is not treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to exceed 24 MGD. The Permittee shall state on the monthly Discharge Monitoring Reports and MOR's when storm induced flows occur.

[2] The Permittee shall record and report on the monthly operating report the minimum, maximum and total flow for each day of discharge and the average daily flow for each sampling month. The Permittee shall report, on the discharge monitoring report, the average daily flow and maximum daily flow for each sampling month.

[3] The instantaneous limits in this column are maximum limits.

[4] The Maximum Daily Concentration to be reported shall be determined by mathematically averaging the results of the four grab samples required above. The Average Monthly Concentration shall be determined by mathematically averaging the results of the Maximum Daily Concentrations required above.

[5] When the influent flows exceed **24** MGD due to storm events the Permittee may bypass secondary biological treatment only those flows over **24** MGD. Those bypassed flows over **24** MGD shall be treated to a minimum of primary treatment and disinfection. In addition to Table A requirements, during bypass events these parameters shall be sampled daily during the event in accordance with Table A-1 below.

[6] During the period beginning after the implementation of Enterococci monitoring, but beginning no later than **May 1, 2016**, lasting until expiration, the discharge shall also not exceed and shall otherwise conform to the specific terms and conditions listed.

Remarks:

(A) Chlorine disinfection shall be utilized year-round.

(B) The geometric mean of the Fecal coliform bacteria values for the effluent samples collected in a period of a calendar month shall not exceed 88 per 100 milliliters.

(C) The geometric mean of the Enterococci bacteria values for the effluent samples collected in a period of a calendar month shall not exceed 35 per 100 milliliters.

(D) The Average Weekly discharge Limitation for BOD_5 and Total Suspended Solids shall be 1.5 times the Average Monthly Limit listed above.

(E) In addition to the discharge limits included herein, the following conditions shall apply with the exception of during bypass events due to storm-induced flows exceeding **24** MGD:

(i) Biochemical Oxygen Demand shall not exceed 50 mg/l on a 6 consecutive hour average.

(ii) Total Suspended Solids content shall not exceed 50 mg/l on a 6 consecutive hour average.

(iii) Fecal Coliform content shall not exceed:

(a) 800 per 100 ml on a 6 consecutive hour geometric mean.

(b) No sample may contain more than 2,400 per 100 ml.

TABLE A-1

Discharge Serial Number: **001-1 (B)**					Monitoring Location: **8**			
Wastewater Description: **Final effluent during secondary treatment bypass events**								
Monitoring Location Description: **Final Effluent during secondary treatment bypass events**								
PARAMETER	**Units**	**FLOW/TIME BASED MONITORING**				**INSTANTANEOUS MONITORING**			
		Average Monthly Limit	**Maximum Daily Limit**	**Sample Frequency**	**Sample Type**	**Instantaneous Limit or Required Range**	**Sample Frequency**	**Sample Type**	**Reporting form**
BOD (5 day)	mg/l	NA	------	Daily/event[1, 3]	Daily Composite	NA	NA	NA	DMR/MOR
Chlorine, Total Residual	mg/l	NA	NA	NR	NA	------	Daily/event[1, 3]	Grab	DMR/MOR
Event Duration	Hours	NA	------	Continuous[2]	Time	NA	NA	NA	DMR/MOR
Fecal Coliform	per 100 ml	NA	NA	NR	NA	------	Daily/event[1, 3]	Grab	DMR/MOR
Enterococci[4]	per 100 ml	NA	NA	NR	NA	------	Daily/event[1, 3]	Grab	DMR/MOR
Flow	MGD	NA	------	Continuous[2]	Daily Flow	NA	NA	NA	DMR/MOR
Solids, Total Suspended	mg/l	NA	------	Daily/event[1, 3]	Daily Composite	NA	NA	NA	DMR/MOR

TABLE A-1 - CONDITIONS

Footnotes:

[1] Sampling shall be performed each calendar day of the overflow event according to the measurement frequency specified. For composite samples, sampling shall be initiated after the first hour of the overflow event and end at the completion of the overflow event or until midnight of that calendar day. For overflow events that last into the next calendar day(s), sampling shall be terminated at midnight of the first day (labeled as Day 1), re-initiated and continued until the end of the overflow event or midnight of the next calendar day (labeled as Day 2) and so on until the end of the overflow event. Samples shall be flow proportional. Analysis for these parameters shall comply with the normal working schedule of the Facility's Laboratory and holding times per the most recently approved version of Standard Methods. For grab samples, sampling shall occur once per calendar day during the overflow event. Analysis for these parameters shall comply with the normal working schedule of the Facility's Laboratory and holding times per the most recently approved version of Standard Methods.

[2] When the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to the wastewater treatment plant to exceed 24 MGD, the Permittee is authorized to allow flows above 24 MGD to bypass secondary treatment facilities and be discharged as disinfected primary treated combined sewer wastewater.

[3] During short duration overflow events (less than one hour in duration) or during intermittent overflow events (with no one overflow exceeding one hour), this sampling requirement is waived.

[4] During the period beginning after the implementation of Enterococci monitoring, but beginning no later than **May 1, 2016**, lasting until expiration, the discharge shall conform to the specific terms and conditions listed.

Remarks - Apply to all of Table A-1:

(a) Permit compliance for the average weekly discharge limitation in accordance with Table A will be based upon the supporting data from Table A and Table A-1.

(b) The Permittee shall make reasonable efforts to maximize the amount of flow receiving final secondary treatment consistent with achieving NPDES effluent limits at the final secondary effluent discharge as described in the Permit.

(c) There is no reporting required under Section 8(C) of this permit for discharges during these events.

(d) Total Residual Chlorine Limits are 0.2 - 1.5 mg/l.

(e) For any month with no overflow events, the Permittee shall enter on the DMR a No Data Indicator ("NODI") code "9" for Discharge Serial Number 001-1 (B).

TABLE B

Discharge Serial Number (DSN): **001-1**					Monitoring Location: **K**
Wastewater Description: **Sanitary Sewage**					
Monitoring Location Description: **Final Effluent**					
Allocated Zone of Influence (ZOI): **293.5 cfs**		In-stream Waste Concentration (IWC): **5.95 %**			
PARAMETER	**Units**	**FLOW/TIME BASED MONITORING**			**REPORT FORM**
		Average Monthly Minimum	**Sample Freq.**	**Sample type**	
Biochemical Oxygen Demand (5 day) Percent Removal[1, 3]	% of Influent	85	3/week	Calculated[2]	DMR/MOR
Solids, Total Suspended Percent Removal[1, 3]	% of Influent	85	3/week	Calculated[2]	DMR/MOR

TABLE B – CONDITIONS

Footnotes:

[1] The discharge shall be less than or equal to 15% of the average monthly influent BOD_5 and total suspended solids (Table E, Monitoring Location G). The 15% provision is waived during periods when the facility is treating dilute influent due to storm runoff collected by the Combined Sewer System causing influent flows to exceed 24 MGD. The Permittee shall enter on the DMR a No Data Indicator ("NODI") code "9" for BOD5 and TSS average monthly minimum and state on the monthly Discharge Monitoring Reports and MOR's when exceedance of the 15% provision is due to storm induced flows.

[2] Calculated based on the average monthly results described in Table A. Removal efficiency = $\frac{\text{Inf.BOD or TSS} - \text{Effluent BOD or TSS}}{\text{Inf.BOD or TSS}} \times 100$

[3] When the influent flows exceed **24** MGD due to storm events the Permittee may bypass secondary biological treatment. During bypass events these parameters shall be sampled daily during the event. During short duration bypass events (less than one hour in duration) or during intermittent bypass events (with no one bypass exceeding one hour), this sampling requirement is waived. For bypass events exceeding one hour and less than 24 hours in duration, sampling shall be performed each day of the event according to the measurement frequency specified. If a bypass event covers all or part of three calendar days, the Permittee shall take three daily composite samples for BOD_5 and TSS, initiating samples at the start of the bypass event and each subsequent calendar day and terminating samples at the end of the calendar day or at the end of the bypass event. Samples shall be flow proportional.

Remarks - Apply to all of Table B:

(a) Once the permittee commences reporting through NetDMR, a copy of the MOR detailing each wet weather event shall be uploaded into NetDMR.

TABLE C

Discharge Serial Number (DSN): **001-1**				Monitoring Location: **T**		
Wastewater Description: **Sanitary Sewage**						
Monitoring Location Description: **Final Effluent**						
Allocated Zone of Influence (ZOI): **293.5 cfs**			In-stream Waste Concentration (IWC): **5.95 %**			
PARAMETER	**Units**	**Maximum Daily Limit**	**Sampling Frequency**	**Sample Type**	**Reporting form**	**Minimum Level Analysis See Section 6**
Aluminum, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Antimony, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
NOAEL Static 48Hr Acute D. Pulex[1]	% survival	------	Quarterly	Daily Composite	ATMR/DMR	
NOAEL Static 48Hr Acute Pimephales promelas[1]	% survival	------	Quarterly	Daily Composite	ATMR/DMR	
Arsenic, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Beryllium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
BOD_5	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Cadmium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Chromium, Hexavalent	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Chromium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Chlorine, Total Residual	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Copper, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Cyanide, Amenable	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Cyanide, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Iron, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Lead, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Mercury, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Nickel, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Nitrogen, Ammonia (total as N)	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Nitrogen, Nitrate, (total as N)	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Nitrogen, Nitrite, (total as N)	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Phosphorus, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Phenols, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Selenium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Silver, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Suspended Solids, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	
Thallium, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*
Zinc, Total	mg/l	------	Quarterly	Daily Composite	ATMR/DMR	*

TABLE C - CONDITIONS

Remarks: [1]The results of the Toxicity Tests are recorded in % survival. The Permittee shall report % survival on the DMR based on criteria in Section 6(B) of this permit.

ATMR – Aquatic Toxicity Monitoring Report

TABLE D

Discharge Serial Number: **001-1**		Monitoring Location: **N**		
Wastewater Description: **Activated Sludge**				
Monitoring Location Description: **Each Aeration Unit**				
PARAMETER	**REPORTING FORMAT**	**INSTANTANEOUS MONITORING**		**REPORTING FORM**
		Sample Frequency	Sample Type	
Oxygen, Dissolved	High & low for each WorkDay	4/WorkDay	Grab	MOR
Sludge Volume Index	WorkDay	WorkDay	Grab	MOR
Mixed Liquor Suspended Solids	WorkDay	WorkDay	Grab	MOR

TABLE E

Discharge Serial Number: **001-1**			Monitoring Location: **G**				
Wastewater Description: **Sanitary Sewage**							
Monitoring Location Description: **Influent**							
PARAMETER	**Units**	**DMR REPORTING FORMAT**	**FLOW/TIME BASED MONITORING**		**INSTANTANEOUS MONITORING**		**REPORTING FORM**
			Sample Frequency	**Sample Type**	**Sample Frequency**	**Sample Type**	
Biochemical Oxygen Demand (5 day)	mg/l	Monthly average	3/Week	Daily Composite	NA	NA	DMR/MOR
Nitrogen, Ammonia (total as N)	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Nitrate (total as N)	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Nitrite (total as N)	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Total Kjeldahl	mg/l		Monthly	Daily Composite	NA	NA	MOR
Nitrogen, Total	mg/l		Monthly	Daily Composite	NA	NA	MOR
Phosphate, Ortho	mg/l		Monthly	Daily Composite	NA	NA	MOR
Phosphorus, Total	mg/l		Monthly	Daily Composite	NA	NA	MOR
pH	S.U.		NA	NA	Work Day	Grab	MOR
Solids, Total Suspended	mg/l	Monthly average	3/Week	Daily Composite	NA	NA	DMR/MOR
Temperature	°F		NA	NA	Work Day	Grab	MOR

TABLE F

Discharge Serial Number: **001-1**							Monitoring Location: **P**
Wastewater Description: **Primary Effluent**							
Monitoring Location Description: **Primary Sedimentation Basin Effluent**							
PARAMETER	**Units**	**REPORTING FORMAT**	**TIME/FLOW BASED MONITORING**		**INSTANTANEOUS MONITORING**		**REPORTING FORM**
			Sample Frequency	**Sample Type**	**Sample Frequency**	**Sample type**	
Alkalinity, Total	mg/l		NA	NA	Monthly	Grab	MOR
Biochemical Oxygen Demand (5 day)	mg/l	Monthly average	Weekly	Composite	NA	NA	MOR
Nitrogen, Ammonia (total as N)	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Nitrate (total as N)	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Nitrite (total as N)	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Total Kjeldahl	mg/l		Monthly	Composite	NA	NA	MOR
Nitrogen, Total	mg/l		Monthly	Composite	NA	NA	MOR
pH	S.U.		NA	NA	Monthly	Grab	MOR
Solids, Total Suspended	mg/l	Monthly average	Weekly	Composite	NA	NA	MOR

TABLE G

Discharge Serial Number: **001-1**	Monitoring Location: **SL**		
Wastewater Description: **Thickened Sludge**			
Monitoring Location Description: **At sludge draw off**			
PARAMETER	**INSTANTANEOUS MONITORING**		**REPORTING FORM**
	Units	**Grab Sample Freq.**	
Arsenic, Total	mg/kg	Bi-monthly	DMR
Beryllium, Total	mg/kg	Bi-monthly	DMR
Cadmium, Total	mg/kg	Bi-monthly	DMR
Chromium, Total	mg/kg	Bi-monthly	DMR
Copper, Total	mg/kg	Bi-monthly	DMR
Lead, Total	mg/kg	Bi-monthly	DMR
Mercury, Total	mg/kg	Bi-monthly	DMR
Nickel, Total	mg/kg	Bi-monthly	DMR
Nitrogen, Ammonia *	mg/kg	Bi-monthly	DMR*
Nitrogen, Nitrate (total as N) *	mg/kg	Bi-monthly	DMR*
Nitrogen, Organic *	mg/kg	Bi-monthly	DMR*
Nitrogen, Nitrite (total as N) *	mg/kg	Bi-monthly	DMR*
Nitrogen, Total *	mg/kg	Bi-monthly	DMR*
pH *	S.U.	Bi-monthly	DMR*
Polychlorinated Biphenyls	mg/kg	Bi-monthly	DMR
Solids, Fixed	%	Bi-monthly	DMR
Solids, Total	%	Bi-monthly	DMR
Solids, Volatile	%	Bi-monthly	DMR
Zinc, Total	mg/kg	Bi-monthly	DMR

(*) required for composting or land application only

Testing for inorganic pollutants shall follow "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846 as updated and/or revised.

ATTACHMENT 2

MONTHLY OPERATING REPORT FORM

Bridgeport East
Sample month/year:

Permit expiration date:
Page 1 of MOR for permit # CT0101010

Facility ID: 015-002

Chief Plant Operator: Steven Silverbush
Phone:

Date received: (stamped)

	Daily Flow			Primary Sludge			Aeration Tank #1				Aeration Tank #2				Aeration Tank #3				Aeration Tank #4				Aeration Tank #5				Aeration Tank #6				Return sludge	
	Max.	Min.	Total	Vol.	%	wt.	MLSS	SVI	high D.O.	low D.O.	MLSS	SVI	high D.O.	low D.O.	MLSS	SVI	high D.O.	low D.O.	MLSS	SVI	high D.O.	low D.O.	MLSS	SVI	high D.O.	low D.O.	MLSS	SVI	high D.O.	low D.O.	%flow	%solids
Units	mgd			gal.	solids	lbs.			mg/l				mg/l				mg/l				mg/l				mg/l				mg/l			
Freq	daily			work day			Work day		4/work day		Work day		4/work day		Work day		4/work day		Work day		4/work day		Work day		4/work day		Work day		4/work day		work day	
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Bridgeport East Permit expiration date: Facility ID: 015-002 Chief Plant Operator: Steven Silverbush

Sample month/year: Page 2 of MOR for permit # CT0101010 Phone:

	Dry Solids In	Dry Solids Out	Waste sludge	Waste accepted septic	Waste accepted indust	BOD (5-day) Inf.	BOD (5-day) Prim. Eff.	BOD (5-day) Final Eff.	BOD (5-day) Final Eff.	Suspended Solids Inf.	Suspended Solids Prim. Eff.	Suspended Solids Final Eff.	Suspended Solids Final Eff.	Settleable Solids Eff.	Turbidity Eff.	Chlorine Dose	Chlorine Dose	Chlorine Residual high	Chlorine Residual low	Chlorine Residual average	Fecal Coliform	Fecal Coliform % of samples exceed 260/100ml	Enterococci	Ammonia Inf.	Ammonia Prim. Eff.	Ammonia Final Eff.
Units	lbs		lbs	gal	gal	mg/l			% of Eff	mg/l			% of Eff	ml/l	NTU	lbs	mg/l	mg/l		mg/l	#/100 ml		#/100 ml	mg/l		
Freq	work day		work day	work day		3 per week	weekly	3 per week	3 per week	3 per week	weekly	3 per week	3 per week	work day	work day	Daily		4/work day		4/work day	3/week	3/week	3/week	Monthly		
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Bridgeport East Permit expiration date: Facility ID: 015-002 Chief Plant Operator: Steven Silverbush

Sample month/year: Page 3 of MOR for permit # CT0101010 Phone:

Nitrite			Nitrate			TKN			Total N			Total N	D.O.	pH		Total P	OrthoP	Temp.		Copper	Alkalinity	
Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.	Inf.	Prim. Eff.	Final Eff.	Eff.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Eff.	Inf.	Eff.
mg/l			mg/l			mg/l			mg/l			lb/d	mg/l	S.U.		mg/l	mg\l	°F		kg/d	mg/l	
Monthly			Monthly			Monthly			Monthly			monthly	workday	work day		monthly	monthly	work day		weekly	monthly	

Bridgeport East Permit expiration date: Facility ID: 015-002 Chief Plant Operator: Steven Silverbush Date received: (stamped)

Sample month/year: Page 3 of MOR for permit # CT0101010 Phone:

Bypass Event							Rain	Comments
Flow	Hours	BOD	CL2	Fecal	Entero	TSS		
Effluent								
MG	Hrs	mg/l				mg/l	Inches	
Per Event							per day	
								Bypass/Rain Event

Sludge Disposal Location:
Waterbury, CT - Synagro

Please return forms to:
DEEP - Water Bureau
ATTN: Municipal Wastewater Monitoring Coordinator
Municipal Facilities
79 Elm Street
Hartford, CT 06106-5127

Statement of Acknowledgement

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

Authorized Official:

Signature: ____________________

Steven A. Silverbush

Title: Chief Operator

Date: __________

ATTACHMENT 3

CSO REGULATORS AND DISCHARGE POINTS

City of Bridgeport East Side NPDES Permitted Regulators as of August 2015
Permit ID: CT0101010

NPDES #	MNEUMONIC	LOCATION	RECEIVING WATER
153	WANN 153	Waterview & Ann Street	Yellow Mill Pond
22	CHUR 22	Church Street West of Waterview	Yellow Mill Pond
17	WASH 17	Seaview & Crescent	Yellow Mill Pond
16	DEAC 16	Seaview & Deacon Street	Yellow Mill Pond
12	STRAT	Connecticut & Stratford	Yellow Mill Pond
6	BAYEL 6	Bay St & Mildner Dr	Johnson's Creek
18	BARN 18	Seaview & Barnum	Yellow Mill Pond

DATA TRACKING AND TECHNICAL FACT SHEET

Permittee: City of Bridgeport

PERMIT, ADDRESS, AND FACILITY DATA

PERMIT #: CT0101010 **APPLICATION #:** 201300409 **FACILITY ID.** 015-002

Mailing Address:	Location Address:
Street: 695 Seaview Avenue	Street: 695 Seaview Avenue
City: Bridgeport ST: CT Zip: 06607	City: Bridgeport ST: CT Zip: 06607
Contact Name: William E. Robinson	Contact Name: William E. Robinson
Phone No.: (203) 332-5550	Phone No.: (203) 332-5550
	DMR Contact email address: Steve Silverbush ssilverb@cox.net

PERMIT INFORMATION

DURATION 5 YEAR X 10 YEAR ___ 30 YEAR ___

TYPE New ___ Reissuance **X** Modification ___

CATEGORIZATION POINT (X) NON-POINT ( ) GIS #

NPDES (X) PRETREAT () GROUND WATER(UIC) ( ) GROUND WATER (OTHER) ( )

NPDES MAJOR**(MA)** X
NPDES SIGNIFICANT MINOR or PRETREAT SIU **(SI)** ___
NPDES or PRETREATMENT MINOR **(MI)** ___

COMPLIANCE SCHEDULE YES X NO______
POLLUTION PREVENTION ___ TREATMENT REQUIREMENT___
WATER QUALITY REQUIREMENT ___ OTHER CSO Monitoring Plan and Annual Report

OWNERSHIP CODE
Private ___ Federal ___ State ___ Municipal (town only) X Other public___

DEP STAFF ENGINEER Ann A. Straut **DATE DRAFTED:** 08/25/015

PERMIT FEES

Discharge Code	DSN Number	Annual Fee
111000f	001-1	$3,005.00

FOR NPDES DISCHARGES
Drainage Basin Code: NA Water Quality Classification Goal: SB Segment: Bridgeport Harbor

NATURE OF BUSINESS GENERATING DISCHARGE
Municipal Sanitary Sewage Treatment

PROCESS AND TREATMENT DESCRIPTION (by DSN)
Secondary treatment with denitrification and chlorine disinfection

RESOURCES USED TO DRAFT PERMIT
_X_ *Federal Effluent Limitation Guideline 40CFR 133 Secondary Treatment Category*

__ *Performance Standards*

_ *Federal Development Document*

X *Department File Information*

X *Connecticut Water Quality Standards*

X *Anti-degradation Policy*

X *Coastal Management Consistency Review Form*

_ *Other - Explain*

BASIS FOR LIMITATIONS, STANDARDS OR CONDITIONS

X *Secondary Treatment (Section 22a-430-4(r) of the Regulations of Connecticut State Agencies)*

_ *Case-by-Case Determination (See Other Comments)*

_ *In order to meet in-stream water quality (See General Comments)*

_ *Anti-degradation policy*

GENERAL COMMENTS

The City of Bridgeport ("Bridgeport") operates a municipal water pollution control facility ("the facility") located at 695 Seaview Avenue, Bridgeport. The facility is designed to treat and discharge up to 10.0 million gallons a day of effluent into the Bridgeport Harbor. The facility currently uses secondary treatment with denitrification and chlorine disinfection to treat effluent before being discharged. Pursuant to Conn. Gen. Stat. § 22a-430, the Department of Energy and Environmental Protection has issued Bridgeport a permit for the discharge from this facility. Bridgeport has submitted an application to renew its permit. The Department has made a tentative determination to approve Bridgeport's application and has prepared a draft permit consistent with that determination.

The most significant changes from the current permit are the inclusion of revised bacteria monitoring requirements (fecal coliform and enterococci), aluminum monitoring to be consistent with the most recent CT Water Quality Standards and iron monitoring to be consistent with EPA's National Recommended Water Quality Criteria.

SPECIFIC REQUIREMENTS OR REVISIONS

The Department reviewed the application for consistency with Connecticut's Water Quality Standards and determined that with the limits in the draft permit, including those discussed below, that the draft permit is consistent with maintenance and protection of water quality in accordance with the Tier I Anti-degradation Evaluation and Implementation Review provisions of such Standards.

The need for inclusion of water quality based discharge limitations in this permit was evaluated consistent with Connecticut Water Quality Standards and criteria, pursuant to 40 CFR 122.44(d). Discharge monitoring data was evaluated for consistency with the available aquatic life criteria (acute and chronic) and human health (fish consumption only) criteria, considering the zone of influence allocated to the facility where appropriate. In addition to this review, the statistical procedures outlined in the EPA Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001) were employed to calculate the need for such limits. Comparison of the attached monitoring data and its inherent variability with the calculated water quality based limits indicates a low statistical probability of exceeding such limits. Therefore, water quality based limits for copper were included in the permit at this time.

WATER QUALITY LIMIT CALCULATIONS

See attached

Bridgeport East Side WPCF

Discharger:	Bridgeport East Side WPCF		by: StrautA, 8/26/2015, 09:12
Receiving Water:	Bridgeport Harbor / LIS	CURRENT CONDITIONS	
Design Flow:	12.000 MGD	Avg. Flow:	6.800 MGD
Allocated ZOI:	293.50 CFS	Max. Flow:	40.000 MGD
Samples/Month:	4	IWC:	5.95 %

WQB Limits - **Saltwater**

Compound	C.V.	AML ug/l	MDL ug/l	AML kg/d	MDL kg/d	LIMIT? ML?
Aluminum	0.6	1.20E+03	2.40E+03	5.44E+01	1.09E+02	
Ammonia	1.1	8.88E+03	2.32E+04	4.04E+02	1.06E+03	
Antimony	0.4	4.71E+03	7.88E+03	2.14E+02	3.58E+02	
Arsenic	0.0	2.10E-02	2.10E-02	9.55E-04	9.55E-04	ML
Beryllium	0.5	2.19E+00	4.03E+00	9.93E-02	1.83E-01	ML
Cadmium	2.3	7.92E+01	2.49E+02	3.60E+00	1.13E+01	
Chlorine	0.6	1.03E+02	2.07E+02	4.69E+00	9.41E+00	
Chromium (hex)	0.2	7.85E+02	1.04E+03	3.57E+01	4.73E+01	
Chromium (tri)	1.5	1.70E+07	4.90E+07	7.71E+05	2.23E+06	
Copper	1.2	5.53E+01	1.49E+02	2.51E+00	6.78E+00	LIMIT/ML
Cyanide (amen)	0.1	1.45E+01	1.68E+01	6.60E-01	7.64E-01	
Lead	0.8	1.05E+02	2.40E+02	4.76E+00	1.09E+01	
Mercury	3.0	8.57E-01	2.79E+00	3.90E-02	1.27E-01	ML
Nickel	0.3	1.25E+02	1.87E+02	5.66E+00	8.49E+00	
Phenol	0.5	1.45E+07	2.67E+07	6.57E+05	1.21E+06	
Selenium	2.3	6.39E+02	2.01E+03	2.90E+01	9.13E+01	
Silver	0.2	2.41E+01	3.19E+01	1.09E+00	1.45E+00	
Thallium	0.0	7.90E+00	7.90E+00	3.59E-01	3.59E-01	
Zinc	0.4	1.32E+03	2.21E+03	6.01E+01	1.01E+02	

Current Conditions

Compound	# DETECTS	AMC ug/l	MMC ug/l	AMM kg/d	MMM kg/d
Aluminum				0.00E+00	0.00E+00
Ammonia	21	8.80E+02	3.50E+03	2.27E+01	5.30E+02
Antimony	5	2.20E+00	4.00E+00	5.67E-02	6.06E-01
Arsenic	0	2.00E+00	2.00E+00	5.15E-02	3.03E-01
Beryllium	0	4.00E+00	8.00E+00	1.03E-01	1.21E+00
Cadmium	9	1.20E+00	1.40E+01	3.09E-02	2.12E+00
Chlorine					
Chromium (hex)	0	5.10E+00	1.00E+01	1.31E-01	1.52E+00
Chromium (tri)	3	3.00E+00	2.40E+01	7.73E-02	3.64E+00
Copper	24	2.32E+01	1.20E+02	5.98E-01	1.82E+01
Cyanide (amen)	0	5.30E+00	8.00E+00	1.37E-01	1.21E+00
Lead	24	1.50E+00	5.00E+00	3.86E-02	7.58E-01
Mercury	2	9.00E-01	1.00E+01	2.32E-02	1.52E+00
Nickel	24	9.80E+00	1.60E+01	2.52E-01	2.42E+00
Phenol	8	3.61E+01	8.00E+01	9.30E-01	1.21E+01
Selenium	0	3.60E+00	4.20E+01	9.27E-02	6.36E+00
Silver	1	1.00E+00	2.00E+00	2.58E-02	3.03E-01
Thallium	0	1.00E+00	1.00E+00	2.58E-02	1.52E-01
Zinc	24	5.29E+01	9.70E+01	1.36E+00	1.47E+01

Final WQB Limits

	AML (kg/d)	MDL (kg/d)
Copper	2.514	6.781

Interim WQB Limits

	AML (kg/d)	MDL (kg/d)

Minimum Levels

Arsenic	0.005 mg/L
Beryllium	0.001 mg/L
Copper	0.005 mg/L
Mercury	0.0002 mg/L

Effluent Chemistry: BRIDGEPORT EAST WPCF

as of **Wednesday, August 26, 2015** **Design Flow** 12 MGD **Avg. Monthly Flow '11:** . MGD **Max. Monthly Flow '11:** MGD

Receiving Waterbody: Bridgeport Harbor
Allocated ZOI: 293.5 cfs
Database IWC: 5.95%

Date	BOD	TSS	NH3	NO2	NO3	CNt	CNa	Be	As	Cd	Cr6	Cr3	Cu	Pb	Th	Ni	Ag	Zn	Sb	Se	Phen	Hg
1/14/2010	5.80	3.00	0.77	< 0.050	1.90	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	19.0	2.0	< 1.0	14.0	< 1.0	89.0	< 2.0	< 2.0	< 50.0	< 0.0
3/4/2010	6.10	4.00	1.20	0.060	0.10	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	16.0	1.0	< 1.0	5.0	< 1.0	54.0	< 3.0	< 2.0	< 50.0	< 0.0
6/3/2010	11.00	9.00	2.90	0.220	0.19	< 5.0	< 5.0	< 5.0	< 2.0	0.8	< 5.0	< 2.0	21.0	5.0	< 1.0	7.0	< 1.0	64.0	4.0	< 2.0	< 50.0	< 0.0
9/2/2010	5.00	< 10.00	< 0.10	< 0.050	5.30	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 10.0	< 2.0	7.0	0.7	< 1.0	14.0	2.0	61.0	4.0	< 2.0	< 50.0	< 0.0
12/9/2010	5.00	< 10.00	0.23	< 0.050	4.90	< 5.0	< 5.0	< 5.0	< 2.0	2.0	< 5.0	< 2.0	7.0	0.9	< 1.0	9.0	< 1.0	61.0	3.0	< 2.0	< 50.0	< 0.0
3/3/2011	5.00	< 2.50	1.20	0.260	1.20	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	4.0	0.6	< 1.0	10.0	< 1.0	51.0	< 2.0	< 2.0	30.0	< 0.0
6/9/2011	5.00	0.25	0.05	3.300	6.00	< 6.0	< 6.0	< 6.0	< 2.0	0.7	< 5.0	< 2.0	6.0	1.0	< 1.0	11.0	< 1.0	54.0	< 2.0	< 2.0	60.0	< 0.1
9/14/2011	5.00	< 2.50	0.44	< 0.050	2.00	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	5.0	1.0	< 1.0	7.0	< 1.0	29.0	< 2.0	< 2.0	< 30.0	< 0.0
10/6/2011	5.00	< 2.50	0.34	< 0.050	4.80	< 8.0	< 8.0	< 8.0	< 2.0	14.0	< 5.0	< 2.0	3.0	0.6	< 1.0	8.0	< 1.0	55.0	< 2.0	< 2.0	< 30.0	< 0.1
12/20/2011	7.80	5.50	0.89	0.130	3.90	< 5.0	< 5.0	< 5.0	< 2.0	0.6	< 5.0	< 2.0	9.0	2.0	< 1.0	11.0	< 1.0	51.0	< 2.0	< 2.0	< 30.0	< 0.0
3/6/2012	5.00	3.30	0.95	0.080	2.40	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	9.0	0.9	< 1.0	8.0	< 1.0	59.0	< 2.0	< 2.0	30.0	< 0.0
6/7/2012	5.00	8.10	0.44	0.080	5.10	< 5.0	< 5.0	< 5.0	< 2.0	0.5	< 5.0	< 2.0	7.0	1.0	< 1.0	6.0	< 1.0	42.0	< 2.0	< 2.0	50.0	< 0.0
12/6/2012	5.00	< 2.50	0.63	< 0.050	4.80	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	36.0	3.0	< 1.0	11.0	< 1.0	54.0	< 2.0	< 2.0	80.0	< 0.0
3/6/2013	27.00	3.50	3.50	0.100	0.73	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 2.0	< 2.0	21.0	1.0	< 1.0	12.0	< 1.0	51.0	< 2.0	< 2.0	< 30.0	<10.0
6/18/2013	5.00	2.90	< 0.10	< 0.050	4.20	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	120.0	1.0	< 1.0	6.0	< 1.0	42.0	< 2.0	< 2.0	< 30.0	0.0
7/10/2013	5.00	< 2.50	< 0.10	< 0.050	4.50	< 5.0	< 5.0	< 5.0	< 2.0	< 0.5	< 5.0	< 2.0	78.0	2.0	< 1.0	7.0	< 1.0	7.0	< 1.0	< 42.0	< 2.0	2.0
9/14/2013	5.00	< 2.50	0.28	< 0.050	< 3.10	< 5.0	< 5.0	< 2.0	< 2.0	< 0.5	< 5.0	< 2.0	75.0	1.0	< 1.0	13.0	< 1.0	54.0	2.0	< 2.0	4.0	< 0.0
12/5/2013	5.00	< 2.50	0.98	< 0.050	3.80	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	24.0	38.0	1.0	< 1.0	11.0	< 1.0	66.0	3.0	< 2.0	30.0	< 0.0
3/6/2014	6.20	4.60	1.60	< 0.250	< 6.90	6.0	< 7.0	< 1.0	< 2.0	0.5	< 5.0	3.0	29.0	1.0	< 1.0	10.0	< 1.0	61.0	< 2.0	< 2.0	< 30.0	<10.0
6/5/2014	5.00	2.80	0.86	< 0.050	2.00	< 5.0	< 5.0	< 2.0	< 2.0	< 0.6	< 5.0	2.0	13.0	0.7	< 1.0	13.0	< 1.0	83.0	< 0.2	< 0.2	< 30.0	< 0.0
9/17/2014	5.00	< 1.30	0.22	< 0.050	2.10	< 5.0	< 5.0	< 1.0	< 2.0	0.5	< 5.0	< 2.0	6.0	3.0	< 1.0	9.0	< 1.0	7.4	< 2.0	< 2.0	30.0	< 0.0
12/3/2014	5.00	1.20	0.20	< 0.250	5.60	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	7.0	0.5	< 1.0	8.0	< 1.0	6.9	< 2.0	< 2.0	< 30.0	< 0.0
3/12/2015	5.00	< 1.00	2.70	0.190	4.50	< 5.0	< 5.0	<	< 2.0	1.0	< 5.0	< 2.0	13.0	4.0	< 1.0	16.0	< 1.0	97.0	< 2.0	< 2.0	< 30.0	< 0.0
6/4/2015	3.50	2.00	0.54	0.160	1.10	< 5.0	< 5.0	< 1.0	< 2.0	< 0.5	< 5.0	< 2.0	8.0	0.9	< 1.0	10.0	< 1.0	70.0	< 2.0	< 2.0	< 30.0	< 0.0

Date	BOD	TSS	NH3	NO2	NO3	CNt	CNa	Be	As	Cd	Cr6	Cr3	Cu	Pb	Th	Ni	Ag	Zn	Sb	Se	Phen	Hg
	BOD	TSS	NH3	NO2	NO3	CNt	CNa	Be	As	Cd	Cr6	Cr3	Cu	Pb	Th	Ni	Ag	Zn	Sb	Se	Phen	Hg
Count	**24**	**24**	**24**	**24**	**24**	24	24	23	24	24	24	24	24	24	24	24	24	24	24	24	24	24
# Detected	**8**	**13**	**21**	**10**	**22**	1	0	-1	0	9	0	3	24	24	0	24	1	24	5	0	8	2
Average	**6.35**	**3.75**	**0.88**	**0.237**	**3.38**	5.2	5.3	4.0	2.0	1.2	5.1	3.0	23.2	1.5	1.0	9.8	1.0	52.9	2.2	3.6	36.1	0.9
Maximum	**27.00**	**10.00**	**3.50**	**3.300**	**6.90**	8.0	8.0	8.0	2.0	14.0	10.0	24.0	120.0	5.0	1.0	16.0	2.0	97.0	4.0	42.0	80.0	10.0
CV	**0.7**	**0.7**	**1.1**	**2.8**	**0.6**	0.1	0.1	0.5	0.0	2.3	0.2	1.5	1.2	0.8	0.0	0.3	0.2	0.4	0.4	2.3	0.5	3.0

Bold => mg/L Normal => ug/L

General Permit for Nitrogen

CDM Smith

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

General Permit for Nitrogen Discharges

Effective Date: January 1, 2019
Expiration Date: December 31, 2023

Bureau of Water Protection and Land Reuse
Water Planning and Management Division
860-424-3704

General Permit for Nitrogen Discharges

Table of Contents

General Permit for Nitrogen Discharges

Section 1. Authority

This general permit is issued under the authority of *Sections 22a-521 through 527 and Chapter 446k* of the Connecticut General Statutes (CGS).

Section 2. Definitions

As used in this general permit, and as defined or modified from Section *22a-521 of the CGS:*

"Annual mass loading of total nitrogen" (expressed in pounds per day) means the sum of monthly mass loading of total nitrogen for each month from January through December divided by 12 and rounded to the nearest whole number.

"Authorized activity" means any activity authorized by this general permit.

"CFR" means Code of Federal Regulations.

"Commissioner" means Commissioner of the Department of Energy and Environmental Protection as defined by Section 22a-2(b) of the CGS.

"Daily composite" means a composite sample taken over a full operating day consisting of grab samples collected at equal intervals of no more than sixty (60) minutes and combined proportionally to flow; or, a composite sample continuously collected over a full operating day proportional to flow.

"Daily mass loading of total nitrogen" (expressed in pounds per day) means the total nitrogen concentration (expressed in mg/L to the nearest 0.1 mg/L) multiplied by the daily flow volume (expressed as MGD, to the nearest 0.1 MGD for facilities with a design capacity of 1.0 MGD or greater and to the nearest 0.01 MGD for facilities with a design capacity of less than 1.0 MGD) multiplied by 8.34 and rounded to the nearest whole number to convert to pounds per day units.

"Department" means the Department of Energy and Environmental Protection.

"Discharge Monitoring Report" or *"DMR"* means a report form provided or approved by the Commissioner for use by a permittee to submit discharge monitoring data to the Department relating to compliance with limits and conditions established in the individual permit for a facility.

"Equivalency factor" means a ratio of the unit response of dissolved oxygen to nitrogen in Long Island Sound for each POTW based on the geographic location of the specific POTW's discharge point divided by the unit response of the geographic area with the highest impact.

"Equivalent nitrogen credit" means a nitrogen credit multiplied by the equivalency factor.

"Individual permit" means a permit issued to a named permittee under Section 22a-430-4 of the Regulations of Connecticut State Agencies (RCSA).

"Monthly mass loading of total nitrogen" (expressed in pounds per day) means the sum of the daily mass loading of total nitrogen for each monitored day during the month divided by the number of monitoring days during the month and rounded to the nearest whole number.

"Monthly Operating Report" or *"MOR"* means a report form provided or approved by the Commissioner for use by a permittee in submitting data to the Department related to the operation of a facility.

"Municipality" means municipality as defined by Section 22a-423 of the CGS.

"Nitrogen Analysis Report" or *"NAR"* means a report form provided or approved by the Commissioner for use by a permittee in submitting monitoring data to the Department related to the discharge of nitrogen from a facility.

"Nitrogen credit" means the difference between the annual mass loading of total nitrogen specified for a POTW in the general permit for treated nitrogen discharges and the monitored annual mass loading of total nitrogen discharged by that POTW expressed as pounds of nitrogen per day.

"Nitrogen credit exchange program" means the program within the Department established pursuant to *Section 22a-524 of the CGS.*.

"Nitrogen Wasteload Allocation" means a total load of nitrogen assigned to a discharger expressed in pounds per day of total nitrogen discharged.

"Permittee" means a municipality or person discharging nitrogen as authorized by the general permit.

"Person" means person as defined by Section 22a-423 of the CGS.

"Publicly Owned Treatment Works" or *"POTW"* means a system used for the collection, treatment or disposal of sewage from one or more parcels of land and that discharges to the waters of the state and is owned by a municipality of the state.

"TMDL" means the Total Maximum Daily Load analysis to achieve water quality standards for dissolved oxygen in Long Island Sound as established by the Department and as approved by the United States Environmental Protection Agency on April 3, 2001.

"Total nitrogen" means the total of the concentrations of ammonia nitrogen, organic nitrogen, nitrite nitrogen, and nitrate nitrogen expressed as milligrams of nitrogen per liter.

Section 3. Authorization Under This General Permit

(a) Eligible Activities or Discharges

This general permit authorizes the discharge of total nitrogen from the POTWs listed in Appendix 1, provided the activities are conducted in accordance with this general permit.

This general permit does not authorize any discharge of water, substance or material into the waters of the state other than the one specified in this section. Any person or municipality which initiates, creates, originates or maintains such a discharge must first apply for and obtain authorization under Section 22a-430 of the CGS.

(b) Geographic Area

This general permit applies throughout the State of Connecticut.

(c) Effective Date and Expiration Date of this General Permit

This general permit is effective on *January 1, 2019 and expires on December 31, 2023.*

(d) Effective Date of Authorization

An activity is authorized by this general permit on the date the general permit is issued.

Section 4. Conditions of this General Permit

A permittee shall conduct activities authorized by this general permit in accordance with the following conditions:

(a) *Discharge Limits*

(1) Annual discharge limit applicable to each POTW are set forth in Appendix 1, which is incorporated herein in its entirety, as part of this general permit.

(2) Each permittee shall limit the discharge of nitrogen to the annual discharge limits set forth in Appendix 1, except as set forth in paragraph (b)(1)(b) of this Section.

(b) *Compliance During Term of Permit*

(1) A permittee shall be in compliance with this general permit if:

(a) the POTW's annual mass loading of total nitrogen is less than or equal to the discharge limit set forth in Appendix 1; or,

(b) the permittee has secured state-owned equivalent nitrogen credits equal to the amount the POTW exceeded the annual discharge limit set forth in Appendix 1 in accordance with the Nitrogen Credit Exchange Program and Sections 22a-521 through 527 of the CGS.

(2) A permittee shall be out of compliance with the general permit and subject to the enforcement provisions of Chapter 446k of the CGS if:

(a) the POTW's annual mass loading of total nitrogen is greater than the discharge limit set forth in Appendix 1; and

(b) the permittee fails to secure sufficient state-owned equivalent nitrogen credits in a timely manner in accordance with the Nitrogen Credit Exchange Program and Sections 22a-521 through 527 of the CGS.

(c) Operation of Nitrogen Removal Process Equipment

The permittee shall not bypass or fail to operate any of the approved nitrogen removal equipment or processes without the written approval of the Commissioner. The permittee shall operate all necessary equipment to optimize nitrogen removal so as to reduce nitrogen discharges to the maximum extent practicable. This includes but is not limited to all recycle pumping systems, aeration equipment, aeration tank cycling, mixing equipment, anoxic basins, chemical feed systems or any other process equipment necessary for the optimal removal of nitrogen.

(d) Monitoring Requirements

(1) Effective upon issuance of this general permit, the permittee shall monitor total nitrogen in the final effluent in accordance with the following frequency:

(a) POTWs with a design flow rate specified in the individual permit for the facility of less than 10 MGD shall monitor the final effluent at a minimum frequency of weekly.

(b) POTWs with a design flow rate specified in the individual permit for the facility equal to or greater than 10 MGD shall monitor the final effluent at a minimum frequency of twice per week.

(2) Monitoring requirements shall commence on *January 1st 2019.*

(3) Final effluent and monitoring location shall be identical to that used to determine compliance with final effluent limitations and monitoring conditions established in the individual permit for the facility.

(4) All samples analyzed to determine compliance with limits on total nitrogen shall be daily composite samples unless otherwise approved in writing by the Commissioner.

(5) Chemical analyses to determine compliance with effluent limits and conditions established in this general permit shall be performed using the methods approved in or pursuant to 40 CFR 136 unless an alternative method has been approved in writing pursuant to 40 CFR 136.4.

(6) The permittee shall measure the total daily flow of wastewater received by the facility at the main flow meter as set forth in the individual permit for the facility.

(7) In the event of a flow meter malfunction on a day when a sample for total nitrogen analysis is collected, the permittee shall utilize the arithmetic average of the 7 highest daily flows measured during the previous 30-day period to calculate the total daily nitrogen loading unless an alternative procedure has been agreed to by the Commissioner.

(e) Reporting Requirements

The results of chemical analyses for the total nitrogen in all samples collected during the month and the total daily flow effluent for each day during the month shall be entered on the MOR and NAR and reported to the Department. Results must also be entered in the DMR as a calculated monthly mass loading of total nitrogen. The MOR, NAR and DMR must be received at the following address by the 15th day of the month following the month samples are collected.

ATTN: Municipal Wastewater Unit
Connecticut Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
79 Elm Street
Hartford, CT 06106-5127

(f) *Record Keeping Requirements*

The permittee shall retain copies of all reports required by this general permit, and records of all data used to compile these reports for a period of at least five years from the date of the report submission to the Department.

(g) *Duty to Correct and Report Violations*

Upon learning of a violation of a condition of this general permit, including any failure of flow monitoring equipment, the permittee shall immediately take all reasonable action to determine the cause of such violation, correct such violation and mitigate its results, prevent further such violation, and report in writing such violation and such corrective action to the Commissioner within five (5) days of the permittee learning of such violation. Such report shall be certified in accordance with subsection 4(i) of this general permit.

(h) *Duty to Provide Information*

If the Commissioner requests any information pertinent to the authorized activity or to ensure compliance with this general permit, the permittee shall provide such information in writing within thirty (30) days of such request. Such information shall be certified in accordance with subsection 4(i) of this general permit.

(i) *Certification of Documents*

Any document, including but not limited to any notice, which is submitted to the Commissioner under this general permit shall be signed by, as applicable, the permittee in accordance with Section 22a-430-3(b)(2) of the RCSA, and by the individual or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute."

(j) *Date of Filing*

For purposes of this general permit, the date of filing with the Commissioner of any document is the date such document is received by the Commissioner. The word "day" as used in this general permit means the calendar day; if any date specified in the general permit falls on a Saturday, Sunday, or legal holiday, such deadline shall be the next business day thereafter.

(k) *False Statements*

(k) *False Statements*

Any false statement in any information submitted pursuant to this general permit may be punishable as a criminal offense, in accordance with Section 22a-6 and under Section 53a-157b of the CGS.

(l) *Correction of Inaccuracies*

Within fifteen days after the date a permittee becomes aware of a change in any information in any material submitted pursuant to this general permit, or becomes aware that any such information is inaccurate or misleading or that any relevant information has been omitted, such permittee shall correct the inaccurate or misleading information or supply the omitted information in writing to the Commissioner. Such information shall be certified in accordance with subsection 4(i) of this general permit.

(m) *Other Applicable Law*

Nothing in this general permit shall relieve the permittee of the obligation to comply with any applicable federal, state and local law, including but not limited to the obligation to obtain and comply with any authorizations required by such law. In the event a POTW is subject to a more stringent nitrogen limitation than set forth in this general permit, the Permittee shall comply with that more stringent limitation and may not purchase or transfer nitrogen credits to comply with that additional limitation.

(n) *Other Rights*

This general permit is subject to and does not derogate any present or future rights or powers of the State of Connecticut and conveys no rights in real or personal property nor any exclusive privileges, and is subject to all public and private rights and to any federal, state, and local laws pertinent to the property or activity affected by such general permit. In conducting any discharge authorized hereunder, the permittee may not cause pollution, impairment, or destruction of the air, water, or other natural resources of the state.

Section 5. Commissioner's Powers

(a) *Abatement of Violations*

The Commissioner may take any action provided by law to abate a violation of this general permit, including the commencement of proceedings to collect penalties for such violation. The Commissioner may, by summary proceedings or otherwise and for any reason provided by law, including violation of this general permit, revoke a permittee's authorization hereunder in accordance with Sections 22a-3a-2 through 22a-3a-6, inclusive, of the RCSA. Nothing herein shall be construed to affect any remedy available to the Commissioner by law.

(b) *General Permit Revocation, Suspension, or Modification*

The Commissioner may, for any reason provided by law, by summary proceedings or otherwise, revoke or suspend this general permit or modify it to establish any appropriate conditions, schedules of compliance, or other provisions which may be necessary to protect human health or the environment or to implement the TMDL.

Issued: October 5, 2018

Robert E. Kaliszewski
Deputy Commissioner

APPENDIX 1

ANNUAL DISCHARGE LIMITS FOR TOTAL NITROGEN

Zone	Publicly Owned Treatment Works	Equivalency Factor	Total Nitrogen (Pounds/Day) 2019-2023
1	JEWETT CITY WPCF	0.17	15
1	GROTON CITY WPCF	0.18	99
1	GROTON TOWN WPCF	0.18	153
1	KILLINGLY WPCF	0.14	131
1	LEDYARD WPC	0.18	7
1	MONTVILLE WPCF	0.18	118
1	NEW LONDON WPCF	0.18	386
1	NORWICH WPCF	0.18	201
1	STONINGTON PAWCATUCK WPCF	0.17	24
1	PLAINFIELD NORTH WPCF	0.14	34
1	PLAINFIELD VILLAGE WPCF	0.14	24
1	PUTNAM WPCF	0.14	53
1	SPRAGUE WPCF	0.16	7
1	STAFFORD SPRINGS WPCF	0.15	60
1	STONINGTON BOROUGH WPCF	0.18	14
1	STONINGTON MYSTIC WPCF	0.18	27
1	THOMPSON WPCF	0.14	10
1	UCONN WPCF	0.15	44
1	WINDHAM WPCF	0.15	125
2	BRISTOL WPCF	0.18	398
2	CANTON WPCF	0.18	24
2	EAST HAMPTON WPCF	0.20	54
2	EAST HARTFORD WPCF	0.19	292
2	EAST WINDSOR WPCF	0.19	59
2	ENFIELD WPCF	0.19	278
2	FARMINGTON WPCF	0.18	178
2	GLASTONBURY WPCF	0.20	98
2	HARTFORD WPCF	0.20	2377
2	MANCHESTER WPCF	0.19	312
2	MATTABASSET WPCF(1)	0.20	834
2	MIDDLETOWN WPCF(1)	0.20	222
2	NEW HARTFORD	0.18	3
2	PLAINVILLE WPCF	0.18	101
2	PLYMOUTH WPCF	0.18	42
2	WINDSOR POQUONOCK WPCF	0.19	98
2	PORTLAND WPCF	0.20	31

Zone	Publicly Owned Treatment Works	Equivalency Factor	Total Nitrogen (Pounds/Day) 2019-2023
2	ROCKY HILL WPCF	0.20	288
2	SIMSBURY WPCF	0.18	107
2	SOUTH WINDSOR WPCF	0.19	106
2	SUFFIELD WPCF	0.19	45
2	VERNON WPCF	0.19	184
2	WINDSOR LOCKS WPCF	0.19	66
2	WINSTED WPCF	0.18	64
3	BRANFORD WPCF	0.60	192
3	CHESHIRE WPCF	0.49	103
3	MERIDEN WPCF	0.49	449
3	NEW HAVEN EAST WPCF	0.60	1568
3	NORTH HAVEN WPCF	0.60	158
3	SOUTHINGTON WPCF	0.49	204
3	WALLINGFORD WPCF	0.60	269
3	WEST HAVEN WPCF	0.60	353
4	ANSONIA WPCF	0.67	115
4	BEACON FALLS WPCF	0.67	12
4	DANBURY WPCF	0.46	442
4	DERBY WPCF	0.67	71
4	LITCHFIELD WPCF	0.35	24
4	MILFORD BEAVER BROOK WPCF	0.67	94
4	MILFORD HOUSATONIC WPCF	0.67	307
4	NAUGATUCK TREATMENT Co.	0.60	246
4	NEW MILFORD WPCF	0.46	28
4	NEWTOWN WPCF	0.46	42
4	NORFOLK WPCF	0.35	11
4	NORTH CANAAN WPCF	0.35	13
4	SALISBURY WPCF	0.35	21
4	SEYMOUR WPCF	0.67	61
4	SHELTON WPCF	0.67	106
4	STRATFORD WPCF	0.67	356
4	THOMASTON WPCF	0.60	42
4	TORRINGTON WPCF	0.60	248
4	WATERBURY WPCF	0.60	1049
5	BRIDGEPORT EAST WPCF	0.85	362
5	BRIDGEPORT WEST WPCF	0.85	1041
5	FAIRFIELD WPCF	0.85	406

Zone	Publicly Owned Treatment Works	Equivalency Factor	Total Nitrogen (Pounds/Day) 2019-2023
5	WESTPORT WPCF	0.85	87
6	GREENWICH WPCF	1.00	479
6	NEW CANAAN WPCF	1.00	64
6	NORWALK WPCF	1.00	718
6	RIDGEFIELD SOUTH ST. WPCF	1.00	29
6	STAMFORD WPCF	1.00	926

(1) The annual discharge limit for total nitrogen for the Mattabasset WPCF will be increased from 834 pounds/day to 1056 pounds/day. This increase will occur when the Middletown WPCF is abandoned and all of Middletown's flow is conveyed to the Mattabasset WPCF.

Appendix C

Flood Mapping

CDM Smith

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Connecticut State Plane Zone (FIPS zone 0600). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on FIRM panels produced for this coastal study revision was derived from United State Geological Survey 2008 High Resolution Orthophotography produced from 1 foot pixel cells from photography dated April 2008. The projection used in the preparation of this map was Connecticut State Plane Feet, FIPS Zone 0600. The horizontal datum used was North American Datum of 1983 (NAD 83).

The AE Zone category has been divided by a **Limit of Moderate Wave Action (LiMWA)**.The LiMWA represents the approximate landward limit of the 1.5 foot breaking wave.The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areaswhere VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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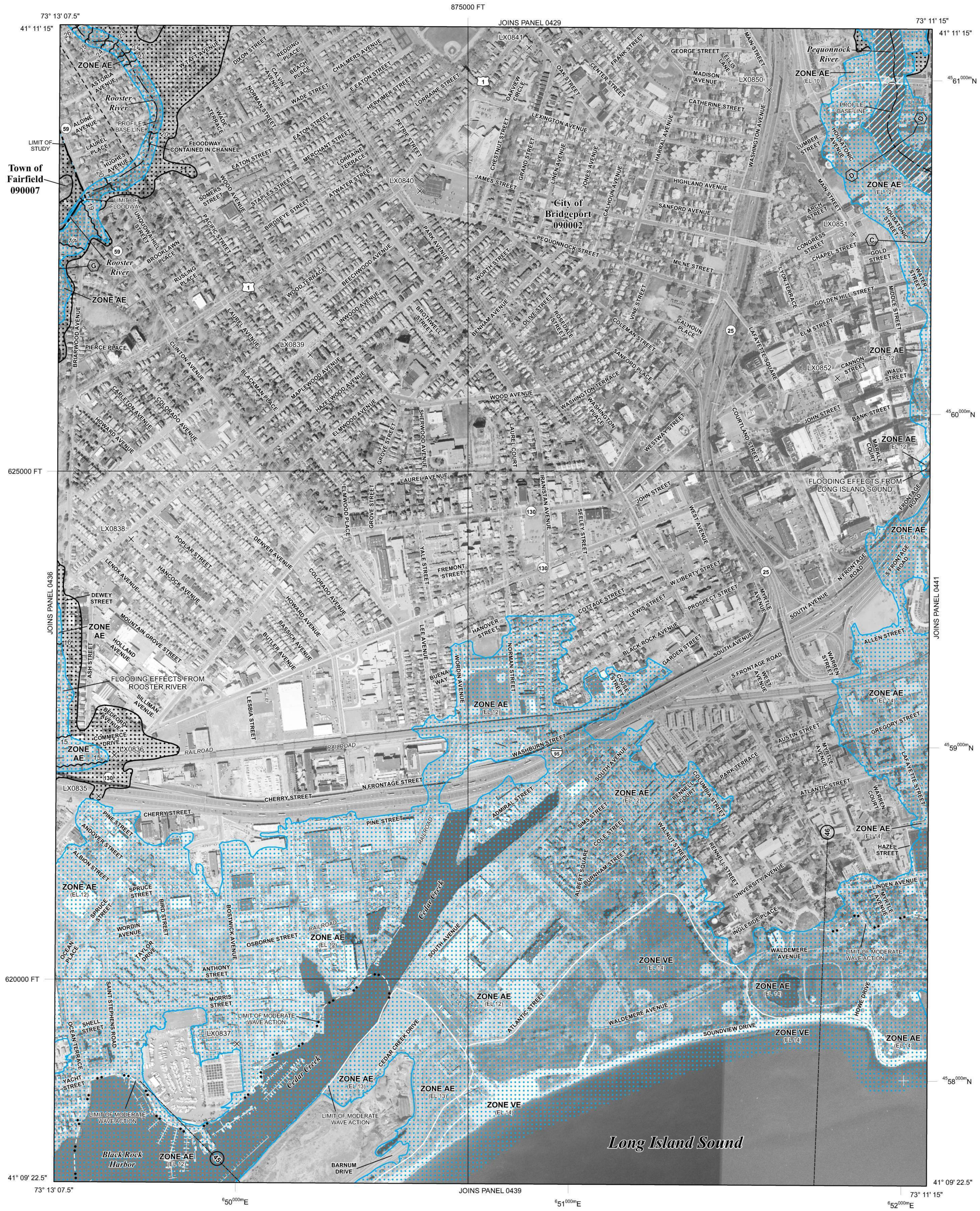
Only coastal structures that are certified to provide protection from the 1-percent-annual chance flood are shown on this panel. However, all structures taken into consideration for the purpose of coastal flood hazard analysis and mapping are present in the FIRM database in S_Gen_Struct.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary
0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

Limit of Moderate Wave Action

Limit of Moderate Wave Action coincident with Zone Break

~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)——(A)	Cross section line
(23)- - - -(23)	Transect line
	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
3100000 FT	5000-foot grid: Connecticut State Plane Feet Zone (FIPS Zone 0600), Lambert Conformal Conic projection
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 18N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)

MAP REPOSITORIES
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MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0437G

FIRM
FLOOD INSURANCE RATE MAP
FAIRFIELD COUNTY, CONNECTICUT (ALL JURISDICTIONS)

PANEL 437 OF 626
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BRIDGEPORT, CITY OF	090002	0437	G
FAIRFIELD, TOWN OF	090007	0437	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 09001C0437G

MAP REVISED JULY 8, 2013

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Connecticut State Plane Zone (FIPS zone 0600). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on FIRM panels produced for this coastal study revision was derived from United State Geological Survey 2008 High Resolution Orthophotography produced from 1 foot pixel cells from photography dated April 2008. The projection used in the preparation of this map was Connecticut State Plane Feet, FIPS Zone 0600. The horizontal datum used was North American Datum of 1983 (NAD 83).

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COASTAL BARRIER RESOURCES SYSTEM (CBRS) LEGEND

11-16-1991 Otherwise Protected Area (OPA)
FLOOD INSURANCE NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR SUBSTANTIALLY IMPROVED ON OR AFTER NOVEMBER 16, 1991 IN DESIGNATED OPAs WITHIN THE CBRS.

Boundaries of the John H. Chafee Coastal Barrier Resources System (CBRS) shown on this FIRM were transferred from the official CBRS source map(s) for this area and are depicted on this FIRM for informational purposes only. The official CBRS maps are enacted by Congress via the Coastal Barrier Resources Act, as amended, and maintained by the U.S. Fish and Wildlife Service (FWS). The official CBRS maps used to determine whether or not an area is located within the CBRS are available for download at http://www.fws.gov. For an official determination of whether or not an area is located within the CBRS, or for any questions regarding the CBRS, please contact the FWS field office for this area at 603-223-2541.

Only coastal structures that are certified to provide protection from the 1-percent-annual chance flood are shown on this panel. However, all structures taken into consideration for the purpose of coastal flood hazard analysis and mapping are present in the FIRM database in S_Gen_Struct.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
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FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
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0.2% Annual Chance Floodplain Boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

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Limit of Moderate Wave Action coincident with Zone Break

513	Base Flood Elevation line and value; elevation in feet*
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*Referenced to the North American Vertical Datum of 1988

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	Bridge
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150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0441G

FIRM

FLOOD INSURANCE RATE MAP

FAIRFIELD COUNTY, CONNECTICUT (ALL JURISDICTIONS)

PANEL 441 OF 626
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BRIDGEPORT, CITY OF	090002	0441	G
STRATFORD, TOWN OF	090016	0441	G

-NOTE-
THIS MAP INCLUDES BOUNDARIES OF THE COASTAL BARRIER RESOURCES SYSTEM ESTABLISHED UNDER THE COASTAL BARRIER RESOURCES ACT OF 1982 AND/OR SUBSEQUENT ENABLING LEGISLATION.

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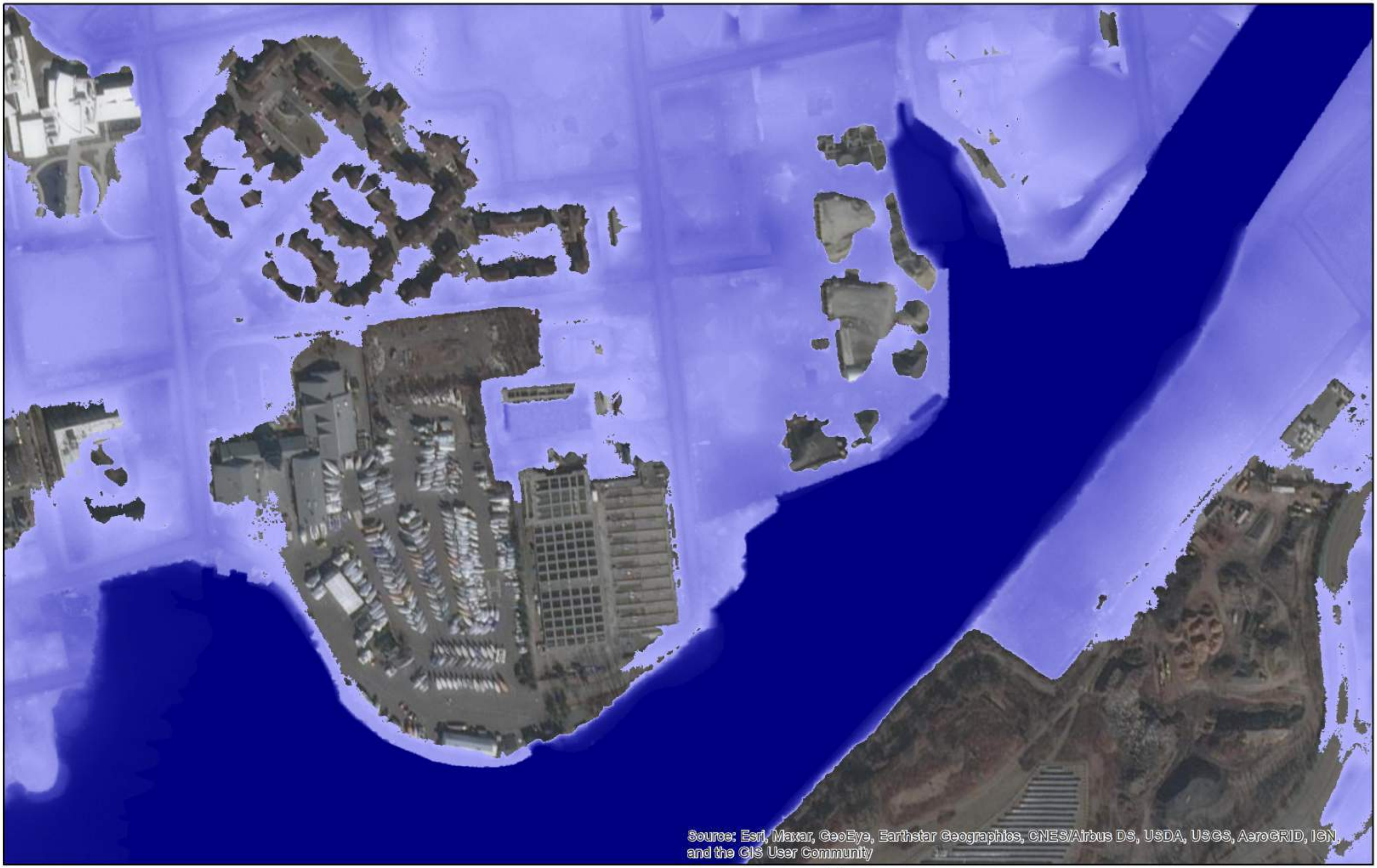
U.S. DEPARTMENT OF HOMELAND SECURITY

MAP NUMBER 09001C0441G

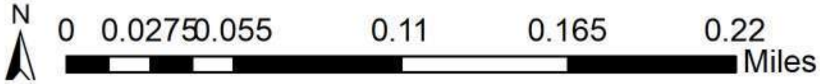
MAP REVISED JULY 8, 2013

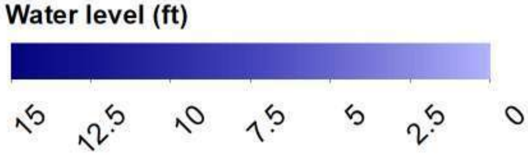
Federal Emergency Management Agency

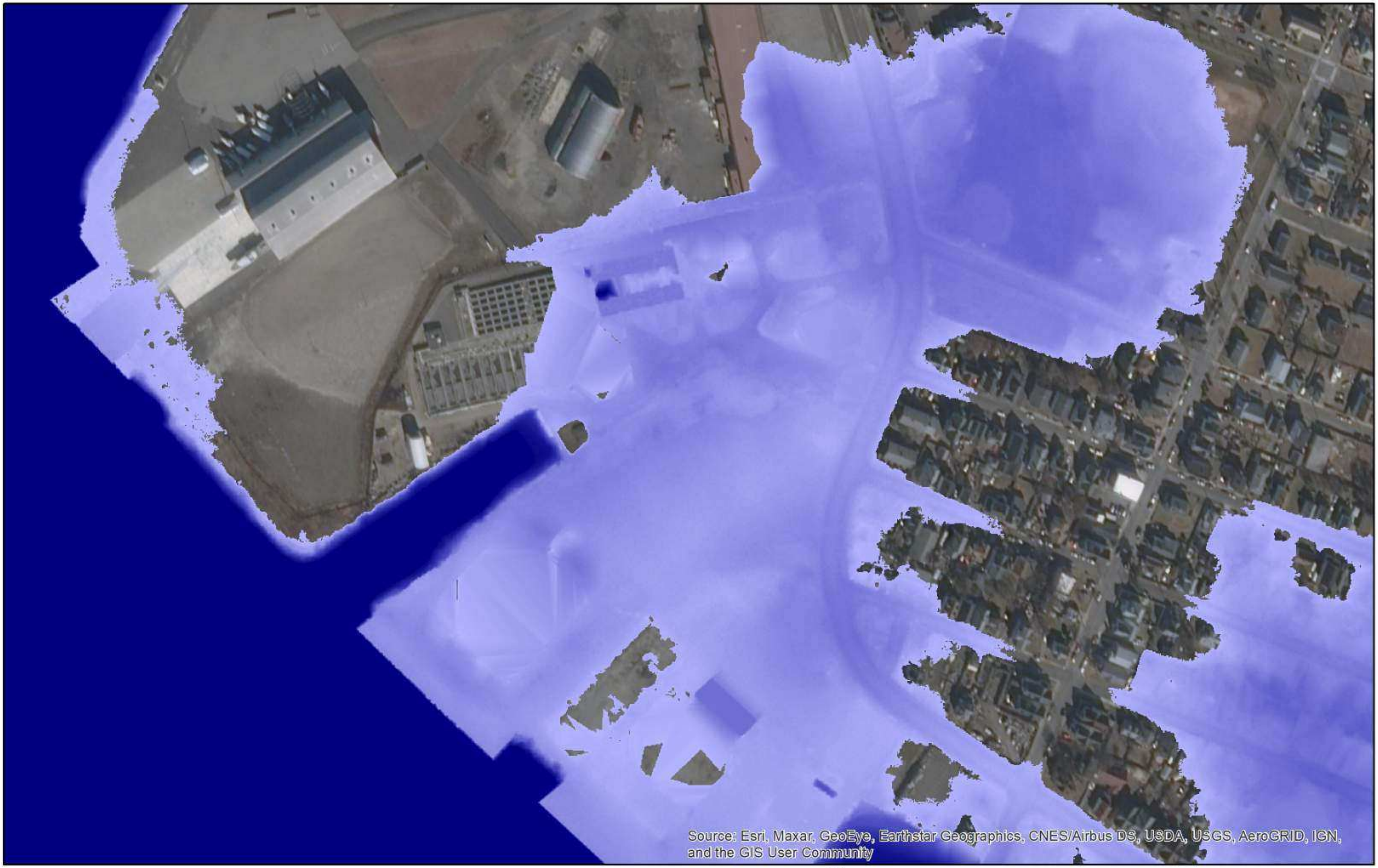


West Side Waste Water Treatment Plant Storm Surge Maps

The flood map presented is the model result for 100-year return interval (or 1% annual exceedance probability) storm surge. The anticipated sea level of 20 inches by 2050 is considered in the flood projection.







East Side Waste Water Treatment Plant Storm Surge Maps

The flood map presented is the model result for 100-year return interval (or 1% annual exceedance probability) storm surge. The anticipated sea level of 20 inches by 2050 is considered in the flood projection.

N

0 0.0225 0.045 0.09 0.135 0.18 Miles

Water level (ft)

15 12.5 10 7.5 5 2.5 0

CIRCA

CONNECTICUT Department of Housing

Appendix D

Technical Memorandum – Model Calibration

CDM Smith

Technical Memorandum M-01

Project: *Bridgeport, Connecticut Wastewater Treatment Plant Facilities Planning*

From: *Laurie Locke, Mitch Heineman, Giana Park, Sarah Jakositz*

Date: *July 2020; Updated October 2020*

Subject: *East and West Side Wastewater Treatment Plants*
Collection System Model Review and Update

Purpose

CDM Smith is currently developing a Wastewater Treatment Plant (WWTP) Facilities Plan (Facilities Plan) for the Water Pollution Control Authority, City of Bridgeport (WPCA). The Facilities Plan evaluates the current needs and future improvements to the two WWTPs operated by the WPCA—the East Side WWTP and the West Side WWTP. To support the development of the Facilities Plan, the City's existing collection system model was updated and used to evaluate peak flow delivered by the collection system to the East Side and West Side WWTPs. This technical memorandum summarizes the model development, data sources, validation, and updated baseline CSO estimates used as the basis for alternatives analysis in the Facilities Plan.

Data Sources

The collection system model was updated with the best-available information on the existing collection system, including several system improvement projects that WPCA has implemented since the last model update in 2010. Data gathering and analysis for this model update focused on both the physical attributes of the system and system performance. CDM Smith worked collaboratively with WPCA to collect and verify this information, as described in this section.

SWMM Model

A hydraulic model of WPCA's collection system was developed in 1999 to support development of a Long-Term Control Plan (LTCP). The original model was developed in Visual Hydro (a variant of XPSWMM). The model was converted to US Environmental Protection Agency Stormwater Management Model version 5 (EPA SWMM), updated, and calibrated in 2009 and 2010 to support WPCA's 2010 LTCP (Arcadis/Malcom Pirnie, 2017).

CDM Smith received the latest version of the model from WPCA in June 2019. The model had been maintained by Arcadis since the 2010 LTCP and most recently had been used to compare simulated and observed overflows during the 2016 and 2017 Pilot Telemetry Program (Arcadis, 2018). This version of the model was the starting point for this analysis.

Spatial and Timeseries Data

Several large, publicly available spatial and timeseries datasets were used to refine model hydrology and set model boundary conditions. These datasets were downloaded from national and state resources identified below:

- 2010 census block outlines and population data from the University of Connecticut State Data Center (US Census Bureau, 2012);
- 2012 imperviousness data from the Department of Energy and Environmental Protection (DEEP) Connecticut Environmental Conditions Online (CT ECO) system with 1-foot resolution (DEEP, 2012);
- Raster based digital elevation (DEM) from the CT ECO system. DEM was developed from 2016 Lidar mission completed in March and April, with 1-meter resolution (Capitol Region Council of Governments, 2016);
- Daily Norwalk River discharge from the United States Geologic Survey (USGS) station 01209700 at South Wilton, CT (USGS, 2020);
- Hourly precipitation, daily temperature, and daily snow depth data from Sikorsky Airport (USW00094702) from the National Centers for Environmental Information (NCEI) (NOAA, 2020a); and
- Hourly tidal stage data from the National Oceanic and Atmospheric Administration (NOAA) station 8467150 in Bridgeport (NOAA, 2020b).

Record Drawings

WPCA provided city-wide mapping including the Fuller Sewer Atlas and WPCA's geographic information system (GIS) data, as well as record drawings for key locations and projects throughout the collection system:

- CSO regulators;
- Marine CSO Improvement Contract C;
- Sewer Separation Contracts F-1, F-2, F-3, F-4, G-1, G-2, G-4, H-1, and H-2;
- Sewer Lining Contracts H-2, H-3, H-4, H-5, H-6, and H-7; and
- New River Street Pump Station.

Flow and CSO Monitoring

Existing monitoring data were used to calibrate system performance in dry and wet weather, as well as to add a variable baseflow component to the model. The following data sources were used to evaluate system performance and for validation of the updated model:

- CSO block testing results at all available CSO regulators for 2017 and 2019;
- Minimum, maximum, and average daily flow (ADF) and both the East Side and West Side WWTP's for 2017 – 2019.
- CSO level sensing at West Side regulators ANTH, ARBOR, GRAND, and HUNT and East Side regulators WANN, CHUR, STRAT, and BAYEL regulators from the 2016-2017 Pilot Telemetry Program (Arcadis, 2018);
- 2009 flow monitoring program, which included four area-velocity meters on the West Side and two area-velocity meters on the East Side deployed from August through November, 2009 (Malcom Pirnie, 2017); and
- 1999 flow monitoring program which included 21 area-velocity meters deployed from May through September 1999 (Malcom Pirnie, 2017).

Additional Information on System Performance

In addition to system monitoring, anecdotal information about system performance was provided by WPCA, including confirmation of the following:

- known flooding areas;
- general condition and verification of tide gates on CSO outfalls; and
- general locations of sediment and debris buildup throughout the collection system.

Model Update

The WPCA collection system model was updated and improved to develop baseline conditions for the existing system to support the Facilities Plan. The updated model incorporates revised hydraulics, hydrology, dry weather flow estimates, and wet weather response. This section describes the improvements made to the model.

Software

The WPCA collection system model uses EPA SWMM. SWMM is the preeminent model for planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems in urban areas. SWMM can be used with its EPA interface; it has also been adapted into commercial products that offer varying degrees of compatibility with the EPA program. For this project, much of the work was conducted using PCSWMM software from CHI, Inc.

PCSWMM offers strong GIS support and tools for model calibration and runs the EPA computational engine directly, attaining complete compatibility with the EPA standard. EPA SWMM version 5.1.013, released August 2018, was used for this project within PCSWMM 7.2. Modeling was supported with custom software developed by CDM Smith, NetSTORM (Heineman, 2004), which provides tools for meteorological data pre-processing and analysis and SWMM calibration.

Datum and Coordinates

All modeling inputs and outputs use the City of Bridgeport vertical datum and the Connecticut State Plane North American Datum 1983 (NAD83) coordinate system with length units of feet. Flows are reported in million gallons per day (mgd). Bridgeport City datum is 14.6 feet above the North American Vertical Datum of 1988 (NAVD88); elevations in NAVD88 (feet) can be converted to Bridgeport City Datum by adding 14.6 feet.

Hydraulics

The modeled pipe network builds upon the dataset described in the 2010 LTCP. The starting model network consisted of 3,958 links (pipes, weirs, orifices, and pumps). The updated model has 4,032 links. Details have been added at CSO regulators, and pipes were extended into the separated sanitary service area in the northern portion of the City. The updated model has a median pipe diameter of 15 inches, including 813 10-inch and smaller pipes. The model represents 156 miles of pipe (**Figure 1**).

The model previously represented flooding from manholes as losses from the collection system. The configuration was revised to allow surface ponding. A ponded area of 9,400 square feet was applied at most model junctions to better represent system dynamics during intense rainfall. The remaining 10 model nodes represent bolted manholes or non-manhole nodes associated with siphons and pump stations.

Hydraulics at all CSO regulators were thoroughly checked against record drawings, notes provided by WPCA, and video taken during CSO block inspections. The updated model has 22 active CSO regulators discharging to 19 outfalls on the West Side and six CSO regulators discharging to six East Side outfalls. CSO regulator configurations were discussed with WPCA and updated as appropriate, including the representation of recent WPCA efforts to raise weirs. Thirteen CSO outfalls have tide gates in the updated model, including two on the East Side and 11 on the West Side. A tidal boundary condition was applied to 23 of the 25 active CSO outfalls using data from the NOAA Bridgeport tide gage. The Ash Creek CSO outfalls (CEM/MAPE and DEW) are simulated as free discharges.

The hydraulics of all siphons were also reviewed and updated as needed. While no siphon record drawings were available, WPCA provided information about locations and capacity.

Six miles of 24-inch and larger pipe were added to the model to extend the network into separated sanitary sewersheds in the northern portion of the City. The model extension includes the new River Street Pump Station sewershed and two miles of the Bridgeport-Trumbull Interceptors (BTI), which receives sanitary inflow from Trumbull via the Beardsley Pump Station and Sunnydale Crossover. No pipes in the Trumbull collection system are included in the updated model, but its sanitary flow and infiltration and inflow (I/I) are explicitly accounted for as loads to the BTI.

Simulated sediment depths were verified by WPCA and updated as needed. Friction and form losses were completely revised for the model update. The 2018 model had an average Manning's N (pipe roughness coefficient) of 0.017 with values ranging from 0.011 to 0.024, and no direct representation of form losses ("K" values). For this update, system-wide roughness was initially revised to 0.013 in most locations and to 0.015 in pipes with sediment build-up. Form losses were added as an exit loss coefficient at junctions where bend angles exceeded 15 degrees as specified in **Table 1**. Friction and form losses were tuned as needed during model validation, including entry loss coefficients at the DEAC and SEAB regulators to improve model validation.

Table 1 - Form Loss Values

Minimum Bend Angle	K
0-14	0
15-29	0.08
30-44	0.2
45-59	0.38
60-74	0.65
75-89	0.94
>=90	1.33
0-14	0
15-29	0.08

Note: Adapted from FHWA HEC-22 Urban Drainage Design Manual, Third Edition (2009)

Representations of both the East Side and West Side WWTPs were simplified and reflect current operations at both facilities. The starting model contained unique outlet rating curves at to control inflow to each facility based on the hydraulic grade line (HGL) in the collection system. The rating curves were removed from the updated model and replaced with a flow limit on the influent to each facility. Based on maximum daily flow data from WPCA, the flow limit of the West Side WPCA was set to 80 mgd and the flow limit of the East Side WPCA was set to 35 mgd.

Hydrology

The model's surficial hydrology was revised extensively. The 2018 model contained 395 subcatchments with no accompanying spatial representation. Subcatchment areas and properties had been calibrated to data collected during the 1999 and 2009 metering programs. The number of subcatchments in the model was small compared with the number of manholes, leaving many pipes dry throughout model simulations.

Subcatchments were re-delineated from 1900 census blocks within the city. Census blocks were subdivided as needed to eliminate dry pipes and were typically routed to the upstream-most model node within the subcatchment. New subcatchments cover the City of Bridgeport and the sewered portion of Trumbull. The updated model contains 2,152 subcatchments in Bridgeport and two in Trumbull as shown in **Figure 2**.

Subcatchment area was assigned according to GIS area in fully combined sewersheds. Separated sanitary sewersheds in the northern portion of the City were assigned 5 percent of the GIS area. More recently separated areas within the combined portion of the system were reduced to 10 to 99 percent of the GIS area according to the reported degree of separation (*Figure* 2).

Imperviousness was assigned using 2012 impervious data (DEEP, 2012), which defines percent imperviousness statewide at 1-foot pixel resolution.

Effective imperviousness is calibrated in the model through adjustment of the Percent Routed parameter, which identifies the fraction of a subcatchment's impervious surface that drains onto adjacent pervious ground (e.g. roof leaders that drain to lawns). Routing fractions were specified as 100 minus imperviousness. This corresponds with the "mostly disconnected" condition described in Sutherland's method for estimating effective imperviousness (Rossman, 2015). CDM Smith has found that the mostly disconnected condition yields good initial estimates of runoff in New England communities.

SWMM's width parameter is a principal calibration parameter, as hydrograph timing has many controlling factors such as catch basin distribution and conveyance capacity of pipes omitted from the hydraulic model. For this study, widths were initially specified based on a regression relationship for existing widths in the model, with width (feet) estimated as $300*A^{0.6}$, where A is area in acres (e.g. the estimated width for a 10-acre subcatchment is 1200 feet).

Soil infiltration occurs in the pervious portion of each subcatchment and influences groundwater hydrology. The modified Green-Ampt infiltration method was assigned to all subcatchments. Infiltration parameters were assigned using a saturated conductivity of 1.4 inches per hour, a typical value for Charlton soil (UC Davis, 2020), a suction head of 2.9 inches, and initial moisture deficit of 0.33, both typical of sandy loam (Rossman, 2015).

Snowpack influences winter runoff and inflow rates. For this project, snow processes were calibrated based on Sikorsky Airport daily snow depth measurements for 2010-2019.

The updated model calculates daily potential evapotranspiration using Hargreaves' method (Hargreaves and Samani, 1985), which estimates potential evapotranspiration as a function of daily maximum and minimum temperatures (input to the model from Sikorsky Airport data), latitude, and day of year. Evaporation influences runoff and inflow through its impact on initial abstraction and snow processes.

Additional subcatchment properties were assigned using values typical of combined systems in the northeast. Catchment slope, impervious surface roughness, and pervious surface roughness were assigned values of 0.5 percent, 0.02, and 0.05, respectively. Depression storage was set to 0.05

inches on impervious surfaces and 0.2 inches on pervious surfaces. Twenty-five percent of the impervious area is assigned no depression storage.

Dry Weather Inflow

Dry weather flow in the model is simulated as the sum of three distinct components: sanitary flow, constant infiltration, and seasonal infiltration. Sanitary flow is specified as average discharge adjusted by hourly factors. Groundwater-driven infiltration is specified as a combination of a constant value derived from invert elevation and a seasonally-varied timeseries. Sanitary flow inputs were applied to 1,019 junctions, seasonal groundwater infiltration (GWI) was added to 1,274 junctions, and constant GWI was added to 391 deep junctions.

The City executed multiple contracts to line large interceptors and connected pipes on the West Side. Model junctions that are located within lining contracts H-2 through H-7 have reduced infiltration and do not have any base infiltration applied.

Sanitary flow was estimated for the West Side and East Side WWTP collection systems and for sanitary inflow from Trumbull using ADF data from each WWTP and monthly records from Trumbull. Sanitary flow was distributed throughout the system using population data from the 2010 census. Sanitary flow of 63 gallons per day per capita was applied to the East Side and West Side collection systems and 60 gallons per day per capita was applied to Trumbull. An hourly diurnal pattern is applied to all sanitary inflow nodes.

Constant GWI was applied to most modeled junctions with inverts below mean sea level (14.6 feet City Datum). This flow is correlated linearly with junction invert level and simulates GWI into large, deep pipes. A 5 mgd load was initially allocated across the system according to invert elevation excluding lined sections of principal interceptors. Values were subsequently adjusted through calibration.

A daily GWI timeseries was scaled from baseflow in Norwalk River at Wilton (USGS gage 01209700). The river was used for this purpose because its baseflow correlates well with observed GWI at the WWTPs, and it has nearly 60 years of continuous records. Daily GWI was estimated by applying a digital filter to separate baseflow from quickflow and scaling the flow to units of mgd per acre. The Norwalk River unit baseflow is applied to modeled junctions as a timeseries scaled according to the contributing area above each load point. Baseflow in the river averaged 0.68 mgd/mi^2 for the period 2010-2019. With a typical scaling factor of one-half the contributing area, a 10-acre subcatchment would contribute an average time-varying GWI of 0.005 mgd ([0.68 mgd/mi^2] x 0.5 x 10 acre / [640 acre/mi^2]), while every square mile of contributing sewershed would account for 0.34 mgd of average time-varying GWI.

Model Calibration

The model was calibrated to the available datasets with consideration of their differing ages and value. The following datasets supported model calibration and validation:

- 21 flow meters deployed throughout the system in 1999
- Six flow meters deployed in 2009
- CSO duration and frequency recorded at eight CSOs in the 2016-2017 Pilot Telemetry Program
- CSO frequency and tidal inflow occurrence observed in 2017-2018 block testing
- Monthly flow records from the two connection points from Trumbull for 2016-2019
- Daily average, maximum, and minimum flows recorded at the WWTPs for 2017-2019
- Thrice-weekly measurements of BOD at the WWTPs for 2017-2019 were used to inform the relative contributions of sewage and GWI
- Weekly measurements of chloride at the West Side WWTP from January 2019 through April 2020 were used to identify the magnitude of seawater leakage into the West Side collection system

Since WPCA has made many improvements to the collection system over the past two decades, data from the older programs has reduced value for calibration to current conditions. The improvements include sewer separation and lining, which reduce flows throughout the collection system, and weir modifications at CSO regulators, which reduce CSO and increase wet weather flow depth. Data from the older programs was used to verify model performance with consideration of the expected changes in system behavior. A higher level of scrutiny was placed on model performance compared with recent CSO measurements and the Trumbull and WWTP data, all of which represent current conditions.

Dry Weather

Dry weather flow includes diurnally-varied sanitary flow along with GWI. Modeled sanitary flows were estimated from ADF observed at the East Side and West Side WWTPs and monthly flows reported for Trumbull from 2016 through 2019 and allocated throughout the system according to 2010 census data. Groundwater infiltration is represented with both constant and seasonally-varied components. Constant groundwater baseflow was correlated linearly with model junction invert, representing infiltration to deep, large pipes. Seasonally varied groundwater infiltration was derived from flow observed in the Norwalk River correlated with observed flow at the WWTPs and scaled at each load point according to contributing sewershed area.

Manning's N for conduits was initially set to 0.013 and calibrated between 0.013 and 0.019 to calibrate dry weather depth and velocity. Higher calibrated roughness coefficients may be due to the combined effects of pipe age, unknown obstructions, and sediment accumulation. Form loss coefficients were increased at some conduits to account for large chambers, constrictions, and other obstructions.

Wet Weather

The model accounts for drainage from combined areas and I/I from separated and combined areas. Hydrology was calibrated to daily flow data at the WWTPs, depth data from the 2016-2017 Pilot Telemetry Program, and CSO frequency from 2017 and 2019 CSO block testing, and checked against the 1999 and 2009 flow monitoring programs.

Hydrology calibration to match observed flows involved:

- Adjusting sewer separation effectiveness to calibration hydrograph volume. Sewer separation is modeled as an area reduction to subcatchments located within a separated area. Sewer separation effectiveness is adjusted by increasing or decreasing the subcatchment area.

- Adjusting the width factor of each subcatchment to calibrate hydrograph slope.

Pipe friction and form losses were adjusted to match observed depths. Additional adjustments were made during wet weather validation.

Validation Results

A high level of scrutiny was placed on simulated flows at the WWTPs and simulated frequency of CSO. Long-term performance of the updated model at the East Side and West Side WWTPs is presented in the timeseries in **Figure 3** and **Figure 4**, respectively. Overall, simulated ADF tracks well with observed values at both facilities. The updated model mimics seasonal variation in baseflow and matches trends of higher spring ADF and lower summer and fall ADF at both facilities. The fall of 2018 was unseasonable rainy, resulting in high observed ADF at both facilities. The updated model matches observed data well during this period. Simulated ADF at the West Side WWTP is low during the second half of 2019. Discussions with WPCA identified that this is likely due to changes in the recycling rate at the WWTP.

Observed and simulated CSO frequency for 2017 and 2019 are compared in bar charts for the East Side and West Side in **Figure 5** and **Figure 6**, respectively. Observed tidal inflow events are shown in the bar charts for 2017. The updated model matches the block testing data reasonably well. East Side CSO and tidal inflow is much less frequent than on the West Side.

The model is reasonably calibrated to dry and wet weather conditions. It robustly represents flow to the WWTPs and discharge via CSOs. It offers a useful tool for assessing the existing state of the system and analyzing the impacts of potential improvements to the WWTPs.

Baseline Conditions

The updated model was used to characterize CSO and flow at the WWTPs for the 1-year design storm. This design storm is described in Section 5 the 2010 LTCP and is the same design storm referred to as the "1 year, 24-hour storm" in DEEP's Administrator Order WRMU18002 issued to the City of Bridgeport on June 14, 2018 (DEEP, 2018). This storm was recorded at Sikorsky Airport on August 20, 1950. Its hourly hyetograph was used to run the model. A total of 2.74 inches of rain was observed over 17 hours, with a peak hourly depth of 0.75 inches. Tidal boundary conditions were included in the design storm assessment. The current conditions sanitary flow used for model validation was also used for baseline conditions assessment. Since 1950 precedes the earliest discharge measurements collected by USGS in the Norwalk River, the baseline conditions assessment uses seasonal groundwater infiltration based on measurements from 2008.

Peak flows and total volumes for the 1-year design storm are summarized by CSO outfall and WWTP in **Table 2**. Total simulated East Side CSO volume is 5.4 million gallons (MG), with 6 of 6 CSOs active, based on a maximum capacity of 35 mgd at the East Side WWTP. West Side CSO totals 44.4 MG, with 21 of 22 CSO regulators active, based on a maximum capacity of 80 mgd at the West Side WWTP.

Table 2 – Baseline Conditions: 1-Year Design Storm Summary

WWTP	CSO	Overflow Volume (MG)	Peak Overflow Rate (mgd)	Duration of Overflow (hr)
East Side	BARN	0.3	4.1	3.8
	BAYEL	0.9	13.7	4.3
	CHUR	0.4	8.4	2.0
	DEAC	0.4	5.3	2.5
	STRAT	2.2	16.5	6.3
	WANN	1.2	8.8	6.3
West Side	ANTH[1]	5.8	28.1	11.3
	ARBOR[1]	8.2	84.4	6.5
	CAP	0.4	9.6	2.0
	CEM/MAPE	2.6	26.6	5.8
	CON	<0.01	0.2	1.0
	DEW	1.8	15.1	6.5
	EWAS	1.4	13.4	6.3
	FAIR	3.5	19.6	9.8
	GRAND	3.3	28.1	8.8
	HOUS	3.9	22.6	9.5
	HUNT	3.0	29.3	7.0
	OVER	0.3	5.4	2.5
	RAILS	0.2	7.8	1.5
	SEAB	2.3	22.5	7.0
	STATEA	3.0	24.1	8.5
	TERN[2]	1.8	10.8	7.5
	TERS[2]	1.1	6.9	9.0
	TIC	0.3	7.1	1.5
	WALL	1.5	10.0	9.0
	WORD	0	0	0

Notes:
1. ANTH and ARBOR regulators both have two regulating weirs. CSO reported in this table is the sum of the discharge over both weirs.
2. TERN and TERS share an outfall.

Alternatives Analysis

An alternatives analysis was conducted to evaluate the impact of expanded wet weather treatment capacity on the collection system. In each alternative, WWTP wet weather capacity was increased and the resulting reduction of CSO volume was assessed. All alternatives assumed a "best case" maintenance scenario for the collection system through removal of all modeled sediment and reducing Manning's N to 0.013. This was done to evaluate the CSO benefit from capacity changes at each WWTP utilizing the maximum conveyance of the existing pipe network.

Design storm simulations were completed to assess the maximum system conveyance to each WWTP to select the wet weather capacities to evaluate for this study. The flow limit to each WWTP was removed from the model, all modeled sediment was removed, and Manning's N was reduced to 0.013. Under these conditions, 60 mgd reached the East Side WWTP and 160 mgd reached the West Side WWTP during the 1-yr design storm. Capacity alternatives exceeding these rates must thus be paired with increased upstream conveyance in order to deliver higher peak flow to each WWTP during the 1-yr design storm.

Five alternatives were evaluated at the West Side WWTP and three at the East Side WWTP. Wet weather capacities of 90, 140, 160, 180, and 200 mgd were simulated at the West Side WWTP and capacities of 40, 60, and 80 mgd were simulated at the East Side WWTP. The 180 and 200 mgd alternatives at West Side WWTP and the 80 mgd East Side alternative included collection system pipe replacement to attain adequate conveyance to the WWTPs. A map of replaced pipes is shown in **Figure 7**. The alternatives simulated are listed in **Table 3**.

Table 3 - Simulated Alternatives

Scenario	West Side WWTP Capacity (mgd)	East Side WWTP Capacity (mgd)	Sediment	Pipe Replacement
Validation Condition[1]	80	35	Existing	None
Baseline[2]	90	40	None	None
WSP1	140	40	None	None
WSP2	160	40	None	None
WSP3	180	40	None	▪ Upsize 4,300 ft of 24" to 42" from SEAB to interceptor ▪ Fix shallow slope in Ellsworth Park ▪ Upsize 1,400 ft of 12/15/18" downstream of ANTH to interceptor to 42" ▪ New 1,600 ft of 48-inch from DEW to interceptor
WSP4	200	40	None	Same as WSP3 pipe replacement
ESP1	90	60	None	None
ESP2	90	80	None	▪ 750 ft of 30" to 48" STRAT to confluence with WANN ▪ Plug recombined WANN stormwater connection ▪ 1,700 ft of 48/54" to 60" from STRAT/WANN confluence to East Side WWTP

Notes:

1. Validation conditions reflect the flow limits in the updated model, which were based on observed maximum daily flow at each WWTP from 2017 to 2019. This scenario has lower capacities at each WWTP than their design capacities.
2. Baseline reflects the wet weather design capacity of each WWTP.

Simulated CSO and surface-level flooding decrease as flow to the each WWTP is increased. Simulated results for the East Side are shown in **Figure 8** and **Figure 9**. *Figure* 8 plots East Side CSO and flooding volume versus WWTP capacity. Both CSO and flooding volume steadily decrease as WWTP capacity increases from 35 mgd to 80 mgd. Three East Side CSOs attain 1-year level of control (LOC) when capacity is increased to 80 mgd, including DEAC, WANN, and STRAT. This is better illustrated in *Figure* 9, which charts overflow volume at each East Side CSO. Benefits observed under alternative ESP2 (80 mgd) are due in part to pipe replacement described in Table 3 and shown in *Figure* 7.

West Side results are shown in **Figure 10** and **Figure 11.** *Figure* 10 plots West Side CSO and flooding volume versus WWTP capacity. Both CSO and flooding volume decrease as WWTP capacity is increased from 80 mgd to 200 mgd. Several key observations can be identified:

- Restoring design capacity of the West Side WWTP from 80 to 90 mgd results in a simulated reduction of 3.9 MG CSO and 0.2 MG flooding.
- Reduction in West Side flooding is small in comparison to CSO reduction.
- CSO reduction plateaus between 140 and 160 mgd. Despite the 20 mgd increase in WWTP capacity, CSO only drops by 0.9 MG.
- CSO volume reduction plateaus between 180 and 200 mgd. Despite the 20 mgd increase in WWTP capacity, CSO only drops by 1.5 MG.
- CSO WORD attains 1-year LOC in all modeled scenarios.
- CSOs RAILS and TIC achieve 1-yr LOC when West Side WWTP wet weather capacity is 140 mgd and 160 mgd.
- CSOs CEM/MAPE, DEW, ANTH, and SEAB achieve 1-year LOC when West Side WWTP wet weather capacity is 180 mgd and 200 mgd.

CSO control is illustrated in *Figure* 11, which charts overflow volume at each West Side CSO. Benefits observed under alternative WSP3 (180 mgd) and WSP4 (200mgd) are due in part to pipe replacement listed in Table 3 and shown in *Figure* 7.

Additional simulations were completed to quantify the impact of upgrading WWTP capacity without completing the pipe replacement listed in Table 3. In addition to the 1-yr design storm, the 2-yr and 5-yr design storms described in the LTCP and a 10-yr, 24-hr synthetic storm (SCS Type 3) were simulated with a maximum capacity of 200 mgd at the West Side WWTP, a maximum capacity of 80 mgd at the East Side WWTP, and clean pipes throughout the collection system. No other conveyance improvements or pipe replacement were included. The resulting peak flow received by both WWTPs and CSO volume are listed in **Table 4.**

- Key observations during the 1-yr storm simulation include: Peak flow delivered to the West Side WWTP is 163 mgd, which is 47 mgd less than the modeled maximum capacity.
- West Side CSO volume is 30.1 MG, which is 14.3 MG (32 percent) less than the baseline CSO volume listed in Table 2 but 8.6 MG higher than alternative WSP4 (200 mgd) which includes pipe replacement.
- Peak flow delivered the East Side WWTP is simulated to be 69 mgd, which is 11 mgd less than the modeled maximum capacity.

- East Side CSO volume is 1.9 MG, which is 3.4 MG (64 percent) less than the baseline CSO volume listed in Table 2 but 0.9 MG higher than alternative EPS2 (80 mgd) which includes pipe replacement.

While neither the East Side nor West Side WWTPs received the peak modeled design flows without pipe replacement during the 1-yr design storm, each WWTP may receive flows of that magnitude in larger storm events. Simulated peak flow received at the East Side WWTP during the 2-yr, 5-yr, and 10-yr events is mgd and mgd, respectively. Simulated peak flow received at the West Side WWTP during the 2-yr, 5-yr, and 10-yr events is mgd and mgd, respectively. The 5-yr design storm peak flows are low because this event occurs in January 1979 and the model simulates most of the event's precipitation as snow. These results suggest that each WWTP may receive flow as high as the maximum modeled capacity of 200 mgd and 80 mgd at the West Side and East Side, respectively, even without pipe replacement during large storm events.

Table 4 – Simulation Results – WWTP Upgrade without Pipe Replacement

Design Storm	Peak Flow to West Side WWTP[1] (mgd)	Peak Flow to East Side WWTP[2] (mgd)	1-yr West Side CSO Volume (MG)	1-yr East Side CSO Volume (MG)
1-yr	163	69	30.1	1.9
2-yr[3]	182	78	--	--
5-yr[4]	167	68	--	--
10-yr[5]	200	80	--	--

Notes:

1. Maximum capacity simulated is 200 mgd with clean pipes in the collection system.
2. Maximum capacity simulated is 80 mgd with clean pipes in the collection system.
3. Historic event observed at Sikorsky Airport on September 3, 1992. Listed in the LTCP (Arcadis, 2017).
4. Historic event observed at Sikorsky Airport on January 21, 1979. Listed in the LTCP (Arcadis, 2017). Simulated as a snow event due to cold temperatures, resulting in lower peak flow that storms with a lower return frequency.
5. Synthetic 24-hour event using a Soil Conservation Survey (SCS) Type 3 curve and 5.35 inches of rainfall (NOAA, 2020c).

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Attachments

Figure 1 - Model Network

Figure 2 - Model Subcatchments

Figure 3 - Long-Term Model Performance at East Side WWTP

Figure 4 - Long-Term Model Performance at West Side WWTP

Figure 5 – Simulated versus Observed East Side CSO Frequency

Figure 6 – Simulated versus Observed West Side CSO Frequency

Figure 7 - Pipe Replacement Map

Figure 8 - Alternative Analysis Results at East Side WWTP

Figure 9 - Alternative Analysis Results at East Side CSOs

Figure 10 - Alternative Analysis Results at West Side WWTP

Figure 11 - Alternative Analysis Results at West Side CSOs

Inset Figure 1 - Model Network

Insert Figure 2 - Model Subcatchments

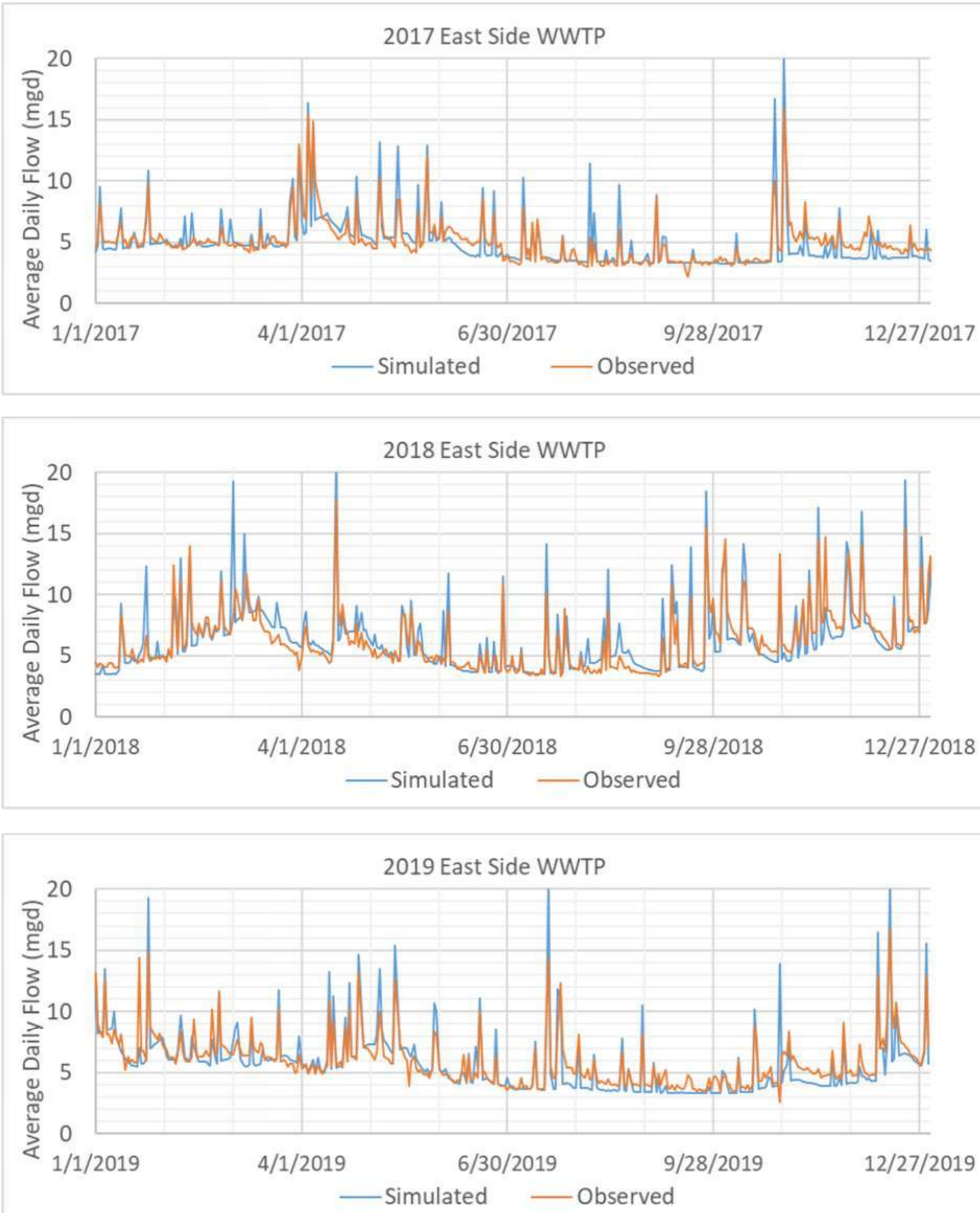


Figure 3 - Long-Term Model Performance at East Side WWTP

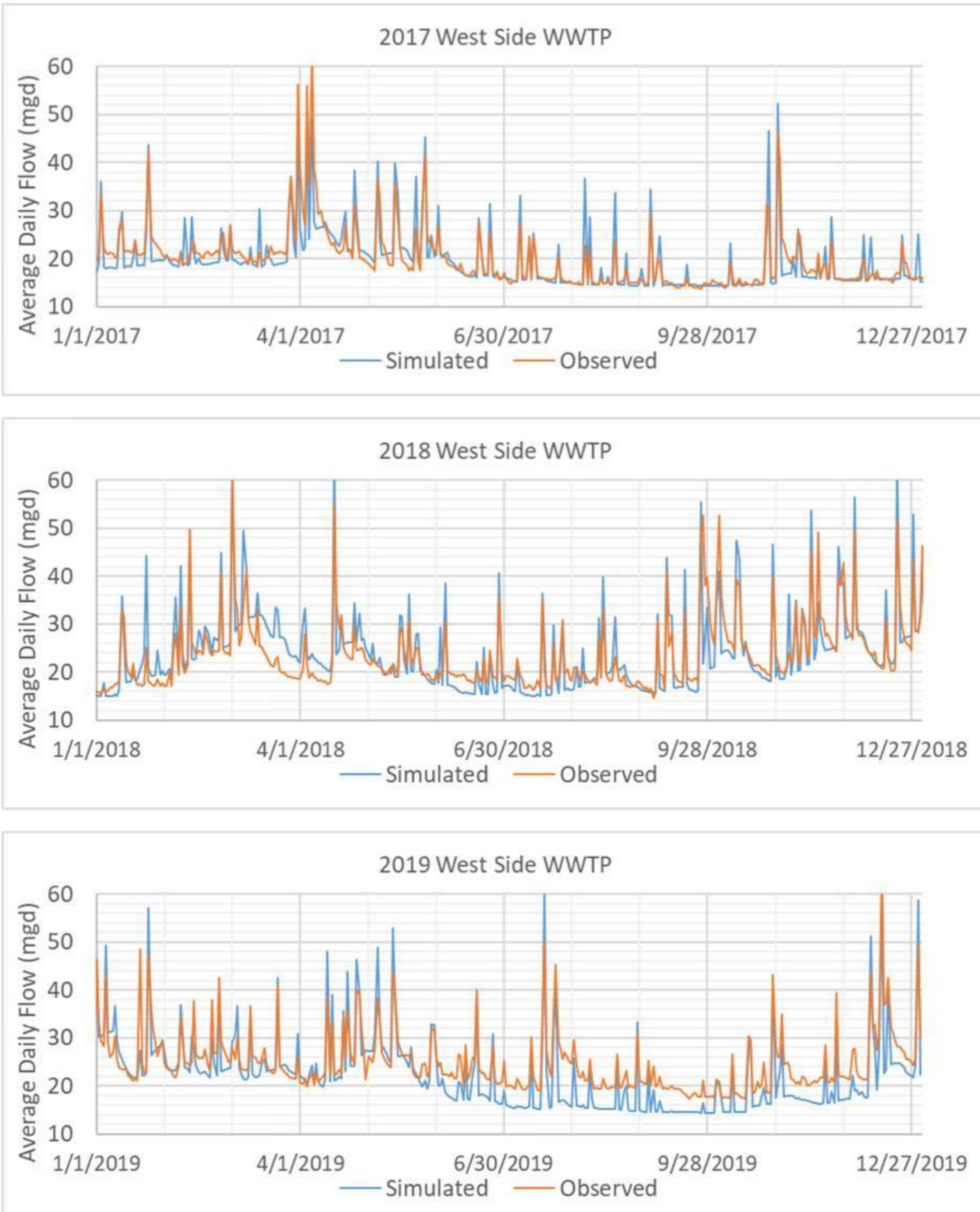
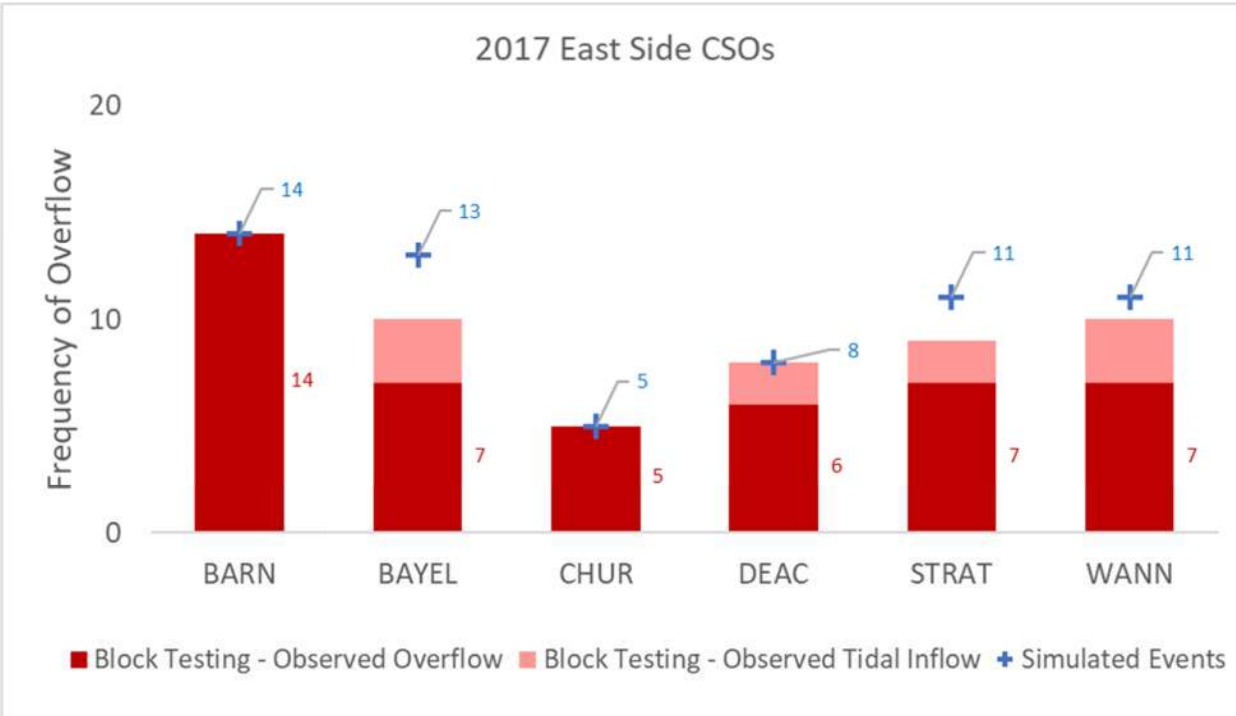


Figure 4 - Long-Term Model Performance at West Side WWTP



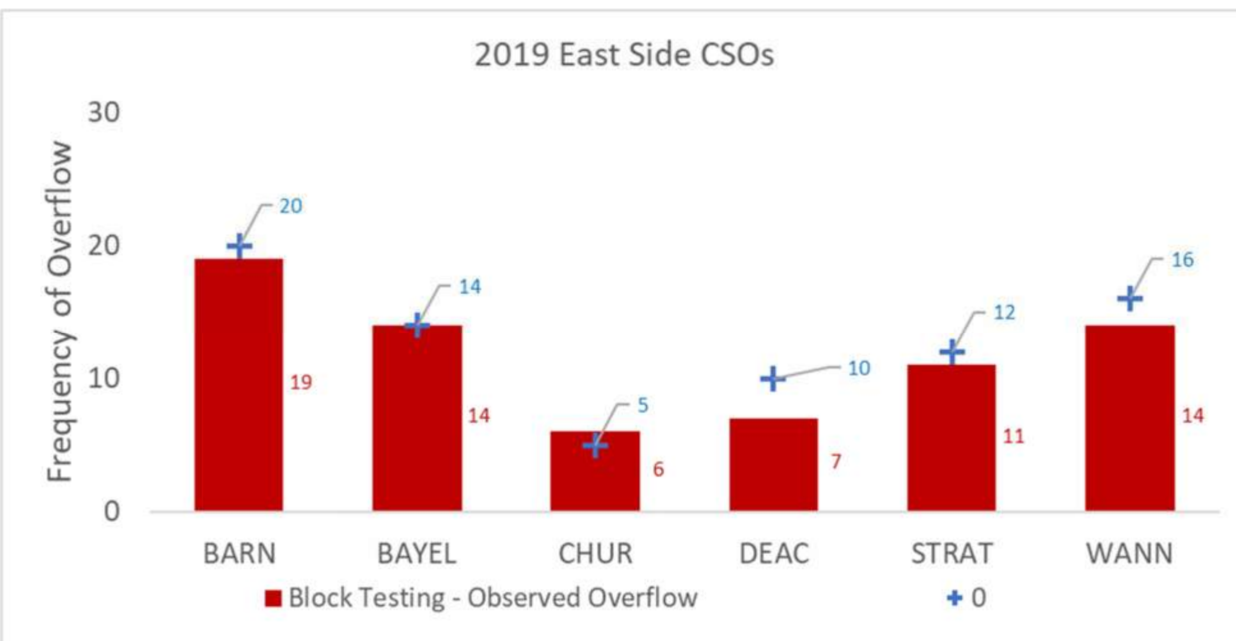


Figure 5 – Simulated versus Observed East Side CSO Frequency

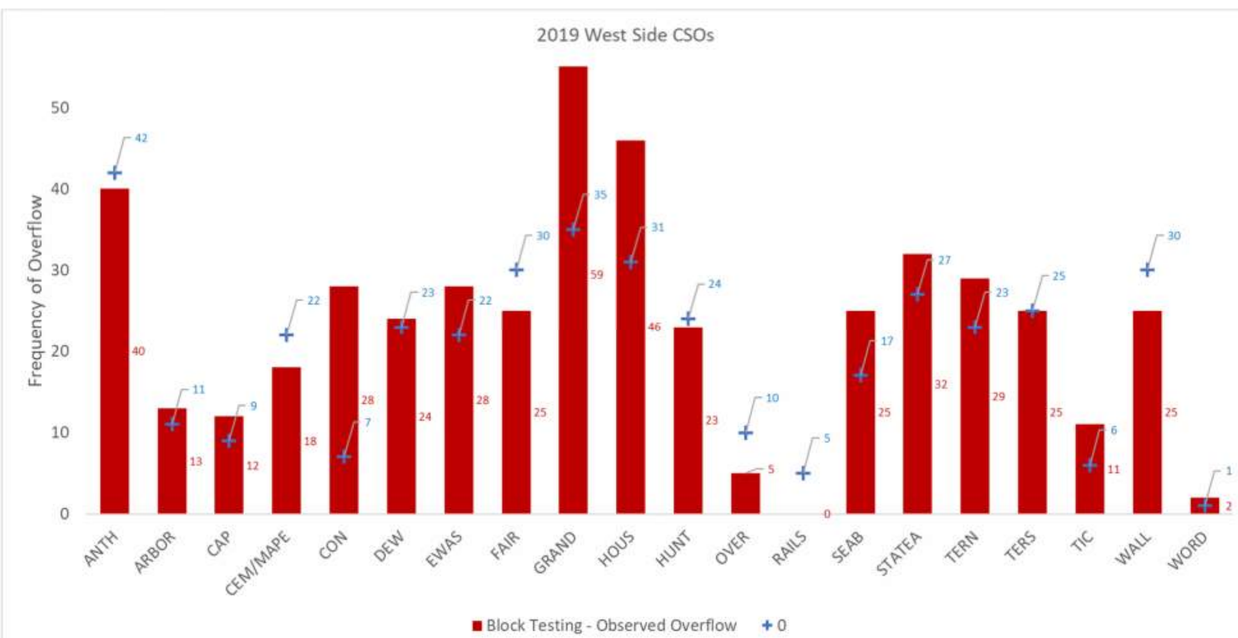


Figure 6 – Simulated versus Observed West Side CSO Frequency

Insert Figure 7 - Pipe Replacement Map

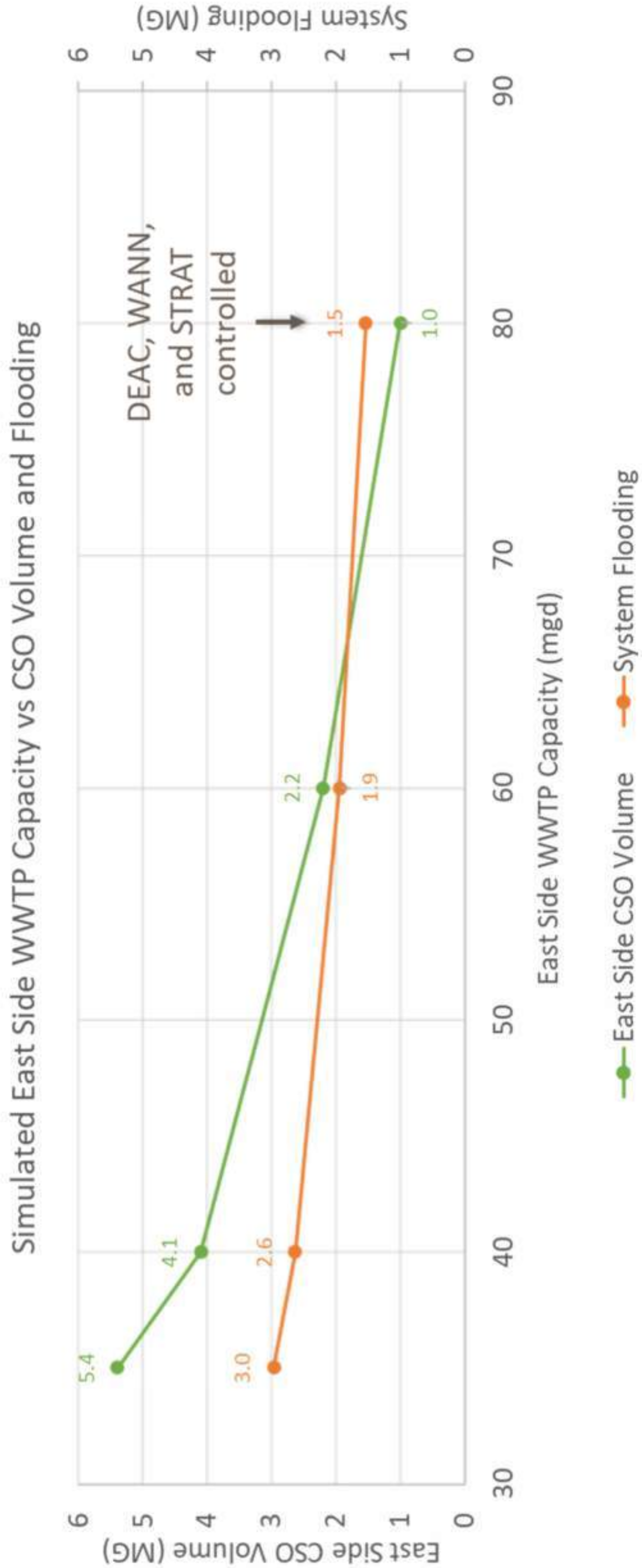


Figure 8 - Alternative Analysis Results at East Side WWTP

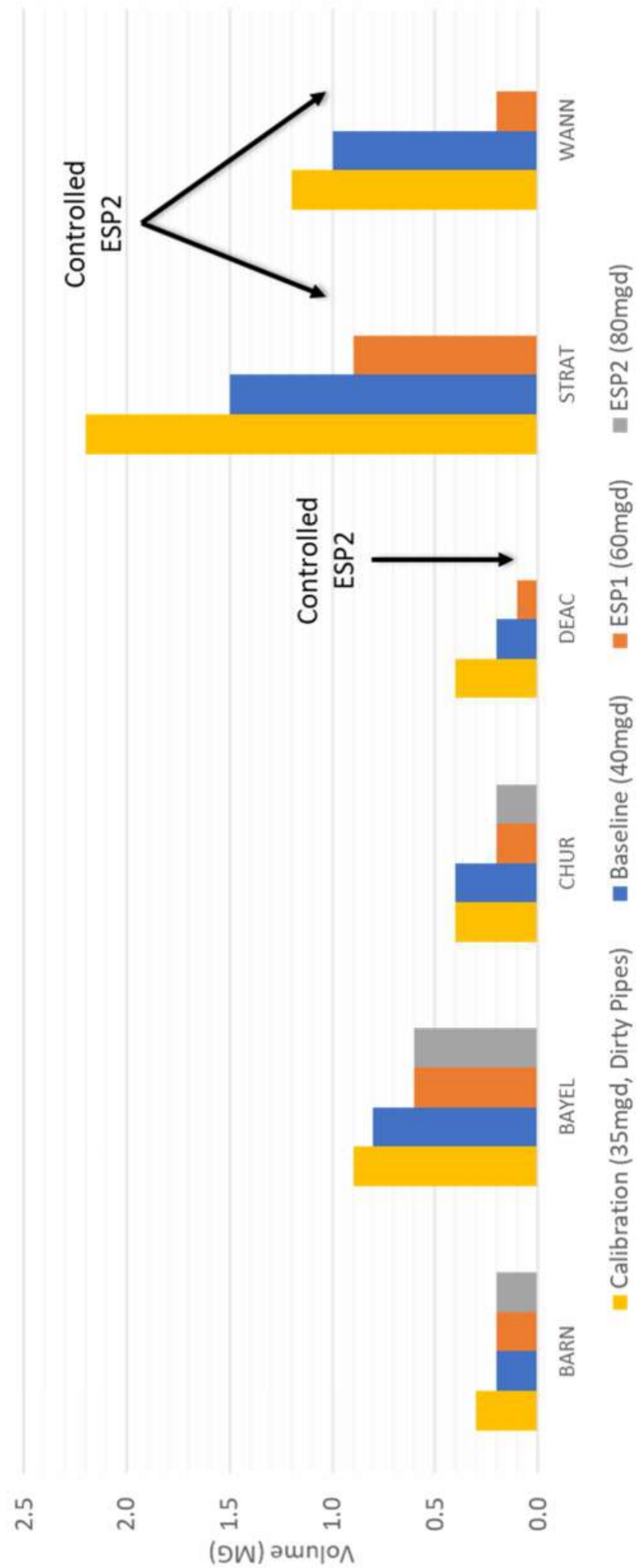


Figure 9 - Alternative Analysis Results at East Side CSOs

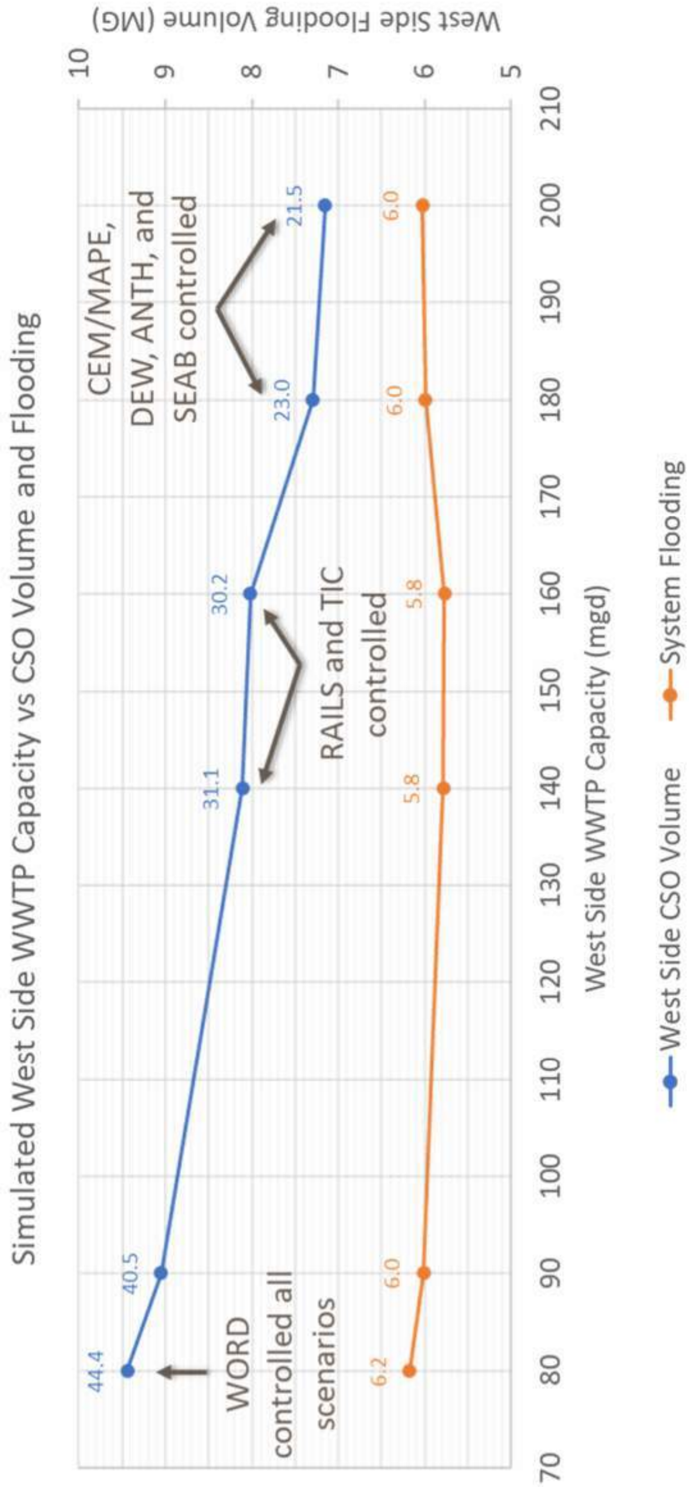


Figure 10 - Alternative Analysis Results at West Side WWTP

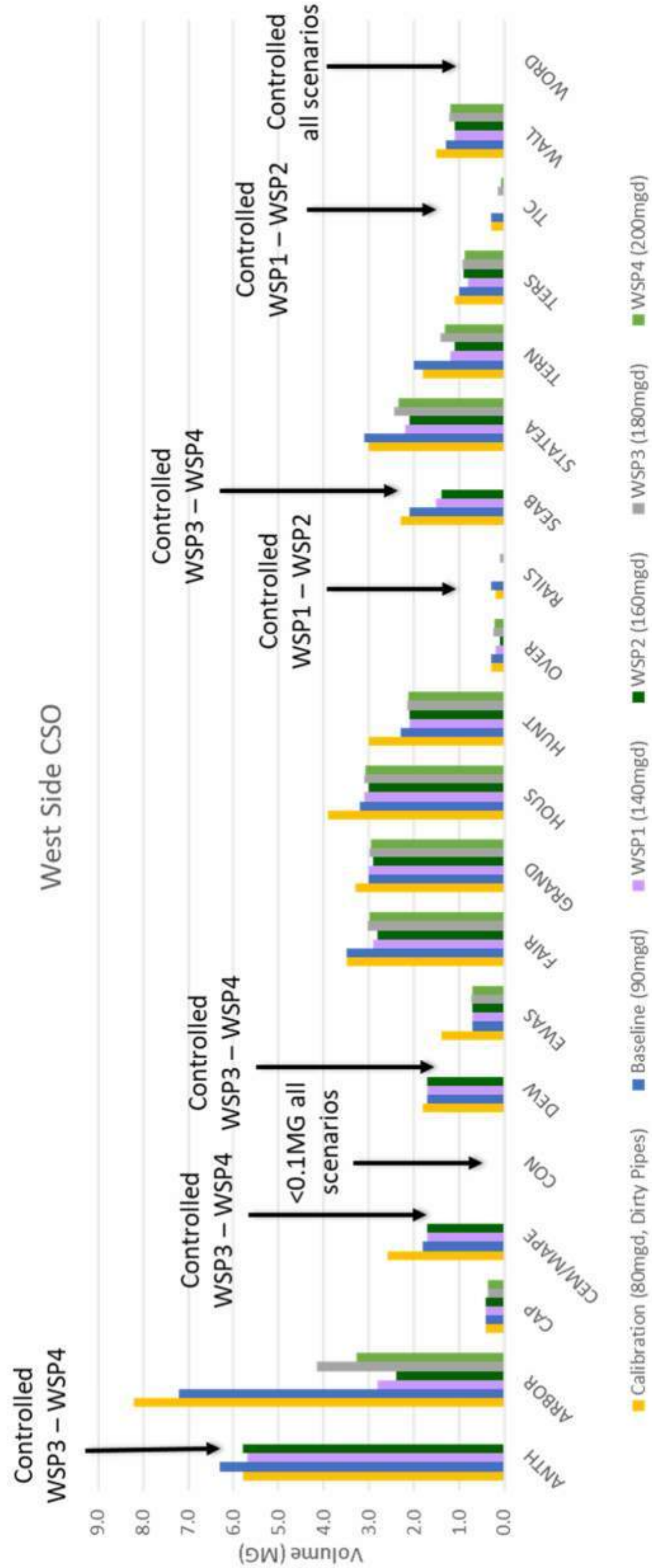


Figure 11 - Alternative Analysis Results at West Side CSOs

Appendix E

Outfall Inspections

CDM Smith

ASI Marine | REPORT

Submitted to:

CDM Smith Inc.
77 Hartland Street, Suite 201
East Hartford, CT 06108

Reference:

Bridgeport Water Pollution Control Authority
Inspection of East and West Outfalls
Using a Remotely Operated Vehicle

Inspection Completed:

29-30 January 2020

Submittal Date:

17 April 2020

ASI Marine Project Reference:

RU19-043

Executive Summary

ASI Marine L.P. was subcontracted by CDM Smith Inc. to provide underwater inspection services using remote inspection technologies at the Bridgeport Water Pollution Control Authority's East and West wastewater treatment plants (WWTP) in Bridgeport, Connecticut.

The inspections took place on 29-30 January 2020 using a small, inspection-class remotely operated vehicle (ROV).The project objective was a general condition assessment of outfalls at the two facilities, identifying any anomalies in the concrete, corrosion, cracks, spalling, and sediment levels.

ASI conducted the inspection with an ROV equipped with a high-definition camera, an imaging sonar, and a profiling sonar. For more information regarding the equipment used during this inspection, refer to Section 2.0.

Profile images were taken in both outfalls to determine ovality and sediment levels. Profiles for the east outfall can be found in Appendix 4.1.3, and profiles for the west outfall can be found in Appendix 4.2.3. High-definition video and sonar images for the east outfall can be found in Appendices 4.1.1 and 4.1.2, and images for the west outfall can be found in Appendix 4.2.

The inspection of the east outfall began at Manhole 1 and the ROV traveled downstream to Manhole 3. Upon recovery back to Manhole 1, the ROV traveled upstream to the chlorine contact tanks. Joints appeared to be intact, without signs of separation or misalignment. The diameter of the outfall was 61 inches in diameter. Small piles of rock debris were located along the invert near the bends. A sensor was noted on the invert near Manhole 1. The plant bypass was inspected and was found to be two-thirds full of sediment and had signs of biofouling on the crown.

The ROV was recovered from Manhole 1 of the east outfall and deployed into Manhole 3 to inspect the remainder of the outfall. Two joints were noted to have a gap between tunnel sections, indicating a possible expansion joint. A small pile of rock debris was noted near the bend at Manhole 3. Additionally, rock debris was noted along the invert near the outlet. The outlet diverges 45 degrees from the outfall and is constructed of brick.

The inspection of the west outfall began at Access Point 1 as the ROV traveled 786 feet downstream to the outlet. Joints appeared to be intact, without signs of separation or misalignment. The diameter of the outfall was 72 inches in diameter. Rock debris was located along the invert throughout the inspection. The debris became more prominent past 600 feet. A structure was noted on the invert, with PVC lines tangled just upstream of Manhole 1. Additionally, a sensor was noted in the west outfall at Manhole 1.

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List of Appendices

ASI Marine

REPORT

CDM Smith Inc.

Bridgeport Water Pollution Control Authority
Inspection of East and West Outfalls
Using a Remotely Operated Vehicle

Inspections Completed: 29-30 January 2020

1.0 INTRODUCTION

ASI Marine L.P. was subcontracted by CDM Smith Inc. to provide underwater inspection services using remote inspection technologies at the Bridgeport Water Pollution Control Authority's East and West wastewater treatment plants (WWTP) in Bridgeport Connecticut.

The project objective was a general condition assessment of the east and west outfalls using a remotely operated vehicle (ROV), identifying any anomalies in the concrete, corrosion, cracks, spalling, and sediment levels.

1.1 Facilities

The East plant is located at 695 Seaview Avenue in Bridgeport. The outfall runs approximately 600 feet from the chlorine contact tanks (CCT) to an outlet at the Pequonnock River (refer to Figure 1). Three manholes, labeled in the figure below, provide access to the east outfall.

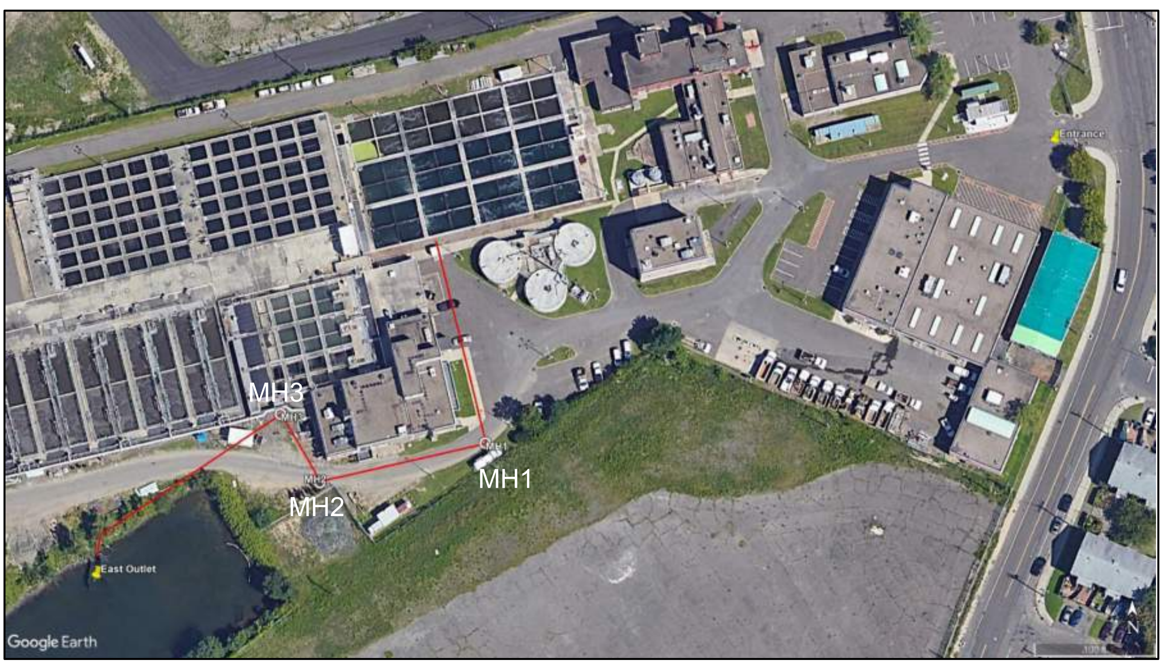


Figure 1: Overview of approximate east outfall piping routes

The West plant in located at 205 Bostwick Avenue in Bridgeport. The outfall runs approximately 800 feet from the CCT to the outlet at Cedar Creek Harbor. Access Point 1 (AP1) is located at the north end near the CCT, with Manhole 2 (MH2) located along the outfall.

Figure 2: Overview of approximate west outfall piping routes

Additional drawings for the outfalls at the east and west plants can be found in Appendix 1 – Site Information.

2.0 EQUIPMENT

2.1 Remotely Operated Vehicle

ASI's MSS Defender ROV was used for the outfall inspections. The MSS vehicle is ballasted to be neutrally buoyant in fresh water and uses seven electric thrusters to propel itself through the water column. Four vectored thrusters are used for lateral movement and forward travel, making it capable of pulling long tether lengths; three vertical thrusters enable the vehicle to move vertically through the water column. This vehicle is also equipped with two dimmable LED lights to illuminate the area of investigation for the high-definition camera mounted on the front of the vehicle.

Figure 3: MSS Defender configured with camera, sonar, and profiler

The MSS Defender system utilizes umbilical cables 1,050 feet and 8,448 feet in length. The 1,050-foot-long umbilical (a.k.a. tether) was used for inspection of the outfalls. The umbilical houses both signal and power conductors, along with a Kevlar strength member and abrasion-resistant protective jacket. The umbilical is neutrally buoyant in water to reduce drag and allow for further penetration distances. An ROV pilot controls the vehicle's movement, lighting, and camera position from the surface with the use of a hand-held control console.

The video signal is routed to the surface through the umbilical. The ethernet signal is transmitted through the tether to the topside recording console and a high-resolution video monitor for the pilot and other stakeholders to view. The video signal is also recorded in real-time onto a video recording computer. A sheave counter measures penetration distance of the ROV, and distance information is annotated on the video overlay. Audio commentary is added to document points of interest and anomalies as they are seen during the operation. Video is collected continuously throughout the operation, visibility permitting.

2.2 Multi-beam Imaging Sonar

A two-dimensional (2D) imaging sonar was integrated onto the tooling tray of the MSS ROV. This sonar provided real-time plan view feedback directly ahead of the ROV.

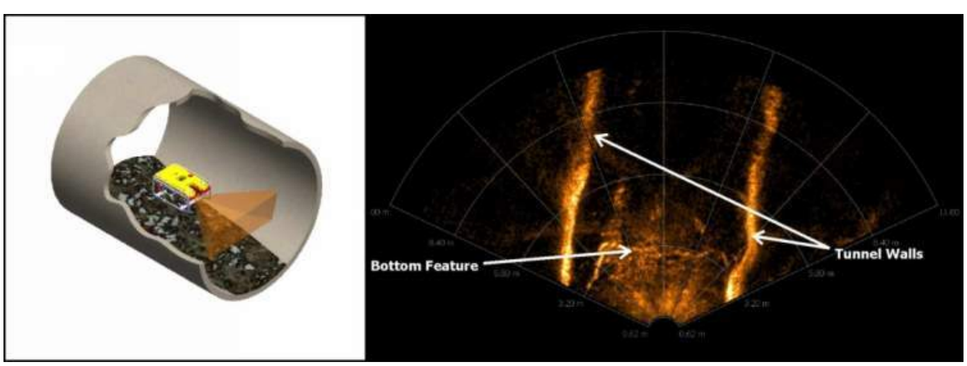


Figure 4: 2D Multibeam imaging sonar on ROV (representative image only)

This type of sonar and mounting configuration provides real-time plan view information directly ahead of the ROV, making it a highly effective navigation and obstacle-avoidance tool. The sonar also provides valuable feature detection capabilities for inspection.

2.3 Profiling Sonar

A profiling sonar, mounted to the bottom of the ROV, was used to provide cross-sectional profiling capability. The ROV and profile sonar are aligned with the structure using the imaging sonar to ensure cross-sectional profiles are collected perpendicular to the walls of the structure. The profiling beam of the sonar rotates a full 360 degrees while collecting measurements. On the right of Figure 5 is a representative example of a profile scan inside a pipeline structure. The ROV pilot monitors these sonar scans in real time on the PC display, and the data is recorded for reporting purposes.

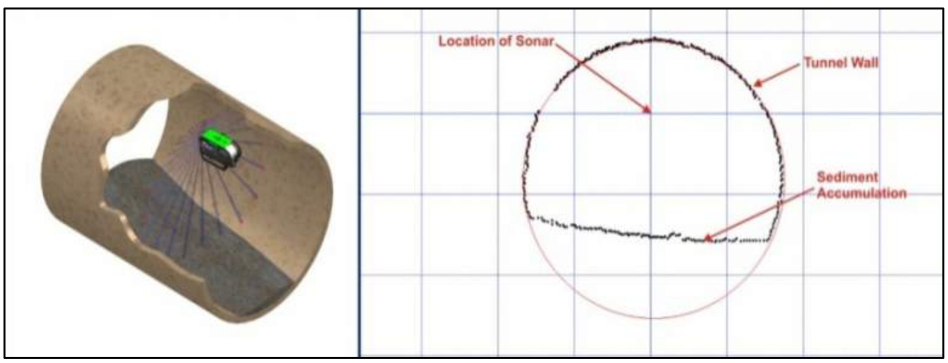


Figure 5: Profiling sonar on ROV (left); Sample sonar image (right)

Typically, profile measurements were collected while the ROV is stationary against the crown of the structure. Through experience, we have found that this practice minimizes the stirring-up of sediments deposited on the invert of a structure, and it also provides good geometry for accurate measurements to the structure's invert, where there are commonly accretions of sediment.

3.0 INSPECTION PROCEDURE

3.1 Shop Preparation and Mobilization

ASI personnel assembled the equipment packages and ancillary tools at ASI's office prior to travel to Bridgeport, CT. All sonar and inspection equipment were integrated onto the ROV in a dry benchtop setting and were function tested. After passing dry tests, the ROV was wet tested in ASI's test tank to ensure all components of the package functioned appropriately. Upon confirmation of system performance, the ROV was trimmed to be neutrally buoyant in fresh water. The ROV and ancillary equipment were packed into ASI's pickup truck and enclosed trailer for transport to Bridgeport, CT.

3.2 Site Operations

Three ASI personnel were assigned to field operations and arrived at the security gate of the east plant at 0800 hours on 29 January 2020 to meet with CDM Smith and plant representatives and receive a visitor pass. A safety orientation was conducted on site before beginning setup for inspection operations.

3.2.1 East Outfall

The control station and equipment were set up in the back of ASI's enclosed trailer, which was parked adjacent to Manhole 1. The ROV and ancillary components were reviewed in accordance with ASI's standard written pre-dive procedure to minimize risk of system failure and to ensure that the system would perform as expected. Before the ROV was powered on, visual and tactile inspections were completed to ensure all connections and mechanical hardware were secure. Power-up checks were then conducted on the ROV. Once setup was complete, the ROV was ready to enter the water at 1000 hours.

Figure 6: ASI truck and operations trailer adjacent to Manhole 3

The ROV was lowered into the chamber for Manhole 1 and the counter was set to zero. The ROV was piloted downstream (west) to the chamber at Manhole 3. The ROV was then recovered to Manhole 1 and continued the inspection upstream (north) towards the CCT and then east into a plant bypass pipe. The ROV was recovered from Manhole 1, and the control station was moved adjacent to Manhole 3 to inspect the remainder of the outfall.

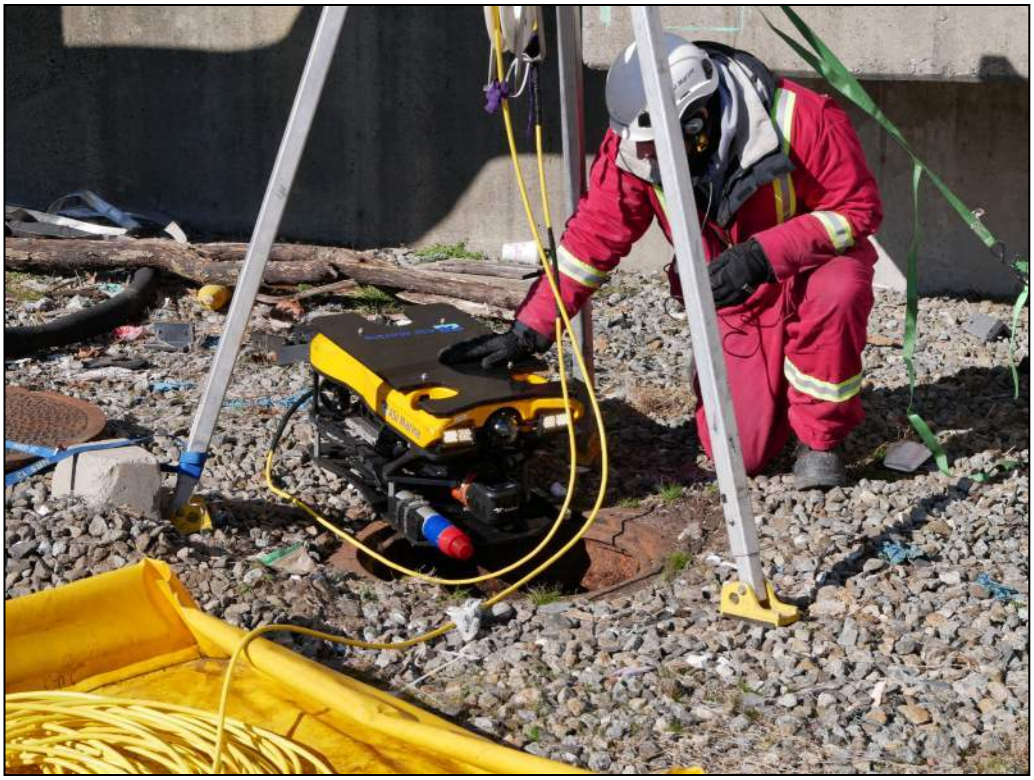


Figure 7: ROV at Manhole 3

The ROV was lowered into the chamber at Manhole 3 and the counter was set to zero. The inspection proceeded downstream from Manhole 3 to the end of the outfall. The ROV was then recovered and the equipment was disassembled for transfer to the west plant.

Video and sonar data were recorded throughout the inspection. Profile images were taken at 50-foot intervals during ROV recovery.

3.2.2 West Outfall

ASI personnel arrived on site at the west plant at 1100 hours on 30 January 2020. The ROV and ancillary equipment were set up in the back of an enclosed trailer and were ready for launch at 1220 hours.

Plant operations halted at 1230 hours and time was allowed for flows rates to subside. Flows subsided by 1310 hours, and the ROV was launched into Access Point 1, where the counter was set to zero. The ROV traveled downstream towards the outlet. Upon reaching the outlet, the ROV was recovered and retrieved to the surface, and post-dive checks were conducted. The equipment was then loaded onto ASI’s vehicle and transported off-site.

Video and sonar data were recorded throughout the inspection. Profile images were taken at 50-foot intervals during ROV recovery.

Figure 8: Access Point 1 at the West plant chlorine contact tanks

3.3 Reporting

A review of the video and data collected during the inspection was completed at ASI offices. The assembly of this report was then completed. The report includes documentation methodology, equipment descriptions, select video and sonar stills, edited video, and inspection observations that were noted during the time of inspection.

The inspection video was reviewed and edited to remove extraneous information. This video can be found in Appendix 5.

4.0 INSPECTION OBSERVATIONS

4.1 East Outfall

The ROV was first launched at Manhole 1, as described in Sections 1.1 and 3.2. Rock debris was noted on the invert 134.8 feet downstream of Manhole 1. The imaging sonar indicated additional rock debris on the invert approaching the bend at 141 feet downstream of Manhole 1 (refer to Figure 9).

Figure 9: Image of debris on invert at 135 feet (left); Sonar image of bend at 141 feet (right)

Upstream of Manhole 1, rock debris was noted on the invert at 34.4 feet (refer to Figure 10–Left). A small amount of rock debris was noted along the invert between 100 and 158 feet, approaching the CCTs. A profile image taken at 116 feet upstream of Manhole 1 shows approximately 6.25 inches of rock debris on the invert (refer to Figure 10 - Right).

Figure 10: Image of debris on invert at 34 feet upstream of Manhole 1 (left); Profile of rock debris at 116 feet upstream of Manhole 1 (right)

A small cable was noted was noted at the crown 5.6 feet upstream of Manhole 1. Floating debris was noted at the crown adjacent to the cable (refer to Figure 11). The cable continues 10 feet upstream, where it turns 90 degrees towards the invert.

Figure 11: Exposed aggregate and line 5ft upstream (left); Exposed line at crown 5ft upstream (right)

The cable leads to a sensor on the invert. The cable and sensor appeared to be properly secured to the walls, and the sensor was free of any debris (refer to Figure 12 - Left). An additional pipe conduit towards the east was noted upon entering the junction at Manhole 1. It was remarked by a plant employee that a plant bypass previously existed (refer to Figure 12 - Right). The sensor is also visible on the sonar image of the pipes.

Figure 12: Image of sensor at 9 feet upstream (left); Sonar image looking down conduits toward CCT and plant bypass from manhole 1 junction (right)

The plant bypass was inspected and was found to be two-thirds full of sediment. A profile image at 16.7 feet in the bypass shows approximately 38 inches of sediment. The cross-section of the bypass is approximately 61 inches (refer to Figure 13 - Left). An HD image taken at 16.7 feet shows a thick layer of biofouling attached to the crown (refer to Figure 13 - Right).

Figure 13: Profile image at 16.7 feet in bypass (left); Image of crown at 16.7 feet in bypass (right)

The ROV was then launched at Manhole 3, as described in Sections 1.1 and 3.2. A small amount of sediment and rock accumulation was noted at 89.2 feet downstream of Manhole 3 (refer to Figure 14 - Left). Sediment levels increased gradually when approaching the outlet. A profile image taken at 145 feet downstream of Manhole 3 shows a sediment level of approximately 14.72 inches (refer to Figure 14 - Right).

Figure 14: Image of sediment and rock debris at 89.2 feet (left); Profile image of debris at 145 feet (right)

Joints were noted at regular 12-foot intervals. A joint at 100.4 feet downstream of Manhole 3 had a large gap without grout (refer to Figure 15 – Left). The size of the gap suggests the joint could be an expansion joint; however, this is unconfirmed. Additionally, a larger gap in a joint was noted at 175.5 feet downstream of Manhole 3, with some small floating debris at the crown (refer to Figure 15 - Right).

Figure 15: Image of joint at 100.4 feet (left); Image of joint at 175.5 feet (right)

The end of the outfall was reached at 175 feet downstream of Manhole 3. The imaging sonar shows that the outfall ends and an outlet structure branches off 45degrees to the left (refer to Figure 16 - Left). The outlet structure had a texture on the invert. HD images of the structure indicated it was of brick construction (refer to Figure 16 - Right).

Figure 16: Sonar image of outfall at 175 feet (left); Image of brick construction at 184 feet (right)

4.2 West Outfall

The ROV was deployed at Access Point 1 as per Sections 1.1 and 3.2. A manhole chamber was noted on the imaging sonar, which was consistent with site drawings. The chamber for Manhole 2 is located approximately 40 feet downstream of Access Point 1. Additionally, debris could be seen on the invert just past the chamber (refer to Figure 17).

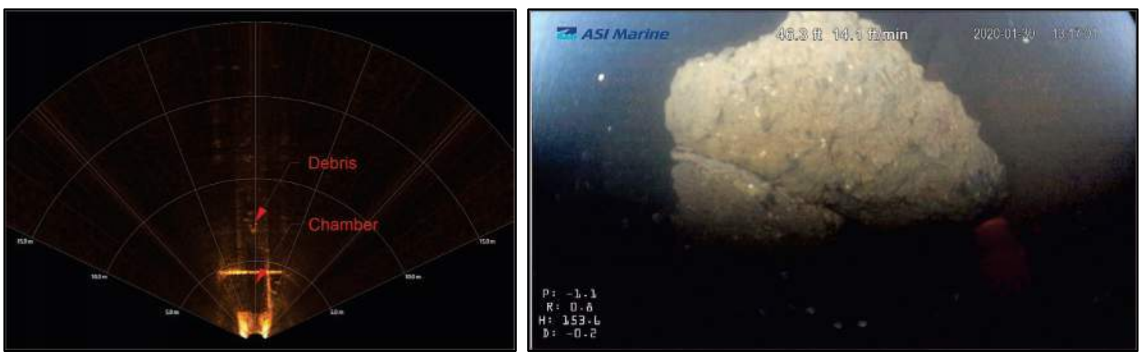


Figure 17: Sonar image of chamber and debris at 36 feet (left); Image of debris at 46 feet (right)

What appeared to be a structure was noted on the invert at 118.8 feet downstream of Access Point 1. Small conduits were seen twisted at the downstream side of the structure, approaching the chamber for Manhole 1 (refer to Figure 18). Due to potential entanglement risk, the ROV was not piloted any closer. A flow sensor was observed on the invert at 154 feet (refer to Figure 18)

Figure 18: Image of structure at 119 feet (left); Image of sensor at 153 feet (right)

A chamber was noted on the imaging sonar at 148 feet downstream of Access Point 1. The feature shown on the imaging sonar image appeared to be the sensor located on the invert (refer to Figure 19 - Left). An inspection of the ladder was completed. The structure appeared to be intact; however, a layer of biofouling existed on the majority of the ladder surface (refer to Figure 19 - Right).

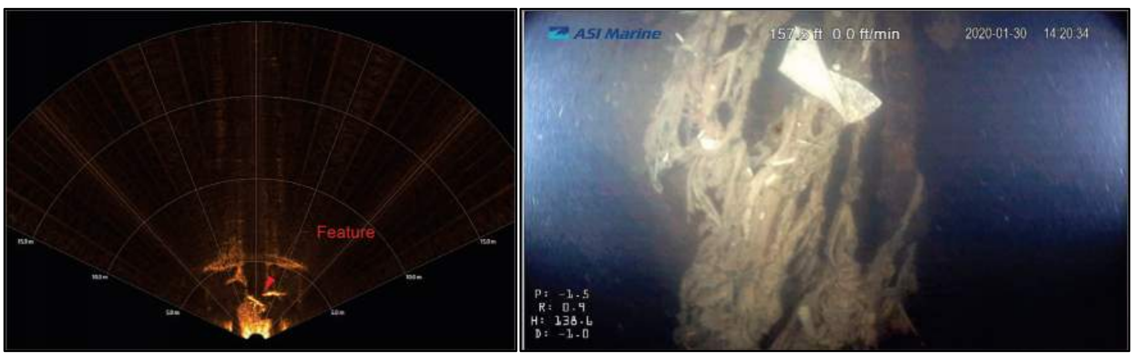


Figure 19: Sonar image of manhole chamber at 148 feet (left); Image of biofouling on ladder at 157 feet (right)

A small opening in the crown was located at 207.3 feet downstream of Access Point 1. There appeared to be a wood structure within the opening (refer to Figure 20 - Left). A small protrusion was noted near the invert with a line wrapped around it (refer to Figure 20 - Right).

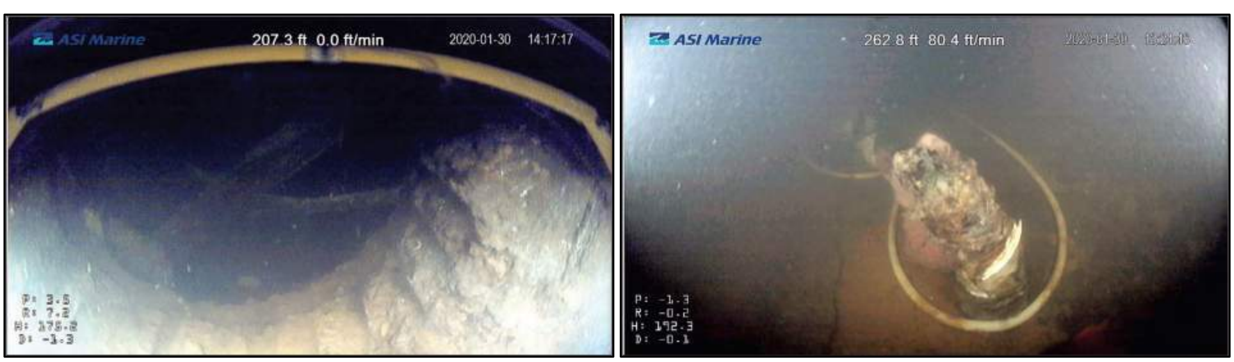


Figure 20: Image of opening in crown at 207 feet (left); Image of protrusion at 263 feet (right)

Rock debris on the invert became more prevalent past 600 feet downstream of Access Point 1. A piece of debris was noted on top of a rock pile at 691.3 feet (refer to Figure 21 - Left). An image taken at 725.1 feet shows the level of rock debris increasing (refer to Figure 21 - Right).

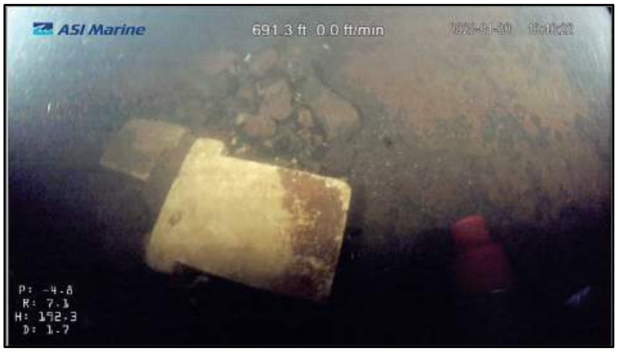


Figure 21: Image of debris at 691 feet (left); Image of rock debris at 725 feet (right)

The rock debris on the invert continued to the outlet. An image at 783.8 feet downstream of Access Point 1 shows rock debris on the invert approaching the exit (refer to Figure 22 - Left). A profile image taken at 786 feet shows a rock pile of approximately 16.5 inches (refer to Figure 22 - Right).

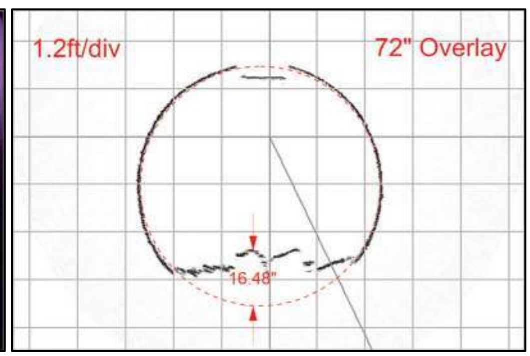


Figure 22: Image of outlet at 784 feet (left); Profile image of debris at 786 feet (right)

5.0 CONCLUSION

The inspection of the two outfalls at the Bridgeport Water Pollution Control Authority's east and west WWTPs was completed using an ROV containing a suite of sensors, including a high-definition camera, an imaging sonar, and a profiling sonar to complete the inspection.

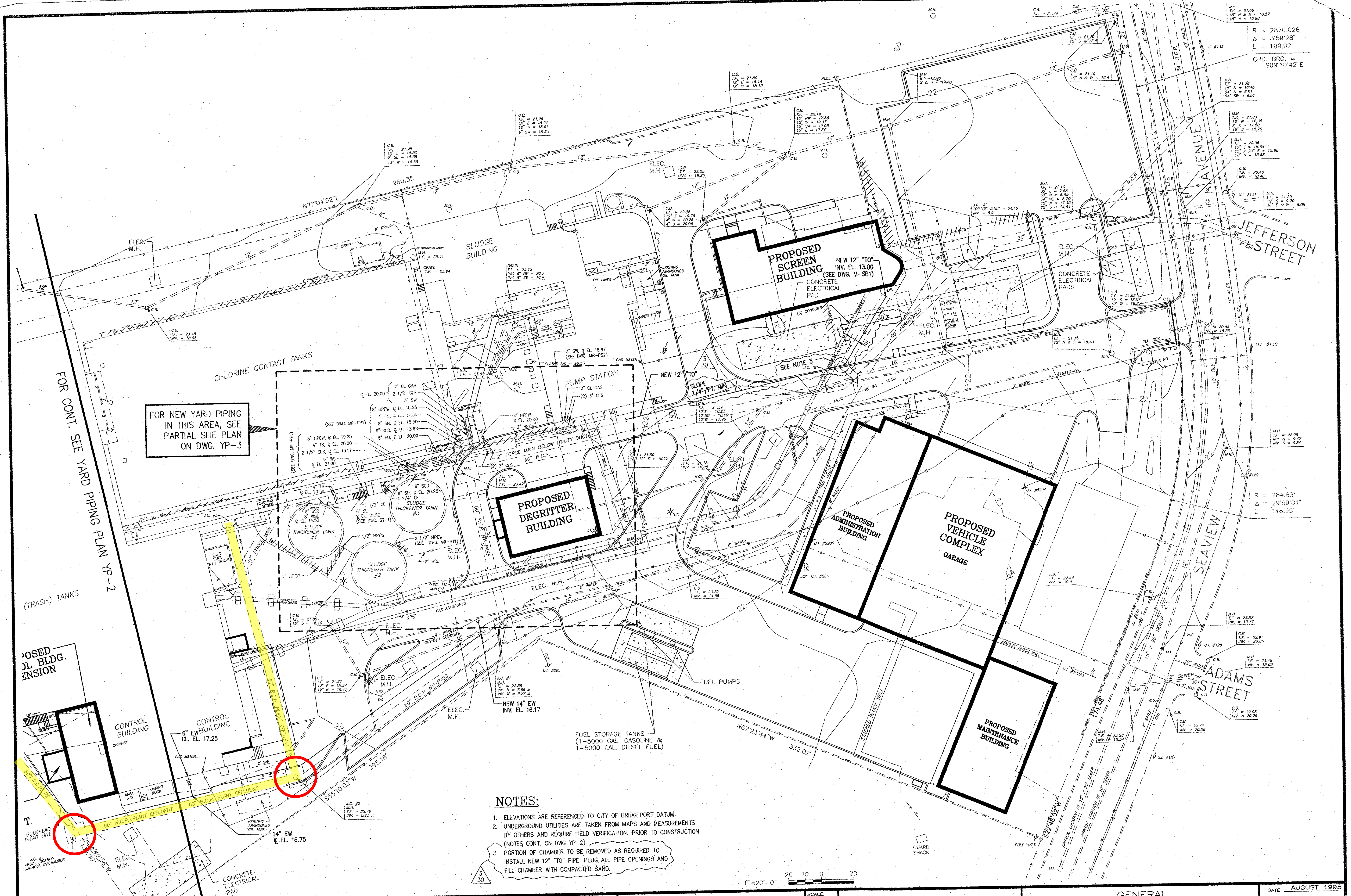
The east outfall was successfully inspected from the chlorine contact tanks to the outlet at Pequonnock River. The inspection began at Manhole 1 and the ROV traveled downstream to Manhole 3. Upon recovery, the ROV traveled upstream to the CCTs. Joints appeared to be intact, without signs of separation or misalignment. The outfall was approximately 61 inches in diameter. Small piles of rock debris were located along the invert near the bends. A sensor was noted on the invert near Manhole 1. The plant bypass was inspected and was found to be two-thirds full of sediment and had signs of biofouling on the crown.

The ROV was recovered from Manhole 1 of the east outfall and deployed into Manhole 3 to inspect the remainder of the outfall. Two joints were noted to have a gap between tunnel sections, indicating a possible expansion joint. A small pile of rock debris was noted near the bend at Manhole 3. Additionally, rock debris was noted along the invert near the outlet. The outlet diverges 45 degrees from the outfall and is constructed of brick.

The west outfall was successfully inspected from Access Point 1 to the outlet at Cedar Creek Harbor. The inspection began at Access Point 1, and the ROV traveled 786 feet downstream to the outlet. Joints appeared to be intact, without signs of separation or misalignment. The diameter of the outfall was approximately 72 inches. Rock debris was located along the invert throughout the inspection. The debris became more prominent past 600 feet. A structure was noted on the invert, with PVC lines tangled just upstream of Manhole 1. Additionally, a sensor was noted in the west outfall at Manhole 1.

Appendix 1:

Site Information



NO.	DATE	ISSUED FOR	BY
1	3/6/97	CONFORMED TO ADD. 1 TO 6	R.M.

DESIGNED B.P.
DRAWN F.E.
PROJ. ENGR. B.P.
PROJ. MNGR. A.W.

KASPER GROUP, INC.
Architects, Engineers, Surveyors
968 Fairfield Avenue, Bridgeport, Connecticut 06605

HAZEN AND SAWYER
Environmental Engineers & Scientists
NEW YORK, NEW YORK

DIVERSIFIED TECHNOLOGIES CORPORATION
Engineers • Planners • Surveyors
566 Washington Avenue
North Haven, CT. 06473
Tel:(203) 239-4200

SCALE: 1"=20'
PLOT DATE: 3/7/97
CAD FILE: 6822YP1

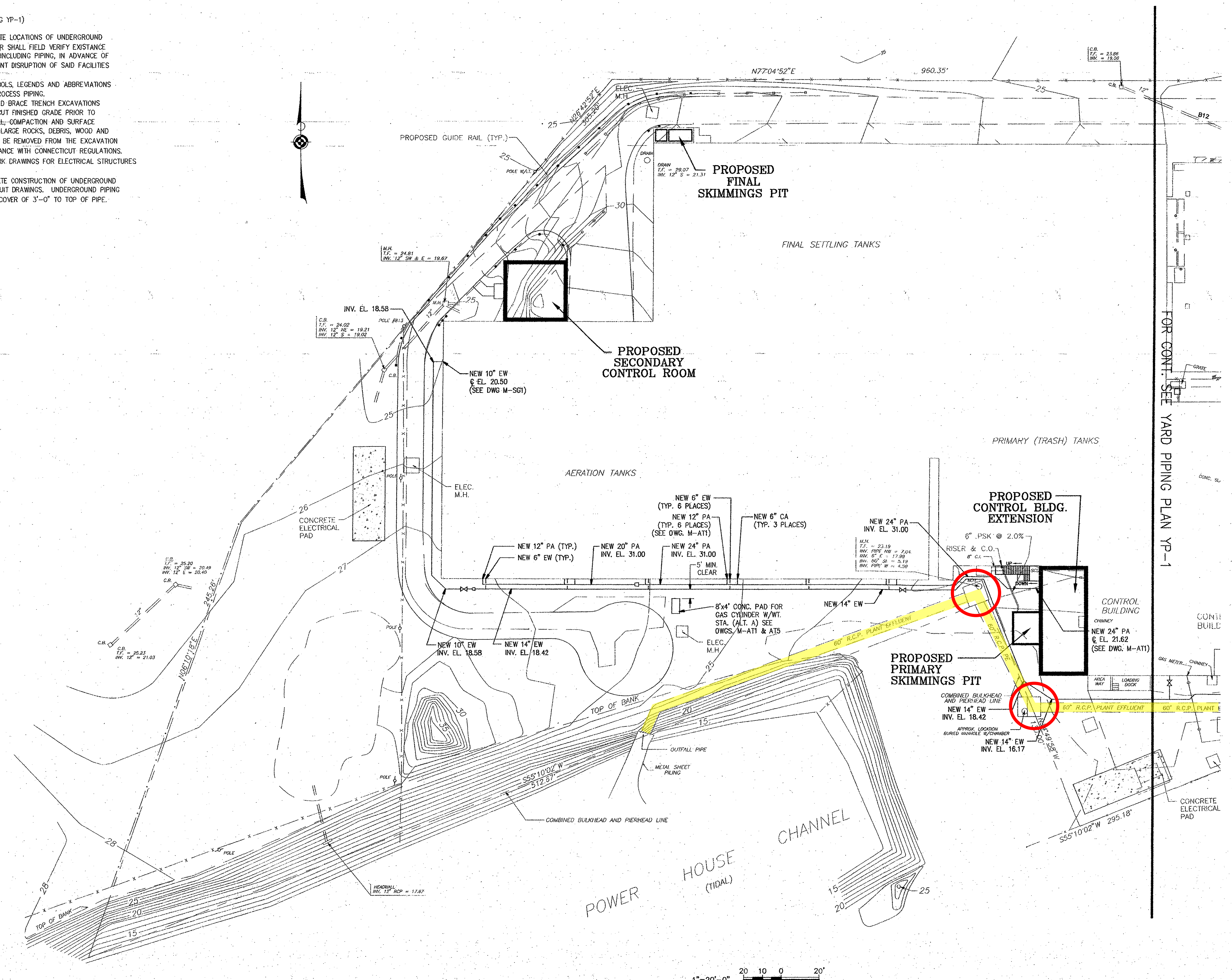
CONTRACT NO. 2
REHABILITATION OF EAST SIDE WASTEWATER TREATMENT PLANT
BRIDGEPORT WATER POLLUTION CONTROL AUTHORITY

GENERAL
YARD PIPING PLAN
SHEET 1

DATE AUGUST 1995
SHEET 16 OF 446
DWG. NO. YP-1

NOTES: (CONT. FROM DWG YP-1)

3. THIS PLAN SHOWS APPROXIMATE LOCATIONS OF UNDERGROUND YARD PIPING. THE CONTRACTOR SHALL FIELD VERIFY EXISTANCE OF UNDERGROUND FACILITIES, INCLUDING PIPING, IN ADVANCE OF NEW CONSTRUCTION TO PREVENT DISRUPTION OF SAID FACILITIES AND PIPE.
4. SEE DRAWING M-D1 FOR SYMBOLS, LEGENDS AND ABBREVIATIONS REGARDING NEW YARD AND PROCESS PIPING.
5. CONTRACTOR SHALL SHEET AND BRACE TRENCH EXCAVATIONS OF 5 FEET DEEP OR MORE. CUT FINISHED GRADE PRIOR TO COMPLETION OF FINAL BACKFILL, COMPACTION AND SURFACE RESTORATION. ALL BOLDERS, LARGE ROCKS, DEBRIS, WOOD AND UNSUITABLE MATERIALS SHALL BE REMOVED FROM THE EXCAVATION AND DISPOSED OF IN ACCORDANCE WITH CONNECTICUT REGULATIONS.
6. REFER TO ELECTRICAL SITEWORK DRAWINGS FOR ELECTRICAL STRUCTURES AND DUCTBANKS NOT SHOWN.
7. CONTRACTOR SHALL COORDINATE CONSTRUCTION OF UNDERGROUND PIPING WITH ELECTRICAL CONDUIT DRAWINGS. UNDERGROUND PIPING SHALL HAVE MINIUM GROUND COVER OF 3'-0" TO TOP OF PIPE.



NO.	DATE	ISSUED FOR	BY	NO.	DATE	ISSUED FOR	BY

DESIGNED B.P.
DRAWN F.F.
PROJ. ENGR. B.P.
PROJ. MNGR. A.W.

KASPER GROUP, INC.
Architects, Engineers, Surveyors
960 Fairfield Avenue, Bridgeport, Connecticut 06605

HAZEN AND SAWYER
Environmental Engineers & Scientists
NEW YORK, NEW YORK

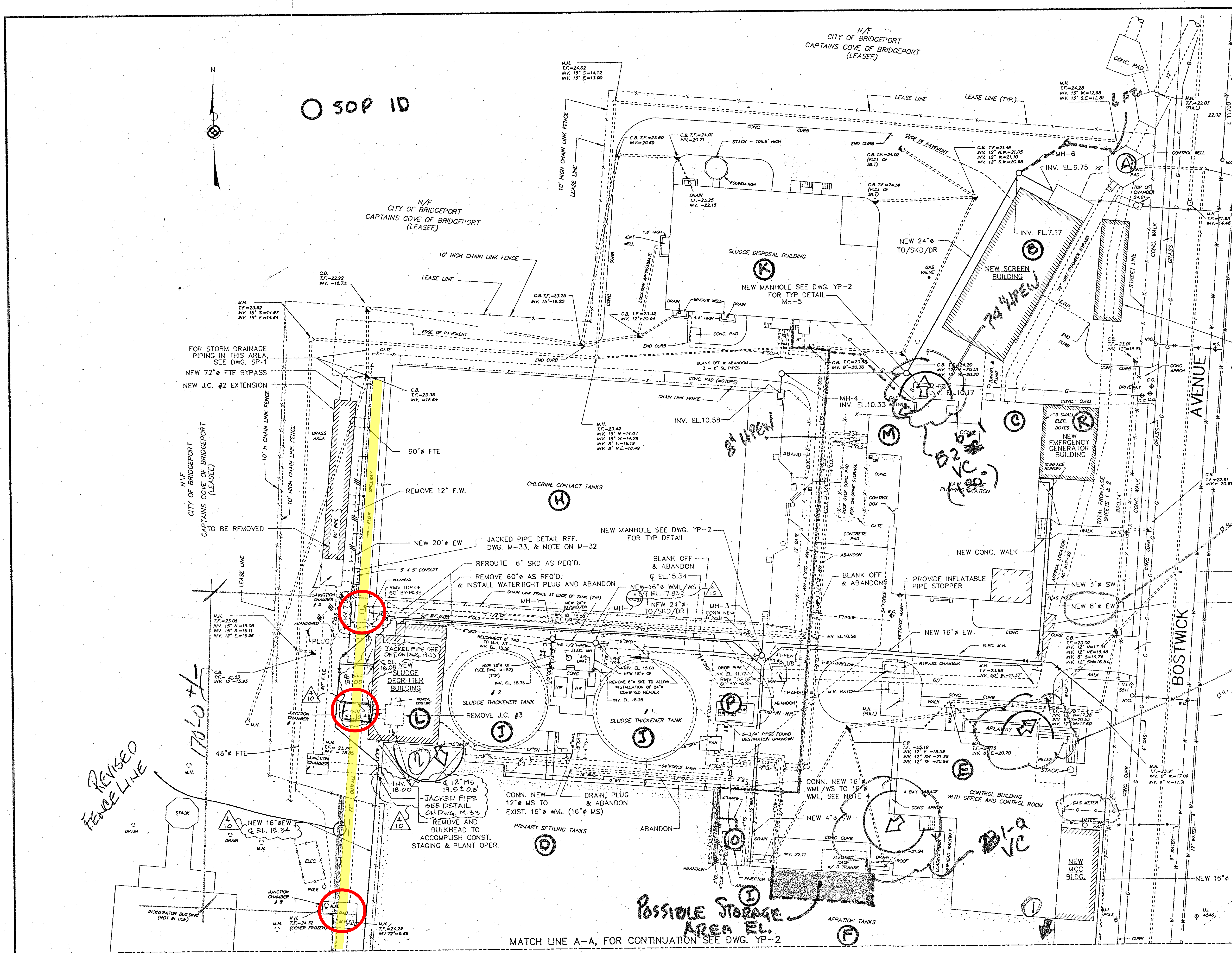
DIVERSIFIED TECHNOLOGIES CORPORATION
Engineers • Planners • Surveyors
556 Washington Avenue
North Haven, CT. 06473
Tel:(203) 239-4200

SCALE: 1"=20'
PLOT DATE: 8/25/95
CAD FILE: 6822YP2

CONTRACT NO. 2
REHABILITATION OF EAST SIDE WASTEWATER TREATMENT PLANT
BRIDGEPORT WATER POLLUTION CONTROL AUTHORITY

GENERAL
YARD PIPING PLAN
SHEET 2

DATE AUGUST 1995
SHEET 17 OF 446
DWG. NO. YP-2



NOTES:

1. ELEVATIONS ARE BASED UPON CITY OF BRIDGEPORT DATUM.
2. BASE SURVEY INFORMATION WAS TAKEN FROM PLAN ENTITLED "SITE PLAN WESTSIDE TREATMENT PLANT." SHEET 1 OF 2, DATED JUNE 20, 1990, BY KASPER ASSOCIATES, INC.
3. THIS PLAN IS INTENDED TO SHOW APPROXIMATE LOCATIONS OF UNDERGROUND YARD PIPING. THE INFORMATION SHOWN WAS DERIVED FROM EXISTING MAPPING AND LIMITED FIELD INVESTIGATION, AND WAS PREPARED BY OTHERS. THE CONTRACTOR SHALL FIELD VERIFY EXISTENCE OF UNDERGROUND FACILITIES, INCLUDING PIPING, IN ADVANCE OF NEW CONSTRUCTION TO PREVENT DISRUPTION OF SAID FACILITIES & PIPE.
4. CLOSE EXISTING 16"ø WML VALVE AT THICKENER STRUCTURE. HAND DIG TO EXPOSE 16"ø WML AT LOCATION OF NEW CONN. PROVIDE TAPPING EQUIP., PIPING & PUMPS TO DRAIN THE EXIST. 16"ø WML TO THE PRIMARY SETTLING TANKS; DISCONNECT & PROVIDE WATERTIGHT PLUG IN EXIST. 16"ø WML TO THE EXIST. THICKENERS; MAKE NEW CONNECTION.
5. SEE DRAWING M-1 FOR SYMBOLS, LEGENDS & ABBREVIATIONS REGURDING NEW YARD & PROCESS PIPING.
6. REFER TO ELECTRICAL SITEWORK DRAWINGS FOR STRUCTURES NOT SHOWN.
7. CONTRACTOR SHALL SHEET AND BRACE TRENCH EXCAVATIONS OF 5 FEET DEEP OR MORE. CUT FINISHED GRADE PRIOR TO COMPLETION OF FINAL BACKFILL, COMPACTION AND SURFACE RESTORATION. ALL BOLDERS, LARGE ROCKS, DEBRIS, WOOD AND TRAMP MATERIALS SHALL BE REMOVED FROM THE EXCAVATION AND DISPOSED OF IN ACCORDANCE WITH CONNECTICUT REGULATIONS.
8. CONTRACTOR SHALL COORDINATE CONSTRUCTION OF UNDERGROUND PIPING WITH ELECTRICAL CONDUIT DRAWINGS. ELECTRICAL CONDUIT SHALL HAVE MAXIMUM GROUND COVER OF 5'-0" TO BOTTOM OF CONDUIT. UNDERGROUND PIPING SHALL HAVE MAXIMUM GROUND COVER 8'-0" TO TOP OF PIPE.

PREPARED BY: HAZEN AND SAWYER, P.C.

NO.	DATE	ISSUED FOR	BY
C	4/30/93	ENTIRE DRAWING CONFORMED W/ADDENDA 1 TO 4	ASN
2	10/92	NEW DWG-ADDENDUM 3	G.B.
1	8/92	BID ISSUE	G.B.

DESIGNED R.H.
DRAWN R.M.
CHECKED R.H.
PROJ. MNGR. G.B.
PROJ. ENGR. G.B.

P.E.

KASPER ASSOCIATES, INC.
ENGINEERS – SURVEYORS – PLANNERS

HAZEN AND SAWYER, P.C.
ENGINEERS
NEW YORK, NEW YORK

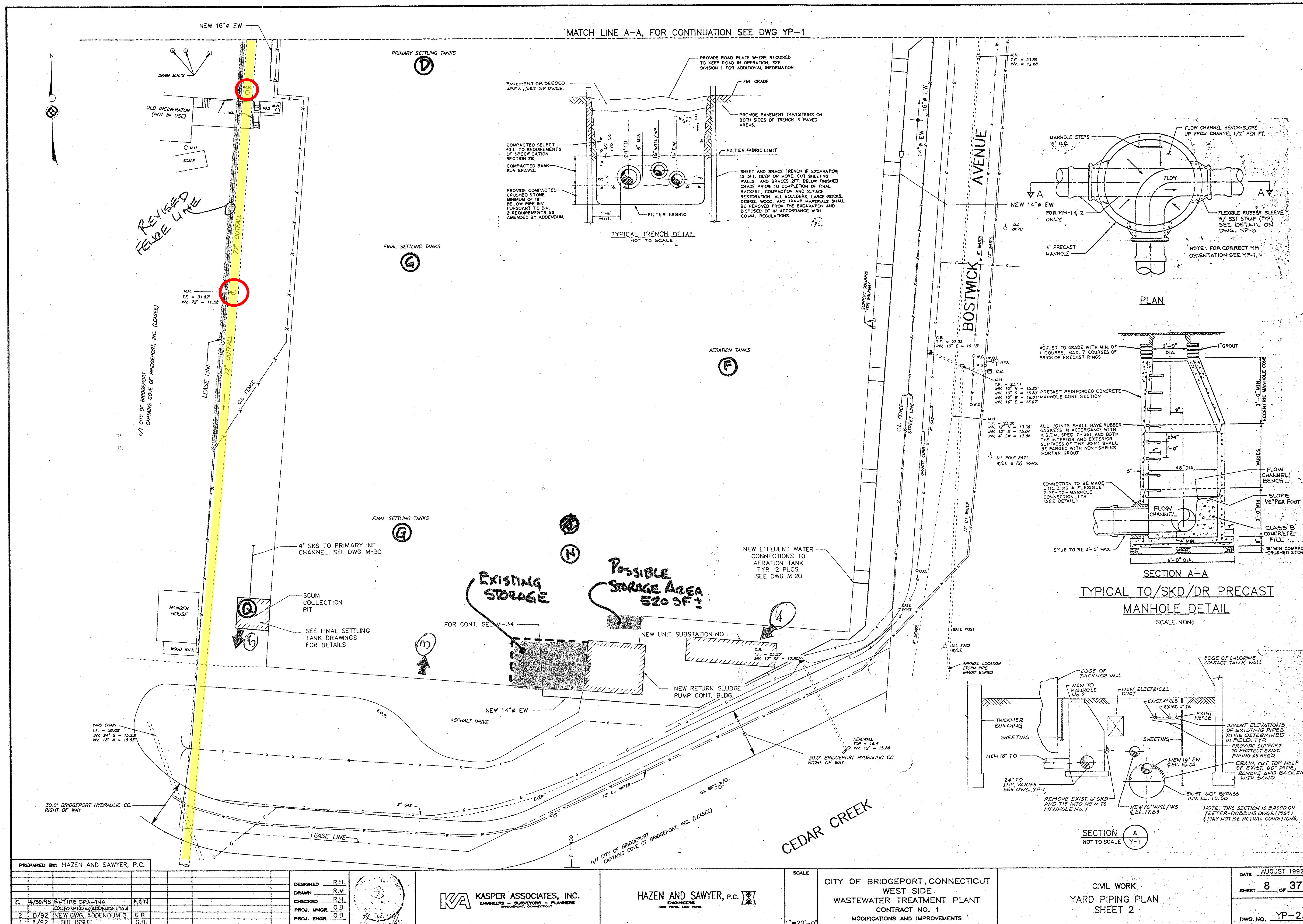
SCALE 1"=20'-0"

CITY OF BRIDGEPORT, CONNECTICUT
WEST SIDE
WASTEWATER TREATMENT PLANT
CONTRACT NO. 1
MODIFICATIONS AND IMPROVEMENTS

CIVIL WORK
YARD PIPING PLAN
SHEET 1

DATE AUGUST 1992
SHEET 7 OF 373
DWG. NO. YP-1A3

\6821\WSYP001 NN 8-10-92



\6821\WSYP002 NN 8-10-92

Appendix 2:

Equipment Description

ASI Marine | ASI MSS Defender

The Mission Specialist Series (MSS) Defender ROV is one of ASI's smallest vectored vehicles. The MSS is a highly interchangeable system which provides a customizable platform that can be easily adaptable for any inspection requirement. The vehicle can be retrofitted with a wide variety of sonars and sensors, as well as additional thrusters for more pull or lifting capability.

VEHICLE DIMENSIONS

Length	0.72 m	2.36 ft
Width	0.40 m	1.31 ft
Minimum Tunnel Diameter	0.45 m	1.47 ft
Depth Rating	300 m	1000 ft
Estimated Weight	16 kg	35 lb

UMBILICAL LENGTHS

Long	2.5 km	1.6 mi
Short	320 m	1050 ft

POWER REQUIREMENTS

- Single phase power for hotel loads 120-140 VAC at 3kW 50/60 Hz
- Single phase power for for 2.5 km winch 208-240 VAC at 4kW 50/60 Hz

OPTIONAL EQUIPMENT

Including but not limited to:

- Single function manipulator
- Scanning & Multibeam profiling sonar
- Inertial navigation system
- Metal thickness NDT probe
- USBL tracking

STANDARD EQUIPMENT

- 2 x dimmable LED lights with wide and narrow beam control
- 4 vectored and 3 vertical brushless DC thrusters
- Portable cable payout counter
- High resolution colour main camera with tilt
- Real-time multibeam navigation imaging sonar
- Video overlay for display of date, time and cable payout

SPECIALIZED TOOLING AVAILABLE ON A PROJECT-SPECIFIC BASIS

asi-group.com
info@asi-group.com
566 Arvin Avenue, Stoney Creek, ON, Canada L8E 5P1 | tel 905-643-3283
40 Centre Drive, Suite 3, Orchard Park, NY USA 14127 | tel 716-667-3507

Appendix 3:

Inspection Logs

ASI Marine

DATE: 2020-01-29 **CLIENT:** CDM Smith Inc.
PROJECT #: RU19-043 **LOCATION:** Bridgeport Water Pollution Control Authority's East Wastewater Treatment Plant

POSITION		TIME	DESCRIPTION
Meters	Feet	(hh:mm:ss)	
1.3	4.27	10:19:10	ROV in water @ manhole 1
42.0	137.80	10:31:46	at manhole 2
50.7	166.34	10:33:05	at manhole 3
58.2	190.94	10:38:20	profile 1 (manhole 2 to 3)
52.2	171.26	10:43:44	*profile 2*
44.5	146.00	10:45:25	profile 3
42.6	139.76	10:46:14	manhole 2
41.1	134.84	10:47:10	profile 4
41.1	134.84	10:47:44	debris of profile 4
39.8	130.58	10:51:02	debris of profile 4
31.7	104.00	10:52:33	*profile 5*
25.3	83.01	10:54:06	return on blueview
32.5	106.63	10:54:48	small debris
24.4	80.05	10:56:28	profile 6
16.9	55.45	10:59:34	profile 7
9.4	30.84	11:02:46	profile 8
1.3	4.27	11:03:24	at manhole 1 (4.3ft slippage)
3.6	11.81	11:05:26	profile 9
3.6	11.81	11:06:14	bifurcation
3.6	11.81	11:06:37	heading upstream to chlorination tanks
5.1	16.73	11:07:42	bifurcation
2.8	9.19	11:09:43	cable
2.8	9.19	11:10:17	metallic object(possible flowmeter)
10.9	35.76	11:11:59	rock debris on invert
18.4	60.37	11:12:56	debris
21.8	71.52	11:13:41	debris
31.5	103.35	11:14:30	rock debris on blueview
38.1	125.00	11:15:07	debris on blueview 5m ahead
42.2	138.45	11:15:36	pile of debris (end of conduit on blueview)
44.5	146.00	11:16:13	debris on camera

ASI Marine

47.1	154.53	11:16:58	at the effluent sample chamber
48.4	158.79	11:18:17	at the end of conduit
42.6	139.76	11:19:41	profile 10
35.3	115.81	11:21:30	profile 11
27.2	89.24	11:23:42	profile 12
20.6	67.59	11:25:33	profile 13
12.0	39.37	11:26:51	profile 14
5.1	16.73	11:28:20	profile 15
-0.6	-1.97	11:28:49	at manhole 1
1.7	5.58	11:29:40	profile 16
1.7	5.58	11:30:18	plastic bottles
1.7	5.58	11:32:54	going into plant bypass
5.1	16.73	11:33:44	sediment
4.9	16.08	11:34:48	profile 17
2.8	9.19	11:35:39	profile 18
2.1	6.89	11:36:34	ROV at surface
			Recover from manhole 1 and prep for deployment at manhole 3
-0.9	-2.95	12:19:31	ROV at Surface Manhole 3 (Swapped Profiler)
1.7	5.58	12:23:23	Heading towards outfall
27.4	89.90	12:25:09	debris on camera and blueview
53.3	174.87	12:29:01	At the Outfall
56.1	184.06	12:29:46	brick wall
54.4	178.48	12:30:44	camera looking at the outfall to the ocean
55.9	183.40	12:37:12	profile outfall
55.0	180.45	12:39:06	profile 19
54.0	177.17	12:40:17	profile outfall 2 (facing 9:00 seaward)
53.5	175.52	12:41:48	plastic bottle and debris
51.8	169.95	12:43:16	profile 20
44.3	145.34	12:45:08	profile 21
37.0	121.39	12:47:13	profile 22
30.6	100.39	12:48:07	possible joint/transition
28.9	94.82	12:49:05	profile 23
21.4	70.21	12:50:26	profile 24
13.7	44.95	12:52:05	profile 25
6.0	19.69	12:53:53	profile 26
1.7	5.58	12:55:26	profile 27
-1.9	-6.23	12:58:13	ROV at surface manhole 3

ASI Marine

DATE: 2020-01-30 **CLIENT:** CDM Smith Inc.
PROJECT #: RU19-043 **LOCATION:** Bridgeport Water Pollution Control Authority's West Wastewater Treatment Plant

POSITION		TIME	DESCRIPTION
Meters	Feet	(hh:mm:ss)	
3.2	10.50	13:13:47	ROV in water
3.0	9.84	13:15:41	In conduit, heading down stream
12.0	39.37	13:16:43	Chamber on the blueview
14.1	46.26	13:17:02	Large debris in chamber
15.8	51.84	13:18:04	*Debris on blueview*
18.2	59.71	13:18:24	Rocks
22.7	74.48	13:19:07	Debris
24.0	78.74	13:19:35	Debris (Cylinder shape)
31.9	104.66	13:20:08	Debris on blueview
34.0	111.55	13:20:23	Rocks and garbage
37.0	121.39	13:20:51	*Cables*
46.9	153.87	13:21:41	Flowmeter
48.0	157.48	13:22:04	Manhole 1
53.7	176.18	13:22:32	Reflection on blueview
58.2	190.94	13:22:57	Visual confirmation of previous payout
76.4	250.66	13:24:26	Strong return on blueview
79.9	262.14	13:24:51	Cable
81.4	267.06	13:25:30	Large debris with cable
139.4	457.35	13:30:36	Return on blueview
144.7	474.74	13:31:03	Debris
188.8	619.42	13:34:15	Debris
190.3	624.34	13:34:47	Return on blueview
193.1	633.53	13:35:16	Rocks
197.4	647.64	13:36:20	Debris pile on blueview
201.3	660.43	13:36:47	Concrete pillar
207.5	680.77	13:40:00	Debris on blueview
210.7	691.27	13:40:24	Debris
215.2	706.04	13:40:50	Metal pole
221.6	727.03	13:41:21	Debris
235.3	771.98	13:42:22	Debris
238.9	783.79	13:42:43	Rocks

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239.6	786.09	13:43:01	End of conduit
239.6	786.09	13:44:27	Object on roof
239.6	786.09	13:44:55	Profile 1
224.6	736.88	13:49:05	Profile 2
208.5	684.06	13:50:55	Minor biofouling buildup on crown
208.5	684.06	13:51:17	Profile 3
193.5	634.84	13:53:18	Profile 4
178.1	584.32	13:56:52	Profile 5
163.1	535.10	13:58:45	Profile 6
155.9	511.48	14:00:15	Debris on crown
147.7	484.58	14:01:51	Profile 7
139.6	458.01	14:03:00	Deformities on crown
133.2	437.01	14:06:34	Profile 8
117.1	384.19	14:08:34	Profile 9
102.1	334.97	14:10:13	Profile 10
101.1	331.69	14:10:41	Profile manhole
99.8	327.43	14:12:24	Manhole in blueview
86.5	283.79	14:14:17	Profile 11
72.2	236.88	14:16:06	Profile 12
63.2	207.35	14:17:18	Break in Manhole
60.4	198.16	14:18:28	Manhole on blueview
57.0	187.01	14:19:17	Profile 13
48.0	157.48	14:20:36	Manhole 1. Debris
48.0	157.48	14:21:10	Mesh screen
48.0	157.48	14:21:41	Ladder
45.0	147.64	14:23:03	Flowmeter
41.5	136.15	14:23:48	Profile 14
25.7	84.32	14:25:33	Profile 15
10.9	35.76	14:27:09	Profile 16
0.0	0.00	14:29:00	Profile 17
-2.1	-6.89	14:29:20	ROV at surface

Appendix 4:

Observation Data

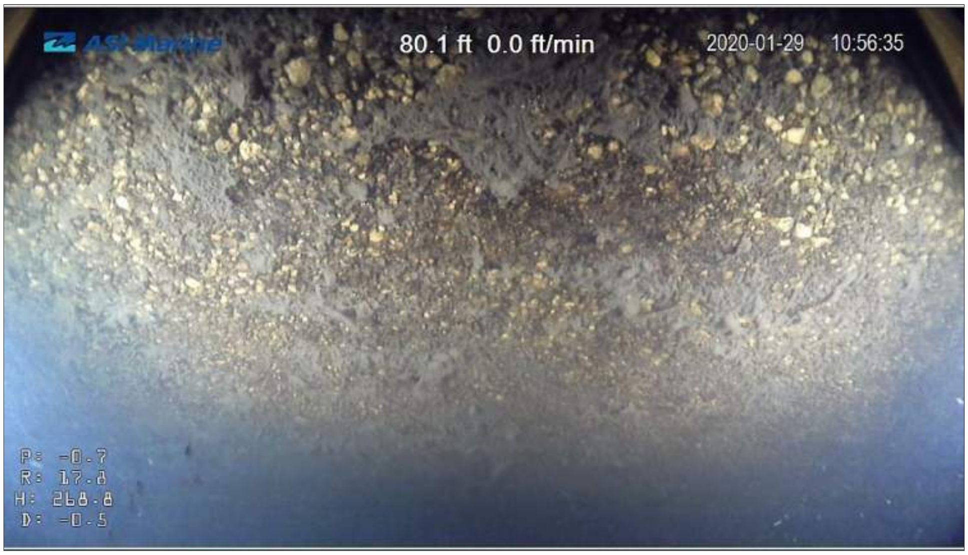


Image 4.1.1A-1: Image of crown 80 feet downstream of Manhole 1.

Image 4.1.1A-2: Feature on invert at 107 feet downstream of Manhole 1.

Image 4.1.1A-3: Debris on invert at 135 feet downstream of Manhole 1.

Image 4.1.1A-4: Exposed aggregate and line at crown 5 feet upstream of Manhole 1.

Image 4.1.1A-5: Floating debris and line at crown 5 feet upstream of Manhole 1.

Image 4.1.1A-6: Image of joint at invert 9 feet upstream of Manhole 1.

Image 4.1.1A-7: Sensor on invert 9 feet upstream of Manhole 1.

Image 4.1.1A-8: Biofouling on crown in plant bypass conduit 17 feet east of Manhole 1 in plant bypass.

Image 4.1.1A-9: Debris on invert 35 feet upstream of Manhole 1.

Image 4.1.1A-10: Image of joint at crown 39 feet upstream of Manhole 1.

Image 4.1.1A-11: Image of crown 68 feet upstream of Manhole 1.

Image 4.1.1A-12: Debris on invert 71 feet upstream of Manhole 1.

Image 4.1.1A-13: Debris on invert 103 feet upstream of Manhole 1.

Image 4.1.1A-14: Debris on invert 138 feet upstream of Manhole 1.

Image 4.1.1A.15: Debris on invert 146 feet upstream of Manhole 1.

Image 4.1.1A.16: Sediment on invert 158 feet upstream of Manhole 1.

Image 4.1.1B-1: Image of crown 45 feet downstream of Manhole 3.

Image 4.1.1B-2: Debris on invert 89 feet downstream of Manhole 3.

Image 4.1.1B-3: Image of crown 95 feet downstream of Manhole 3.

Image 4.1.1B-4: Image of joint 100 feet downstream of Manhole 3.

Image 4.1.1B-5: Image of crown 121 feet downstream of Manhole 3.

Image 4.1.1B-6: Image of crown and joint ahead 145 feet downstream of Manhole 3.

Image 4.1.1B-7: Image of crown 170 feet downstream of Manhole 3.

Image 4.1.1B-8: Floating debris at crown 176 feet downstream of Manhole 3.

Image 4.1.1B-9: Outfall 180 feet downstream of Manhole 3.

Image 4.1.1B.10: Outfall structure 184 feet downstream of Manhole 3.

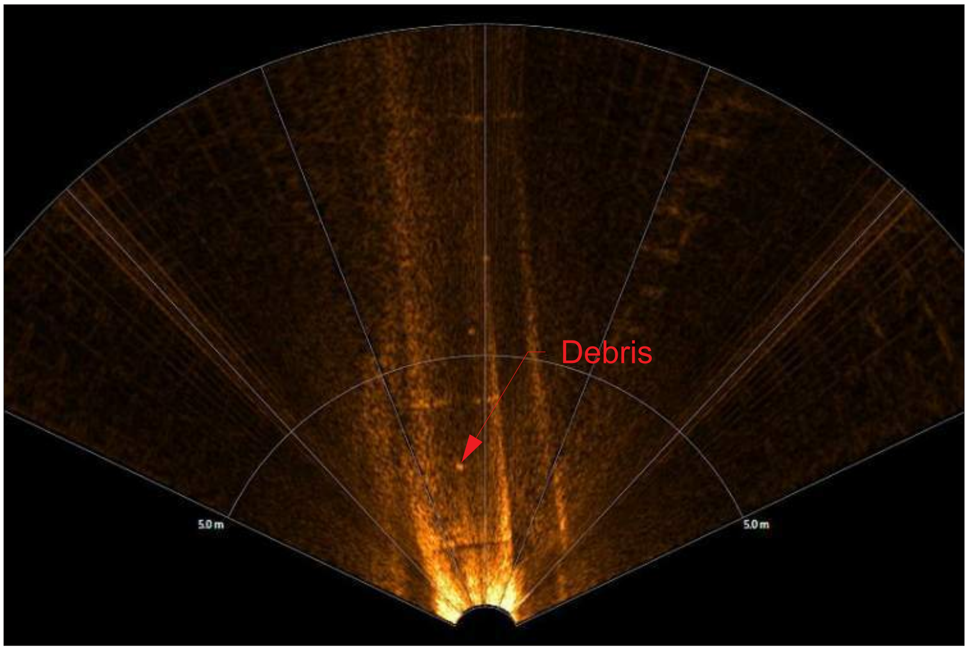


Image 4.1.2A-1: Sonar image at 83 feet downstream of Manhole 1. Small debris on invert 10 feet ahead.

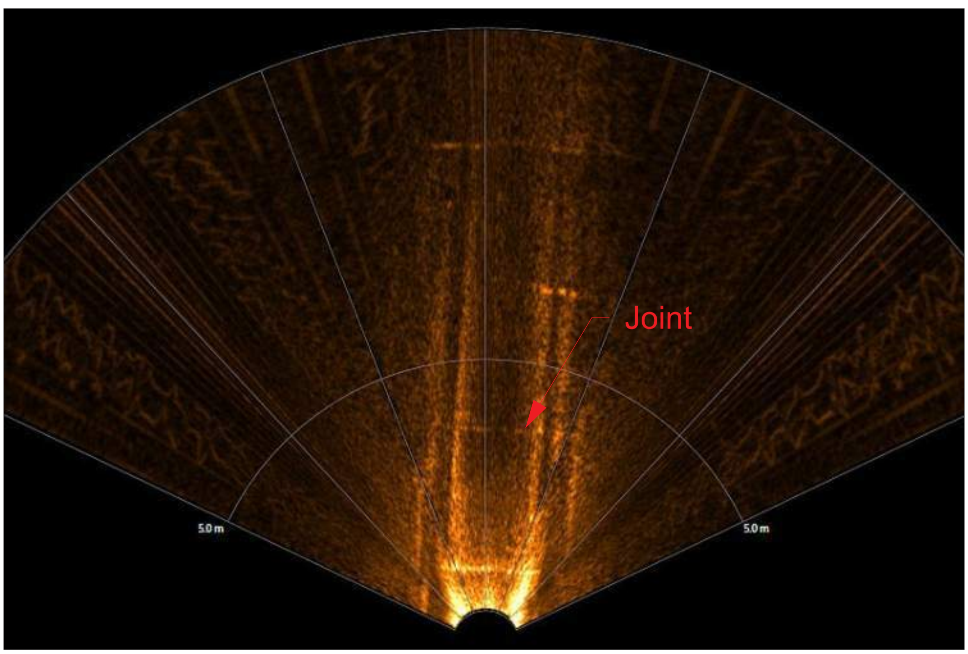


Image 4.1.2A-2: Sonar image at 83 feet downstream of Manhole 1. Joint spacing visible on sonar.

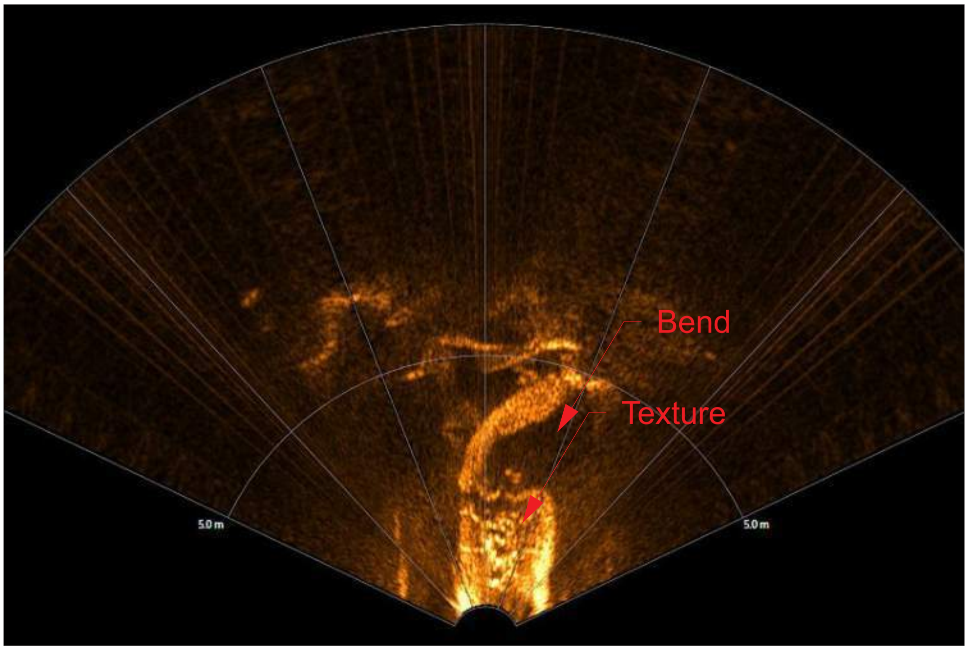


Image 4.1.2A-3: Sonar image at 130 feet downstream of Manhole 1. Image approaching bend and texture on invert .

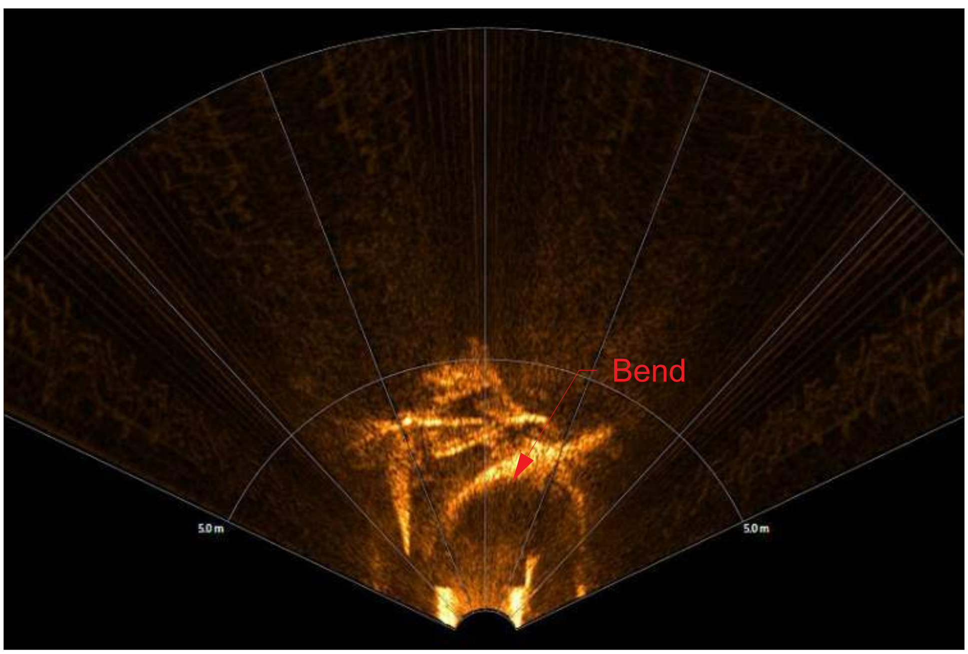


Image 4.1.2A-4: Sonar image at 135 feet downstream of Manhole 1. Bend visible 5 feet ahead.

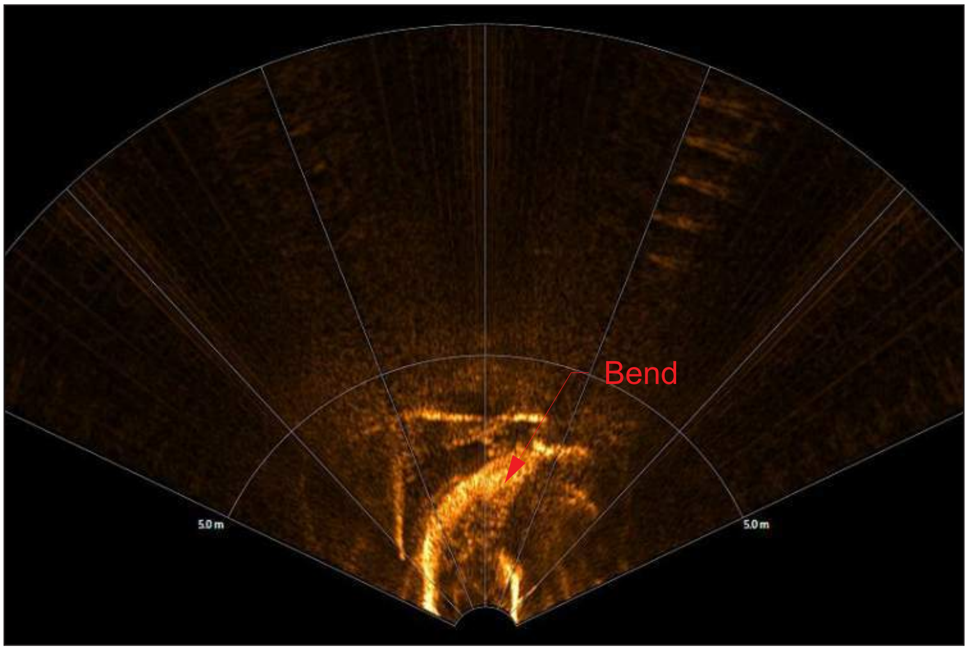


Image 4.1.2A-5: Sonar image at 141 feet downstream of Manhole 1. Bend visible ahead.

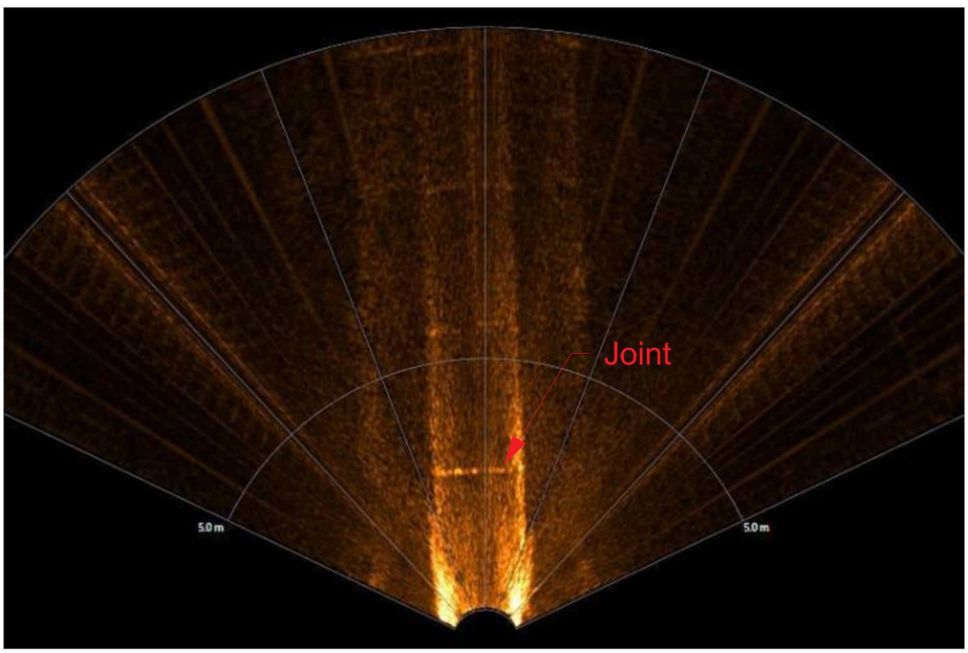


Image 4.1.2A-6: Sonar image at 146 feet downstream of Manhole 1. Joint spacing visible on sonar.

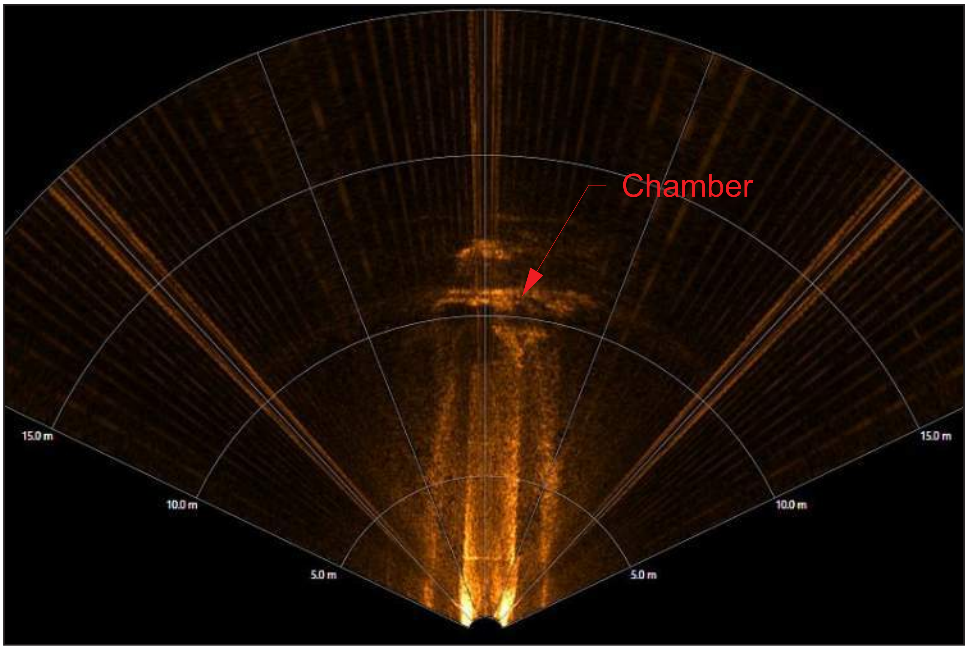


Image 4.1.2A-7: Sonar image at 165 feet downstream of Manhole 1. Manhole 3 chamber 35 feet ahead.

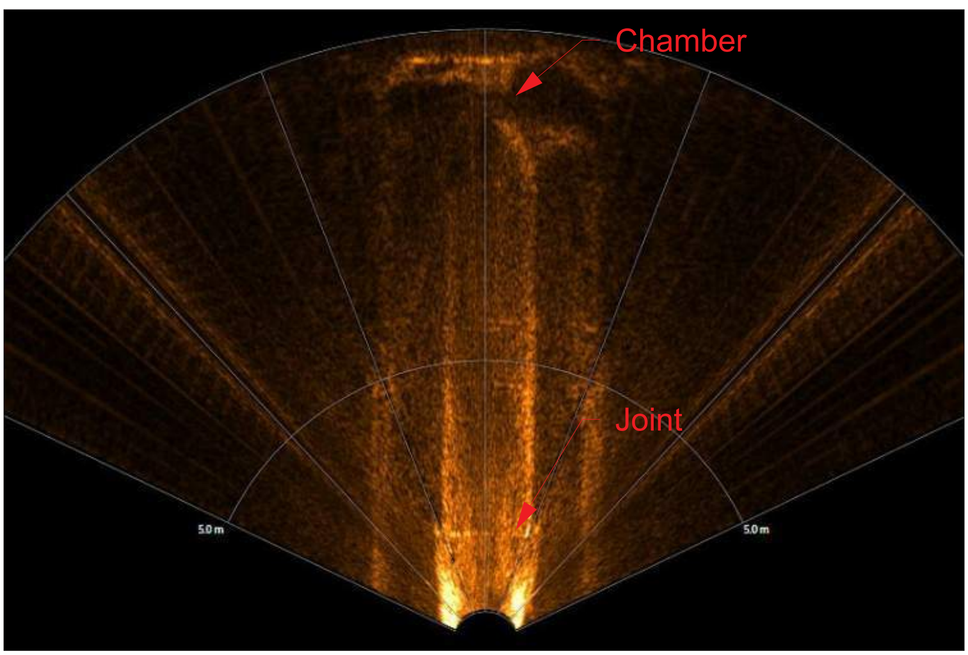


Image 4.1.2A-8: Sonar image at 171 feet downstream of Manhole 1. Manhole 3 chamber 30 feet ahead.

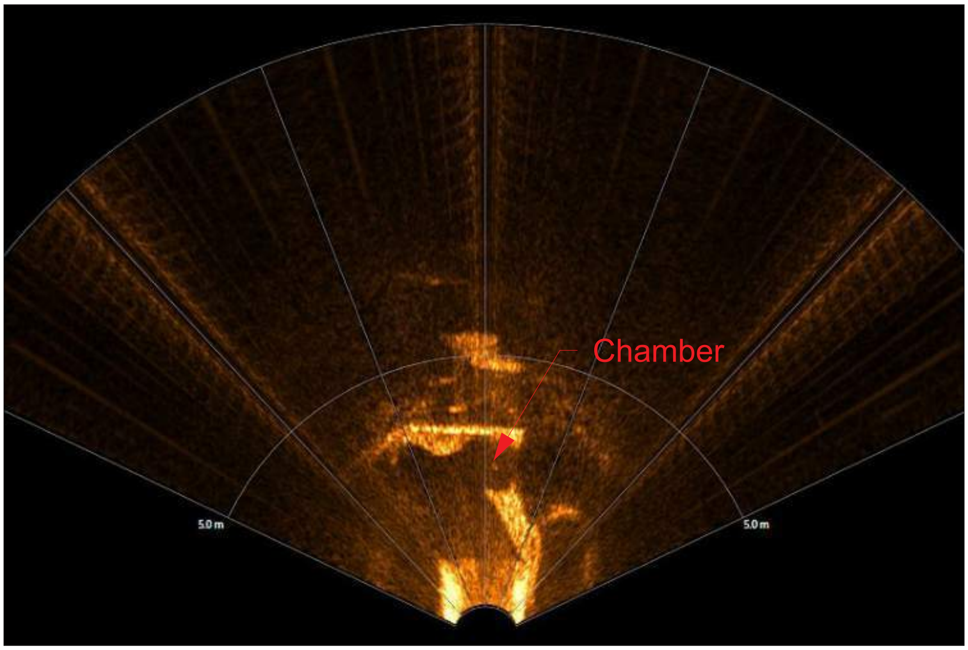


Image 4.1.2A-9: Sonar image at 190 feet downstream of Manhole 1. Manhole 3 chamber 5 feet ahead.

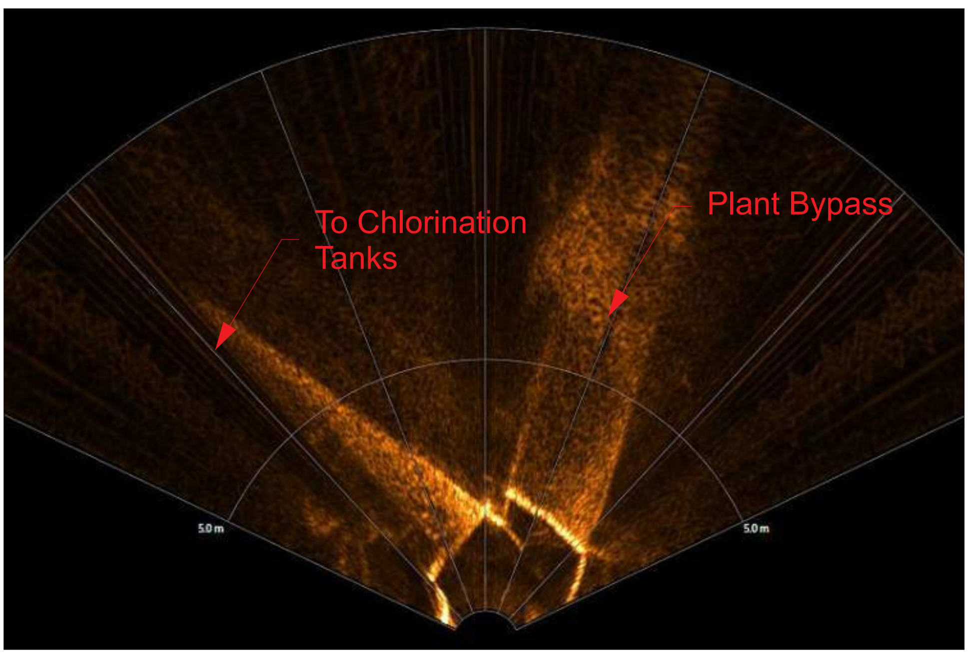


Image 4.1.2A-10: Sonar image within Manhole 1 chamber. Image of bifurcation.

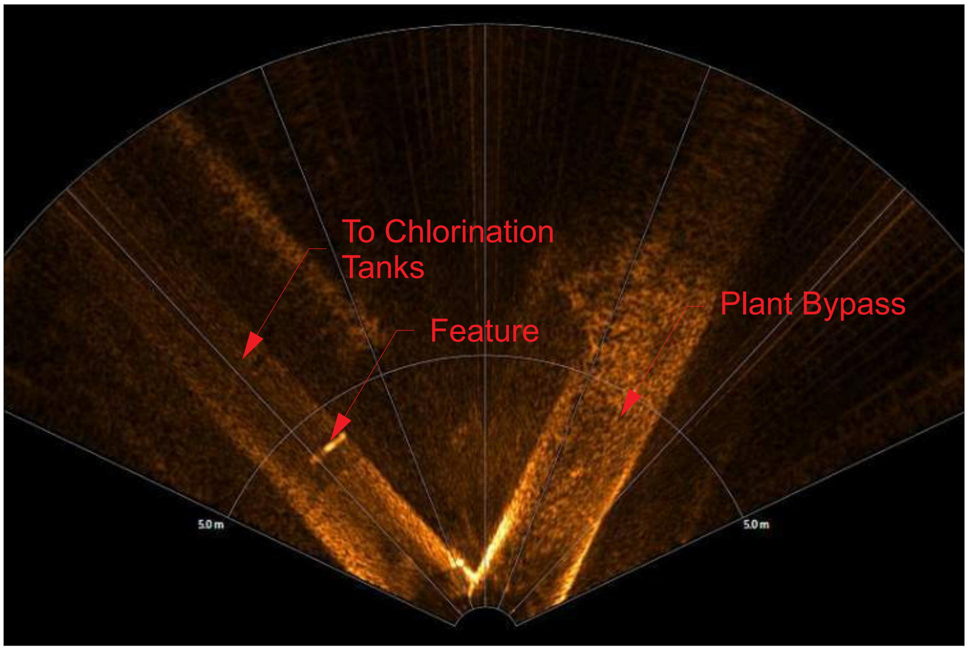


Image 4.1.2A-11: Sonar image within Manhole 1 chamber. Image of bifurcation and feature on invert.

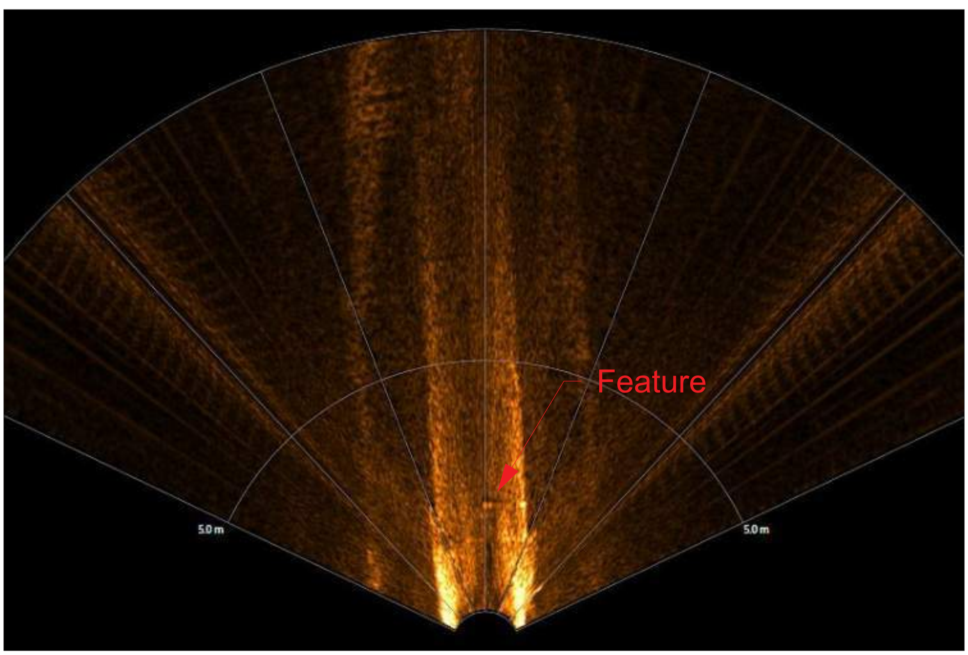


Image 4.1.2A-12: Sonar image at 6 feet upstream of Manhole 1. Feature on invert 6 feet ahead.

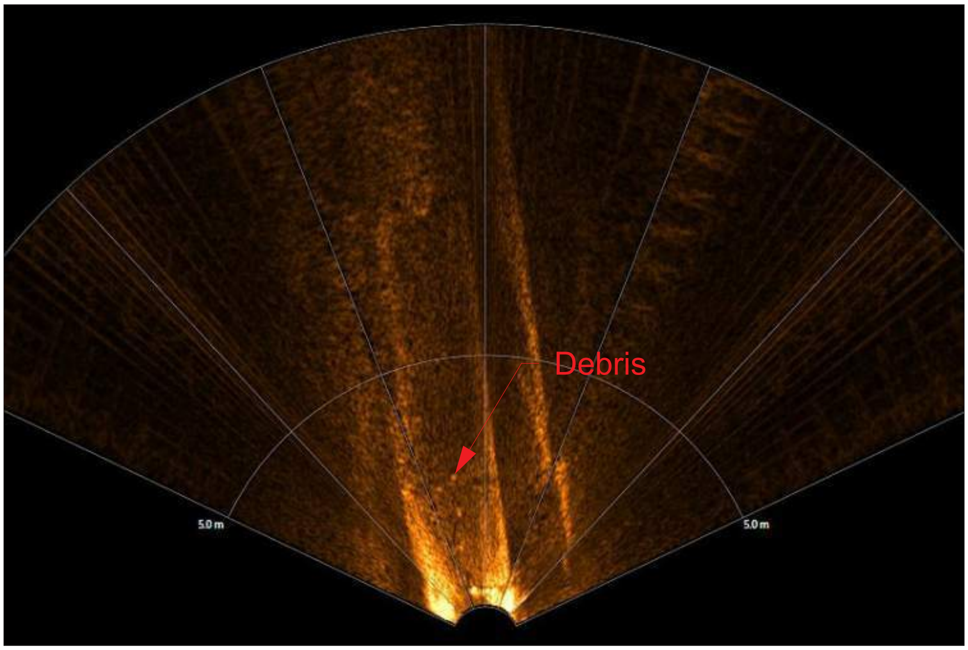


Image 4.1.2A-13: Sonar image at 11 feet upstream of Manhole 1. Debris on invert 10 feet ahead.

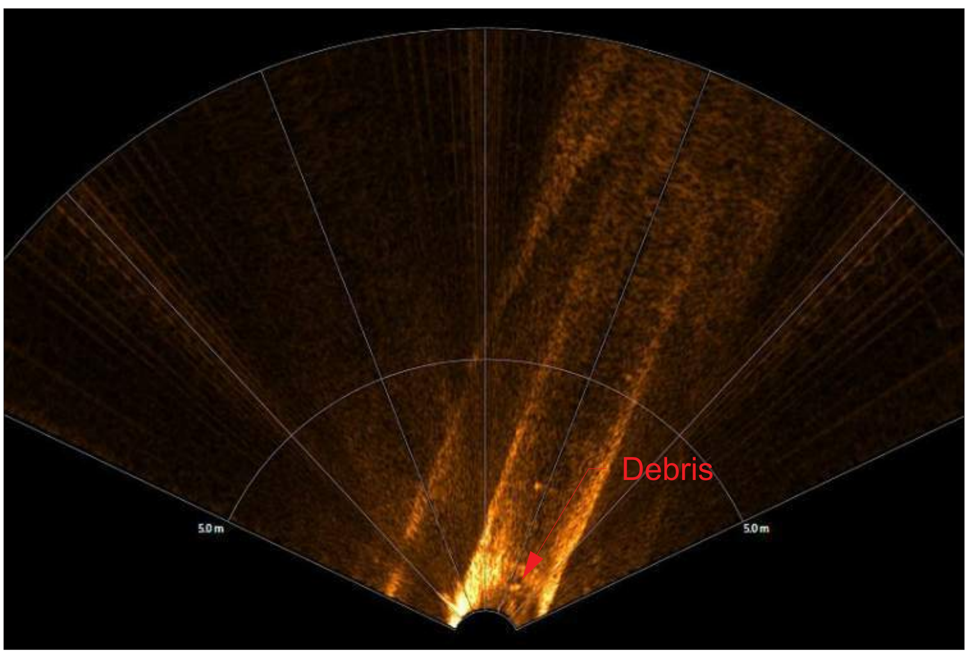


Image 4.1.2A-14: Sonar image at 60 feet upstream of Manhole 1. Small debris on invert 2 feet ahead.

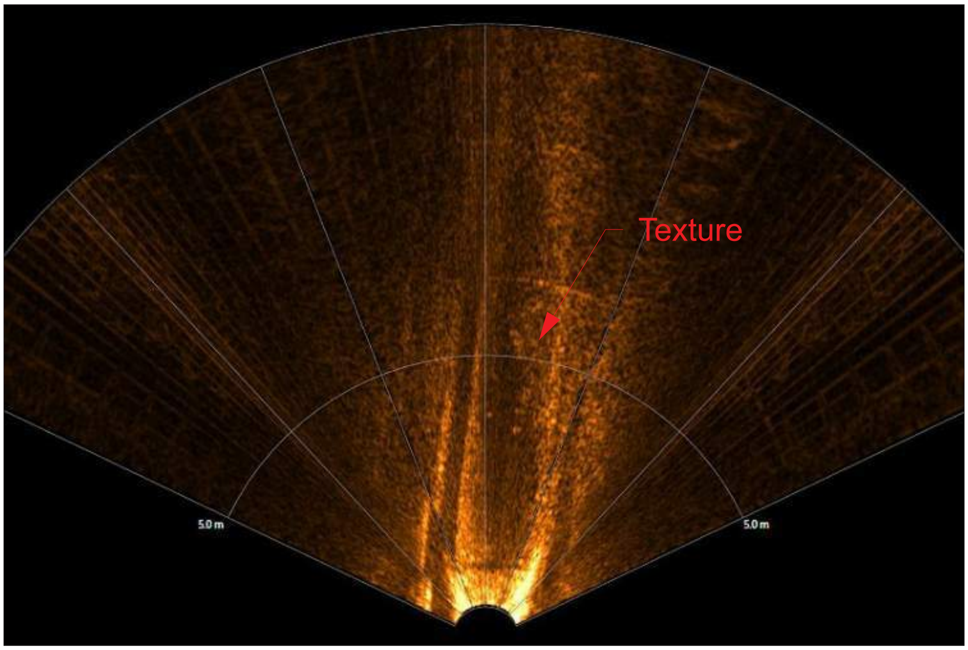


Image 4.1.2A-15: Sonar image at 72 feet upstream of Manhole 1. Texture on invert 16 feet ahead.

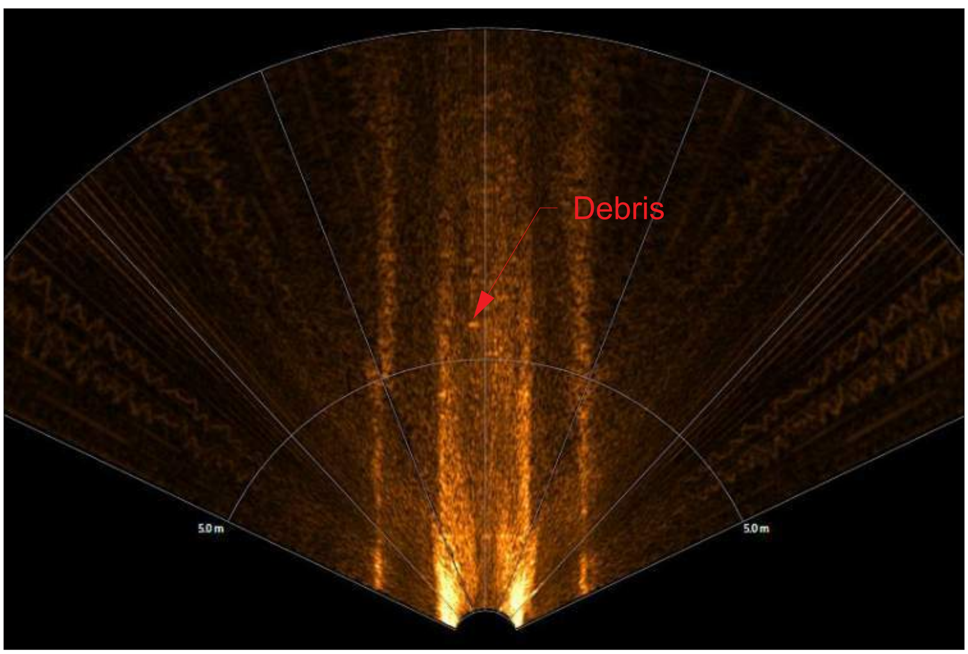


Image 4.1.2A-16: Sonar image at 89 feet upstream of Manhole 1. Small debris on invert 17 feet ahead.

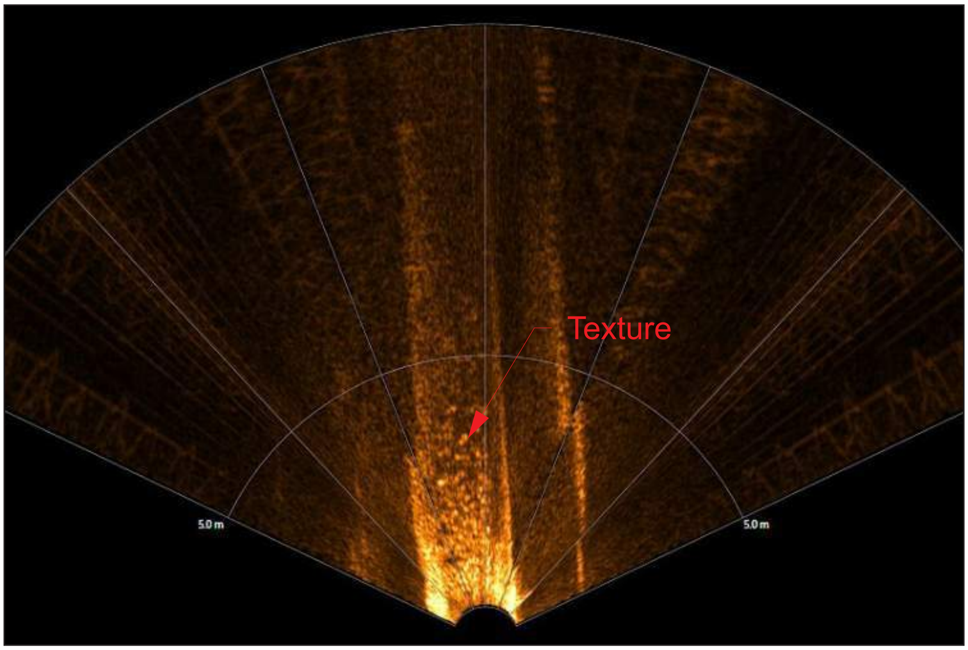


Image 4.1.2A-17: Sonar image at 103 feet upstream of Manhole 1. Texture on invert

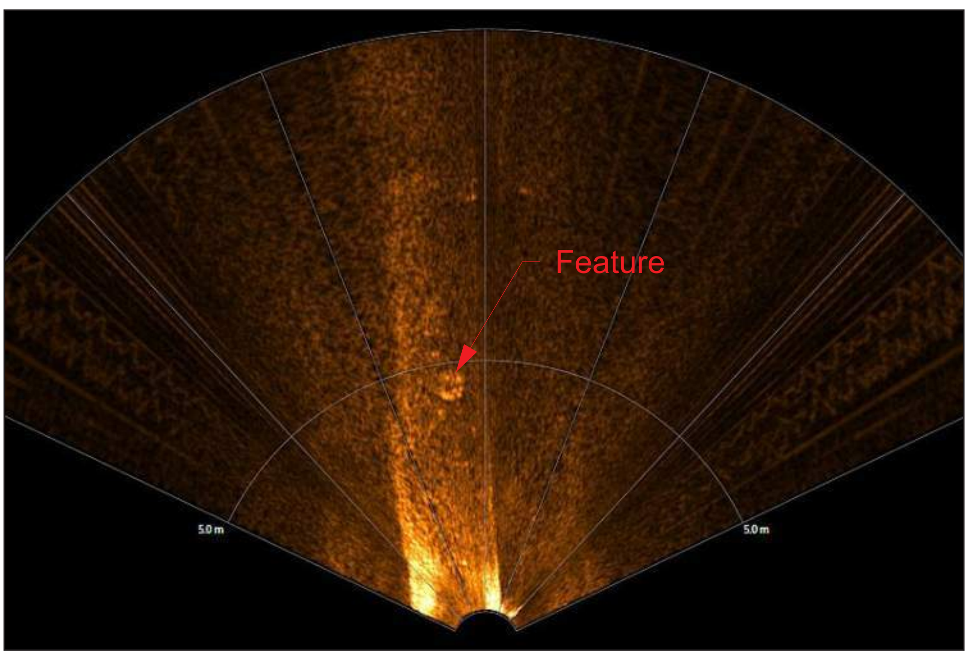


Image 4.1.2A-18: Sonar image at 124 feet upstream of Manhole 1. Feature on invert 16 feet ahead.

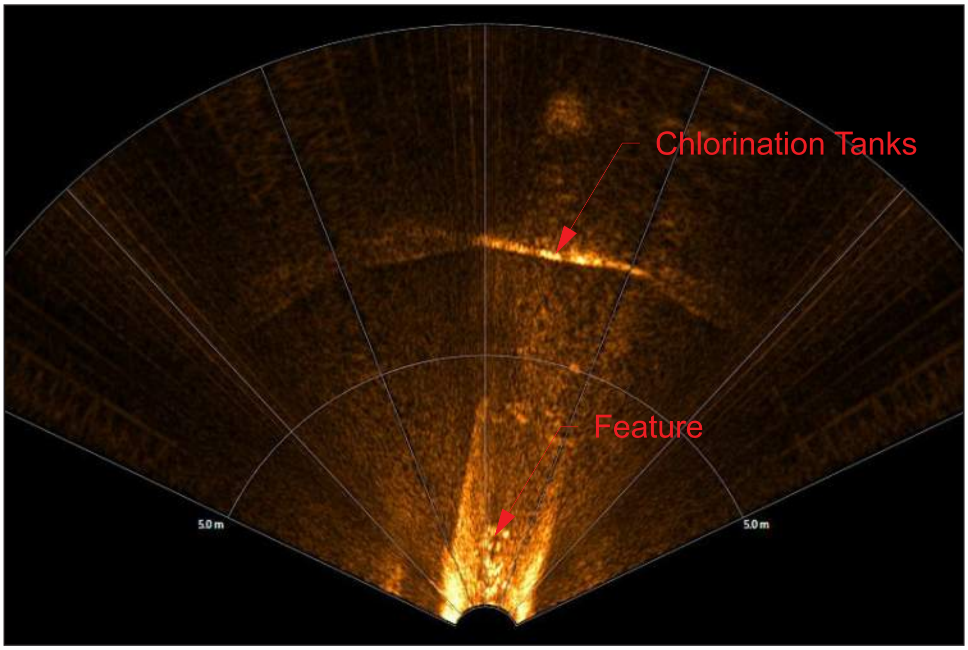


Image 4.1.2A-19: Sonar image at 138 feet upstream of Manhole 1. Feature on invert 3 feet ahead. chlorination tanks visible 23 feet ahead.

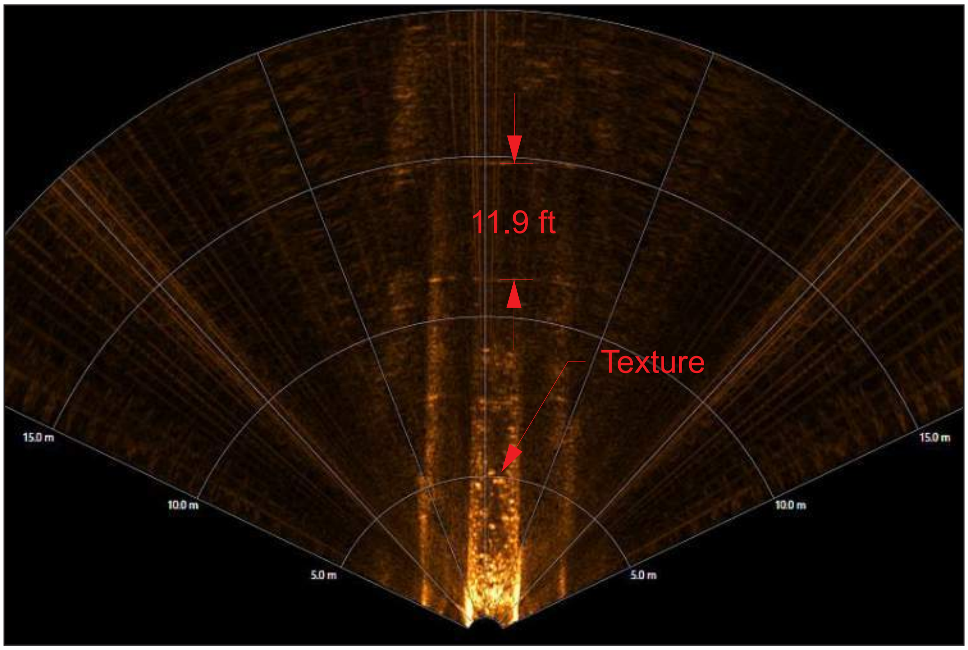


Image 4.1.2B-1: Sonar image at 90 feet downstream of Manhole 3. Texture on invert. Approximately 12 feet between joints.

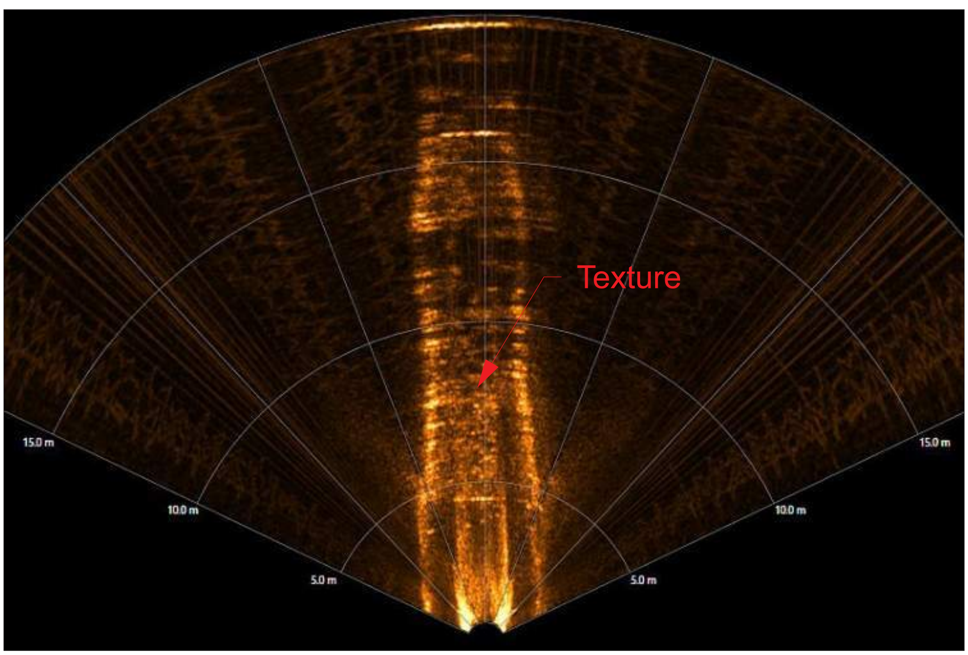


Image 4.1.2B-2: Sonar image at 121 feet downstream of Manhole 3. Texture on invert approaching outlet.

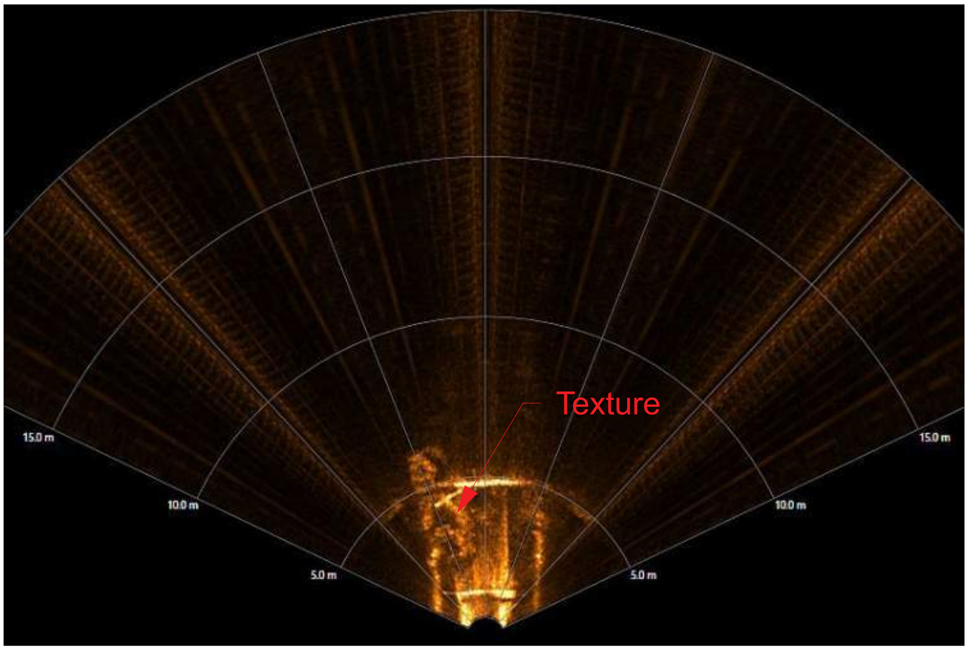


Image 4.1.2B-3: Sonar image at 170 feet downstream of Manhole 3. Texture on invert at outlet 16 feet ahead.

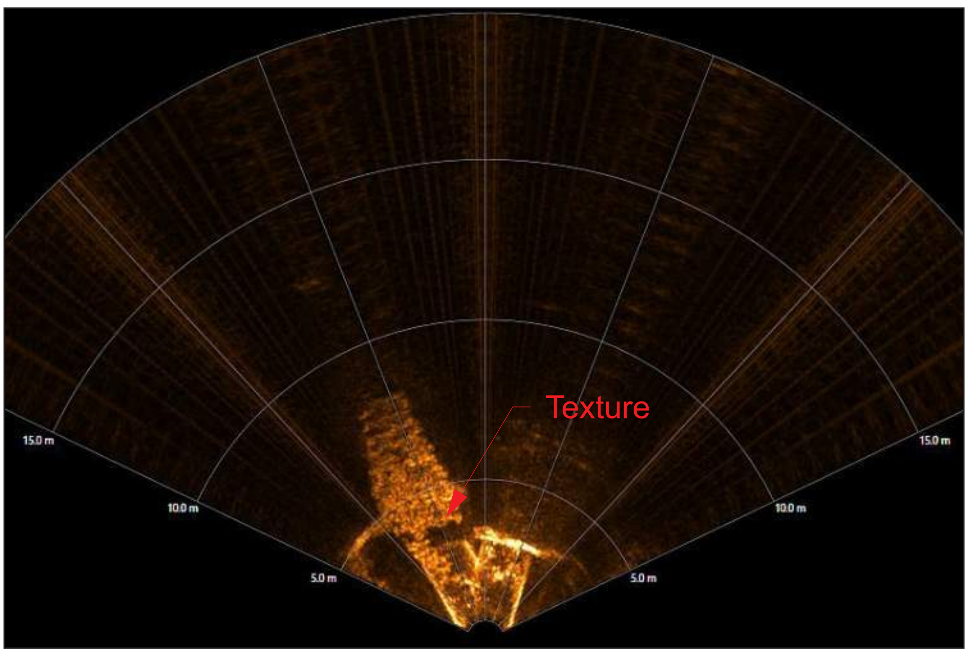


Image 4.1.2B-4: Sonar image at 175 feet downstream of Manhole 3. Texture on invert within outfall

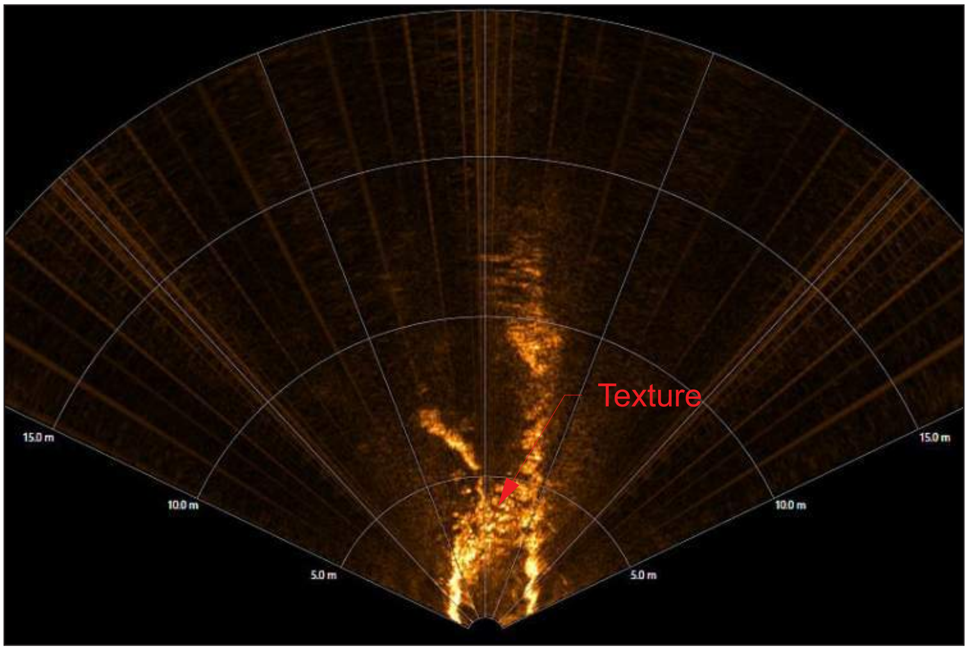


Image 4.1.2B-5: Sonar image at 183 feet downstream of Manhole 3. Texture on invert within outlet.

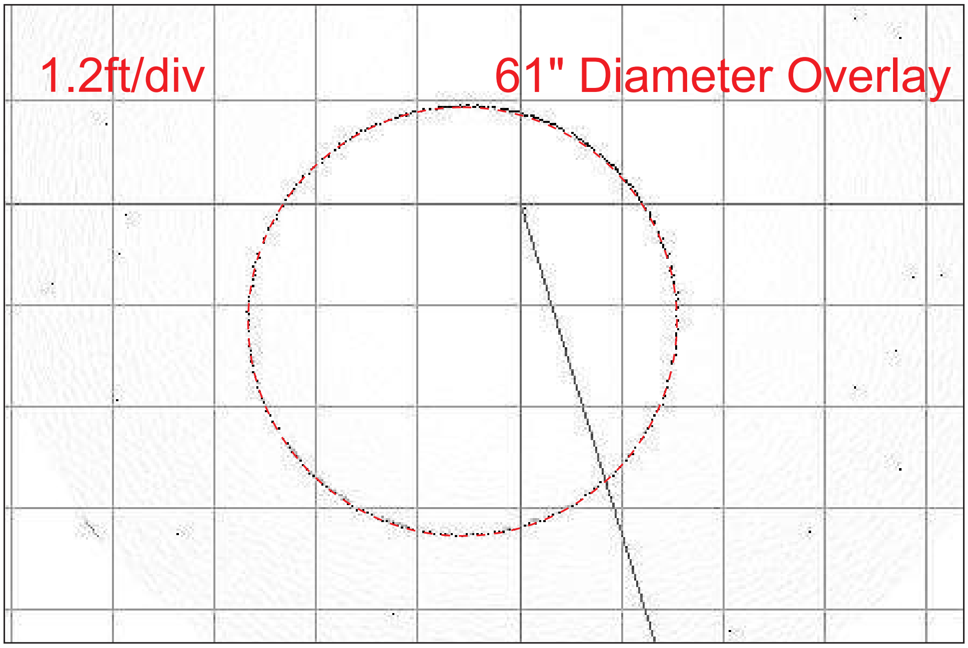


Image 4.1.3A-1: Sonar Profile 9 - 11 feet downstream of Manhole 1.

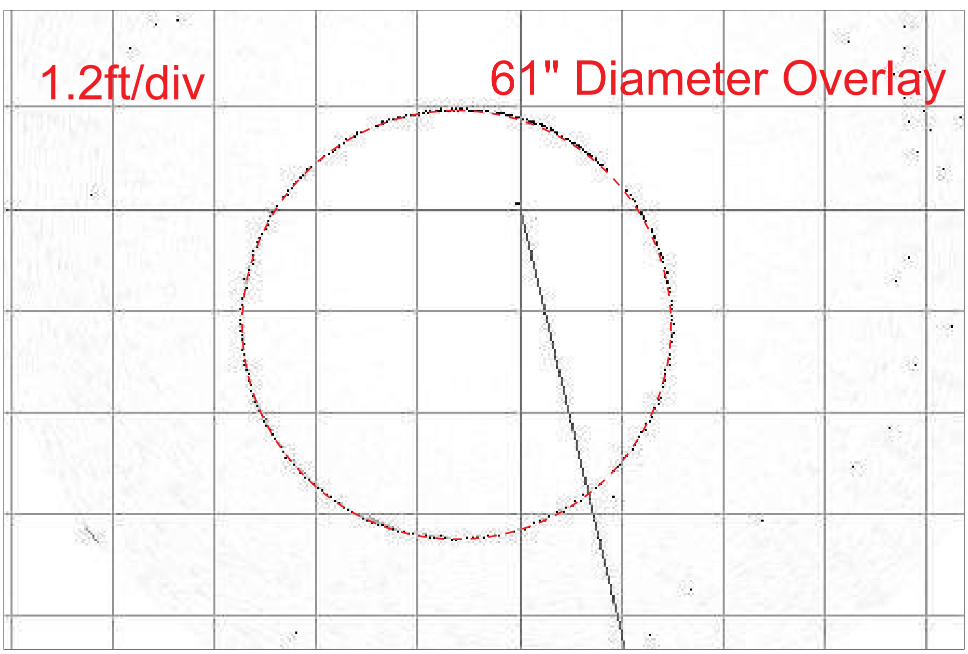


Image 4.1.3A-2: Sonar Profile 8 - 31 feet downstream of Manhole 1.

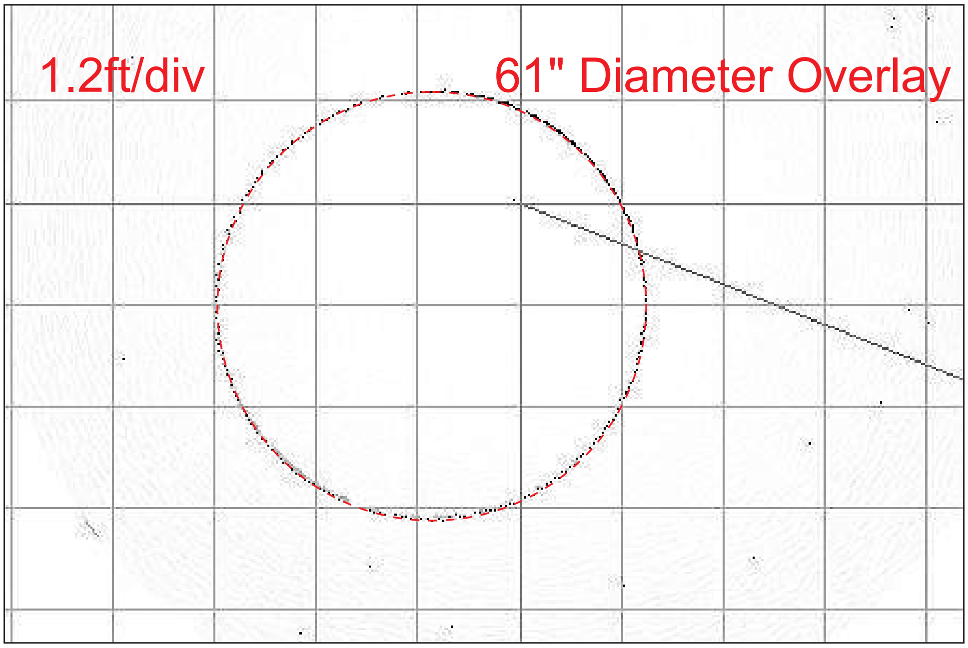


Image 4.1.3A-3: Sonar Profile 7 - 55 feet downstream of Manhole 1.

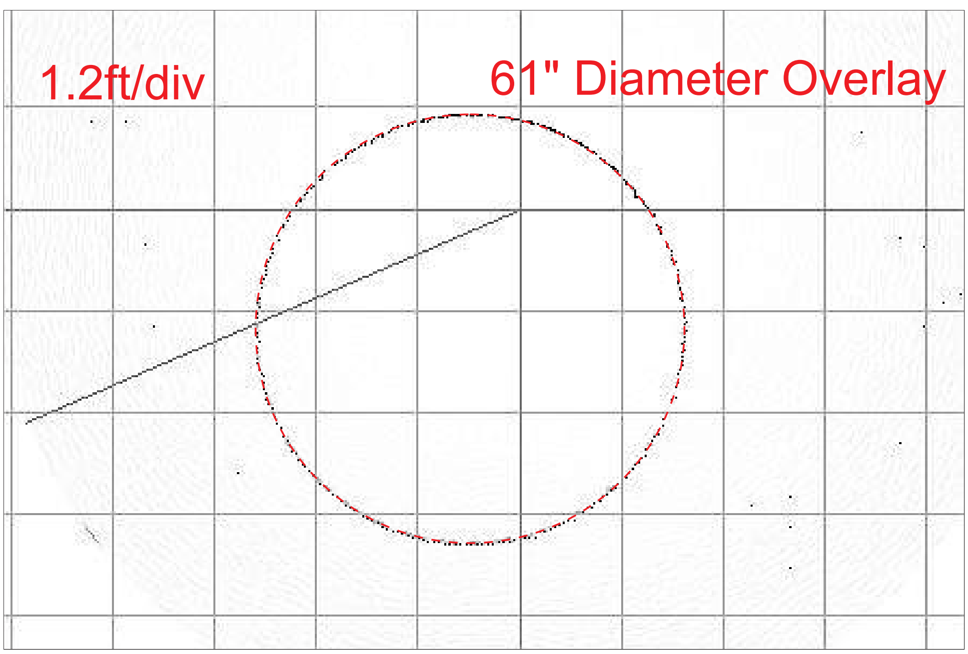


Image 4.1.3A-4: Sonar Profile 6 - 80 feet downstream of Manhole 1.

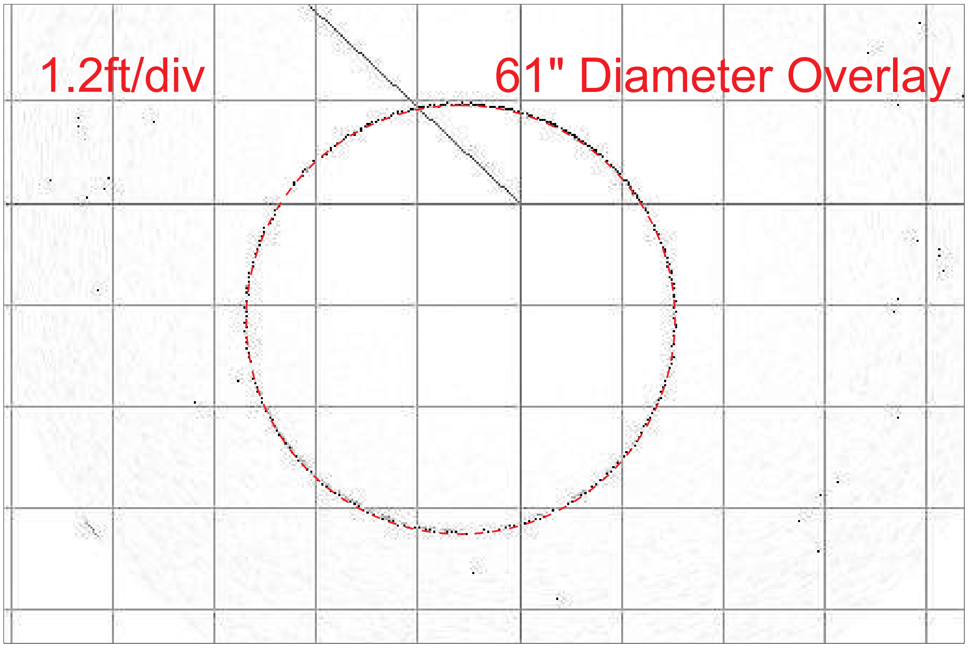


Image 4.1.3A-5: Sonar Profile 5 - 104 feet downstream of Manhole 1.

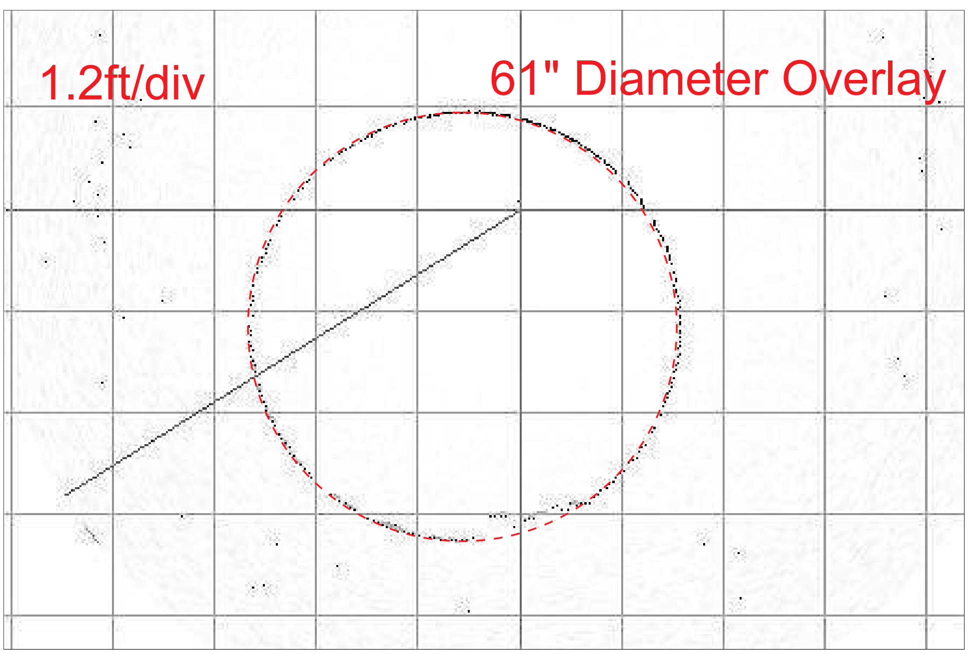


Image 4.1.3A-6: Sonar Profile 4 - 135 feet downstream of Manhole 1.

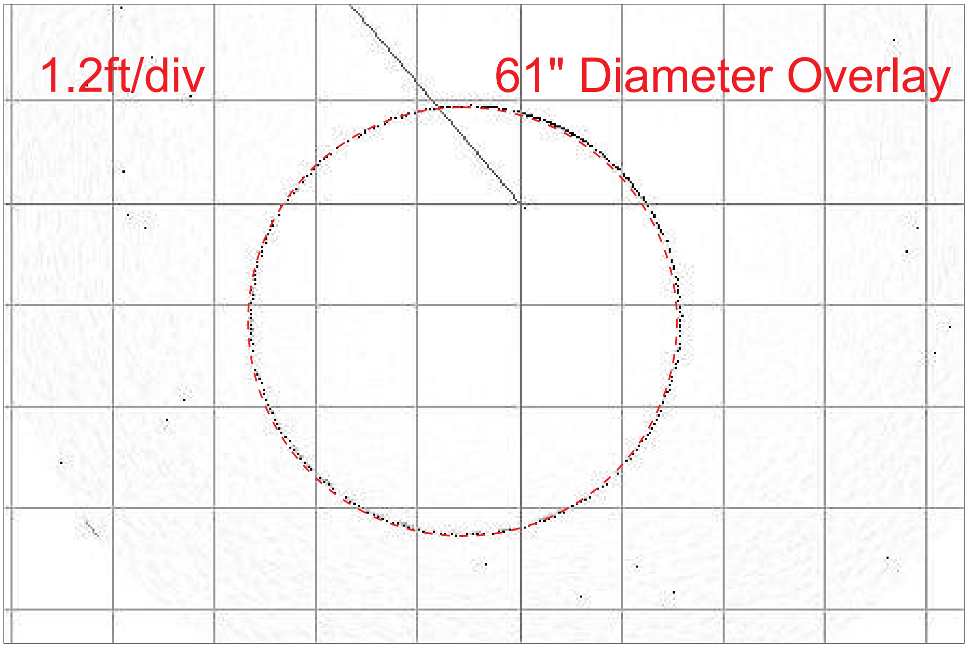


Image 4.1.3A-7: Sonar Profile 3 - 146 feet downstream of Manhole 1.

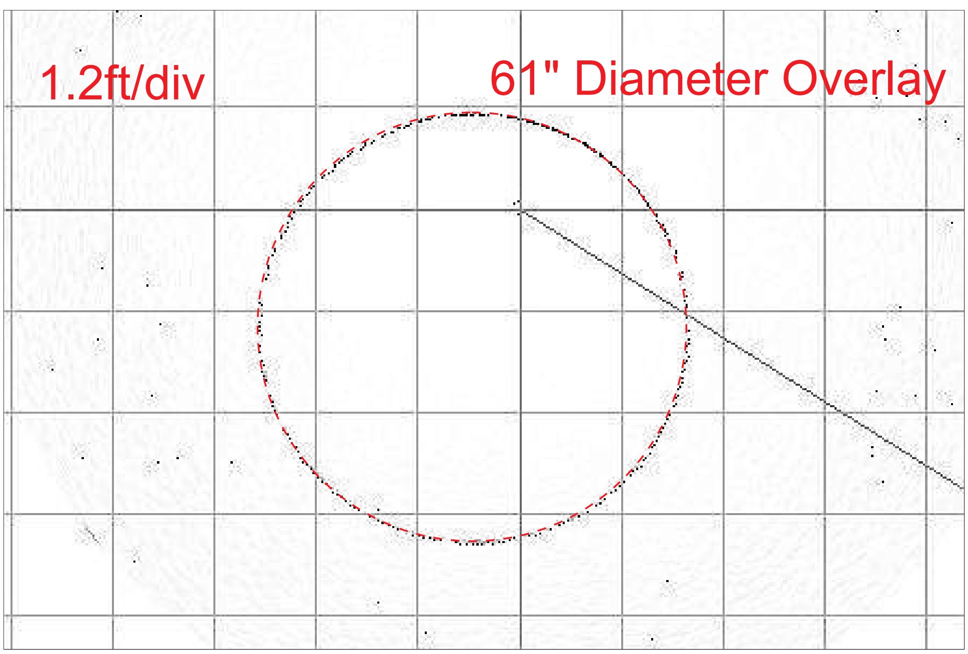


Image 4.1.3A-8: Sonar Profile 2 - 171 feet downstream of Manhole 1.

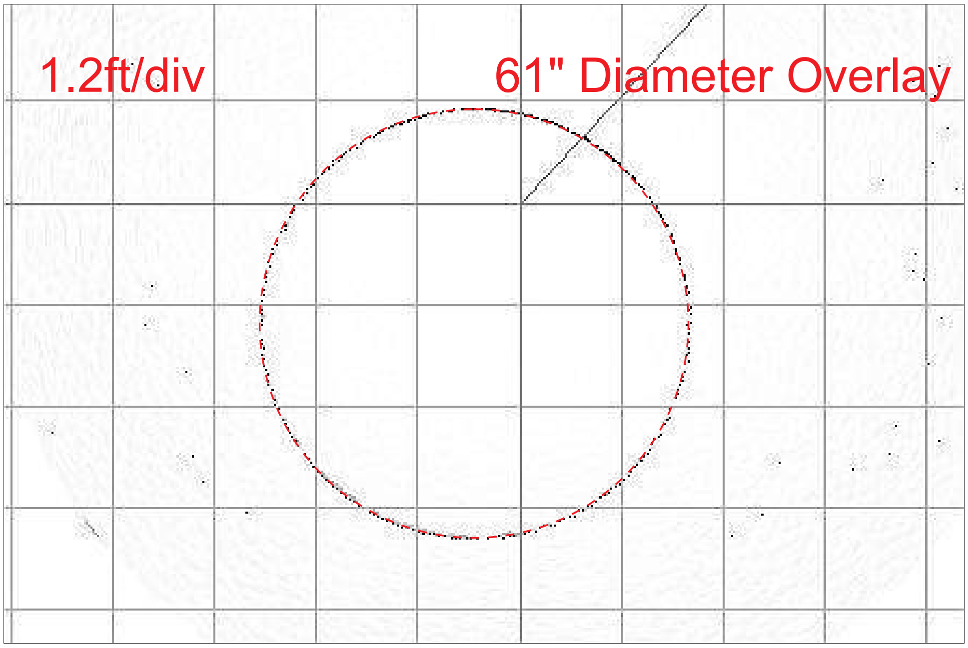


Image 4.1.3A-9: Sonar Profile 1 - 190 feet downstream of Manhole 1.

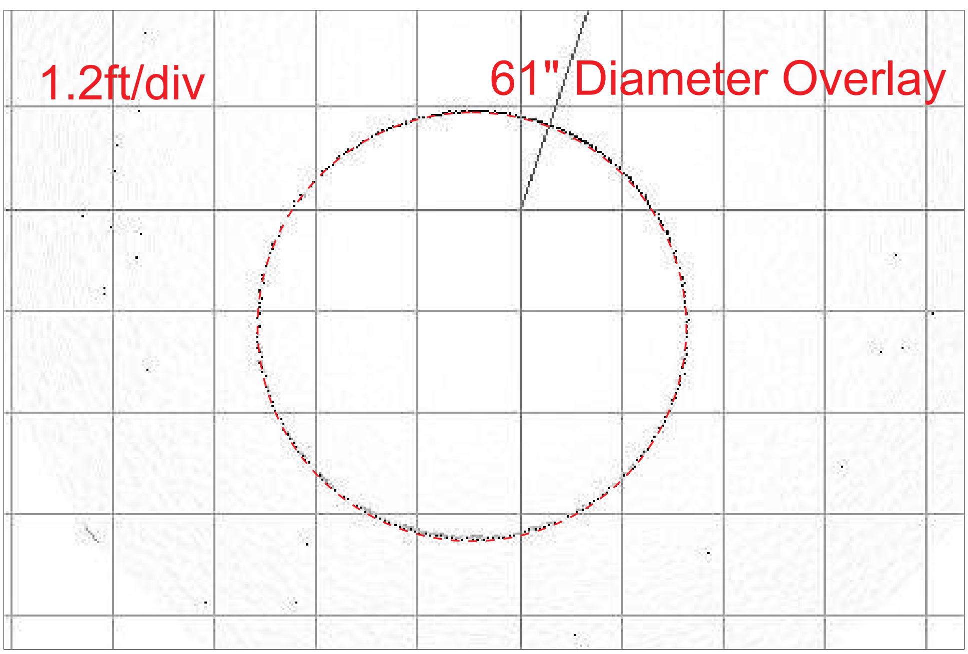


Image 4.1.3A-10: Sonar Profile 15 - 17 feet upstream of Manhole 1.

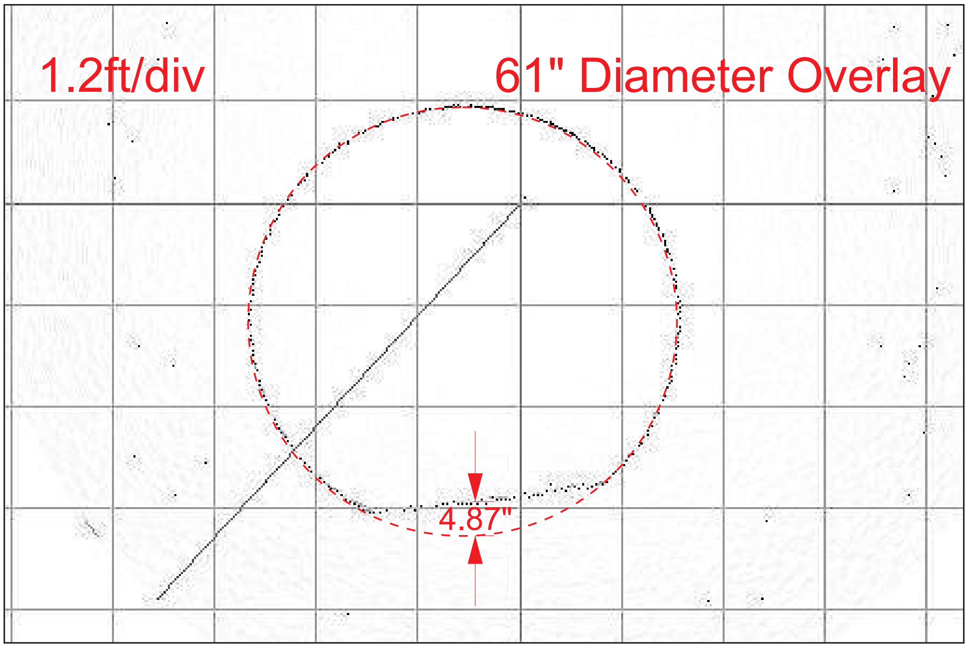


Image 4.1.3A-11: Sonar Profile 14 - 39 feet upstream of Manhole 1.

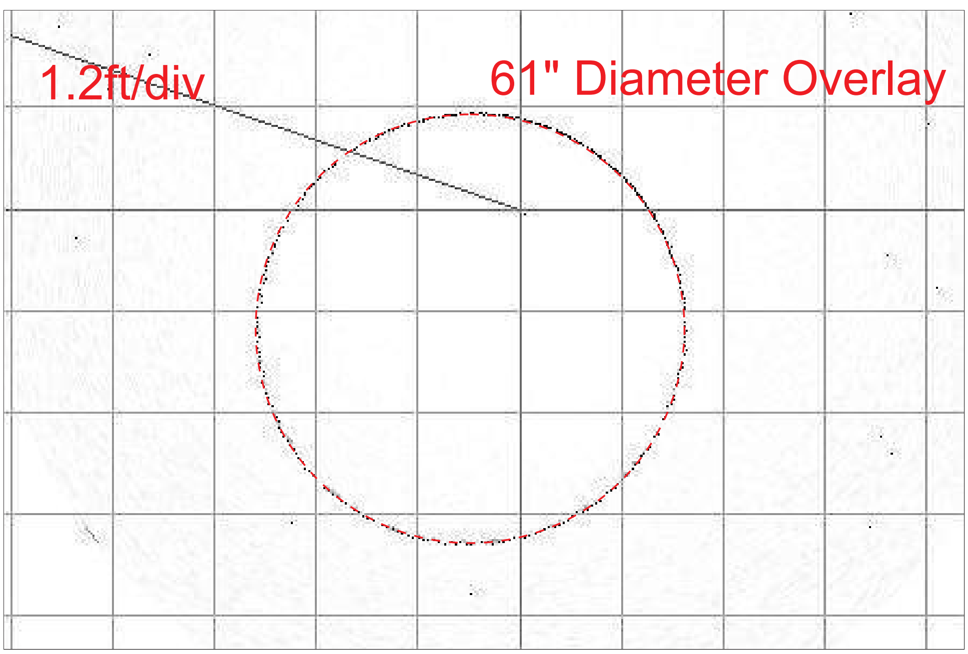


Image 4.1.3A-12: Sonar Profile 13 - 67 feet upstream of Manhole 1.

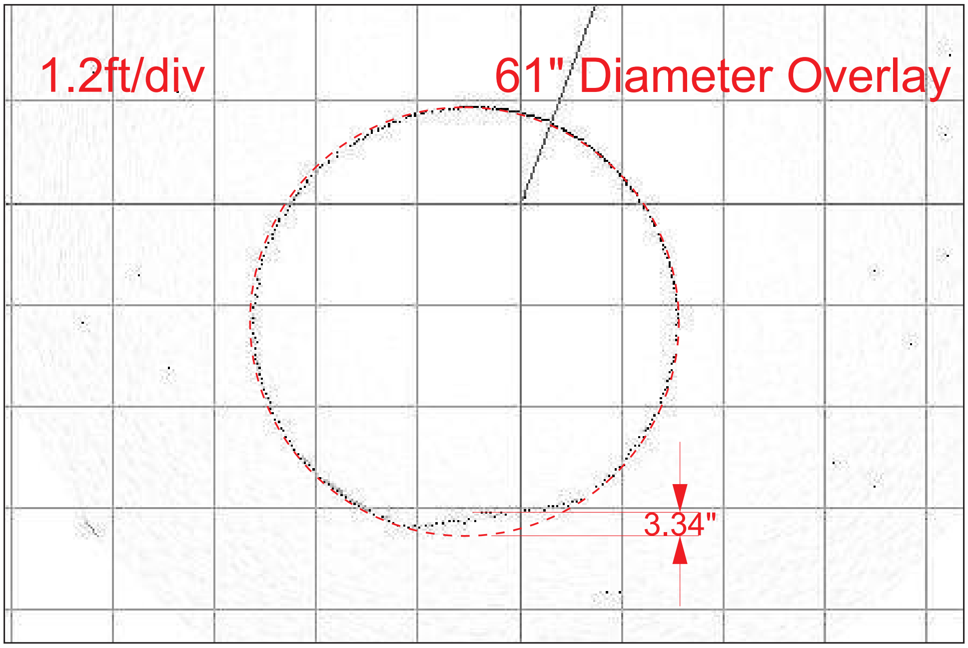


Image 4.1.3A-13: Sonar Profile 12 - 89 feet upstream of Manhole 1.

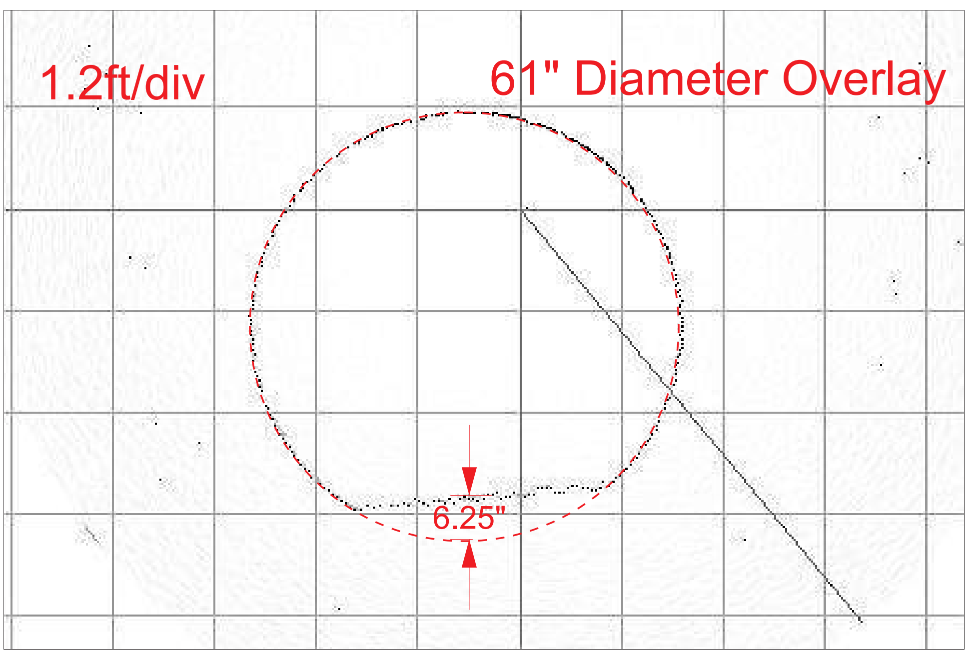


Image 4.1.3A-14: Sonar Profile 11 - 116 feet upstream of Manhole 1.

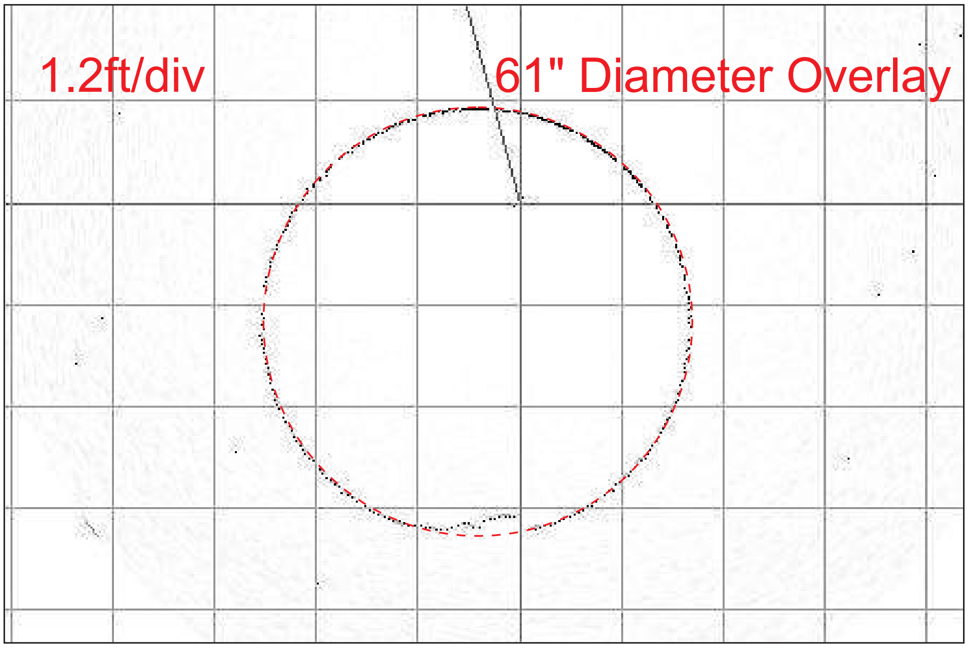


Image 4.1.3A-15: Sonar Profile 10 - 140 feet upstream of Manhole 1.

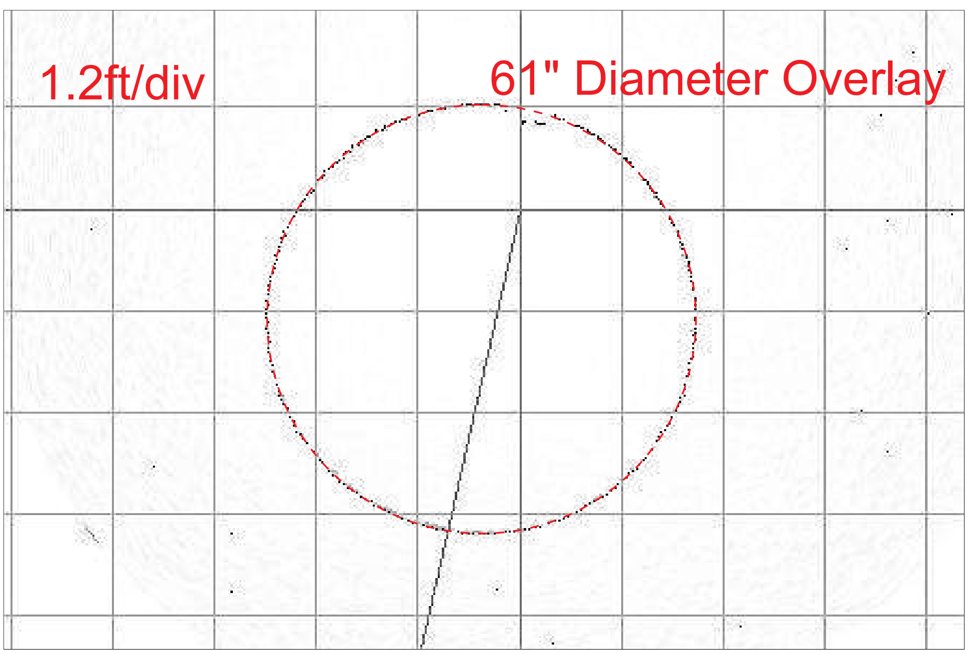


Image 4.1.3A-16: Sonar Profile 16 - In plant bypass, 5 feet upstream of Manhole 1.

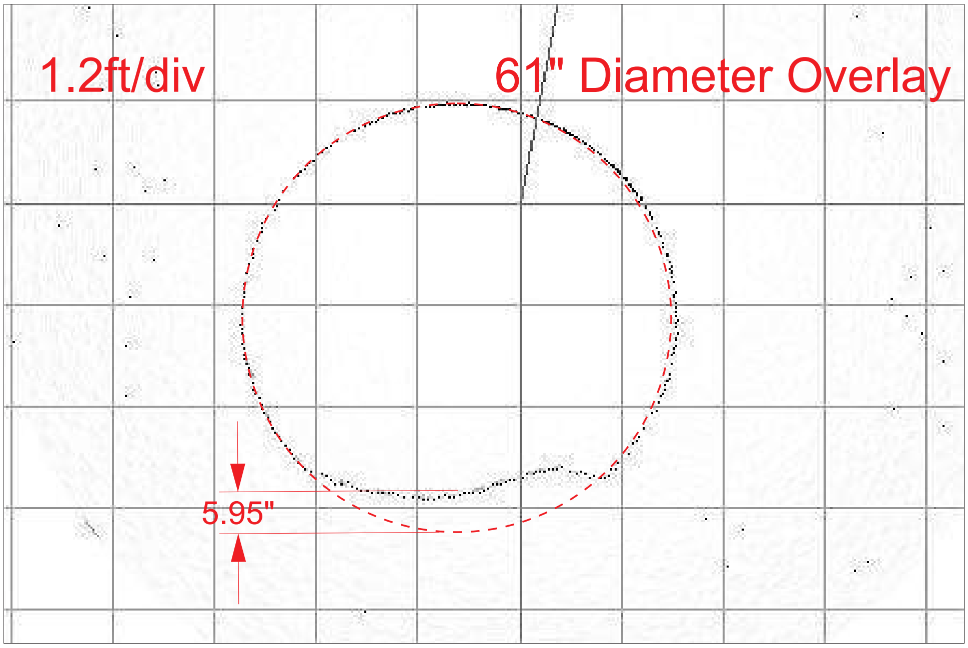


Image 4.1.3A-17: Sonar Profile 17 - In plant bypass, 9 feet upstream of Manhole 1.

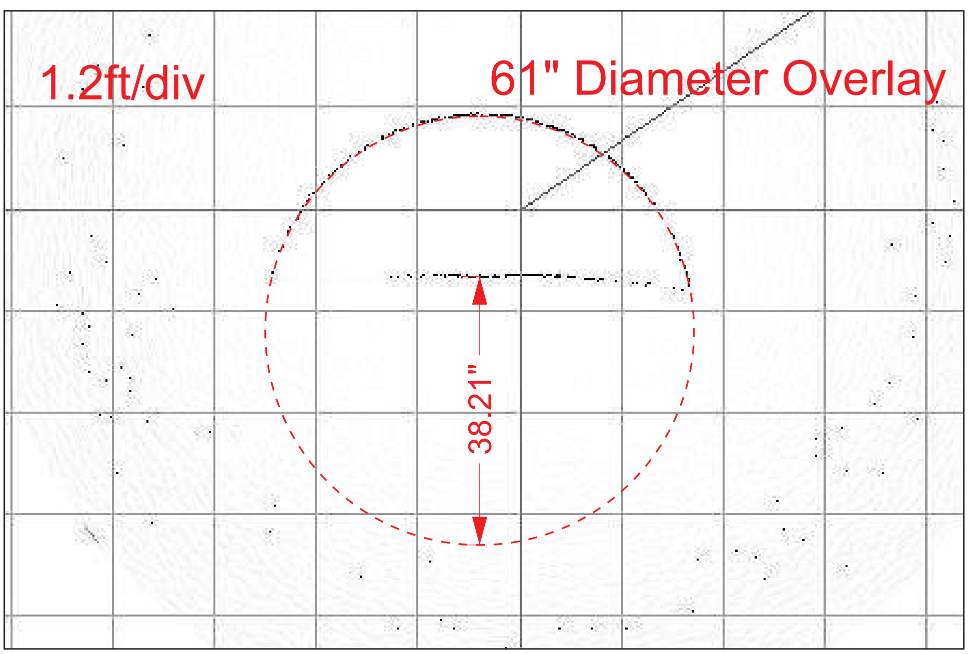


Image 4.1.3A-18: Sonar Profile 18 - In plant bypass, 16 feet upstream of Manhole 1.

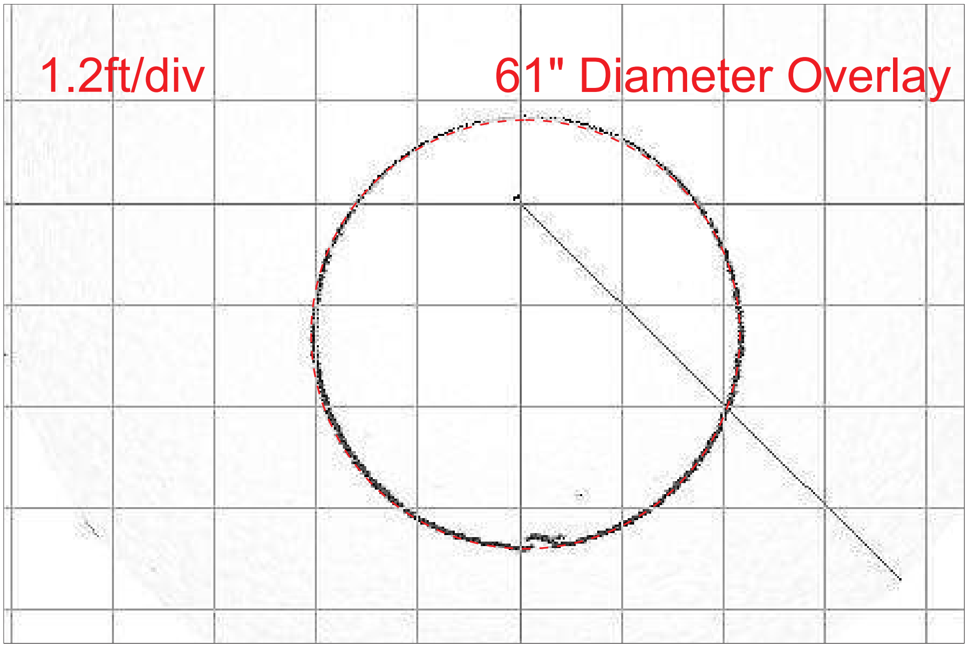


Image 4.1.3B-1: Sonar Profile 27 - 6 feet downstream of Manhole 3.

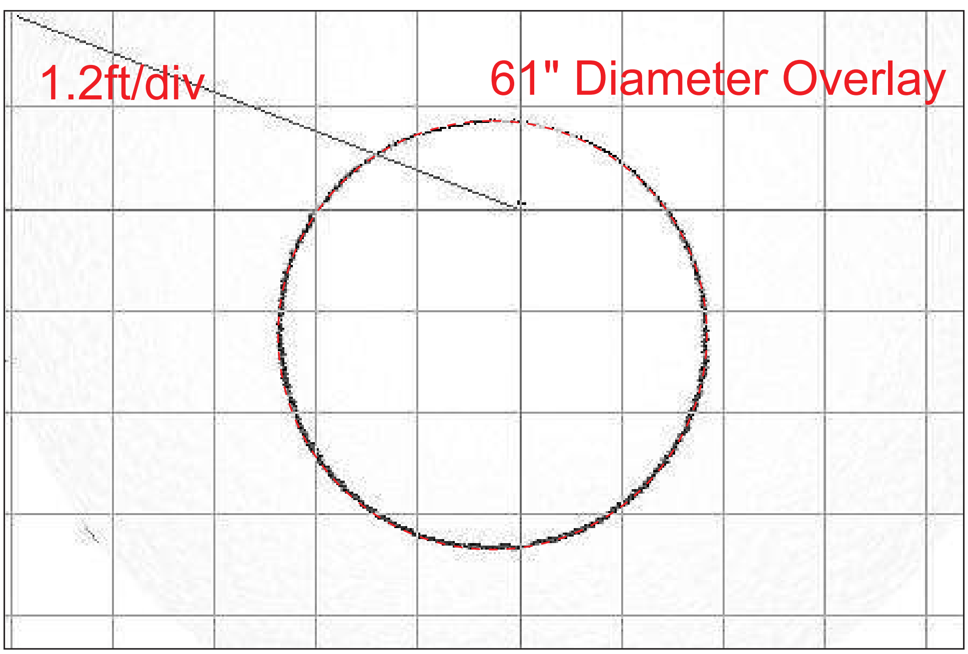


Image 4.1.3B-2: Sonar Profile 26 - 20 feet downstream of Manhole 3.

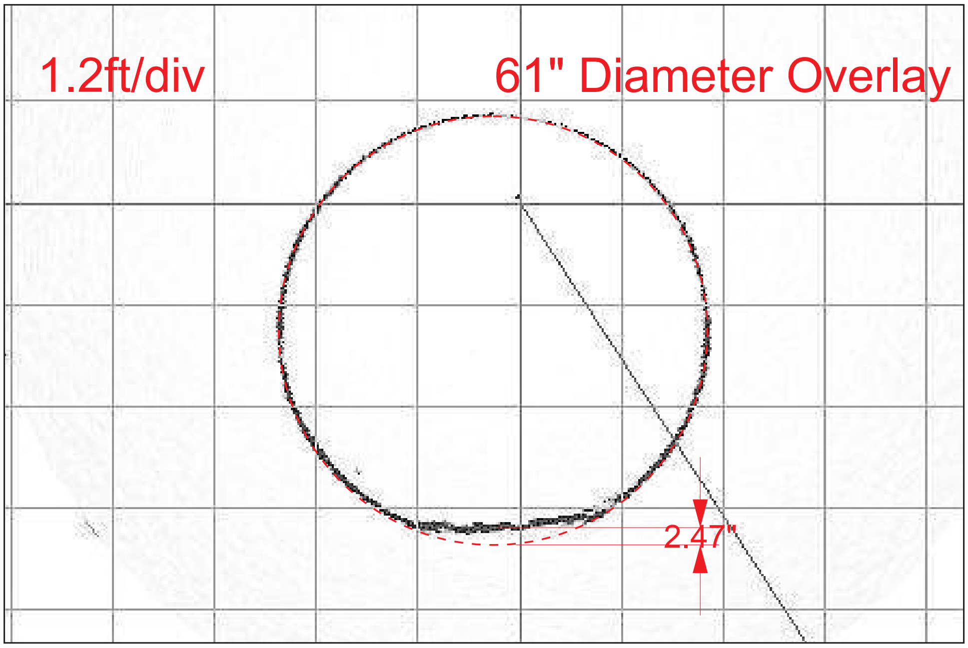


Image 4.1.3B-3: Sonar Profile 25 - 45 feet downstream of Manhole 3.

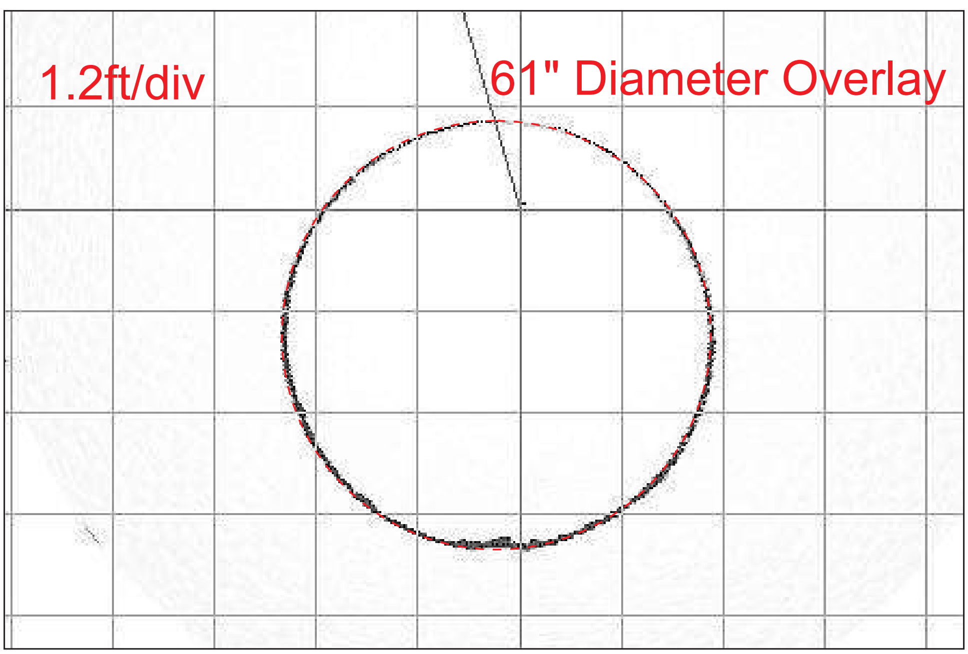


Image 4.1.3B-4: Sonar Profile 24 - 70 feet downstream of Manhole 3.

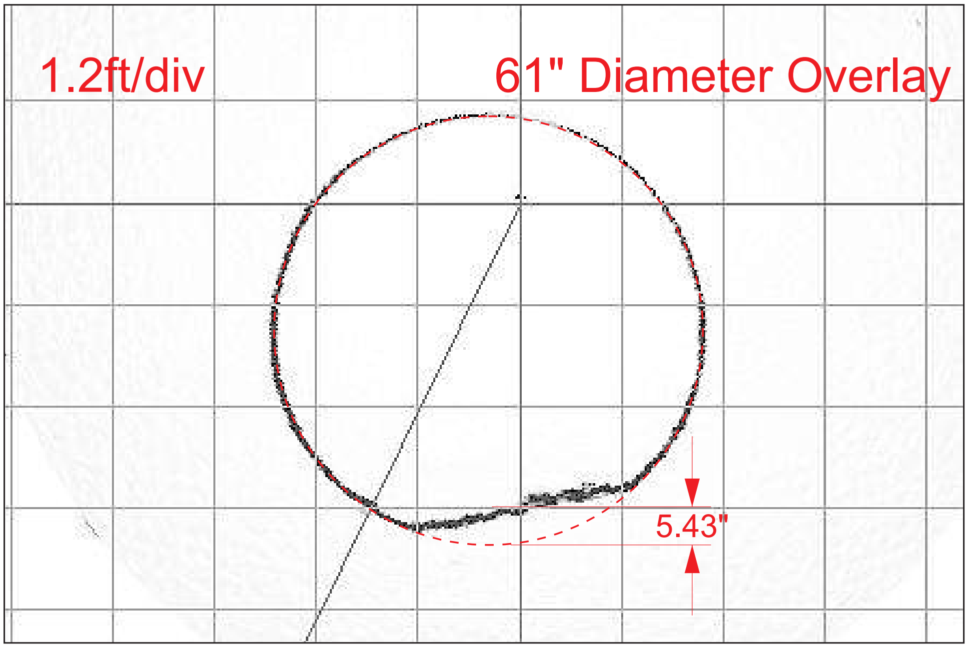


Image 4.1.3B-5: Sonar Profile 23 - 95 feet downstream of Manhole 3.

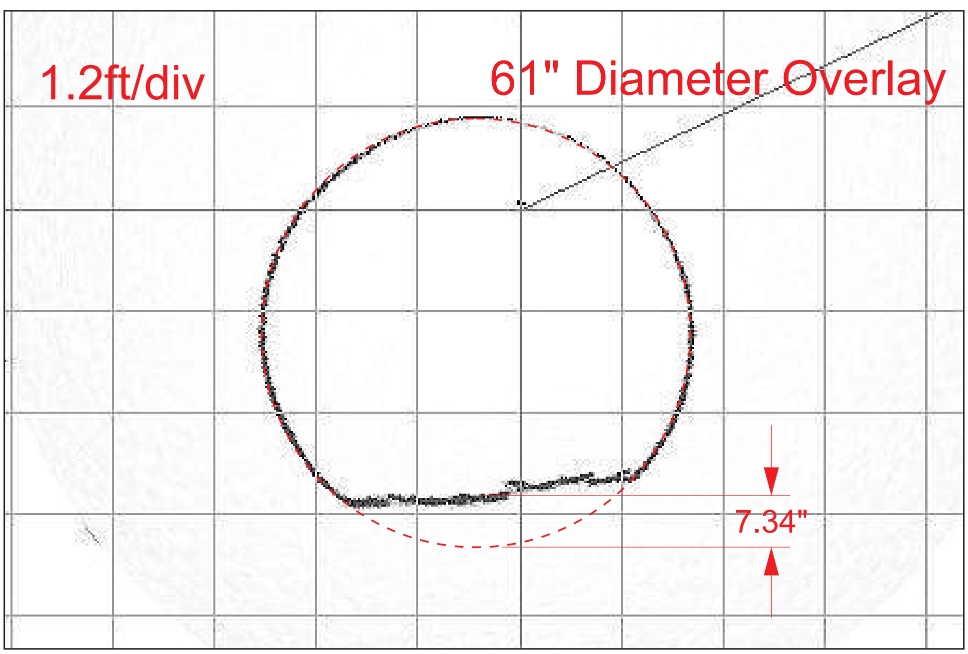


Image 4.1.3B-6: Sonar Profile 22 - 121 feet downstream of Manhole 3.

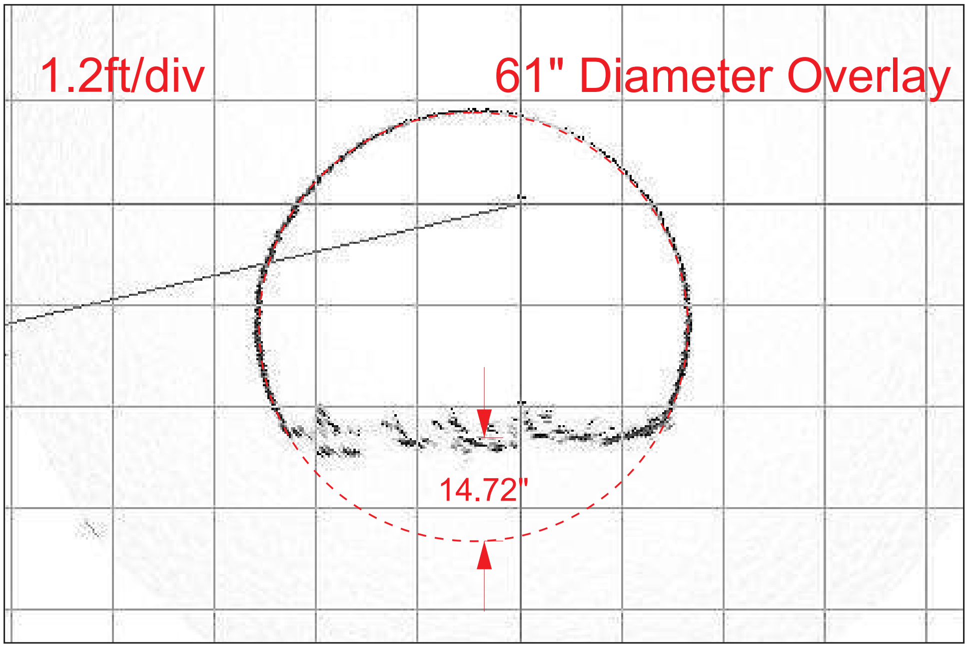


Image 4.1.3B-7: Sonar Profile 21 - 145 feet downstream of Manhole 3.

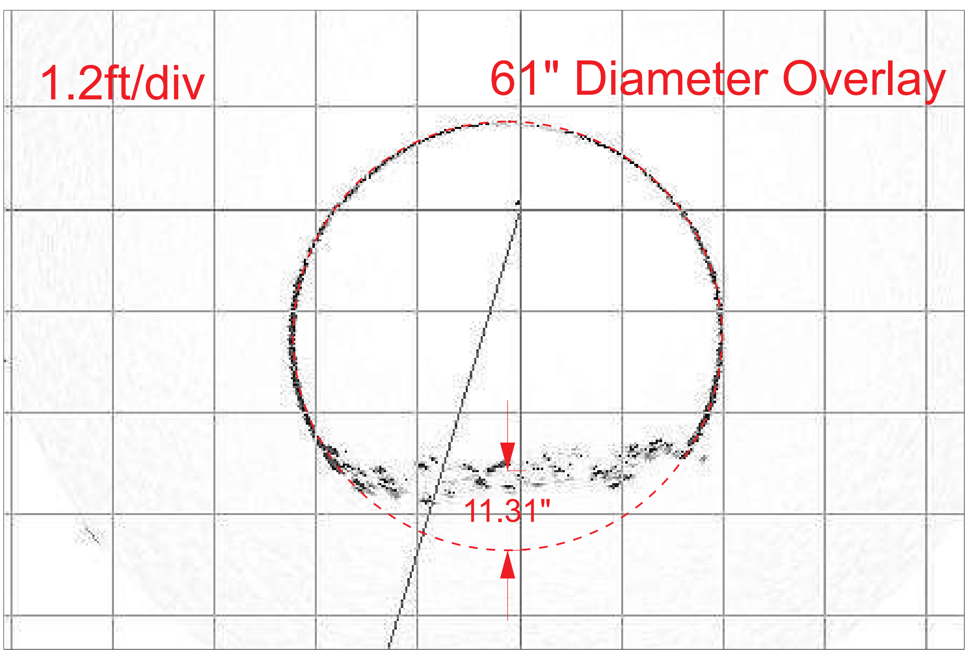


Image 4.1.3B-8: Sonar Profile 20 - 170 feet downstream of Manhole 3.

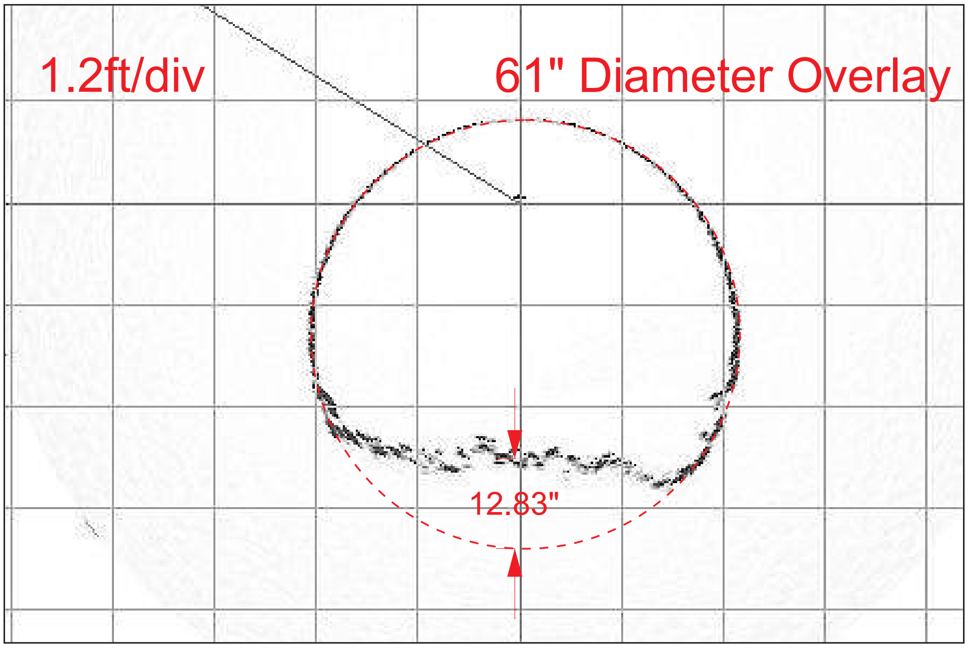


Image 4.1.3B-9: Sonar Profile 19 - 180 feet downstream of Manhole 3.

Image 4.2.1-1: Debris on invert 46 feet downstream of Access Point 1.

Image 4.2.1-2: Debris on invert 60 feet downstream of Access Point 1.

Image 4.2.1-3: Debris on invert 74 feet downstream of Access Point 1.

Image 4.2.1-4: Debris on invert 76 feet downstream of Access Point 1.

Image 4.2.1-5: Debris on invert 112 feet downstream of Access Point 1.

Image 4.2.1-6: Debris and possibly instrumentation on invert 121 feet downstream of Access Point 1.

Image 4.2.1-7: Instrumentation on invert 148 feet downstream of Access Point 1.

Image 4.2.1-8: Instrumentation on invert 154 feet downstream of Access Point 1.

Image 4.2.1-9: Ladder rungs at manhole access 157 feet downstream of Access Point 1.

Image 4.2.1-10: Biofouling on ladder 157 feet downstream of Access Point 1.

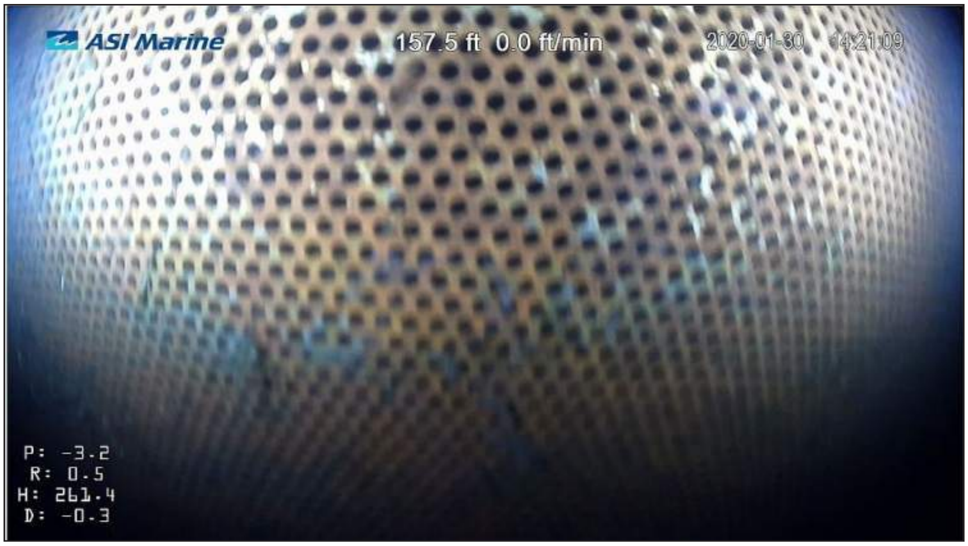


Image 4.2.1-11: Screen at base of manhole access 157 feet downstream of Access Point 1.

Image 4.2.1-12: Debris on invert 188 feet downstream of Access Point 1. Debris on invert.

Image 4.2.1-13: Opening in crown 207 feet downstream of Access Point 1.

Image 4.2.1-14: Opening in crown 207 feet downstream of Access Point 1.

Image 4.2.1-15: Opening in crown 207 feet downstream of Access Point 1.

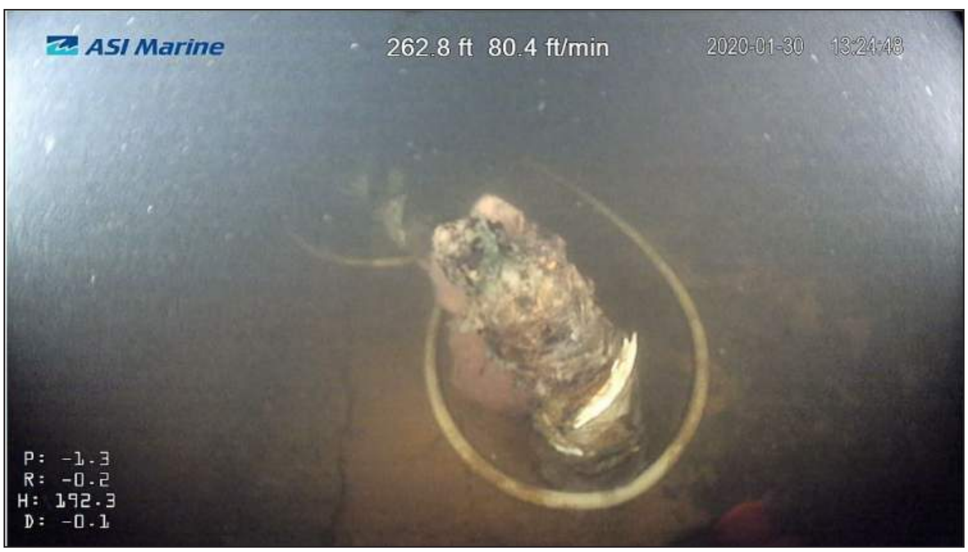


Image 4.2.1-16: Protrusion at invert 262 feet downstream of Access Point 1.

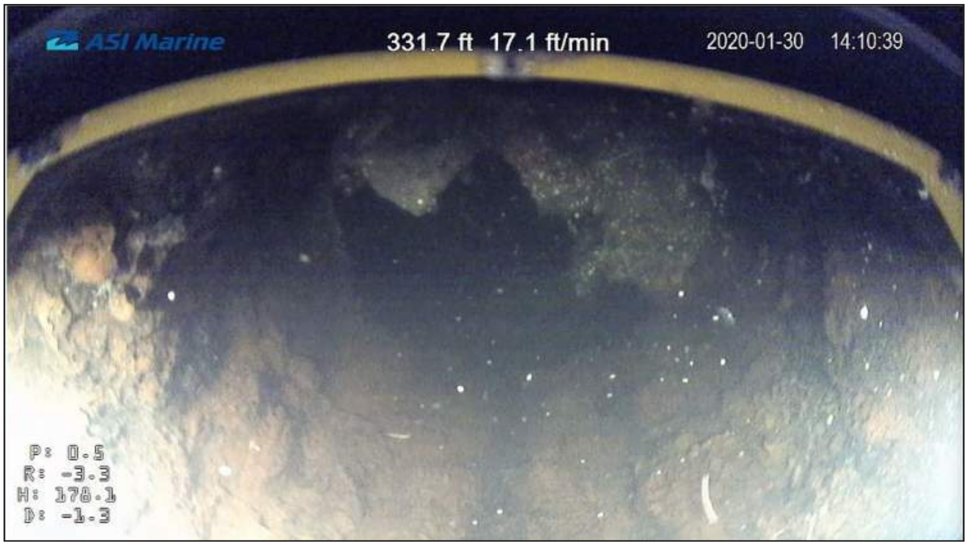


Image 4.2.1-17: Opening in crown 332 feet downstream of Access Point 1.

Image 4.2.1-18: Image of crown 458 feet downstream of Access Point 1.

Image 4.2.1-19: Image of invert 475 feet downstream of Access Point 1.

Image 4.2.1-20: Protrusion at crown 511 feet downstream of Access Point 1.

Image 4.2.1-21: Image of joint 535 feet downstream of Access Point 1.

Image 4.2.1-22: Image of crown and joint 584 feet downstream of Access Point 1.

CDM Smith	ASI Marine	ASI PROJECT: RU19-043	VIDEO STILLS	APPENDIX: 4.2.1
		PROJECT DATE: January 2020	INSPECTION OF WEST WWTP OUTFALL IN BRIDGEPORT, CT	
		DRAWN BY: T. Parker		PAGE 11 OF 15

Image 4.2.1-23: Debris on invert 634 feet downstream of Access Point 1.

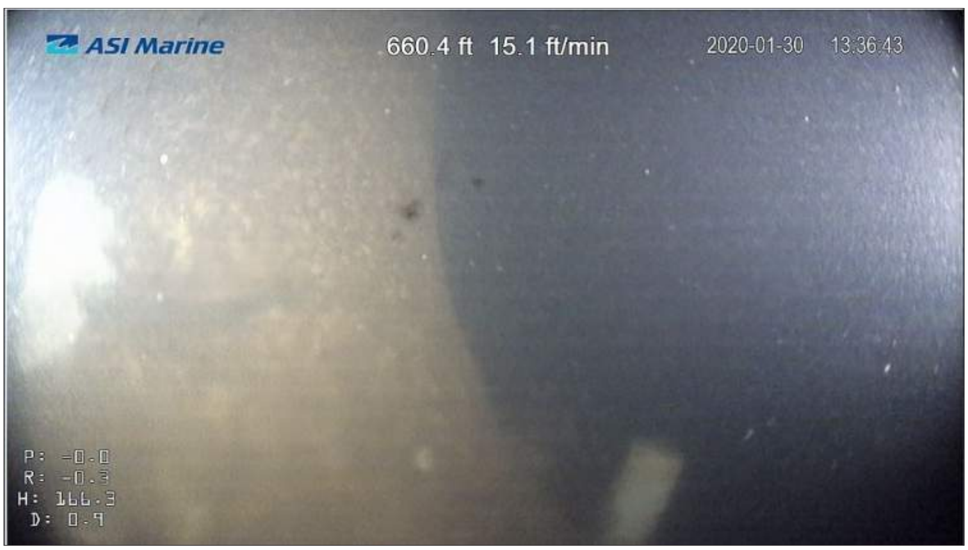


Image 4.2.1-24: Image of debris 660 feet downstream of Access Point 1.

Image 4.2.1-25: Debris on invert 691 feet downstream of Access Point 1.

Image 4.2.1-26: Debris on invert 704 feet downstream of Access Point 1.

CDM Smith	ASI Marine	ASI PROJECT: RU19-043	VIDEO STILLS	APPENDIX: 4.2.1
		PROJECT DATE: January 2020	INSPECTION OF WEST WWTP OUTFALL IN BRIDGEPORT, CT	
		DRAWN BY: T. Parker		PAGE 13 OF 15

Image 4.2.1-27: Rock debris on invert 725 feet downstream of Access Point 1.

Image 4.2.1-28: Debris on invert 772 feet downstream of Access Point 1.

Image 4.2.1-29: Debris on invert at outfall 784 feet downstream of Access Point 1.

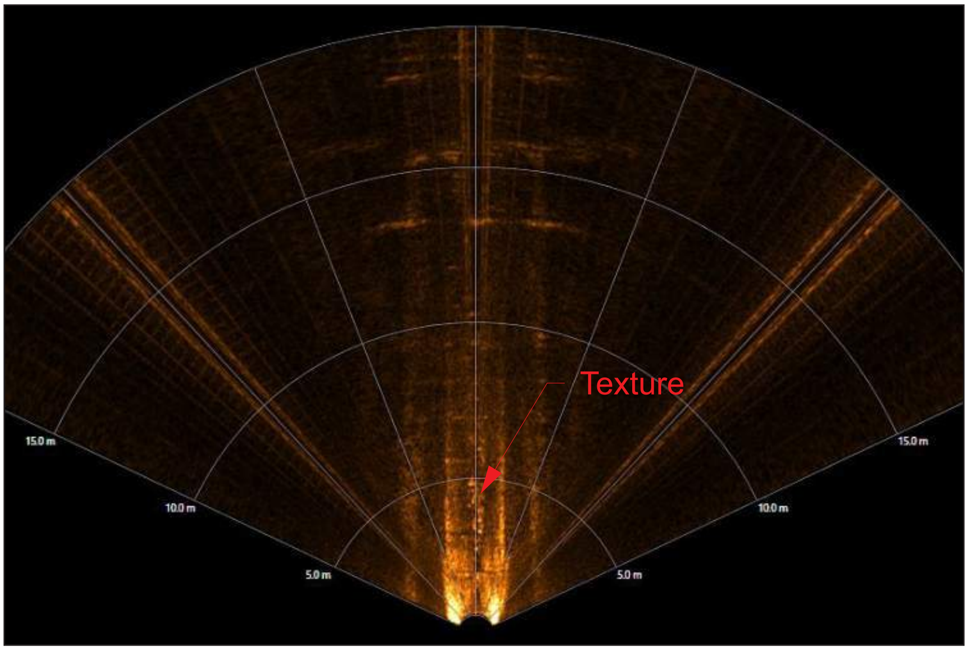


Image 4.2.2-1: Sonar image at 0 feet downstream of Access Point 1. Texture on invert ahead.

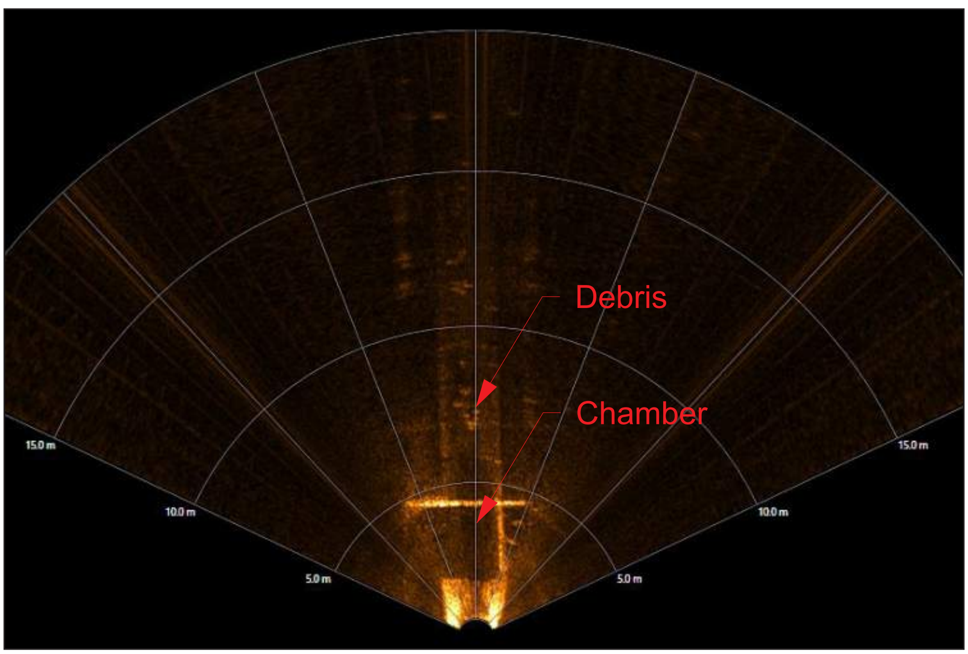


Image 4.2.2-2: Sonar image at 36 feet downstream of Access Point 1. Manhole chamber visible and debris on invert 24 feet ahead.

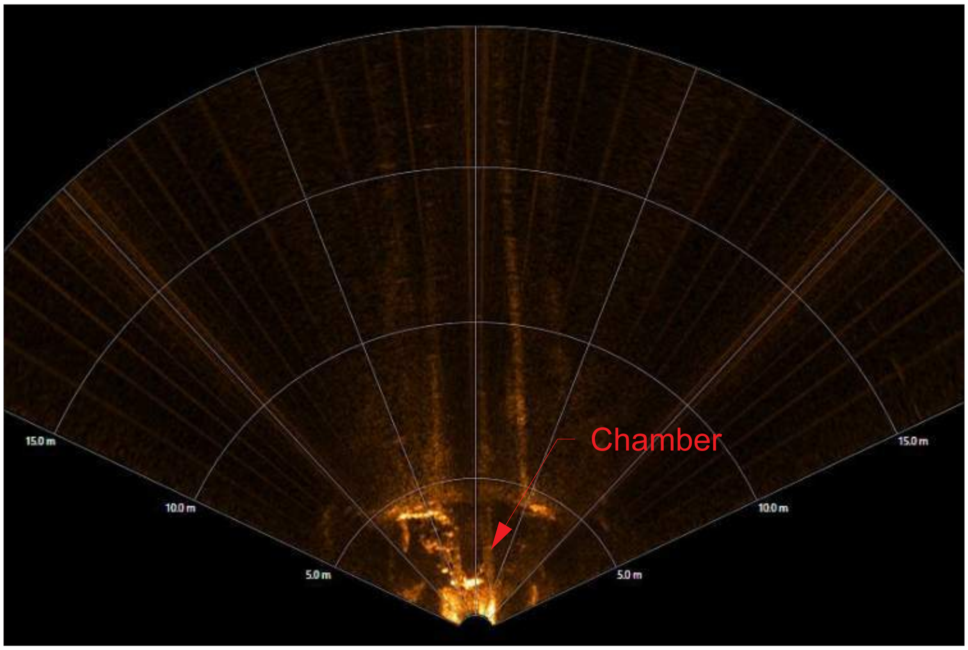


Image 4.2.2-3: Sonar image at 39 feet downstream of Access Point 1. Chamber for manhole access 3 feet ahead.

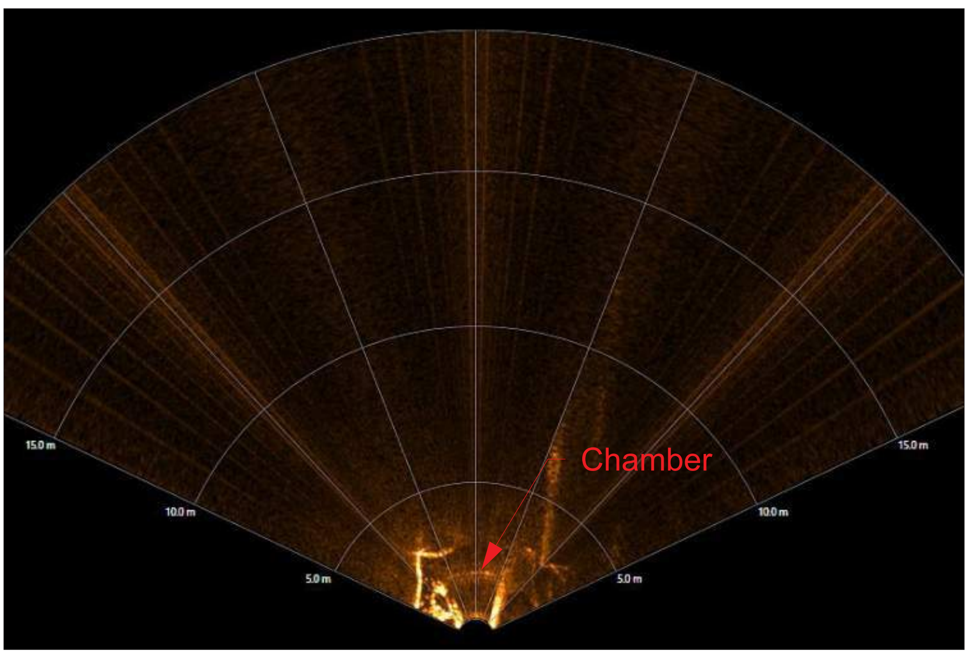


Image 4.2.2-4: Sonar image 46 feet downstream of Access Point 1. Entering chamber for manhole access

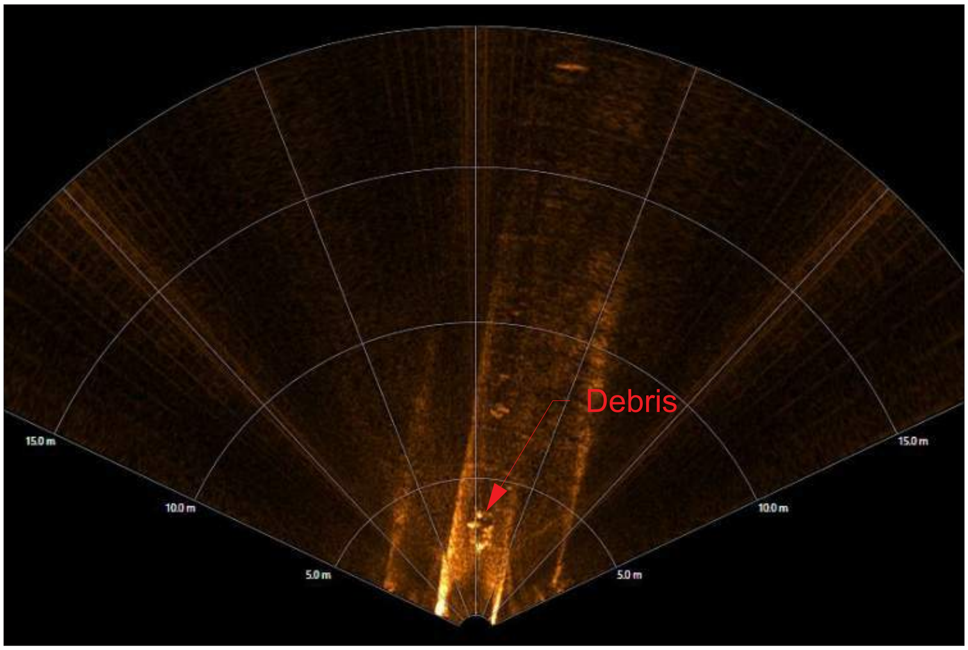


Image 4.2.2-5: Sonar image 52 feet downstream of Access Point 1. Debris on invert 13 feet ahead.

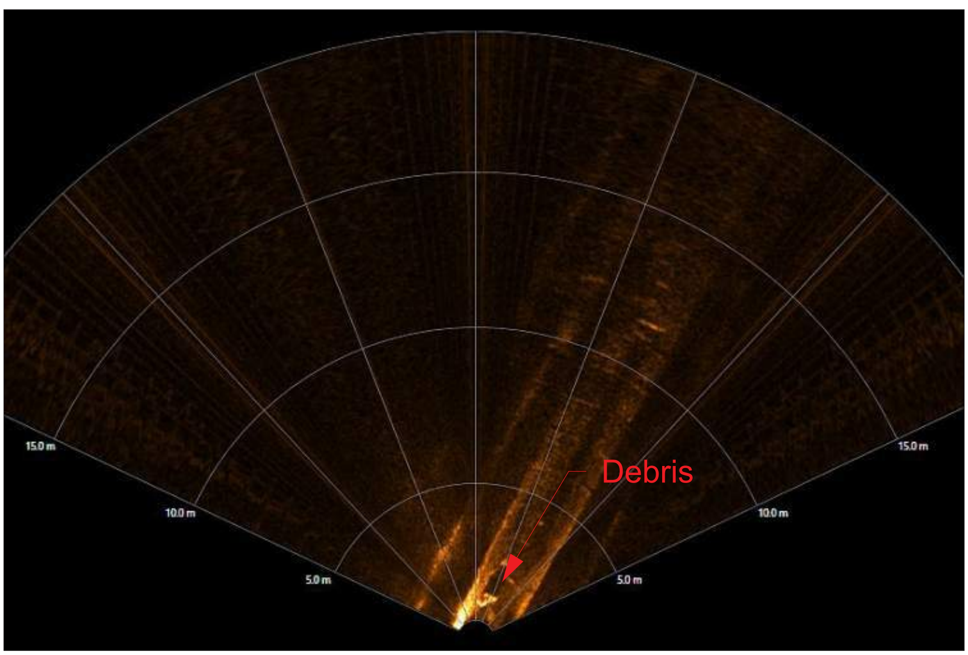


Image 4.2.2-6: Sonar image at 74 feet downstream of Access Point 1. Debris on invert 2 feet ahead.

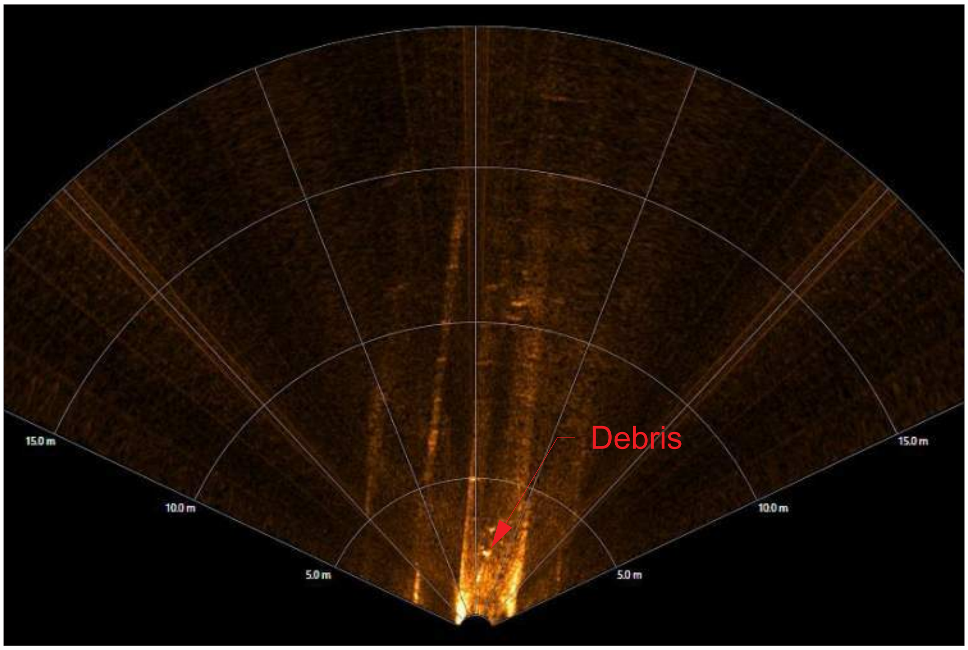


Image 4.2.2-7: Sonar image at 76 feet downstream of Access Point 1. Debris on invert 6 feet ahead.

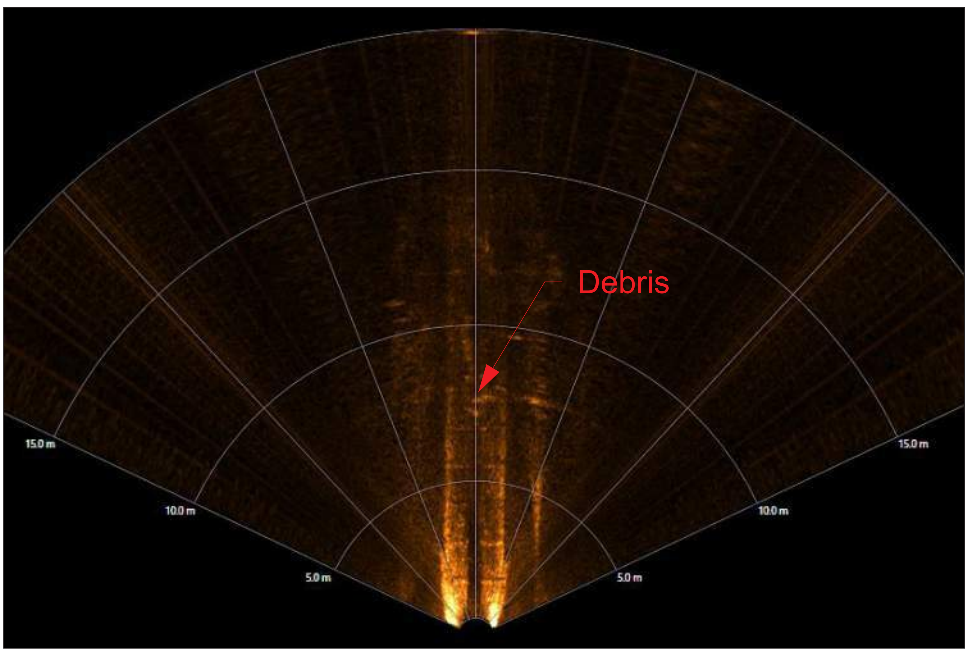


Image 4.2.2-8: Sonar image at 84 feet downstream of Access Point 1. Debris on invert 26 feet ahead.

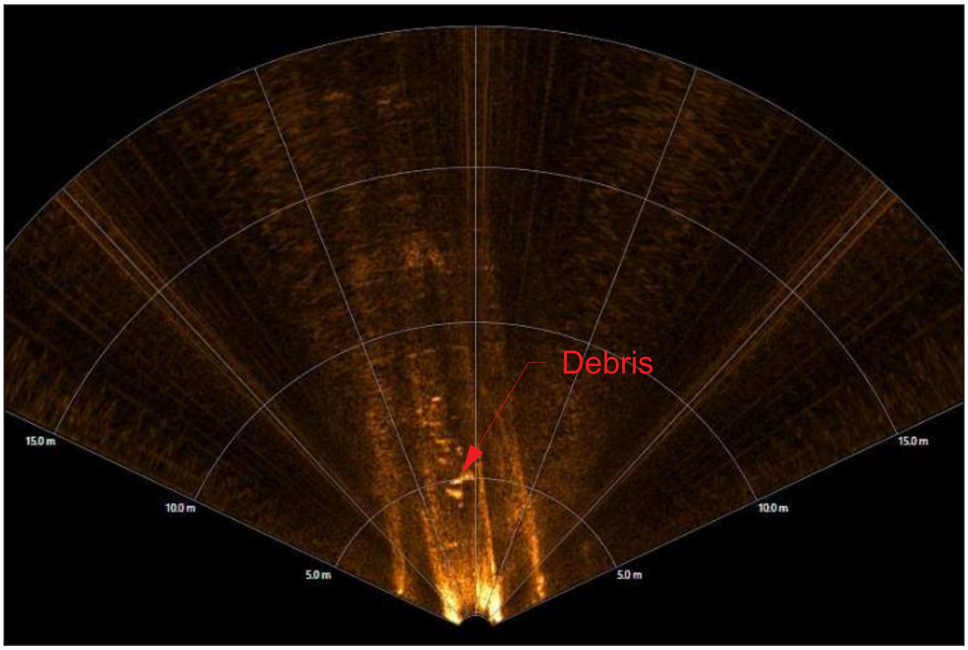


Image 4.2.2-9: Sonar image at 96 feet downstream of Access Point 1. Debris on invert 17 feet ahead.

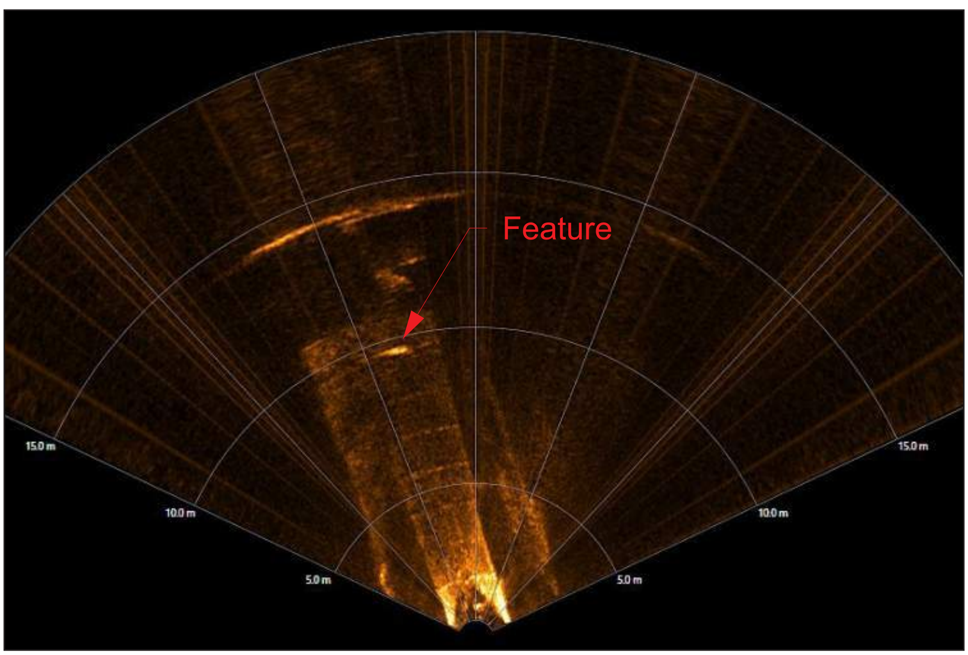


Image 4.2.2-10: Sonar image at 121 feet downstream of Access Point 1. Feature on invert 31 feet ahead

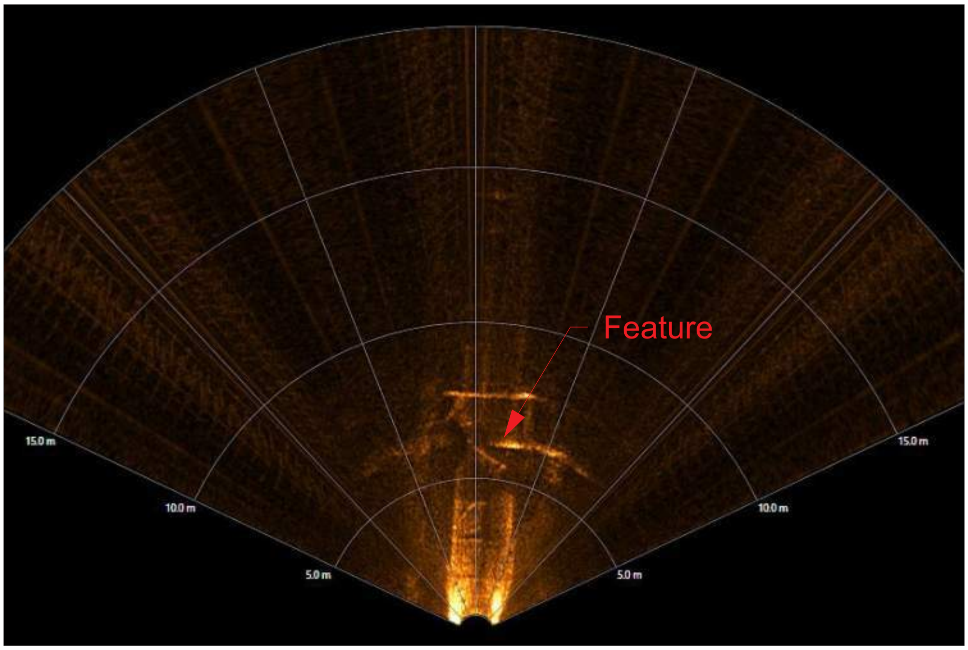


Image 4.2.2-11: Sonar image at 136 feet downstream of Access Point 1. Feature within manhole chamber 18 feet ahead.

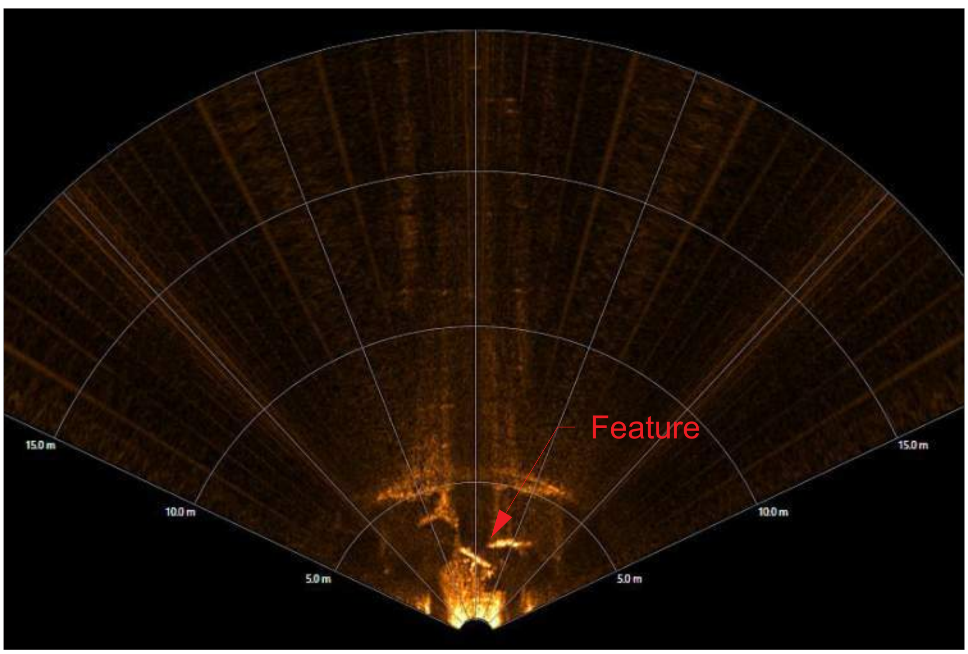


Image 4.2.2-12: Sonar image at 148 feet downstream of Access Point 1. Feature in manhole chamber 10 feet ahead.

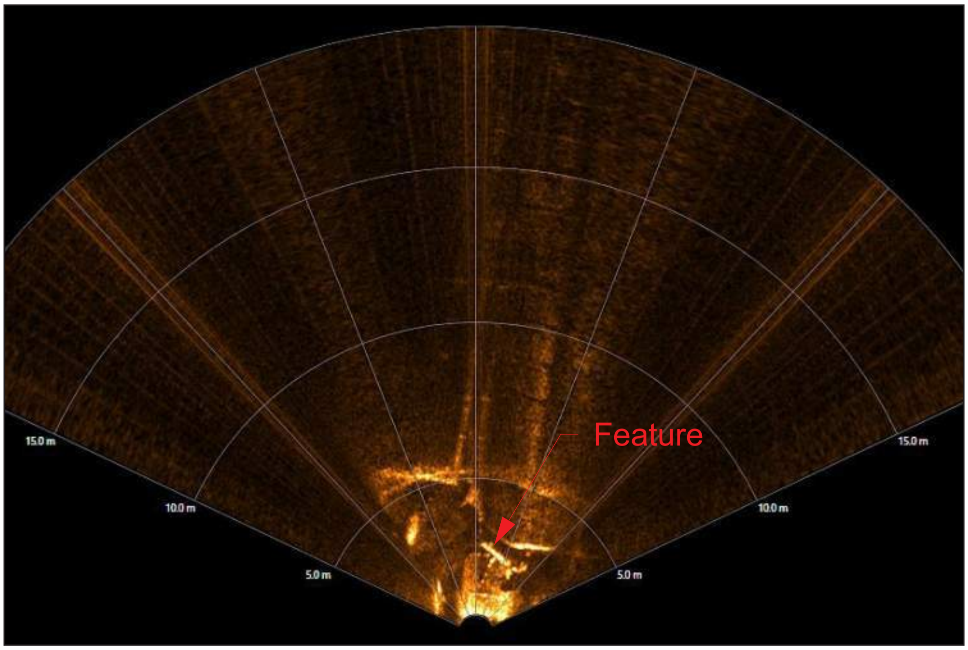


Image 4.2.2-13: Sonar image at 154 feet downstream of Access Point 1. Feature in manhole chamber 8 feet ahead.

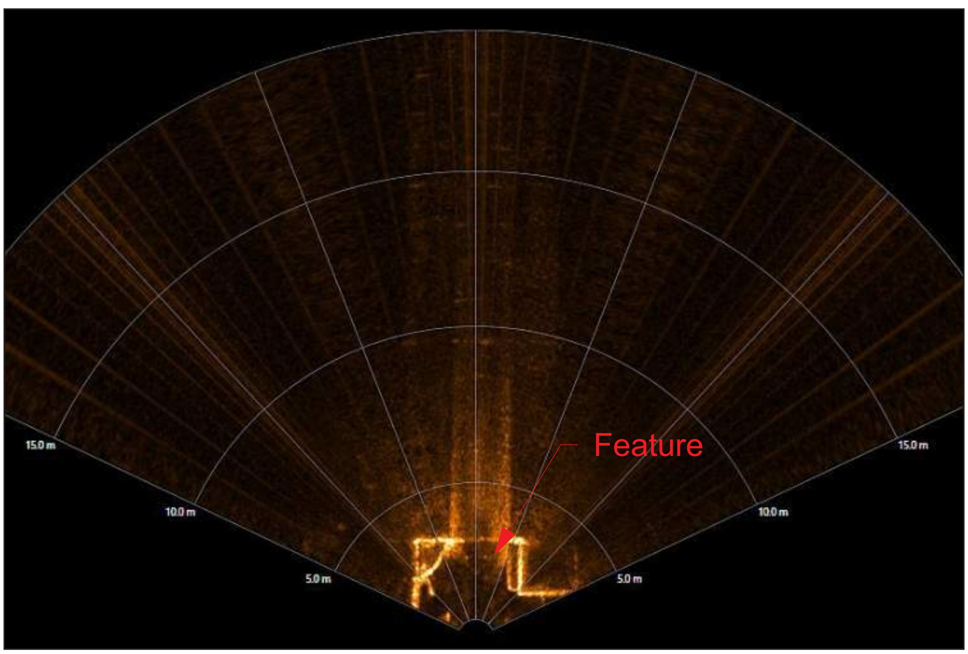


Image 4.2.2-14: Sonar image within manhole chamber at 156 feet downstream of Access Point 1.

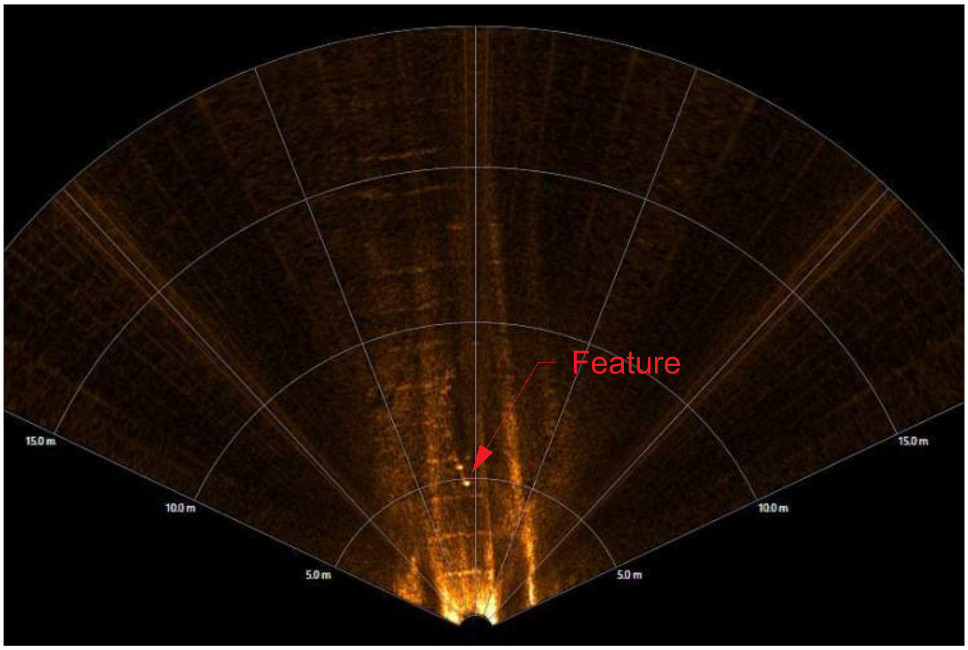


Image 4.2.2-15: Sonar image at 251 feet downstream of Access Point 1. Feature on invert 16 feet ahead.

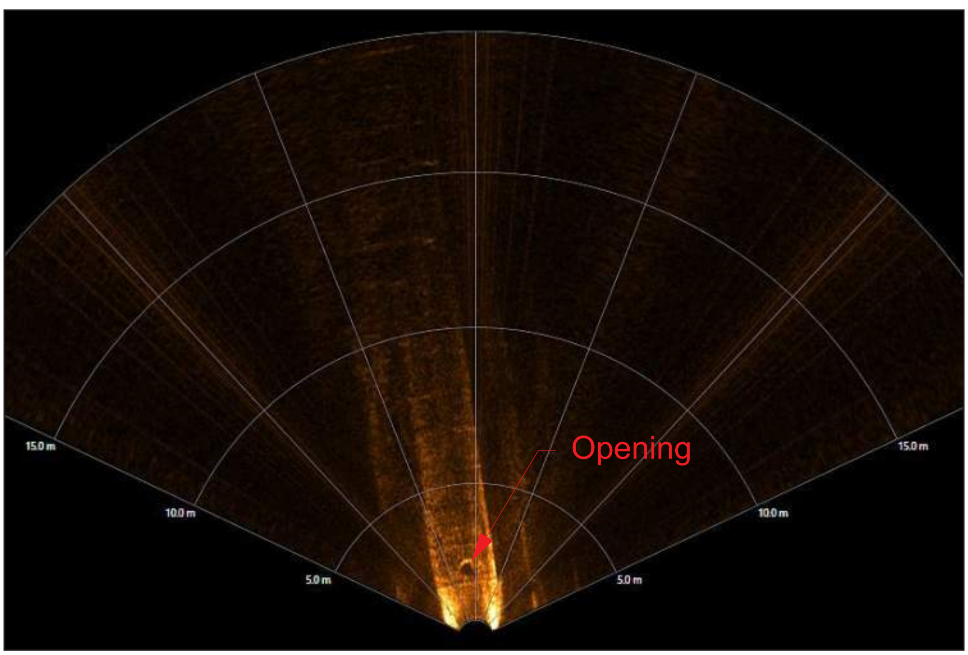


Image 4.2.2-16: Sonar image at 327 feet downstream of Access Point 1. Opening in crown 6 feet ahead.

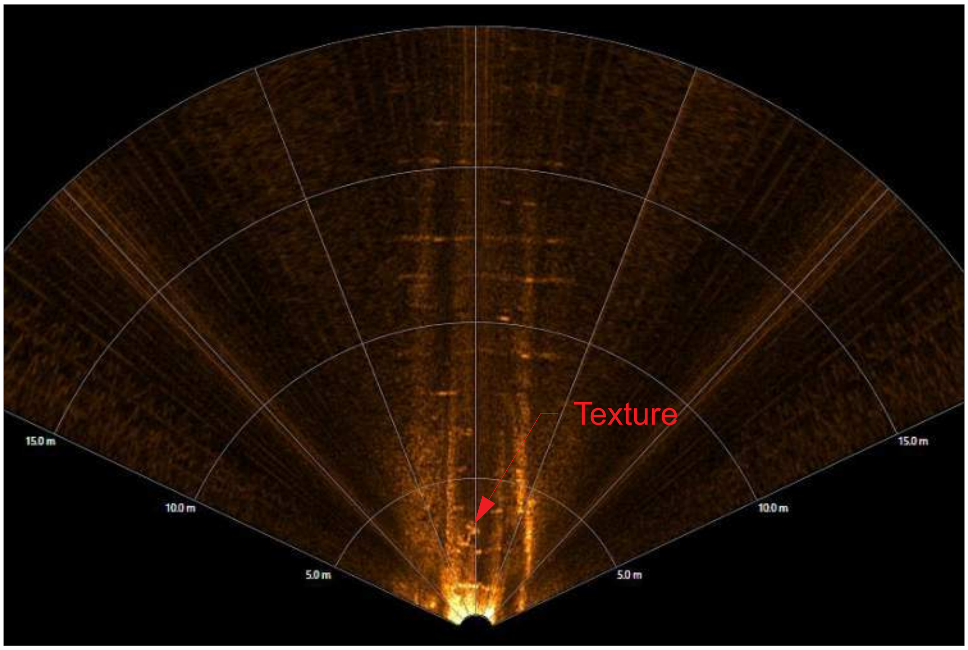


Image 4.2.2-17: Sonar image at 457 feet downstream of Access Point 1. Texture on invert 8 feet ahead.

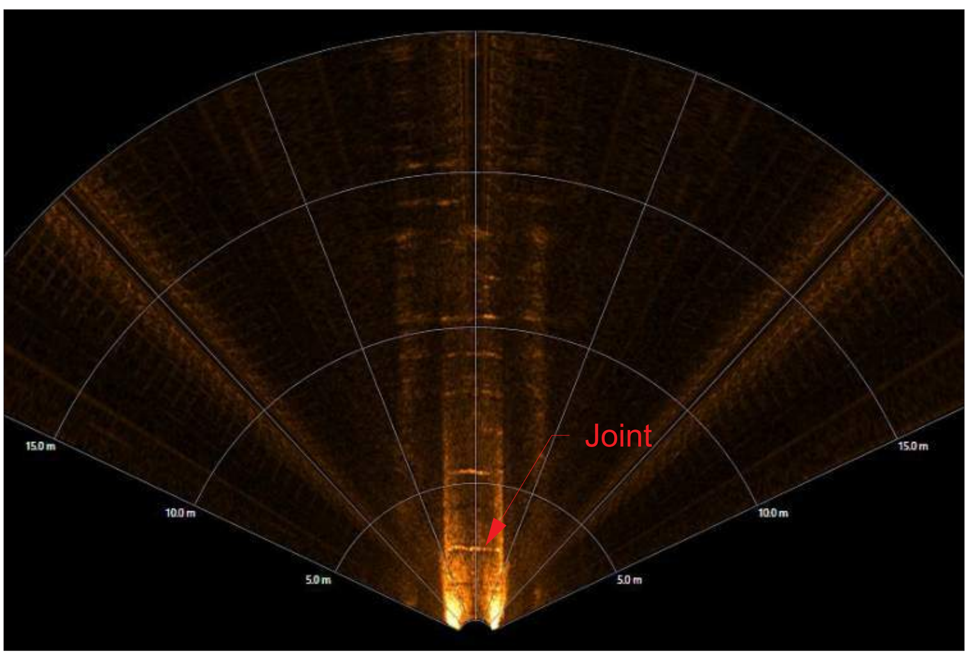


Image 4.2.2-18: Sonar image at 584 feet downstream of Access Point 1. Joint spacing visible.

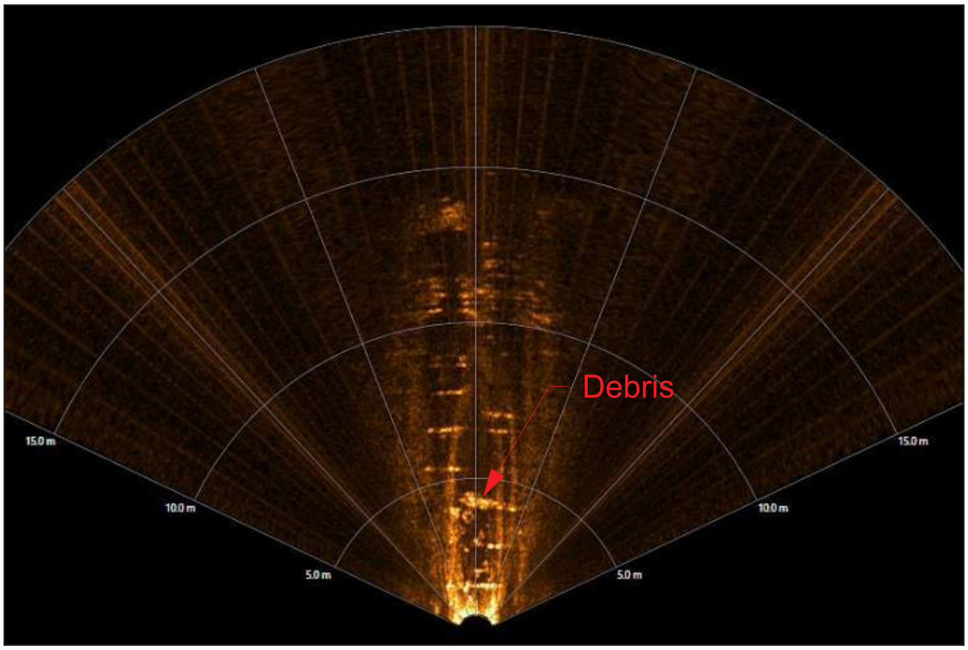


Image 4.2.2-19: Sonar image at 619 feet downstream of Access Point 1. Debris on invert ahead.

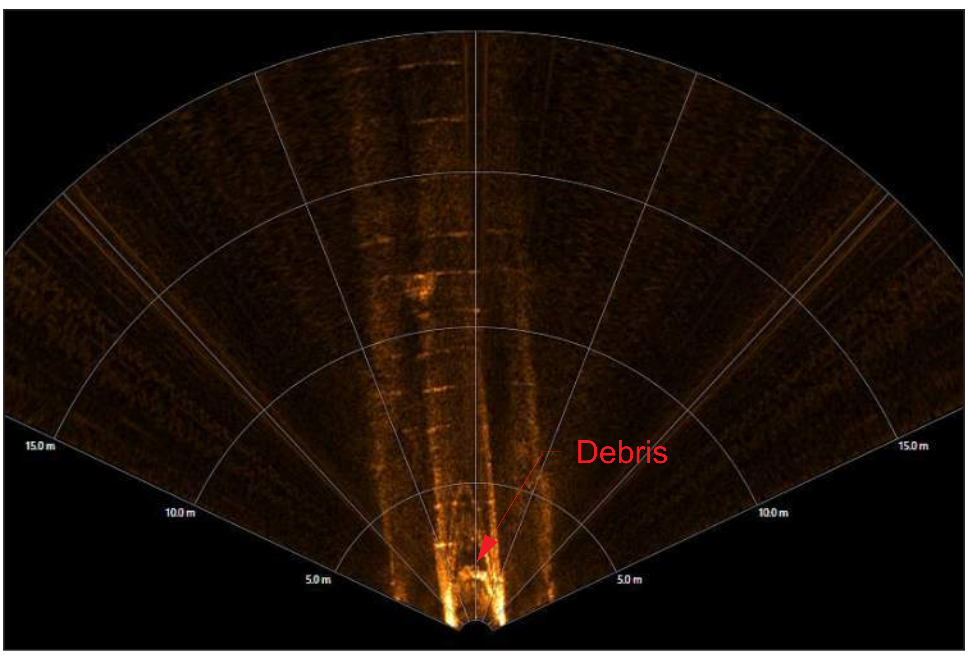


Image 4.2.2-20: Sonar image at 624 feet downstream of Access Point 1. Debris on invert 5 feet ahead.

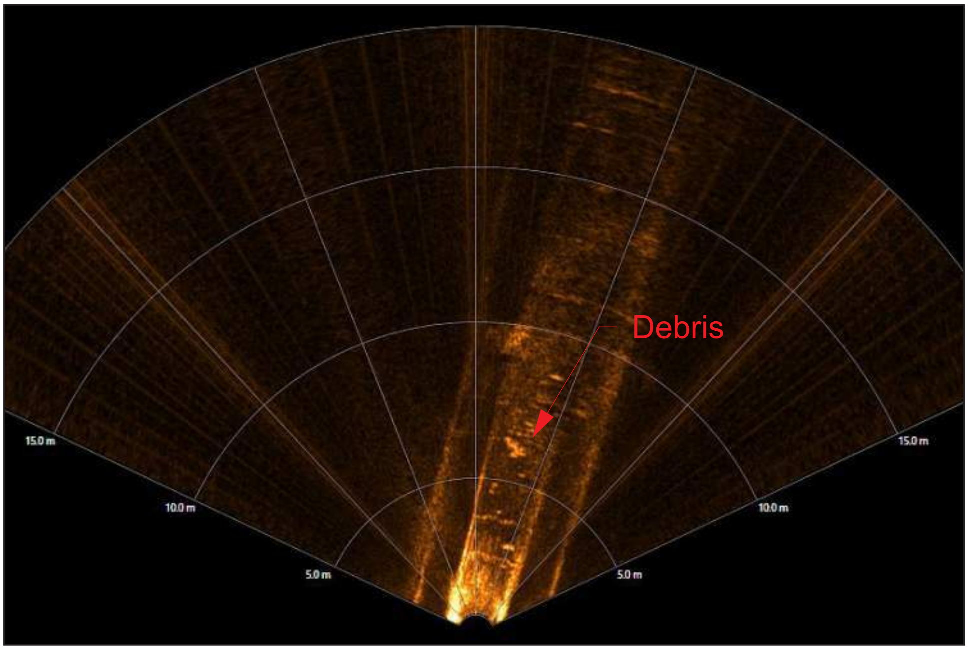


Image 4.2.2-21: Sonar image at 634 feet downstream of Access Point 1. Debris on invert 20 feet ahead.

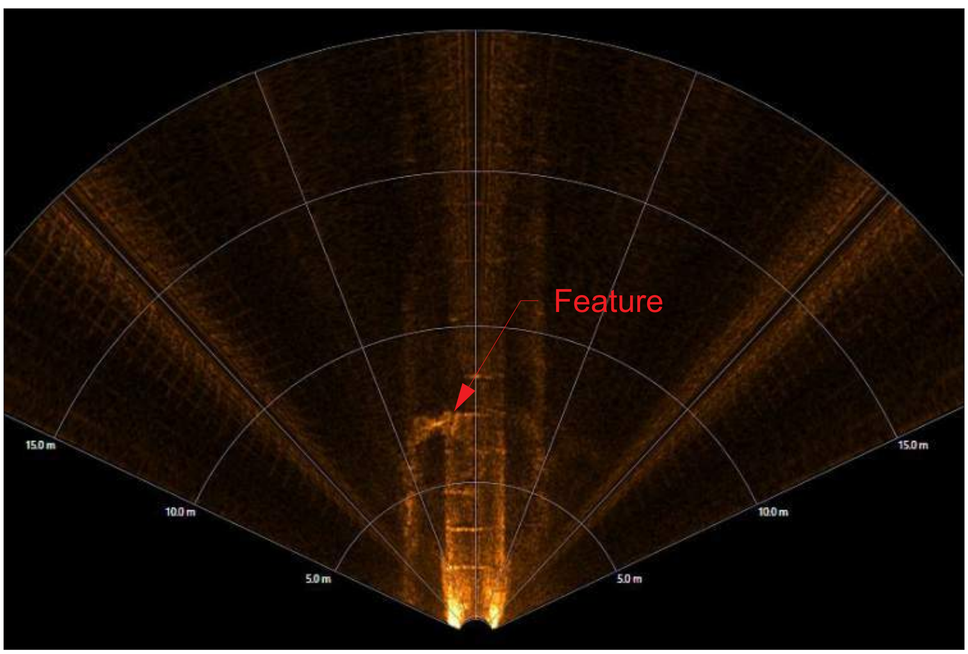


Image 4.2.2-22: Sonar image at 635 feet downstream of Access Point 1. Feature on tunnel left 25 feet ahead.

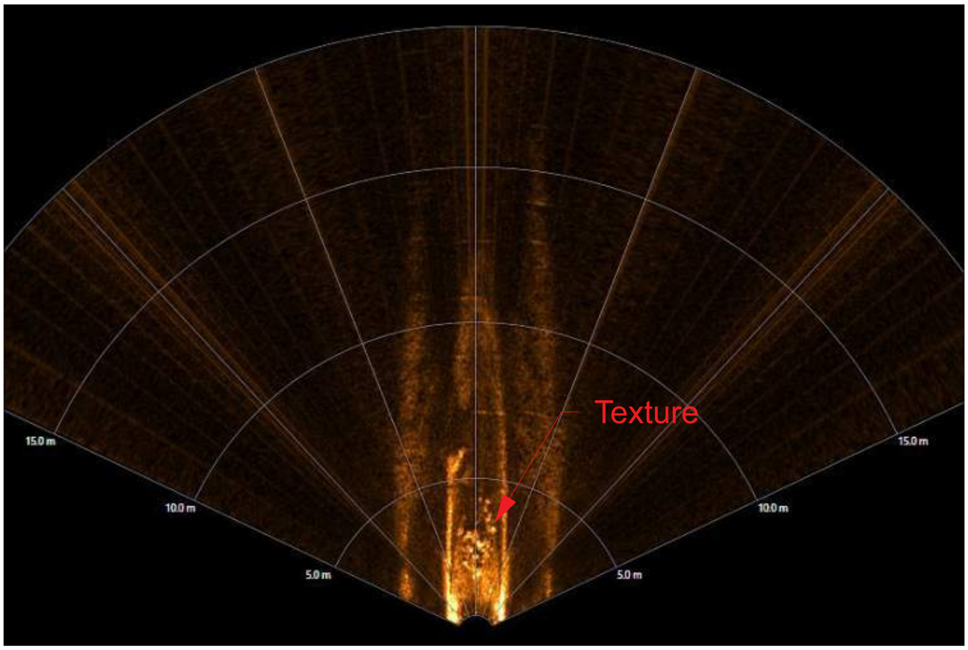


Image 4.2.2-23: Sonar image at 645 feet downstream of Access Point 1. Texture on invert 7 feet ahead.

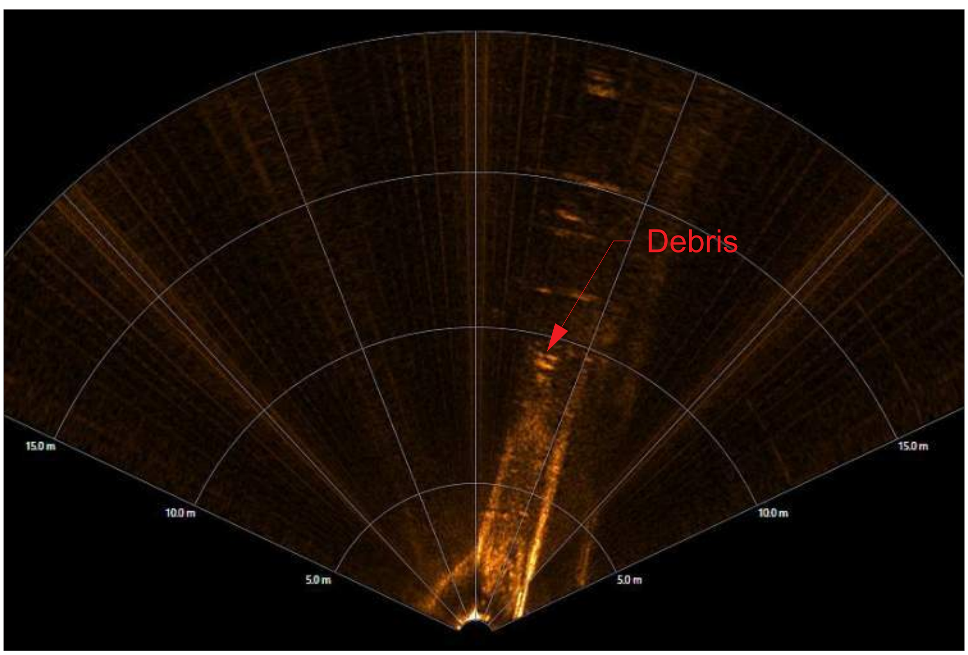


Image 4.2.2-24: Sonar image at 660 feet downstream of Access Point 1. Debris on invert 30 feet ahead.

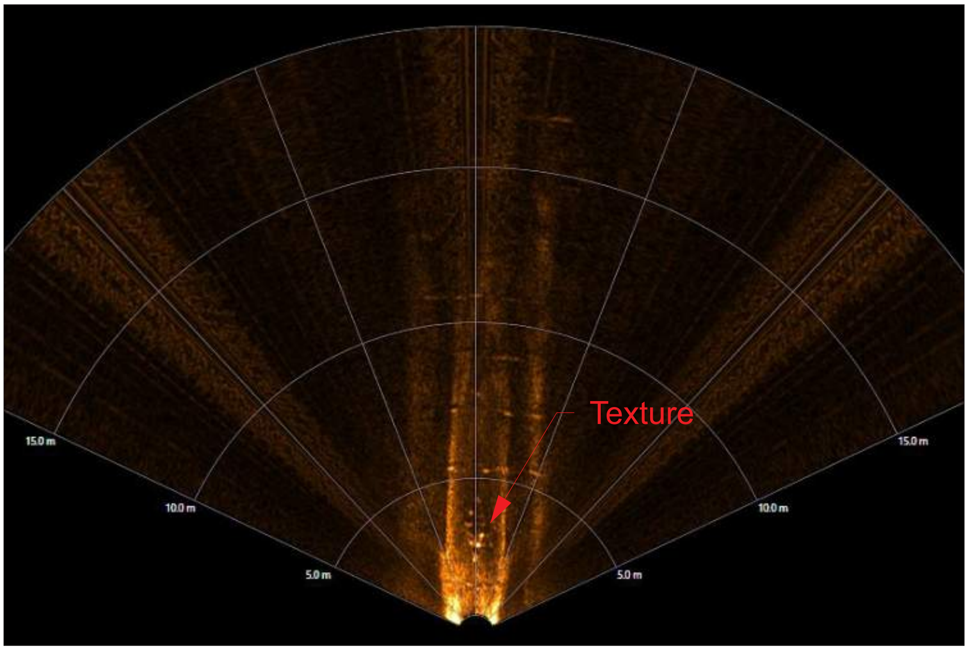


Image 4.2.2-25: Sonar image at 679 feet downstream of Access Point 1. Texture on invert 7 feet ahead.

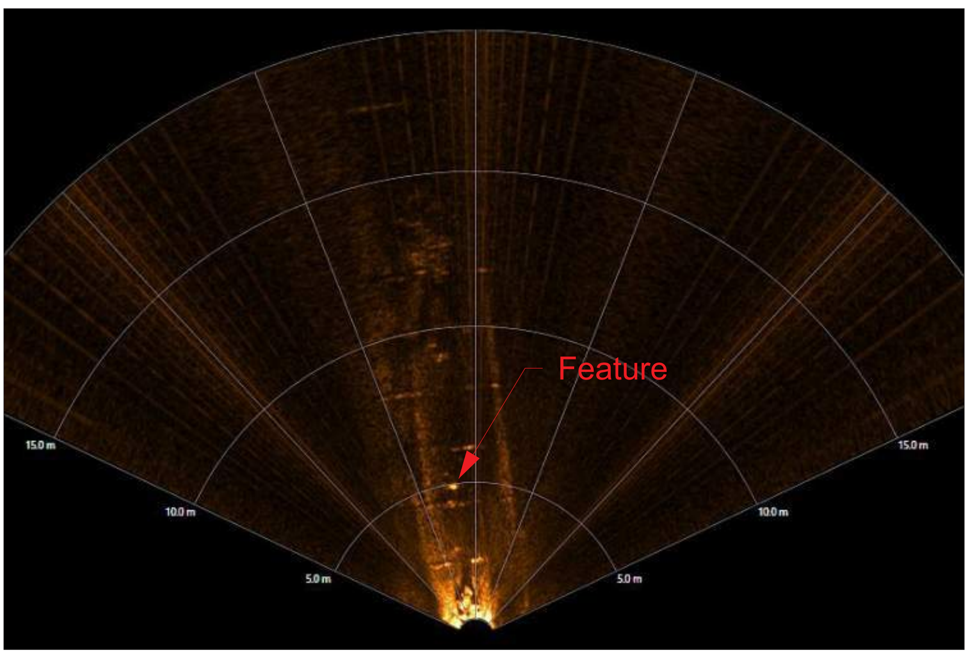


Image 4.2.2-26: Sonar image at 691 feet downstream of Access Point 1. Feature on invert 16 feet ahead.

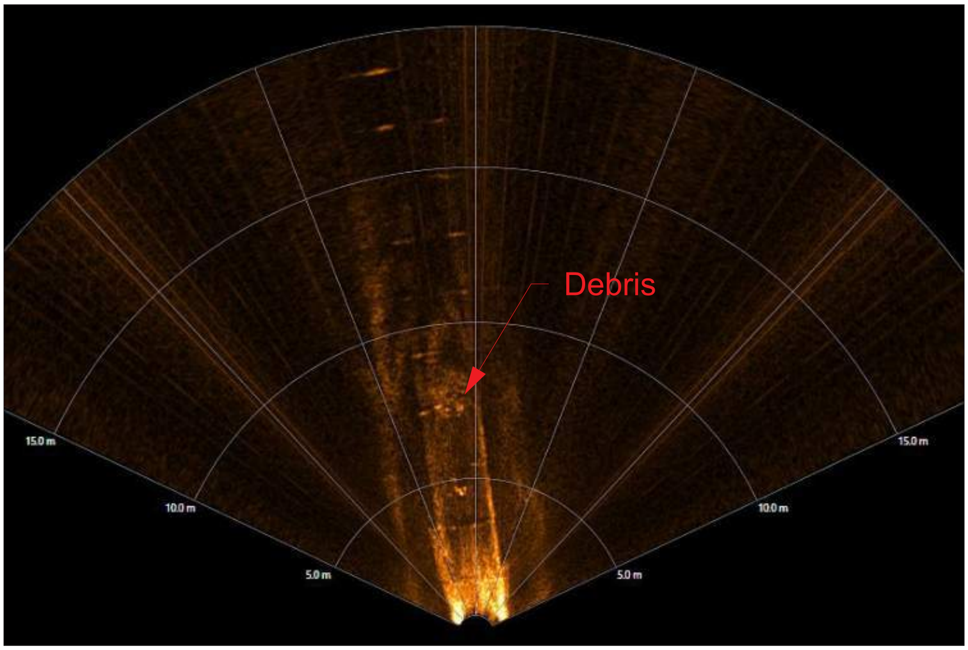


Image 4.2.2-27: Sonar image at 704 feet downstream of Access Point 1. Debris on invert 13 and 43 feet ahead.

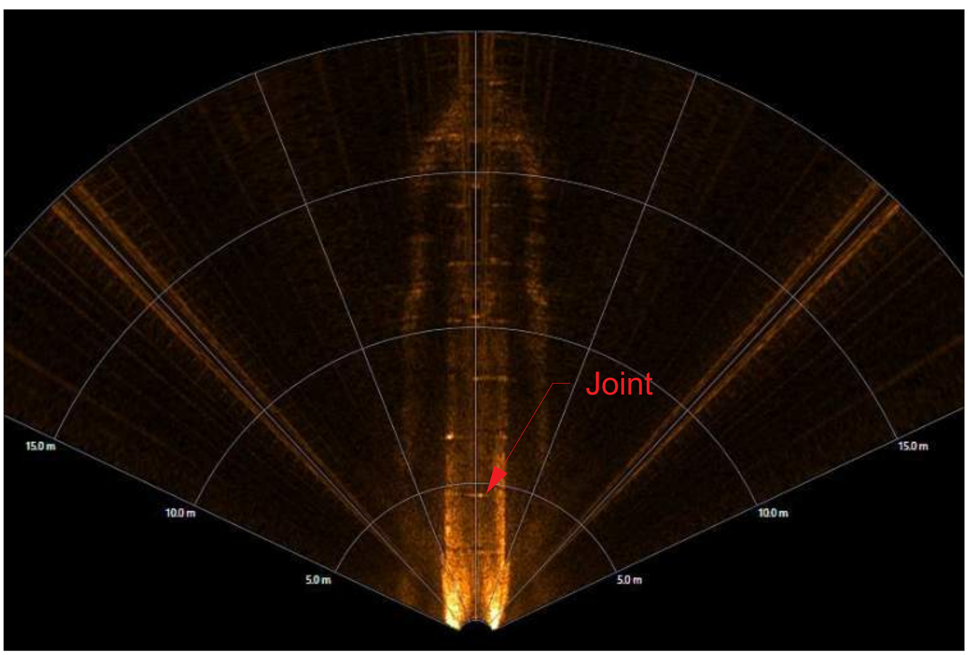


Image 4.2.2-28: Sonar image at 737 feet downstream of Access Point 1. Joint spacing visible.

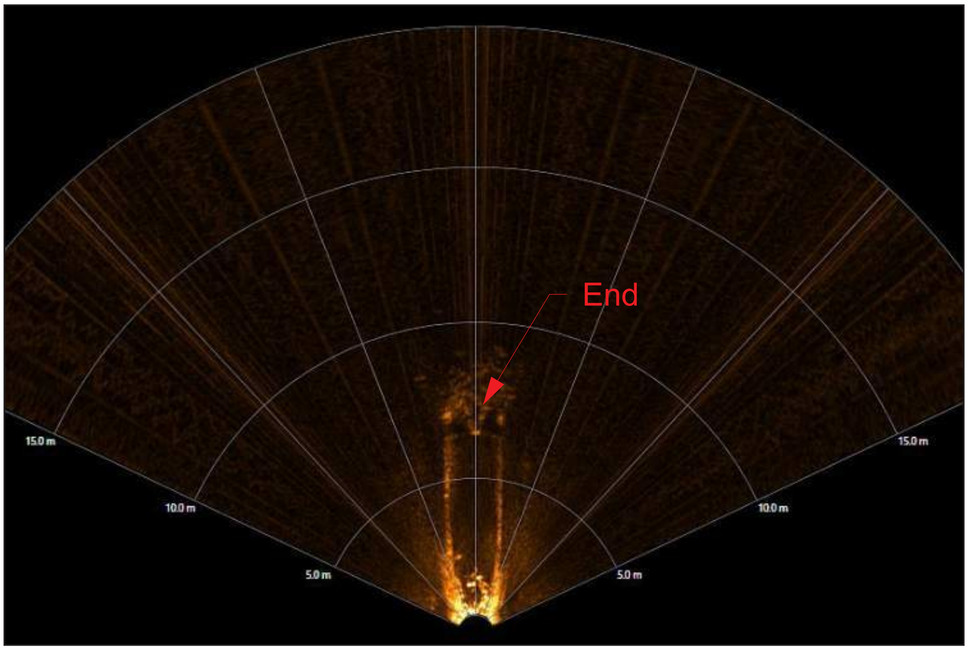


Image 4.2.2-29: Sonar image at 772 feet downstream of Access Point 1. End of outfall 26 feet ahead.

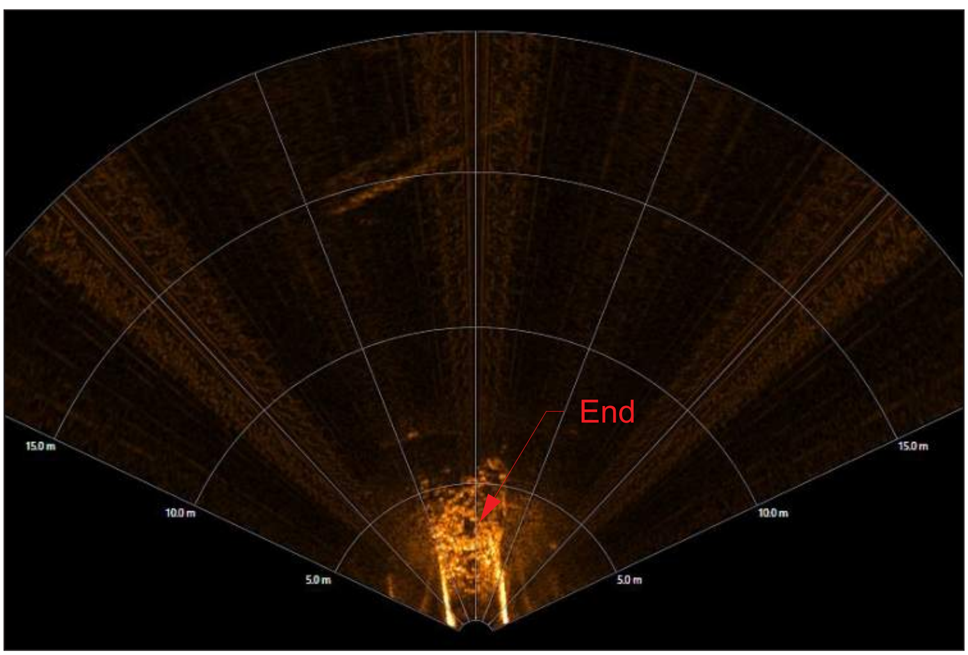


Image 4.2.2-30: Sonar image at 784 feet downstream of Access Point 1. End of outlet 12 feet ahead.

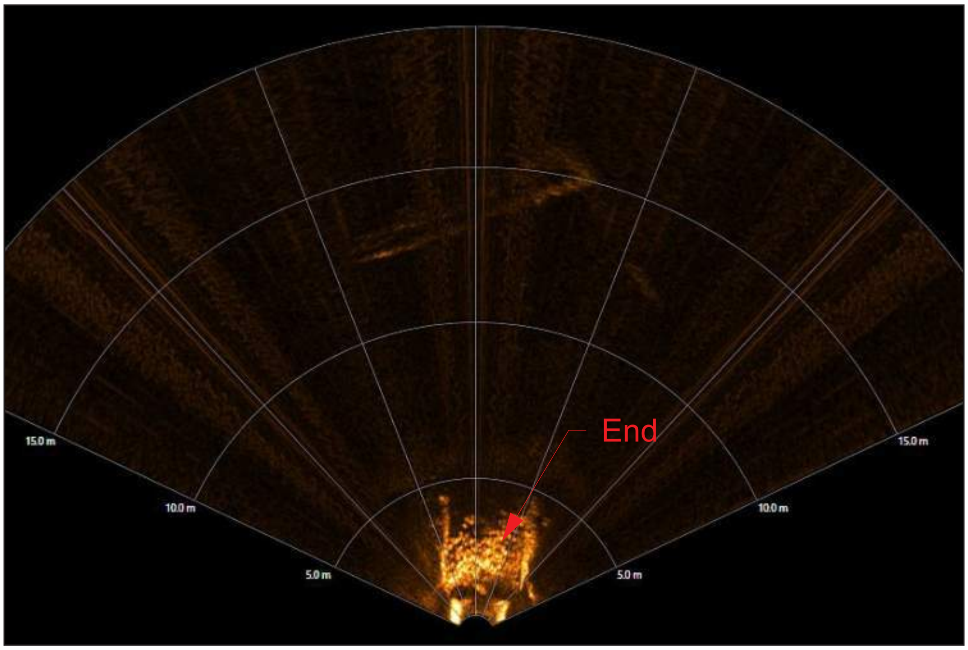


Image 4.2.2-31: Outfall outlet at 788 feet downstream of Access Point 1.

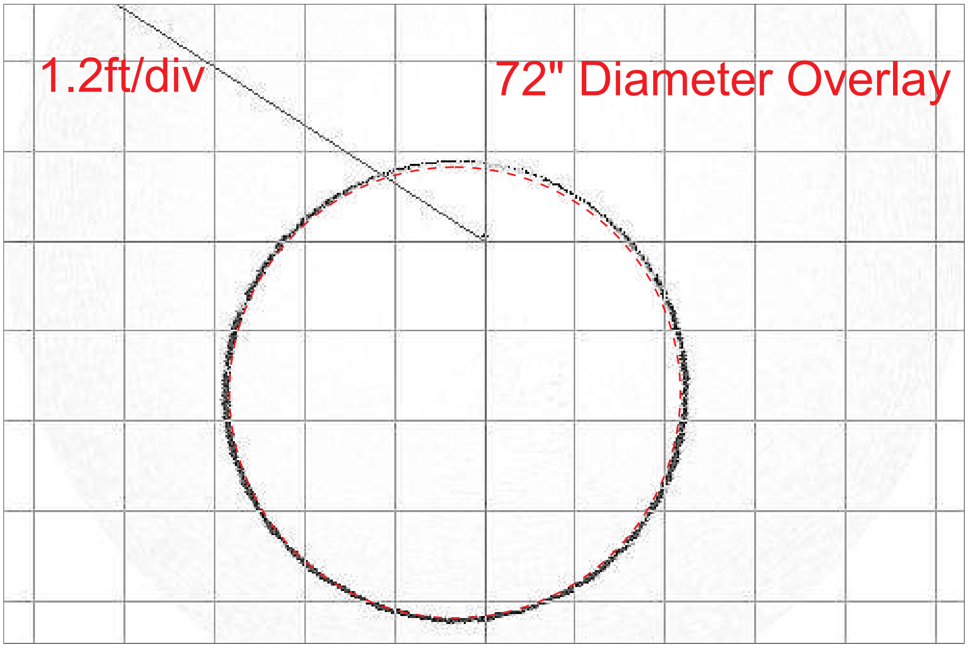


Image 4.2.3-1: Sonar Profile 17 - 0 feet from Access Point 1.

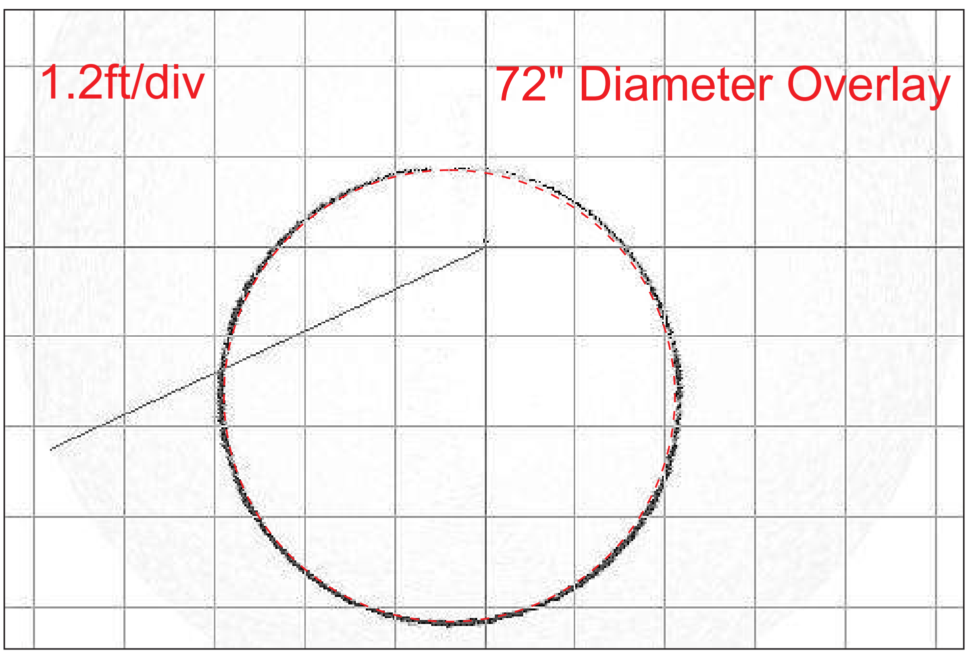


Image 4.2.3-2: Sonar Profile 16 - 35 feet downstream of Access Point 1.

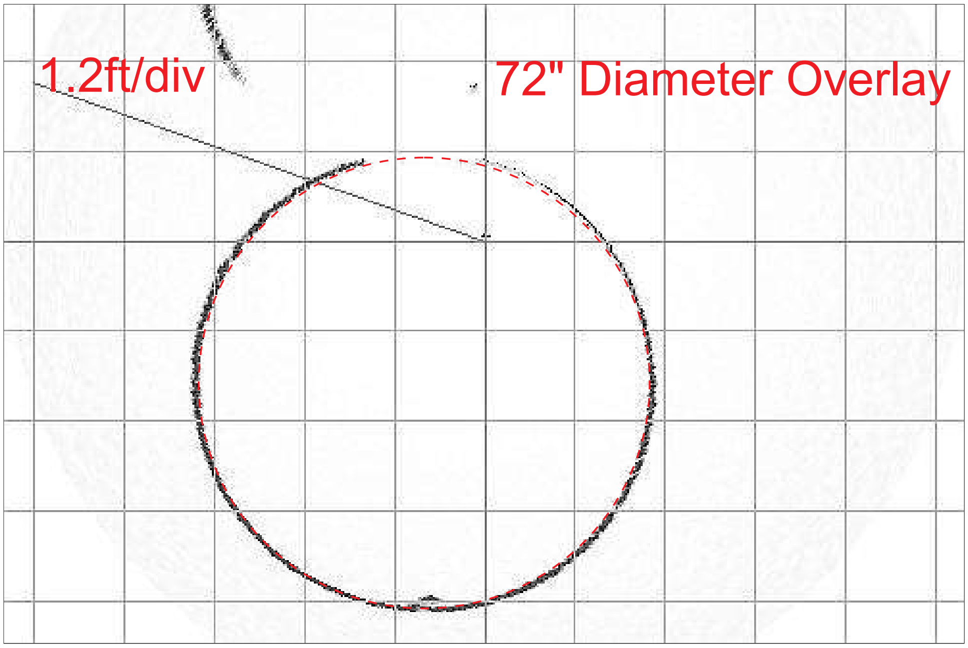


Image 4.2.3-3: Sonar Profile 15 - 84 feet downstream of Access Point 1.

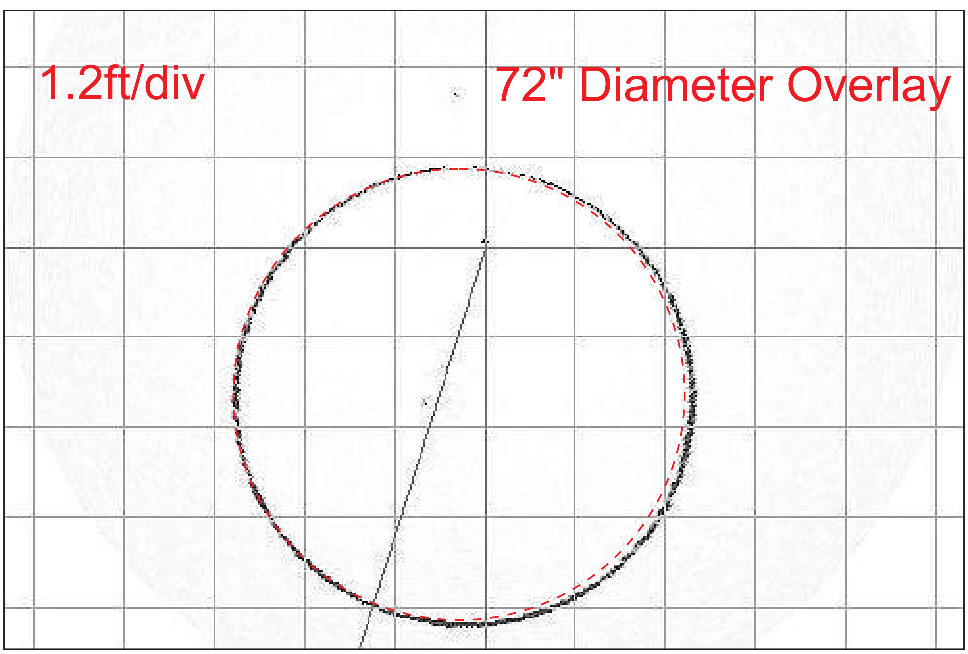


Image 4.2.3-4: Sonar Profile 14 - 136 feet downstream of Access Point 1.

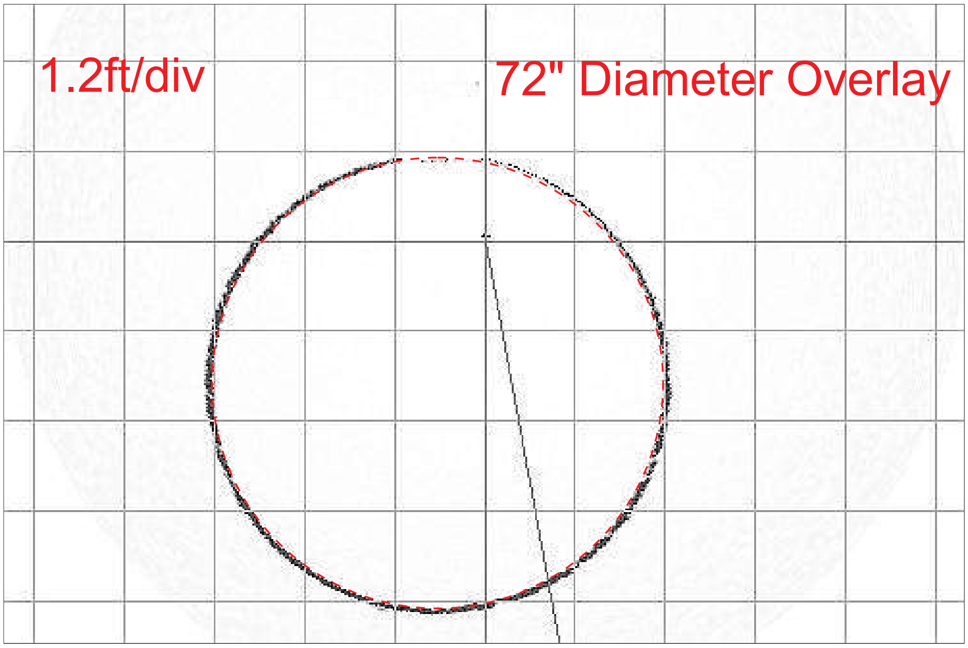


Image 4.2.3-5: Sonar Profile 13 - 187 feet downstream of Access Point 1.

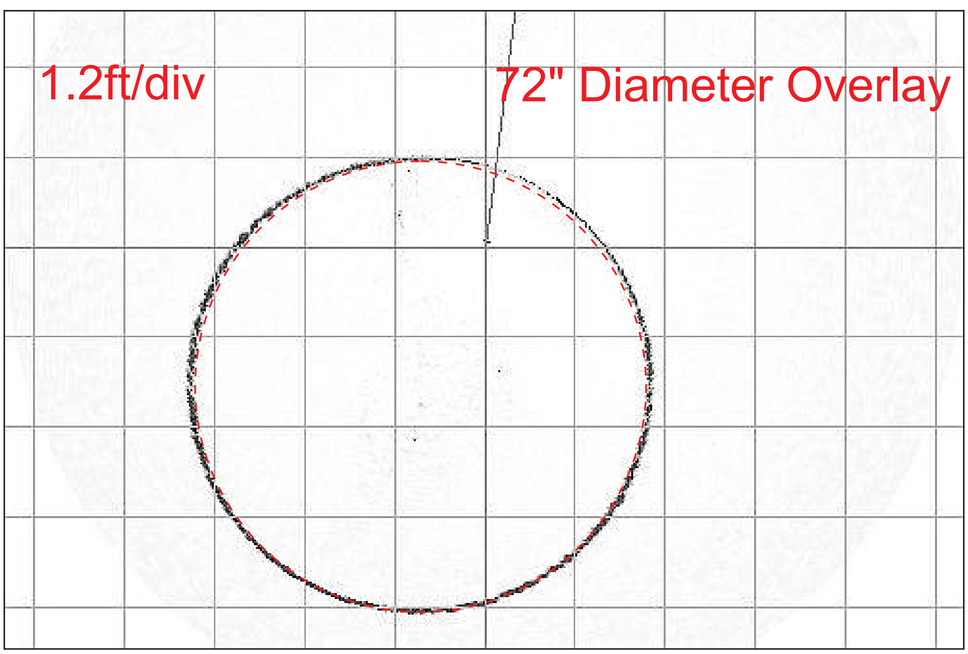


Image 4.2.3-6: Sonar Profile 1 - 237 feet downstream of Access Point 1.

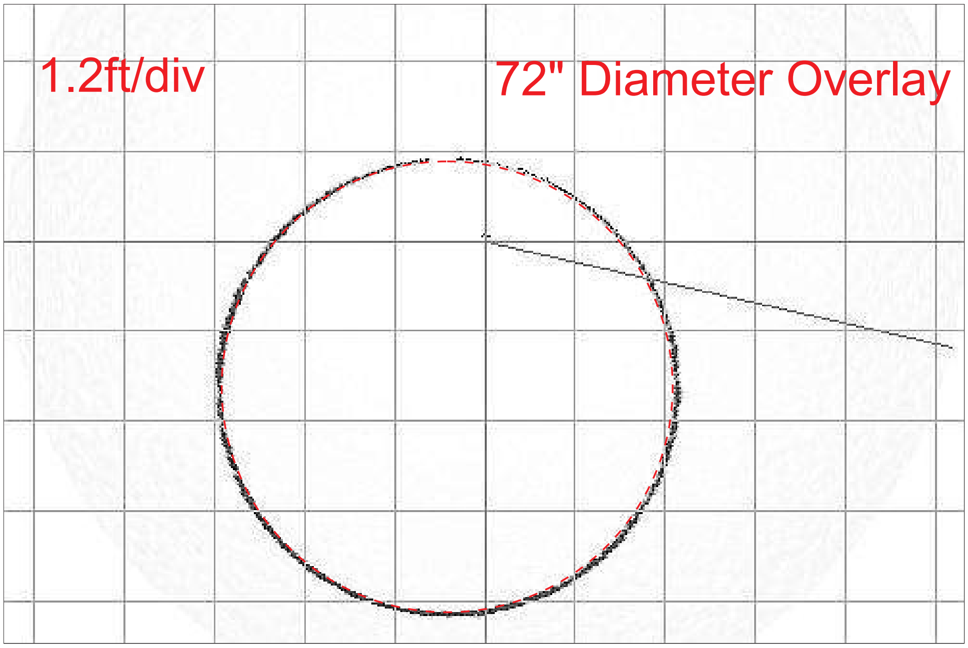


Image 4.2.3-7: Sonar Profile 11 - 284 feet downstream of Access Point 1.

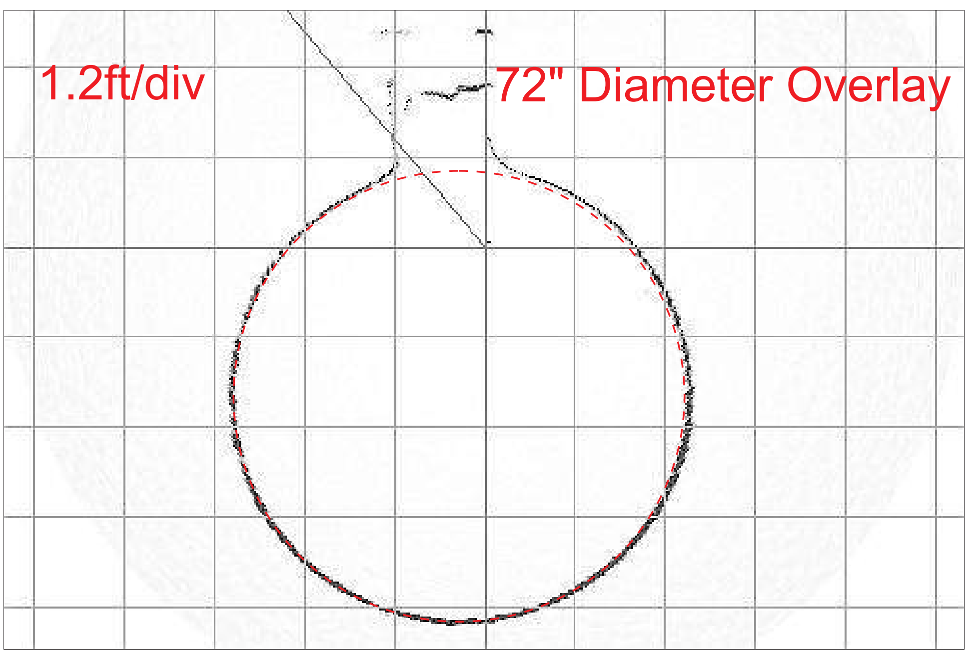


Image 4.2.3-8: Sonar Profile of manhole - 331 feet downstream of Access Point 1.

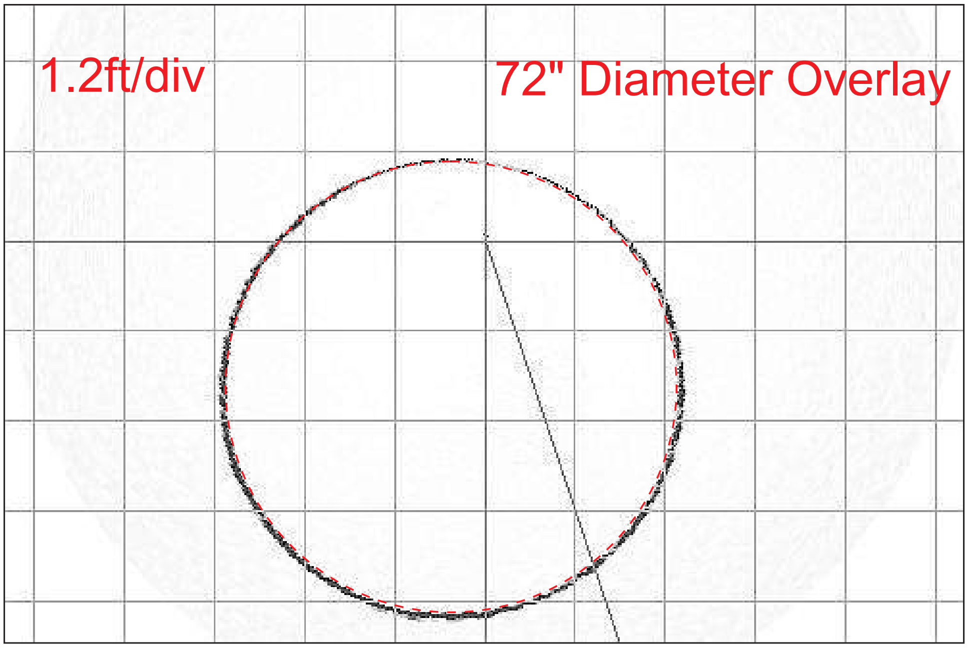


Image 4.2.3-9: Sonar Profile 10 - 334 feet downstream of Access Point 1.

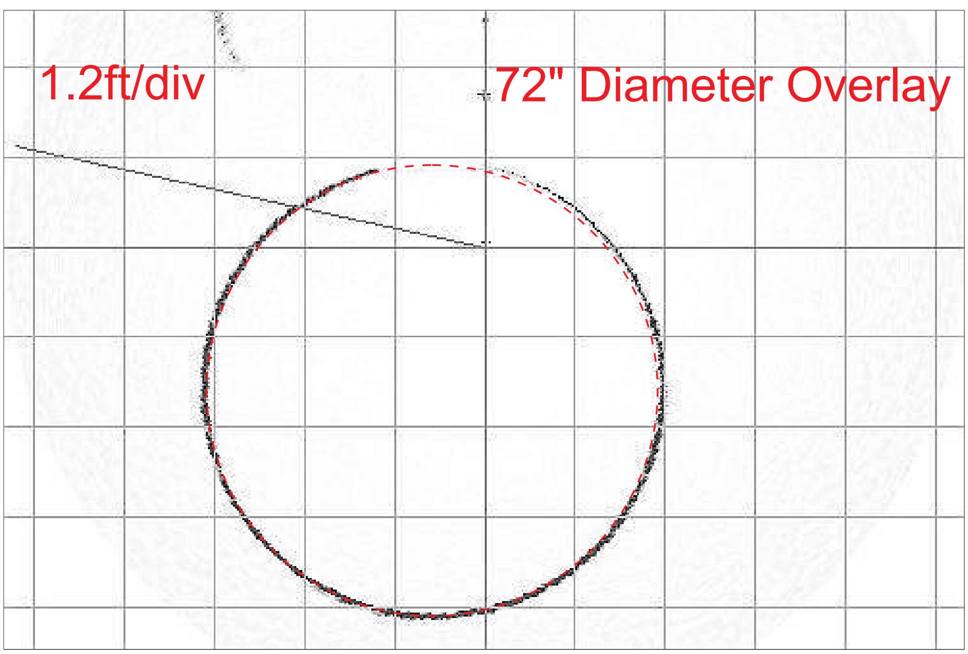


Image 4.2.3-10: Sonar Profile 9 - 384 feet downstream of Access Point 1.

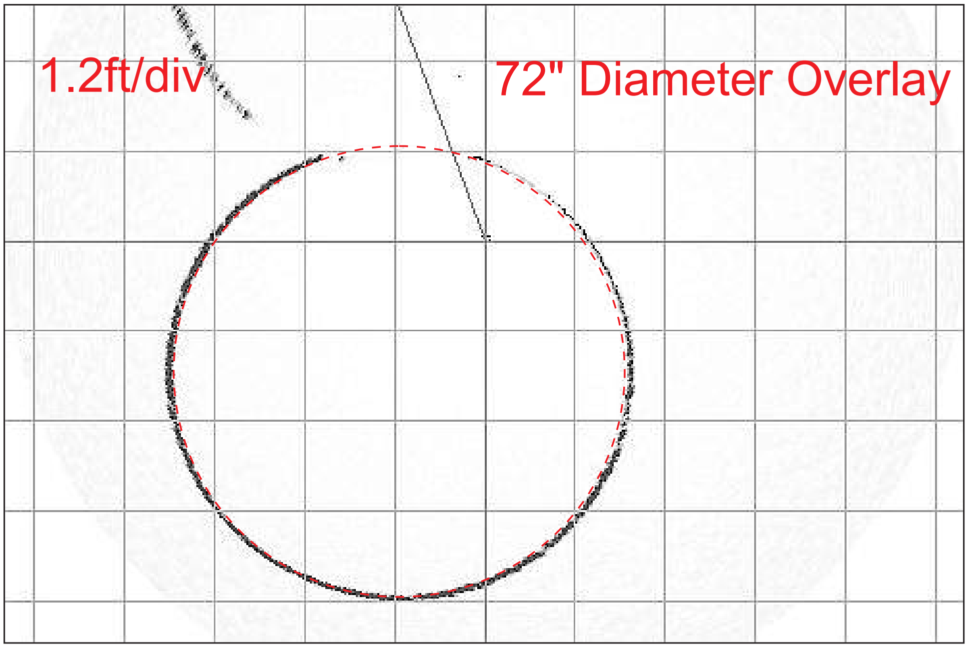


Image 4.2.3-11: Sonar Profile 8 - 437 feet downstream of Access Point 1.

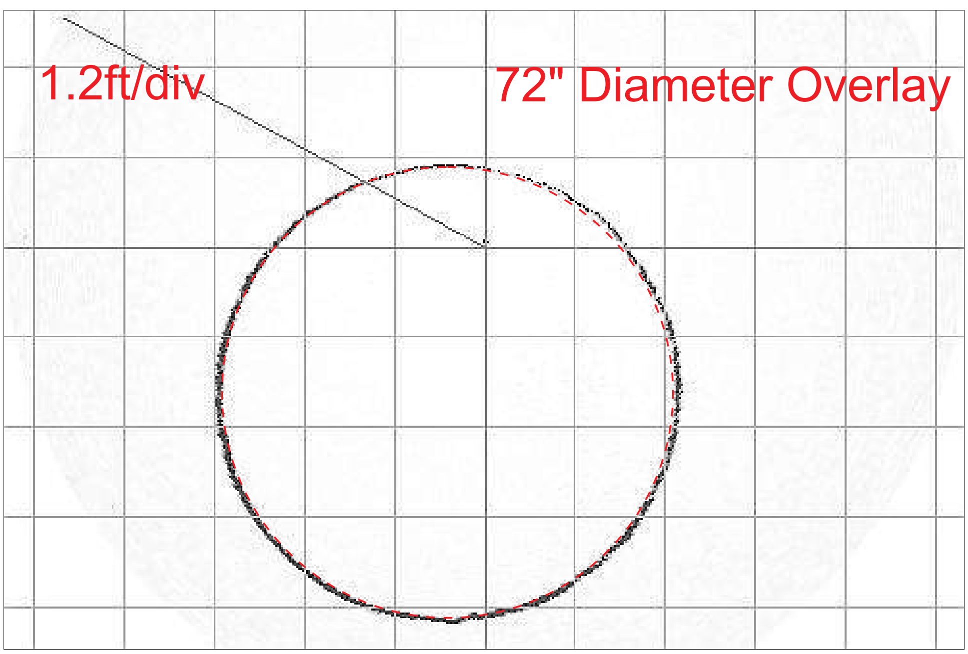


Image 4.2.3-12: Sonar Profile 7 - 484 feet downstream of Access Point 1.

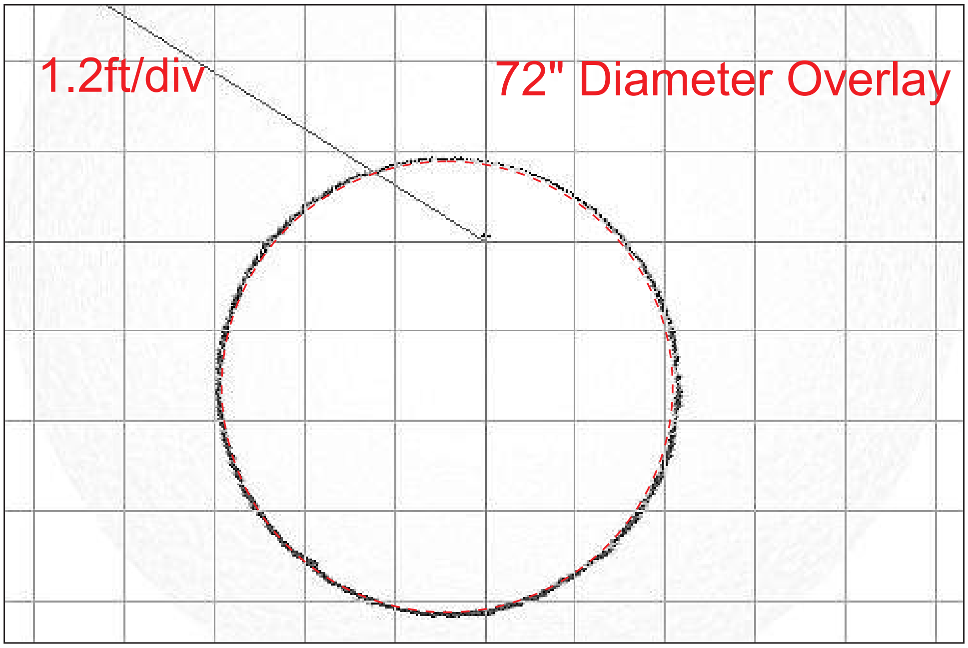


Image 4.2.3-13: Sonar Profile 6 - 535 feet downstream of Access Point 1.

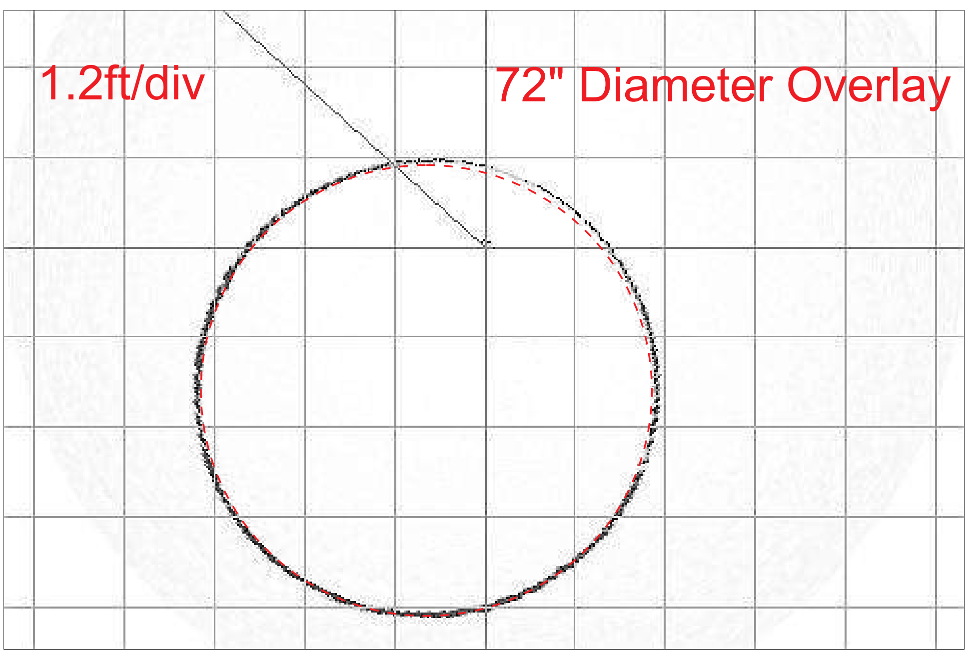


Image 4.2.3-14: Sonar Profile 5 - 584 feet downstream of Access Point 1.

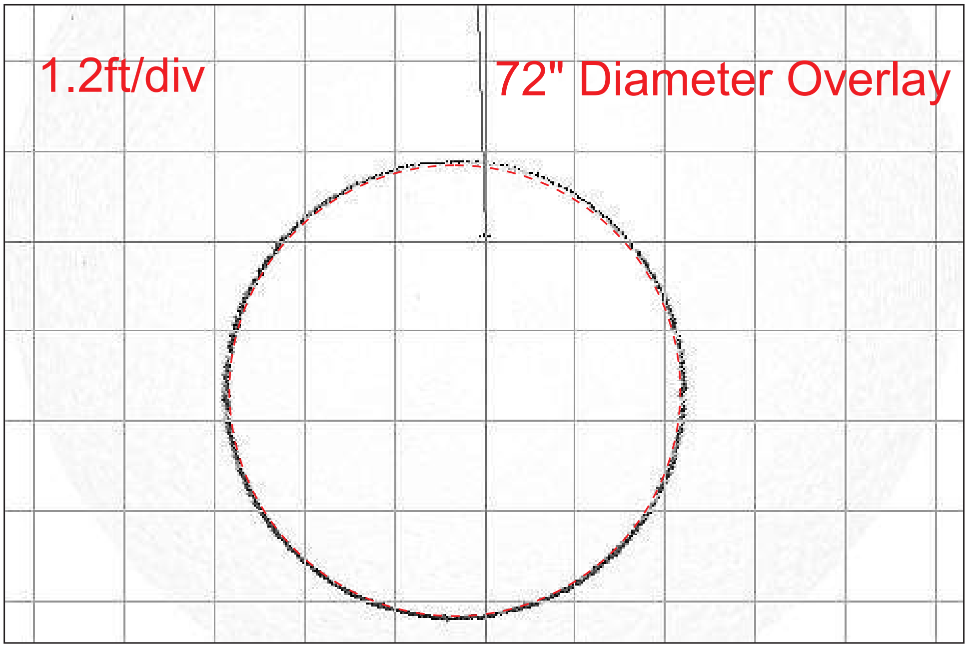


Image 4.2.3-15: Sonar Profile 4 - 634 feet downstream of Access Point 1.

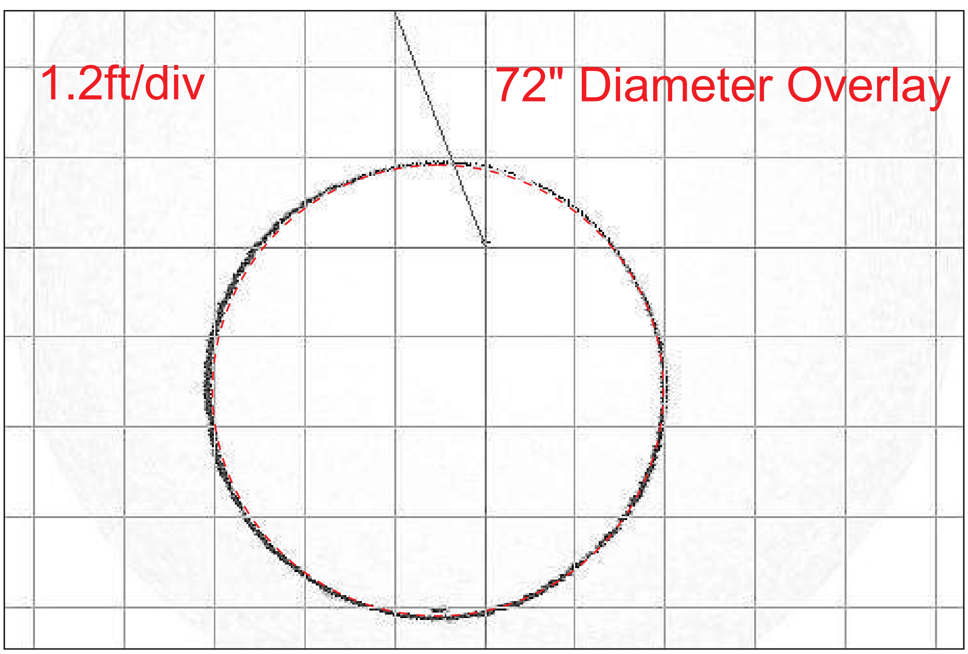


Image 4.2.3-16: Sonar Profile 3 - 684 feet downstream of Access Point 1.

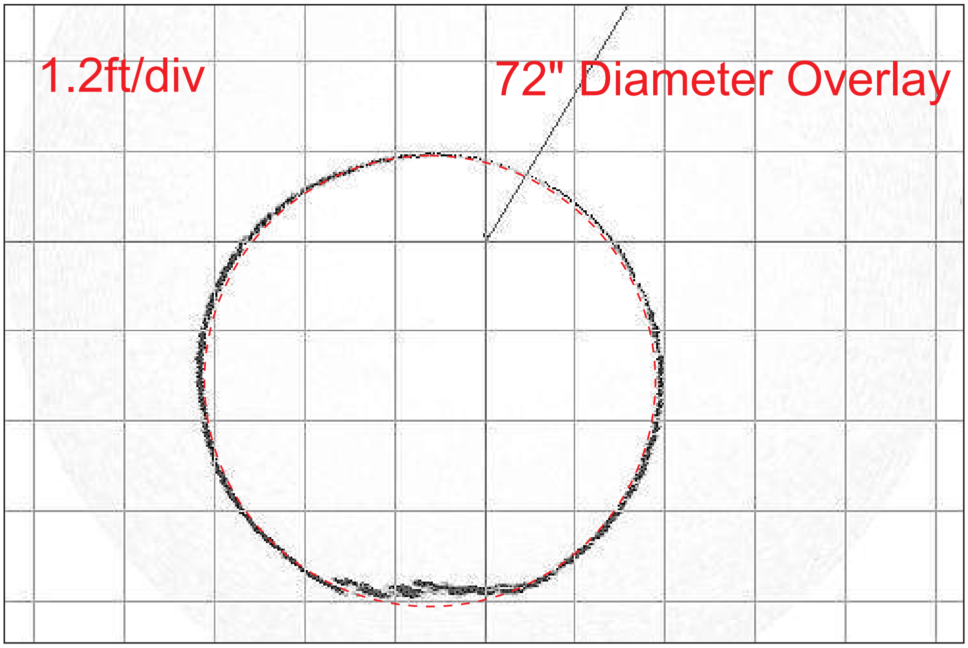


Image 4.2.3-17: Sonar Profile 2 - 736 feet downstream of Access Point 1.

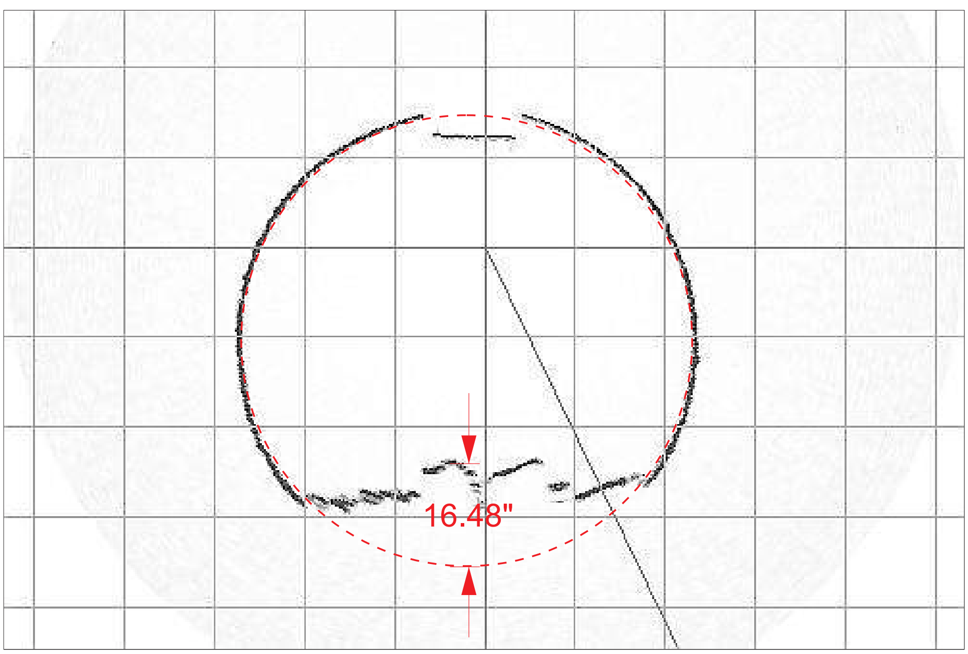


Image 4.2.3-18: Sonar Profile 1 - 786 feet downstream of Access Point 1.

Appendix 5:

Media

Additional Media Available Upon Request

CDM Smith

Appendix F

WWTP Audit Memorandum

CDM Smith

West Side WWTP

CDM Smith

DRAFT Technical Memorandum

Project: *Bridgeport, Connecticut Wastewater Treatment Plant Facilities Planning*

From: *Alexandra Greenfield, PE*

Date: *September 14, 2020*

Subject: *West Side Wastewater Treatment Plant Process Audit*

Purpose

It is our understanding that the WPCA is a party to a Wastewater Treatment System Service Agreement ("Agreement") with its operator, Inframark ("Operator"). Pursuant to that agreement, the WPCA is permitted to inspect, sample and test the system to determine if the Operator is operating the WWTP in compliance with the requirements of the agreement, including meeting all applicable technical requirements. This memorandum will serve to memorialize our findings with respect to the operations at the WWTP.

This memorandum compares operational data from the Bridgeport Water Pollution Control Authority (WPCA)'s West Side Wastewater Treatment Plant (WWTP) for two time periods: 2013-2015 and 2017-2019. Influent flow and loading conditions coupled with process observations are used to examine and compare plant performance during each of these time periods to identify operational strategies in play and those that may promote better process performance in comparison to operational strategies that may inhibit process performance.

Executive Summary

Conclusions

There are issues with the current data that call into question whether the West Side WWTP is operating in full compliance with the Agreement between the WPCA and its Operator. These issues include:

- Gaps throughout the datasets for each time period require this analysis to incorporate numerous assumptions regarding plant operation including;
    - Sidestream and septage flow rates and characteristic data,
    - Where sidestreams were directed, e.g. upstream of headworks vs. to primary effluent channel
    - RAS solids concentrations

- WAS pumping rates and solids concentrations
- When the plant was operating in step feed mode
- VSS data

- Reliability of the given data is in question
    - Daily grab samples of Dissolved Oxygen (DO) and mixed liquor suspended solids (MLSS) concentrations may not be representative.
    - Internal Recycle (IR) flow rates are reported as percentages of forward flow, but flowrates change daily and pumps are not adjusted based on influent flowrates.
    - Solids mass balance across the plant cannot be reconciled.
- The plant was not originally designed to achieve total nitrogen removal. Plant modifications to achieve nitrogen level converted 25% of the existing aeration tanks into anoxic zones to promote denitrification (remove nitrate). This decreased aeration volume has negatively impacted the plant's ability to fully nitrify (remove ammonia) through the winter months.
- Influent flow across the two data sets was fairly consistent, however influent cBOD was slightly higher in the recent data set while TSS And TKN were significantly lower in the recent data set. Higher cBOD:TKN ratios favor denitrification (nitrate removal) performance.
- Effluent TN has degraded overtime from 5.2 mg/L in 2013-2015 to 8.0 mg/L in 2017-2019.
- Septage receipt has increased in recent years.
- Significant change in sludge management practices since November 2018 has had a detrimental effect on plant operations (sidestreams from gravity thickeners).
- When the gravity thickener overflow was introduced upstream of the influent Parshall Flume, the WWTP did not adjust flow when reporting effluent total nitrogen to CT DEEP. This mis-reporting could have cost the WPCA $31,000 in 2018 and $261,000 (estimated) in 2019 of purchased nitrogen credits.
- The plant is operating with a high aerobic SRT throughout the year, similar to aerobic digestion conditions in the secondary process, which promote the growth of nuisance filamentous bacteria that can cause foaming and scum accumulation. Nitrifiers may preferentially accumulate in foam and scum which can impact nitrification performance particularly during colder periods. It is likely that this long SRT is maintained to reduce sludge production.

- Sludge Volume Index (SVI), used to describe the settle characteristics of secondary sludge, has significantly degraded in recent years, making the over-loaded secondary clarifiers susceptible to washout.
- Effluent TSS has degraded overtime which has contributed to effluent total nitrogen loads.

Recommendations

- CDM Smith operations specialist should visit the WWTP and meet with plant operators to understand standard operating procedures.
- Increase sampling of septage. Increasing septage loading can contribute to the higher primary effluent loads that are stressing the secondary process.
- Review with CDM Smith operations specialists DO and MLSS sampling procedures and locations. An improved protocol should be developed after this meeting.
- Regular microscopic analysis of biomass should be implemented to first characterize the existing biomass and then use microscopic analyses to undertand how the population reacts to changing conditions.
- The new rotary drum thickener (RDT) should be brought online as soon as possible to increase solids capture and remove captured solids from the system.
- Scum should be regularly removed from the tanks to avoid recycling the scum throughout the system.
- Wasting practices should be better understood and monitored. Flowmeters should be installed on RAS and WAS lines.
- Review, and modify as necessary, procedures for step feed operation (e.g. turn off IR pump when in step feed mode).
- Assess DO return in internal recycle and make modifications if excessive.
- Concurrent collection systems modeling, not covered within this memorandum, have theorized that potentially 2 mgd of seawater is flowing into the collection system through malfunctioning tide gates at high tide. This sea water is contributing salinity to the wastewater which may be negatively impacting the plant's sludge settleability and could be stressing the biomass' health at fluctuating salinity levels.

Introduction

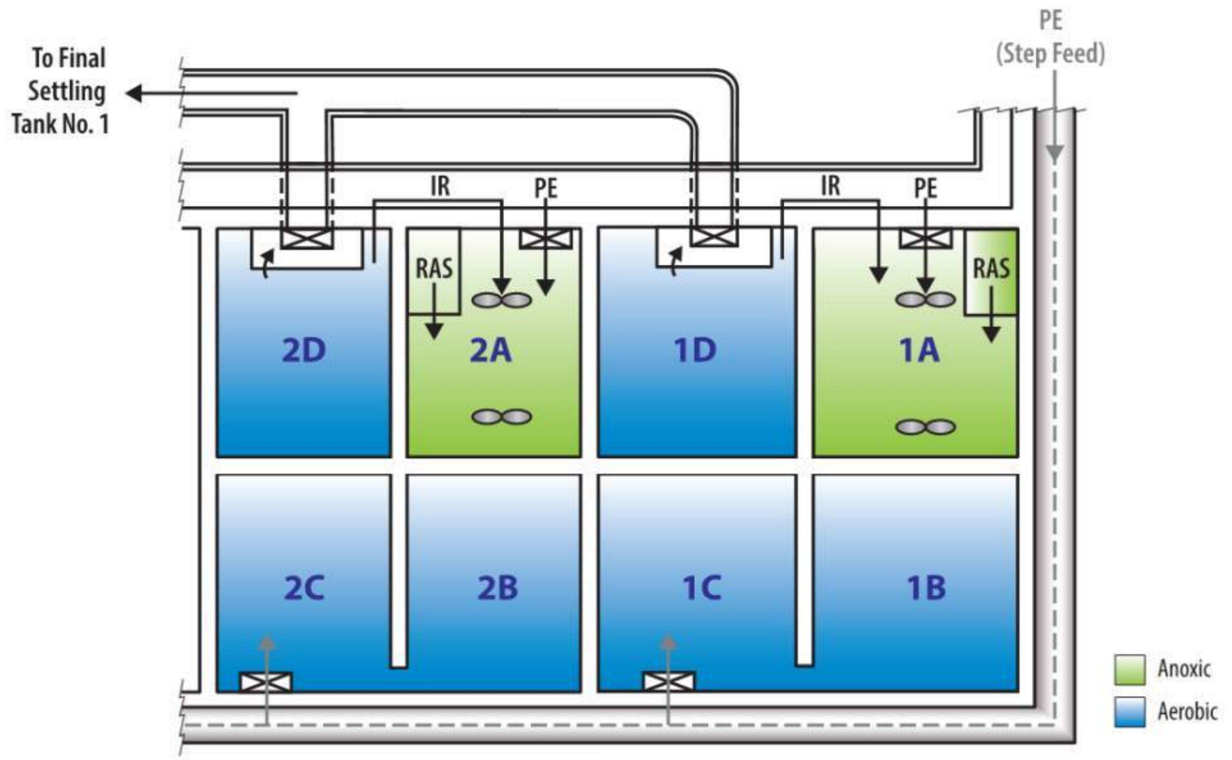
Bridgeport WPCA owns two wastewater treatment plants (WWTPs): the West Side WWTP and the East Side WWTP in Bridgeport, CT. Each plant is currently operated by Inframark, under contract. This memorandum presents the evaluation of the West Site WWTP.

The original activated sludge process was designed to treat an average daily flow of 30 mgd and a maximum daily flow of 58 mgd to achieve conventional secondary treatment standards. A secondary treatment bypass exists to direct influent flow in excess of 58 mgd from the primary effluent channel directly to the chlorine contact tanks. The secondary process is currently operated as three individual treatment trains, each consisting of two bioreactors and one secondary clarifier. Each treatment train has a dedicated Return Activated Sludge (RAS) pumping systems from its designated secondary clarifier, and waste activated sludge (WAS) is removed from each train separately. Each bioreactor is divided into four, evenly sized compartmentalized cells referred to as zones "A" through "D". Fine bubble diffused aeration was incorporated in the early 1990's.

The bioreactors were again modified in 2002 to operate in a Modified Ludzack-Ettinger (MLE) process configuration to achieve some level of nitrogen removal. Zone A was converted to an anoxic zone for denitrification with mechanical mixing and internal recycle pumping to pump return nitrate from the end of the aerobic zone to the anoxic zone as shown in **Figure 1**. Each bioreactor is comprised of a one-stage anoxic zone (A), followed by a three-stage aerobic zone (B, C, and D). The six bioreactors have a total volume of approximately 6 MG (one MG per bioreactor). Each anoxic zone has two submersible mechanical mixers. Internal recycle pumps are designed to provide a recycle up to three times the average design flow.

The bioreactors and influent channels are configured such that it is possible to operate it step feed mode for wet weather management by introducing a portion of the primary effluent to Zone B, C, or D. When the WWTF flow exceeds 30 mgd, the plant is operated in step-feed mode by directing 50% of the primary effluent to Zone C, as shown in **Figure 1.**

Figure 1. Schematic of the WPCA's Existing MLE Process: Bioreactors No. 1 and No. 2



The WPCA notes that there has been deteriorating effluent performance at the West Side Plant compared to previous years. The WPCA used to receive monetized nitrogen credits through the CT DEEP Nitrogen Credit Trading Program, whereas now the WPCA must purchase credits to offset increased effluent nitrogen loading.

The purpose of this memorandum is two-fold. The first purpose is to discuss the differences between two datasets:

- **2013-2015:** Three years of data when the plant was performing well and complying with effluent nitrogen permit limits. The plant achieved an average effluent total nitrogen of 5.2 mg/L.
- **2017-2019:** Three years of data when the performance of the plant declined and was exceeding effluent nitrogen loading limits. The plant achieved an average effluent total nitrogen of 8.0 mg/L.

The second purpose of this memorandum is to make recommendations for process improvements to the West Side WWTP.

NPDES Permit and General Permit for Nitrogen Discharges

The West Side WWTP is regulated by NPDES permit #CT0100056 issued by the Connecticut Department of Energy and Environmental Protection (CT DEEP). The permit authorizes the discharge of effluent from the West Side WWTP to Cedar Creek which flows to the Long Island Sound.

In addition to the WWTP's NPDES permit, the plant has an annual nitrogen discharge limit established by the General Permit for Nitrogen Discharges, issued by CT DEEP. This permit establishes the WWTP's limit at 1,041 pounds per day of Total Nitrogen (TN) on an annual average basis. Note that the General Permit had a phased implementation therefore, limit for 2013 was 1,065 lbs/day TN before being lowered to the 2014 limit where it has remained.

Figure 2 shows the effluent nitrogen discharged from the West Side WWTP in comparison to its permit from 2013-2019. **Table 1** presents the monetized results of the annual effluent total nitrogen discharges.

Figure 2. Effluent Total Nitrogen Discharges at the West Side WWTP

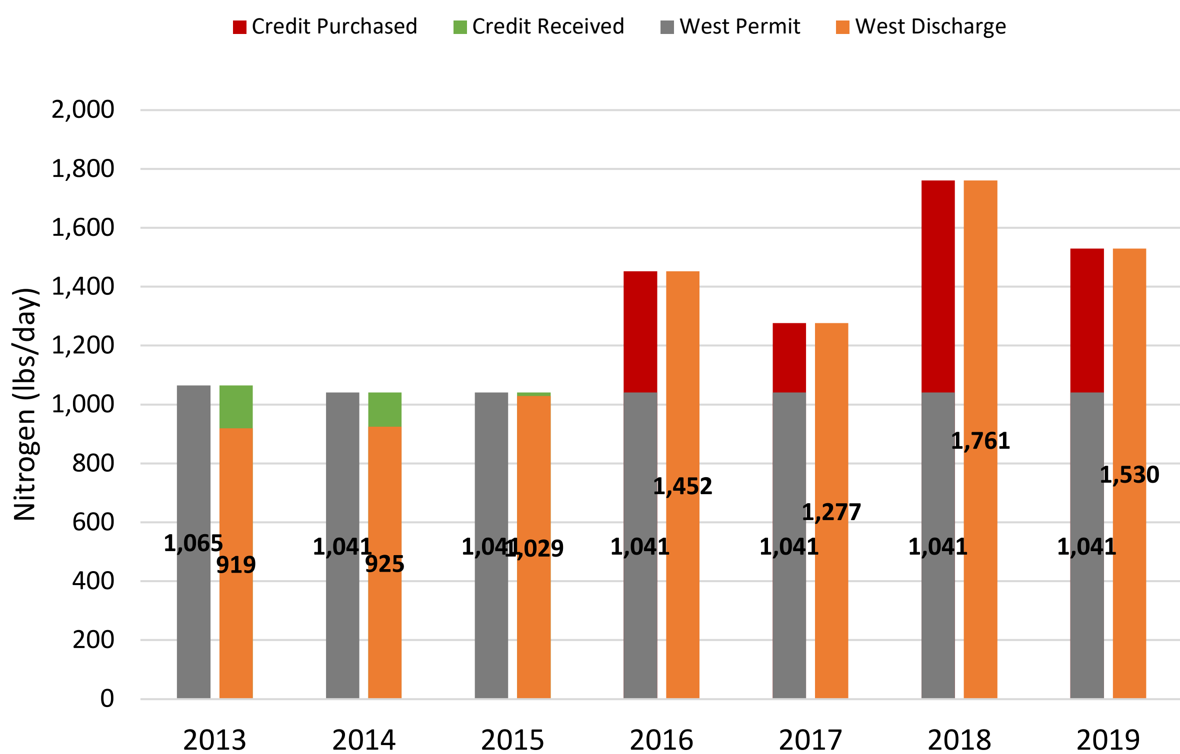


Figure 2 illustrates that the WWTP was achieving its effluent discharge limit in from 2013-2015 and was able to sell credits. Since 2016, however, the WWTP has consistently exceeded this effluent TN limit. The WWTP exceeded the effluent limit of 1,041 lbs/day by more than 700 lbs in 2018 which required the WPCA to purchase over $1.5 million in nitrogen credits as shown in **Table 1**.

Table 1. Monetized Effluent Total Nitrogen Discharges at West Side WWTP

Reporting Year	Purchased/Received Credit $ (rounded)
2013	Received Credit of $254,100
2014	Received Credit of $232,800
2015	Received Credit of $26,580
2016	Purchased $856,700 of Credits
2017	Purchased $484,000 of Credits
2018	Purchased $1,579,000 of Credits
2019*	Purchased $1,072,000 of Credits*

***Note: 2019 selling and purchased credit value not yet established. Cost based on 2018 credit value.**

Influent Flow and Loading Conditions

Flow Data

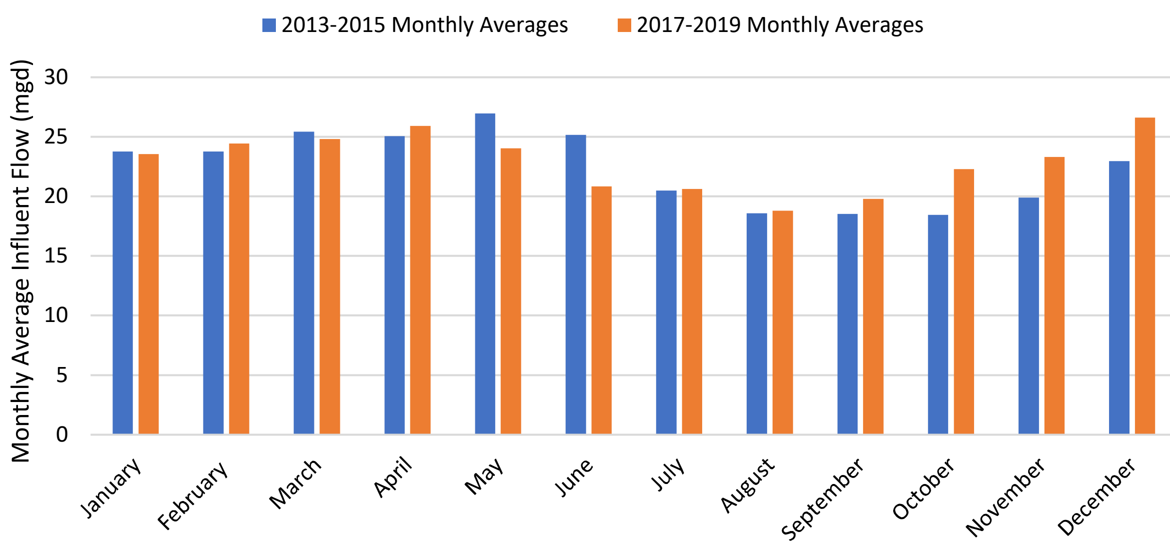
The WPCA records daily influent flow measurements utilizing a Parshall Flume located upstream of the Primary Clarifiers, as shown on the Process Flow Diagram included as **Appendix A**. This flow measurement includes sidestreams (gravity thickener overflow) during certain periods of the data set. Other flow data includes RAS pumping rates (expressed as percentages of forward flow) and IR pumping rates (expressed as percentages of pump speed and percentages of forward flow). When influent flow exceeds the secondary treatment capacity and is bypassed this flow is also measured using a Parshall flume in the bypass channel.

The average influent flow for each of the datasets were:

- **2013-2015:** 22.4 mgd
- **2017-2019:** 22.1 mgd

Figure 3 presents the monthly average influent flow calculated from each of the three-year datasets for comparison.

Figure 3. Monthly Average Influent Flow: 2013-2015



The influent flow to the West Side WWTP was not significantly different between the two datasets. The average daily influent flow of 22 mgd to the WWTP remained unchanged throughout the two datasets. Note that the data was skewed upward from November 2018 through the end of 2019 because, due to the safety issues in the sludge processing building. The WWTP staff re-routed the gravity thickener overflow to the headworks (upstream of the Parshall Flume) rather than pumping it to the primary effluent channel (downstream of the flow meter). It is estimated that the gravity thickener overflow represents approximately 1.8 mgd.

Septage Receiving

The West Side Plant has historically accepted septage throughout the week. Daily gallons of received septage are reported on monthly operating reports (MORs). Septage flows are included in the influent flow measurement but are not captured by the influent sampler. In 2013-2015, the WWTP accepted septage approximately 4 days per week, whereas in 2017-2019, the WWTP accepted septage closer to 6 days per week. The weighted average septage received in the 2013-2015 dataset was 35,000 gpd which is about 15% less than the weighted average septage received in 2017-2019; 40,200 gpd. The WWTP only recently began monitoring septage quality by taking a pH measurement. More comprehensive septage quality monitoring should be conducted, as toxic or highly concentrated loads can negatively impact process performance, particularly at a BNR WWTP.

Analytical Data

CDM Smith received the following analytical data:

- Influent samples from a composite sampler located at the influent junction box to the WWTP reported three days per week that include: 5-day biochemical oxygen demand (BOD5, or carbonaceous BOD, cBOD), total suspended solids (TSS), total nitrogen (TN), Total Kjeldahl Nitrogen (TKN), ammonia, nitrate, pH, and temperature.

- Primary effluent samples from a composite sampler located downstream of the primary settling tanks in the primary effluent channel that include: cBOD, TSS, TKN, ammonia, nitrate, pH, alkalinity.
- Daily effluent samples from a composite sampler located downstream of the chlorine contact tanks that include: cBOD, TSS, TN, TKN, ammonia, nitrate, pH, alkalinity, temperature, fecal coliform and E. coli.
- Daily measurements of high and low dissolved oxygen (DO) within anoxic zones and aeration basins.

There was no available data for influent volatile suspended solids (VSS).

Table 2 presents the average raw influent concentrations of cBOD, TSS, and TKN for the two datasets.

Table 2. Raw Influent Concentrations: 2013-2015 vs. 2017-2019

Parameter	2013-2015	2017-2019
cBOD	129 mg/L	140 mg/L
TSS	263 mg/L	211 mg/L
TKN	38 mg/L	24 mg/L

cBOD concentrations were about 10 mg/L lower in 2013-2015 compared to 2017-2019 data. However, both TSS and TKN concentration were higher in 2013-2015 compared to 2017-2019.

There is no analytical data available for received septage other than the pH value. Because septage is received downstream from the influent composite sampler, the septage load is not captured by the influent sampler. To account for any load contributed by septage received, typical parameter concentrations consistent with TR-16 were used to establish daily cBOD, TSS, and TKN loads from septage:

- 6,500 mg/L cBOD,
- 12,900 mg/L TSS, and
- 590 mg/L TKN.

The septage loads were added to raw influent loads to establish primary influent loads. **Figures 4, Figure 5,** and **Figure 6** presents monthly average primary influent loads for cBOD, TSS, and TKN for the 2013-2015 dataset and the 2017-2019 dataset.

Figure 4. Monthly Average Influent cBOD Load: 2013-2015 vs. 2017-2019

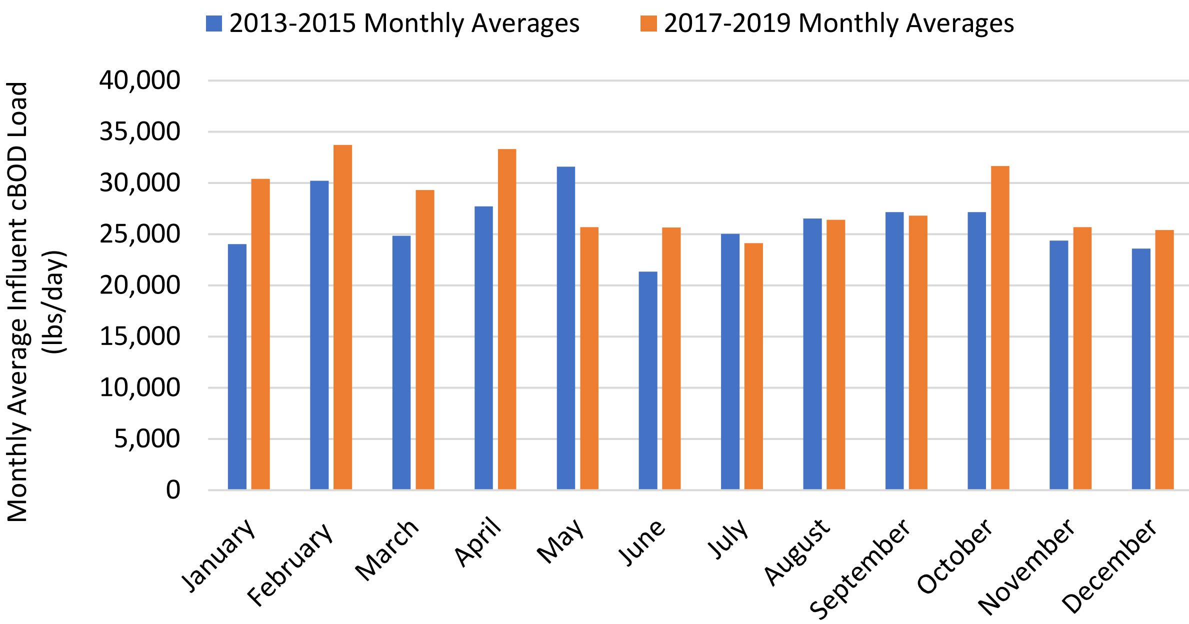


Figure 5. Monthly Average Influent TSS Load: 2013-2015 vs. 2017-2019

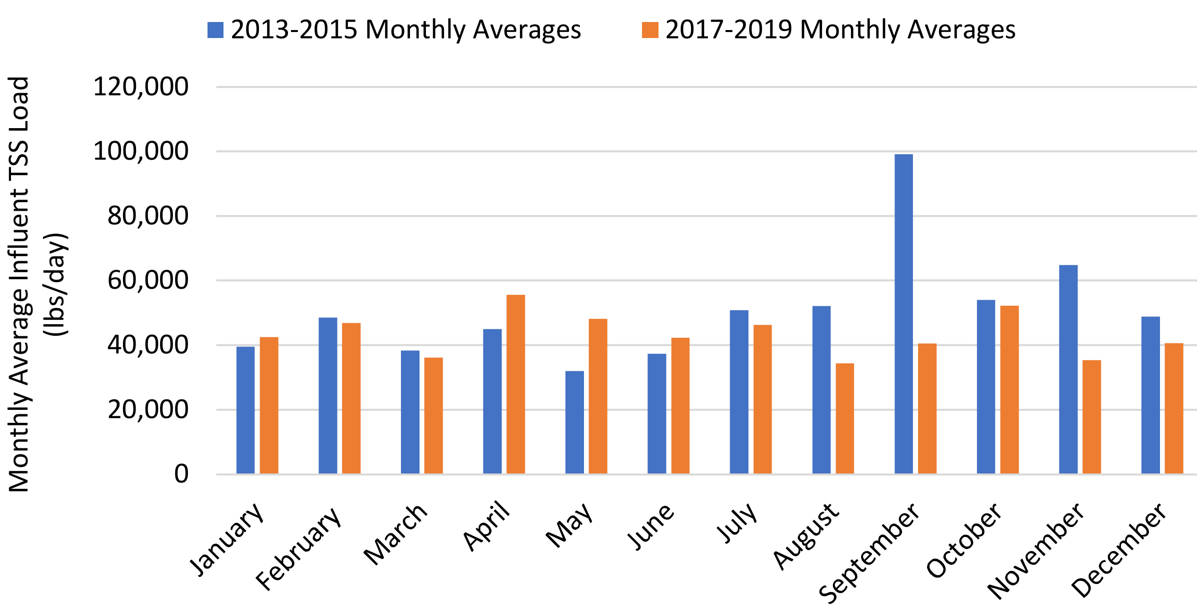
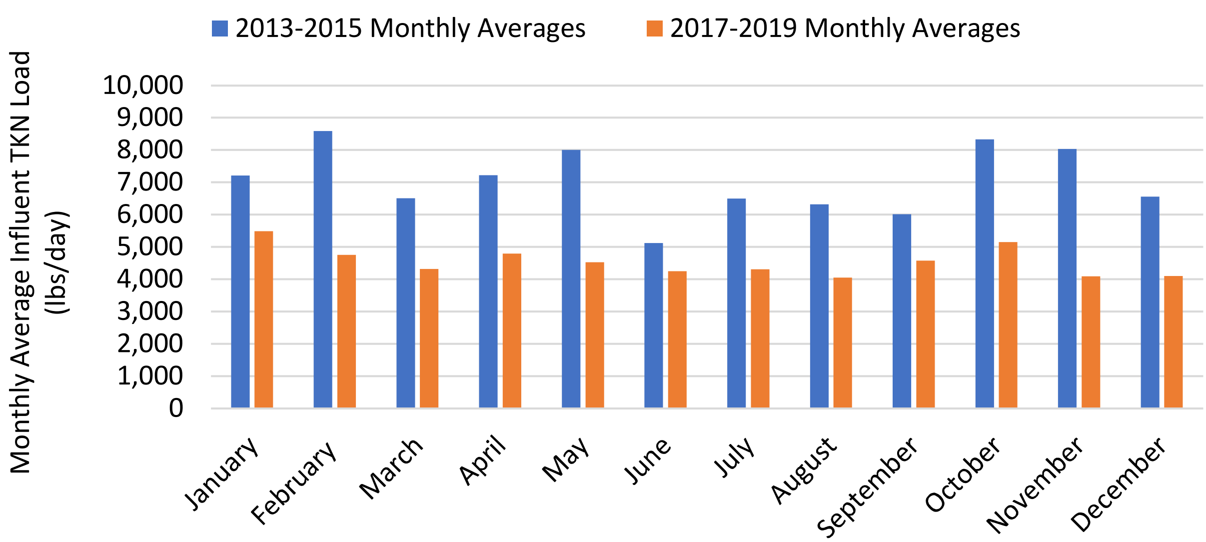


Figure 6. Monthly Average Influent TKN Load: 2013-2015 vs. 2017-2019



Primary influent cBOD loads were slightly higher in 2017-2019 compared to 2013-2015 (about 8 percent greater, or 2,000 lbs/day).

Primary influent TSS loads were higher in the 2013-2015 dataset compared to 2015-2017, by about 17%. There was a very high influent TSS loading condition that occurred September of 2015. The average raw influent TSS concentration for the month was 1,000 mg/L TSS, despite this high influent TSS loading condition, the plant managed to achieve effluent TSS concentrations below 5 mg/L.

As shown in **Table 2**, the dramatic difference in influent TKN concentration impacted primary influent TKN loading substantially. 2017-2019 TKN loads were significantly lower (62% lower) than the 2013-2015 data. The higher cBOD:TKN ratio for 2017-2019 is more favorable for dentification performance compared to the 2013-2015 ratio. This more favorable cBOD:TKN ratio should have promoted conditions for improved overall BNR performance (improved denitrification performance).

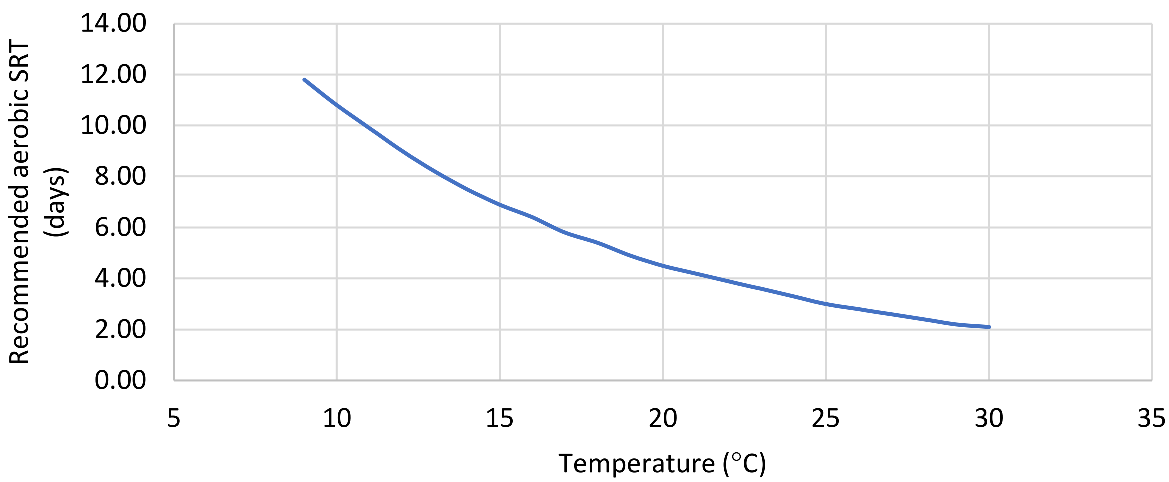
Operational Parameters

During each time period, the WWTP utilized the same tankage and the majority of equipment. There were changes in solids management operations that will be discussed in latter sections of this memorandum. The change in effluent performance is either attributed to influent flows and loading characteristics, primary clarifier performance, operational parameters, or potentially a unique combination of the three.

Aerobic SRT and Nitrification

For nitrification to occur, the aerobic SRT must be greater than the growth rate of the nitrifying organisms. Nitrification is adversely impacted by low temperatures and requires a relatively long SRT to maintain nitrification at winter temperatures; conversely, nitrification can be maintained with a relatively short SRT at higher temperatures. The recommended SRT is 2.5x the washout SRT to include a factor of safety against washout. The recommended SRT shown in **Figure 7** includes this safety factor.

Figure 7. Recommended aerobic SRT as a Function of Temperature



With all size aeration tanks in service, aerobic SRT, in days, can be calculated using the following formula:

$$SRT = \frac{Total\ Mass\ of\ Solids\ in\ the\ Aerobic\ Cells}{Total\ Mass\ of\ Suspended\ Solids\ leaving\ the\ System}$$
$$= \frac{\sum V_{Aer} * X_T * 8.34}{Q_{EFF} * X_{EFF} * 8.34 + Q_{WAS} * X_{WAS} * 8.34}$$

Where:

V_{AER} = Aerobic Basin volume, 4.92 MG

X_T = Oxic Cell MLSS, mg/l

Q_{EFF} = Final Effluent flow, MGD

X_{EFF} = Secondary Clarifier effluent TSS, mg/l

$Q_{WAS} * X_{WAS} * 8.34$ = WAS, pounds

A comparison of the calculated average aerobic SRT's for the two datasets are shown in **Table 3.**

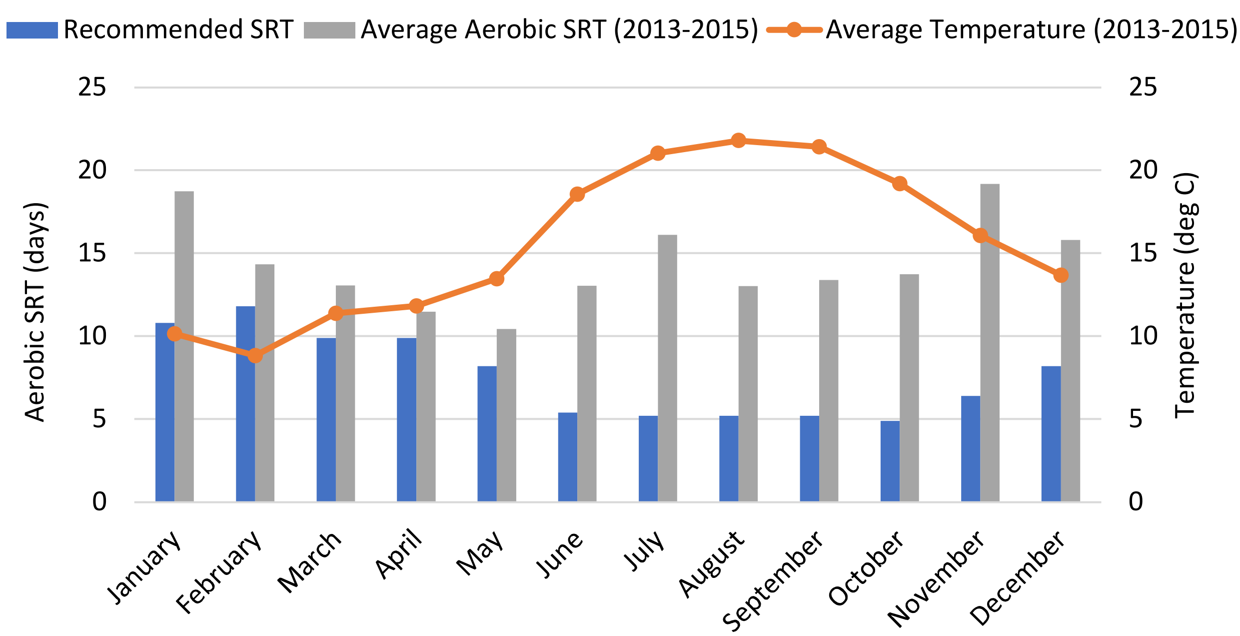
Table 3. Average Calculated Aerobic SRT

Parameter	2013-2015	2017-2019
Average Aerobic SRT	14.1 days	15.0 days

It should be noted that without VSS characterization data available, the calculated aerobic SRT values assume that the MLSS measurements from each bioreactor represent the active biomass.

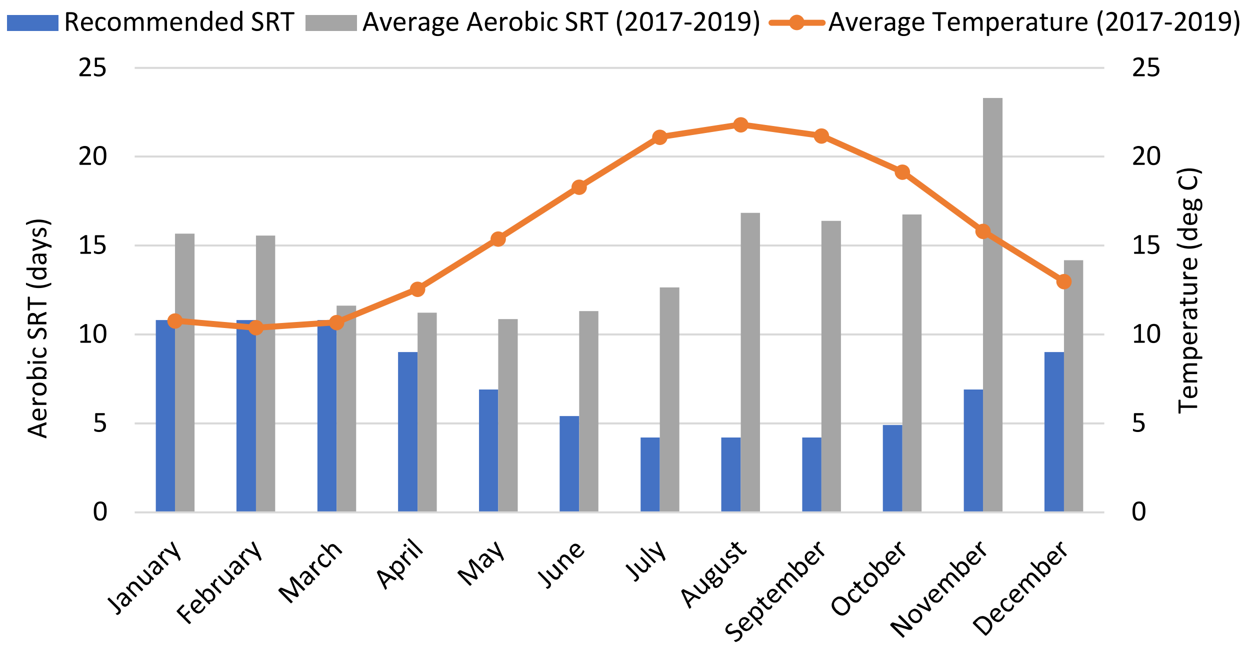
Wastewater temperatures fluctuate throughout the year, particularly in New England. Monthly average wastewater temperatures ranged from 8.3 degrees C to 22.4 degrees C in the 2013-2015 data set and ranged from 9.4 to 22.4 degrees C in the 2017-2019 dataset. It becomes difficult to maintain nitrification when temperatures fall below 10 degrees C, which is why it is critical to maintain a long enough SRT to avoid wasting or washing out the slow growing nitrifiers from the system. If nitrification is lost in the winter months it typically cannot be re-established until the temperatures rise. **Figure 8** and **Figure 9** present the average monthly temperature over each of the three-year datasets along with the recommended SRT and the average monthly SRT maintained at the WWTP.

Figure 8. 2013 to 2015: Monthly Average Temperatures and Recommended Aerobic SRTs vs. Average Aerobic SRT



The WWTP consistently maintained an adequate SRT to maintain nitrification throughout winter months. The average SRT over the course of the 3-year dataset was 14.1 days, which is consistent with an SRT for conventional activated sludge processes (3-15 days).

Figure 9. 2017-2019: Monthly Average Temperatures and Recommended Aerobic SRT vs. Average Aerobic SRT



The WWTP consistently operated at a long enough aerobic SRT to maintain nitrification. It is uncommon to maintain a longer SRT in warm summer months compared to cold winter months. The WWTP does not have a WAS pumping system. The WWTP wastes by or opening a valve on the on the discharge of the RAS pumps. The ability to provide an accurately measured WAS flow is one of the most important features in activated sludge plant design. Currently, the facility does not have WAS flow meter capabilities. It is critical to provide good flow metering conditions and an accessible, representative sample location on the WAS pump discharge line due to the importance of the WAS calculation in the determination of SRT.

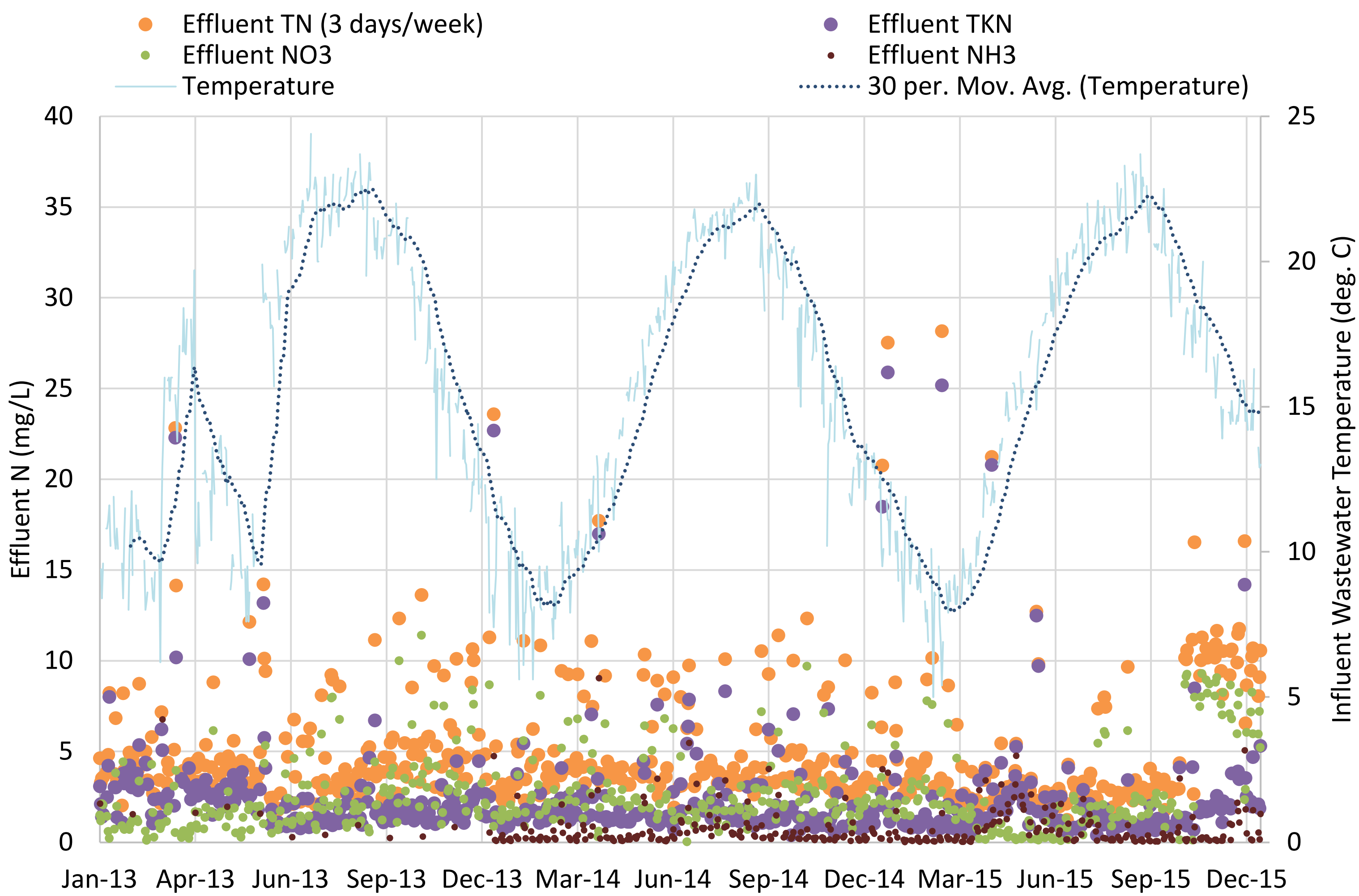
The average SRT over the 2017-2019 timeframe was determined to be 15 days, which is considered a long SRT. One benefit of operating at a long SRT is decreased solids production. However, long SRTs require significantly greater bioreactor volumes and/or clarifier capacity. Additionally, long SRT's favor predomination of nuisance foaming organisms. Based on various site visits and discussions with operators, the West Side WWTP has suffered from excessive foaming and scum accumulation. Excessive foaming can remove slow-growing nitrifiers from the active MLSS in solution. This can be a big issue for nitrification at lower temperatures, as the nitrifier population can be preferentially removed from the active biomass and into the floating foam.

Existing scum removal provisions circulate secondary scum to the head of the plant instead of removing the scum, with exacerbates foaming and scum problems. Skimmed/collected scum should be permanently removed from the treatment train. **Figure 10** shows a photo of one the West WWTP's anoxic tanks that is covered with floating foam and scum.

Figure 10. Floating Scum in West Side WWTP's BNR Basins

Figure 11 and **Figure 12** show the resultant effluent nitrogen and temperatures for each dataset.

Figure 11. 2013-2015: Effluent Nitrogen Species and Temperature



Note: 2013 effluent ammonia (NH_3) represent monthly averages.

Figure 12. 2017-2019: Effluent Nitrogen Species and Temperature

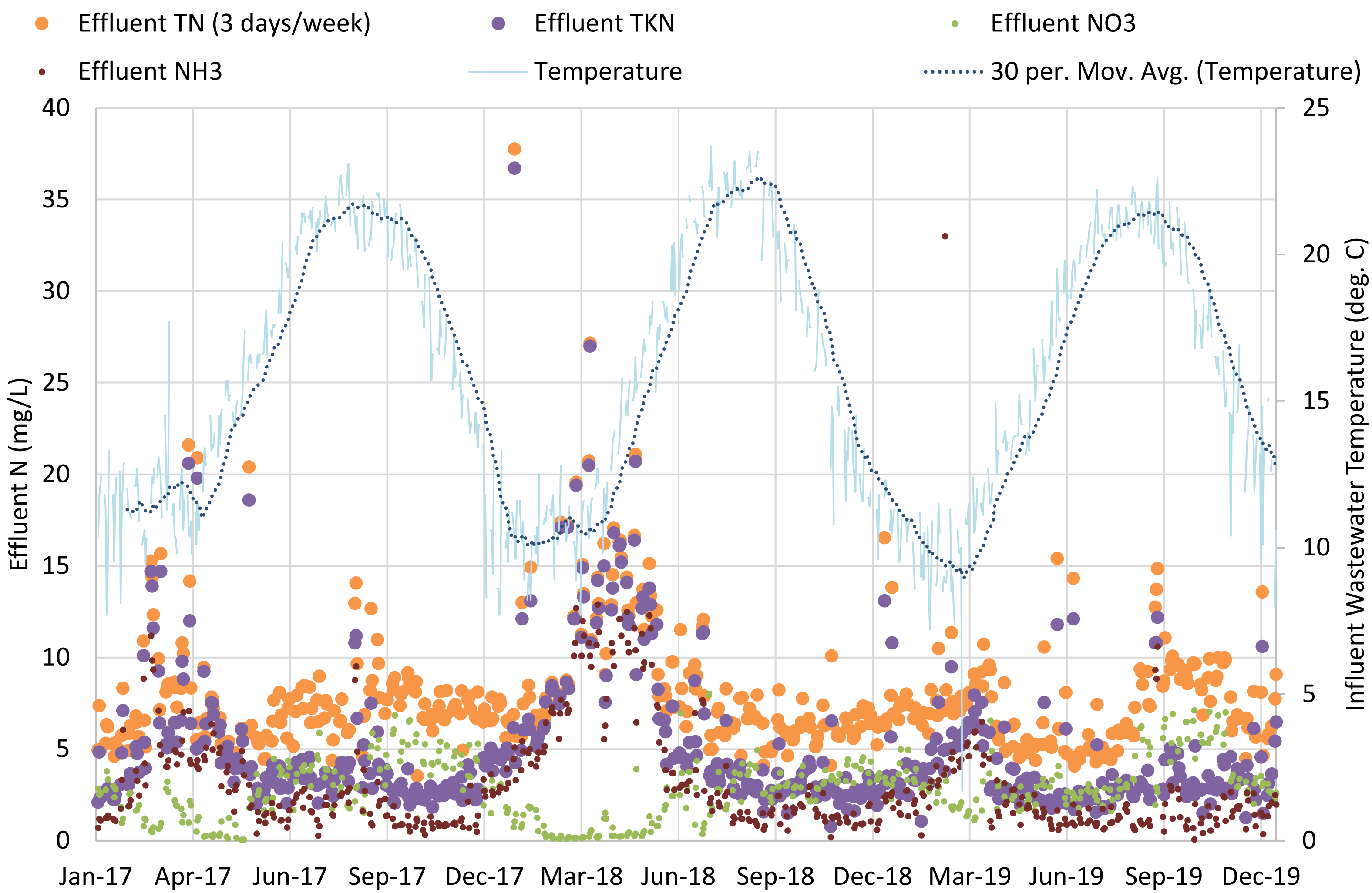
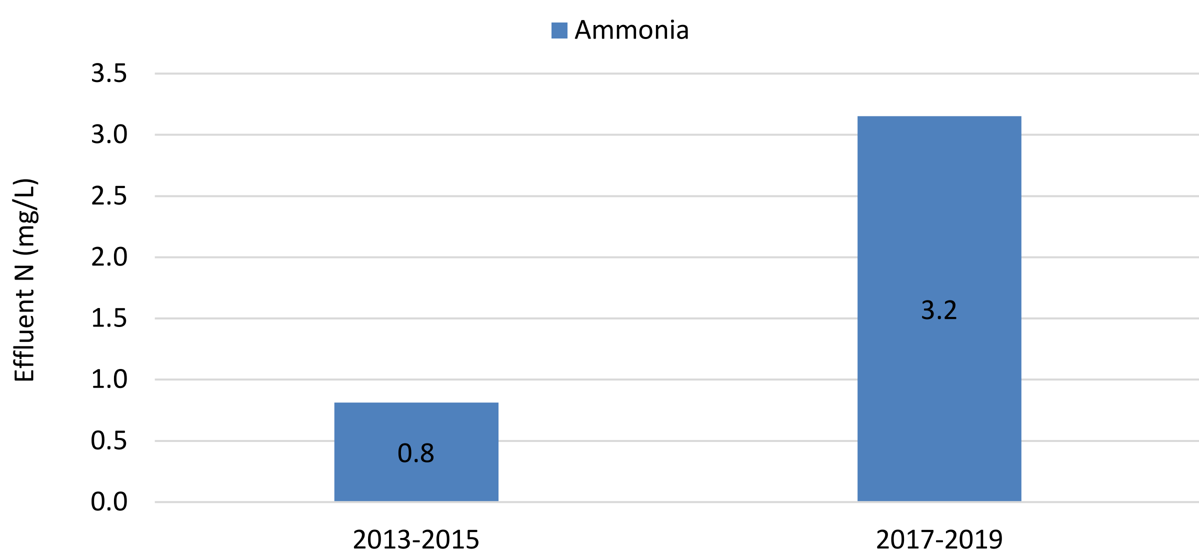


Figure 11 shows that the secondary system was generally able to maintain nitrification through the cold winter and early spring months. There was a short-term loss of nitrification in April and May of 2015, with effluent ammonia concentrations reaching a maximum of 5 mg/L. The WWTP was able to recover nitrification fairly readily, particularly compared to the severe losses of nitrification that occurred in 2017 and 2018 shown in **Figure 12**. During these process upsets, effluent ammonia concentrations exceeded 10 mg/L for more than two months. Based on the operating data, the WWTP appeared to maintain adequate SRT throughout the 36-month data set from 2017-2019, so nitrification loss is unlikely to be attributed to insufficient SRT alone.

Effluent NH_3

Figure 13 presents the average effluent ammonia concentrations for the two datasets. The average effluent ammonia concentration of the 2013-2015 dataset was 0.8 mg/L which is consistent with a well nitrifying system. The chronic loss of nitrification during colder winter/early spring temperatures in 2017-2019 results in a high average effluent ammonia concentration of 3.2 mg/L.

Figure 13. Average Effluent Ammonia: 2013-2015 vs. 2017-2019



Net Yield

Average net yield values were calculated for each of the three-year datasets using the Pitter and Chudoba (1990) equation as a function of SRT and primary effluent TSS/BOD ratios. The average calculated net yields are presented in **Table 4** along with typical net yields for low rate, nitrifying activated sludge processes.

Table 4. Average Calculated Net Yield Values

Parameter	2013-2015	2017-2019
Primary Effluent TSS/BOD	1.3	2.2
Average Net Yield	0.95 lbs TSS/lbs BOD removed	1.2 lbs TSS/lbs BOD removed
Typical Net Yield for Low rate, nitrifying (SRT > 7 days) with primary settling tanks	*0.5-0.8 lbs TSS/lbs BOD removed*	
Typical Net Yield for Low rate, nitrifying (SRT > 7 days) without primary settling tanks	*0.7-1.0 lbs TSS/lbs BOD removed*	

Primary effluent TSS:cBOD ratios are consistently very high. Consequentially, calculated net yield values for each dataset are also high. These calculated net yield values are more like the reported typical net yield for a low rate, nitrifying activated sludge process *without* primary settling tanks than the typical net yield for a plant *with* primary settling tanks. This finding agrees with historic influent and primary effluent data. The existing primary settling tanks are undersized for a WWTP of the West Plant's size from both a solids loading and hydraulic loading perspective.

Primary Effluent and Sidestream Loads

Historically, gravity thickener (GT) overflow was pumped to the primary effluent channel, where the load would be captured by the primary effluent composite sampler. The gravity belt thickener (GBT) filtrate was discharged to the headworks building prior to the screens, but was not included in the influent sampler. In November of 2018, the solids handling building where the GBT was located was condemned and the GBT was then removed from service. Coincidentally, around this time, the pump that had been used to pump the GT overflow to the primary effluent channel fell into disrepair. Without the pump in service, the GT overflow was directed (by gravity) upstream of the influent screen in the Screen Building.

This GT overflow is currently pumped with the influent flow and captured in the influent flow measurement from the Parshall Flume. The raw influent composite sampler is located upstream of the Screen Building, therefore; the load associated with the GT overflow is not included in the samples collected. Since November of 2018, the added GT overflow (approximately 1.8 mgd) has been included in the Monthly Operating Reports submitted to CT DEEP, and used to report discharged TN. Based on MOR data, it is estimated that this excess flow is responsible for approximately 87 lbs/day of excess effluent TN equating to $31,000 in nitrogen credit purchasing for 2018. The MORs in 2019 estimate that the excess flow contributed 119 lbs/day of effluent nitrogen which will likely contribute to the WPCA needing to purchase $261,000 (estimated) of nitrogen credits.

With very little data available to characterize the sidestreams (GT overflow and GBT filtrate, alike), it is difficult to isolate contributing loads from the solids processing activities. To account for sidestream loads, an approximate flow of 1.8 mgd has been applied to primary effluent concentrations before November 2018. **Table 5** compares influent and primary effluent loads, along with removal efficiencies across the primary settling tanks for the two datasets.

Table 5. Influent, Primary Effluent, and Across Removal Efficiencies

Parameter	2013-2015	2017-2019
cBOD		
Raw Influent Load, lbs/day	24,200	25,400
Septage Load, lbs/day	1,900	2,700
Primary Influent (Raw Influent + Septage), lbs/day	26,100	28,100
Primary Effluent, lbs/day	25,900	31,900
TSS		
Raw Influent Load, lbs/day	47,600	37,900
Septage Load, lbs/day	3,700	5,400
Primary Influent (Raw Influent + Septage), lbs/day	51,300	43,300
Primary Effluent, lbs/day	34,200	71,200
TKN		
Raw Influent (Raw Influent + Septage), lbs/day	6,900	4,300
Septage Load, lbs/day	400	200
Primary Influent (Raw Influent + Septage), lbs/day	7,300	4,500
Primary Effluent ,lbs/day	5,200	4,500
Primary Removal Efficiencies		
cBOD	1%	-14%
TSS	33%	-64%
TKN	29%	0%

The 2013-2015 dataset shows that the primary settling tanks were achieving removal of cBOD, TSS, and TKN. The loss of primary settling tank performance observed in the 2017-2019 is quite dramatic, with calculated "negative" percent removals across the primary settling tanks. With lack of sidestream characterization data, it is difficult to quantify what loads, particularly solids loads, are being recirculated through the plant and negatively impacting performance.

It is possible that a large portion of these excessive effluent solids in primary effluent are inert solids, and are not part of the active biomass fraction (MLVSS/MLSS). If this is the case, the calculated SRT values that indicate the plant should be able to maintain nitrification through winter months, are deceptively high.

Solids Inventory and Settleability

Solids flux analyses is a tool used to define critically loaded conditions for secondary clarifiers based on solids loading, hydraulic loading, mixed liquor suspended solids (MLSS) concentrations, and settleability (sludge volume index, SVI). For each of the datasets, the secondary system's capacity (or peak hour flow) of 58 mgd dictates the maximum allowable MLSS to be maintained within the secondary process.

SVI is typically measured from each aeration tank daily. A conservative (98th percentile) SVI of 100 mL/g was used to establish the maximum allowable MLSS concentration within the secondary process for the 2013-2015 data. The 2017-2019 98th percentile SVI value significantly changed since the older dataset, and increased to 180 mL/g. This higher SVI of 180 mL/g is more representative of aeration tanks that do not utilize selectors. This dramatic loss of sludge settleability suggests that the microorganisms are under stressed conditions. The pre-anoxic selector zones are discussed in more detail in a later section.

This increase in SVI resulted in lower secondary clarifier capacity for the 2017-2019 dataset, compared to the 2013-2015 dataset. **Table 6** presents the data used to determine maximum allowable MLSS concentrations for the two datasets.

Table 6. Solids Flux Analyses Parameters

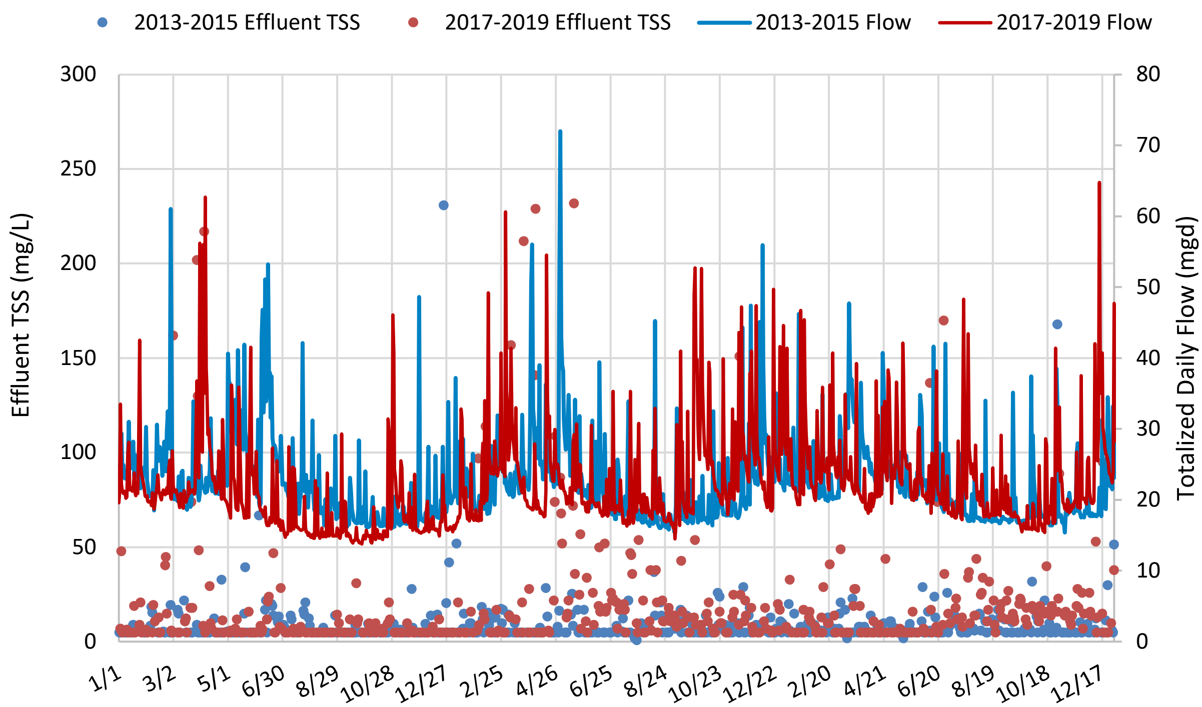
Parameter	2013-2015	2017-2019
Total Clarifier Surface Area (3)	48,750 ft^2	48,750 ft^2
98th Percentile SVI	100 mL/g	180 mL/g
Peak Hour Flow	58 mgd	58 mgd
Maximum Allowable MLSS	3,600 mg/L	2,600 mg/L
Actual Average MLSS	5,300 mg/L	4,400 mg/L

The maximum allowable MLSS for the 2017-2019 data was 2,600 mg/L, 1,000 mg/L less than the maximum allowable MLSS for the 2013-2015. This would significantly lower the secondary system's ability to perform biological nutrient removal. Both data sets show that the plant has continually operated at much higher MLSS concentrations (5,300 mg/L and 4,400 mg/L for the 2013-2015 and 2017-2019 datasets respectively) than the capacity of the secondary clarifiers presumably to maximize nitrogen removal. Operating at such high MLSS concentrations leaves the WWTP susceptible to solids washout. 3,600 mg/L is less than the 5th percentile of the MLSS concentrations reported within the 2013-2015 data set. 2,600 mg/L represents the 5th percentile of MLSS concentrations reported within the 2017-2019 dataset, meaning that the clarifiers were solids overloaded throughout each time period 95% of the time.

The SVI used for this analysis is 180 mL/g, which represents the 98th percentile of the daily average SVI measurements taken from the six aeration tanks in the 2017-2019 dataset. Operators have noted that they began continuously chlorinating their RAS to prevent sludge bulking and growth of filamentous organisms in August of 2019. The continued use of chlorine to RAS on a daily basis is atypical in the industry. Chlorine is typically used as a tool during intermittent periods of increased sludge bulking, but seldom used continuously. It is possible that the chlorine is unintentionally oxidizing active biomass, and the measured MLSS assumed to represent the active biomass, is falsely high.

Figure 14 shows effluent TSS and flows for the two datasets.

Figure 14. Effluent TSS and Totalized Daily Flow



The WWTP experienced very high effluent TSS concentrations throughout the 2017-2019 dataset, particularly in comparison to the 2013-2015 database. **Figure 14** does not include the TSS excursions that exceed 300 mg/L effluent TSS. **Table 7** presents the number of days with effluent TSS exceeding 50 mg/L (permitted maximum daily effluent TSS) along with excessively high effluent TSS exceeding 100 mg/L for comparison.

Table 7. High Effluent TSS and Flows

Parameter	2013-2015	2017-2019
Total Number of Samples	468	468
Average Effluent TSS	10 mg/L	22 mg/L
Maximum Effluent TSS	327 mg/L	488 mg/L
Days Exceeding 50 mg/L Effluent TSS	7	38
▪ Average Totalized Daily Flow	*22.1 mgd*	*27.1 mgd*
▪ Average Maximum Daily Flow	*45.9 mgd*	*44.5 mgd*
Days Exceeding 100 mg/L Effluent TSS	3	18
▪ Average Totalized Daily Flow	*24.4 mgd*	*26.5 mgd*
▪ Average Maximum Daily Flow	*66.7 mgd*	*39.9 mgd*

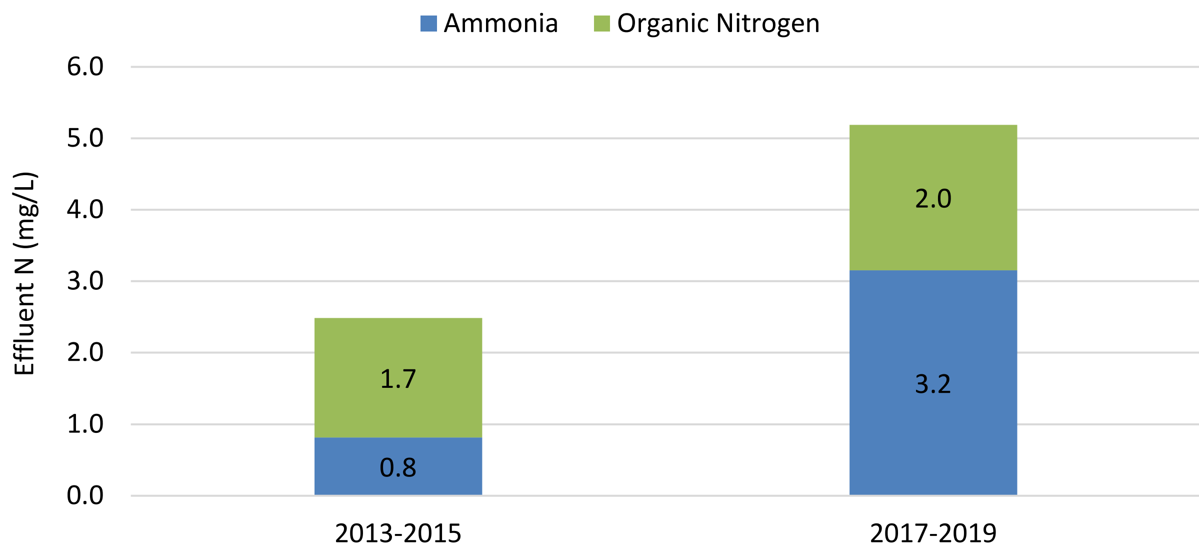
The average effluent TSS from 2013-2015 was 10 mg/L whereas the 2017-2019 average effluent TSS was more than twice as high, calculated to be 22 mg/L. The maximum effluent TSS in the 2017-2019 was nearly 500 mg/L, and daily effluent TSS values exceeded 100 mg/L 18 times. Corresponding totalized daily and maximum flowrates are shown to compare the flowrates at which this high effluent solids events occur, the similar flowrates between the 2013-2015 and 2017-2019 datasets show that the loss of solids in the effluent cannot be attributed to higher flow events.

The difference between the 2013-2015 and 2017-2019 average effluent TN concentration of 12 mg/L contributes to higher effluent organic nitrogen loading. With reasonable assumptions based on CDM Smith's experience at other plants that effluent TN contains particulate organic nitrogen, 70% is volatile, and 8.8% is volatile as nitrogen, this difference in effluent TSS contributed approximately 136 lbs/day of effluent nitrogen loading at an average daily flow of 22.1 mgd. Using the 2018 price for buying nitrogen credits, 136 lbs/day amounts to nearly $300,000/year that could be saved if solids were retained in the system and properly wasted.

Effluent TKN

Figure 15 presents the average effluent TKN concentrations broken out into organic nitrogen and ammonia concentrations (previously presented) for the two datasets. The average effluent organic nitrogen concentration from the 2013-2015 dataset was 1.7 mg/L. Likely due to increased effluent solids, the average effluent organic nitrogen from the 2017 to 2019 dataset was 2.1 mg/L, 0.4 mg/L higher than the previous dataset.

Figure 15. Average Effluent Ammonia and Organic Nitrogen (TKN): 2013-2015 vs. 2017-2019



Pre-Anoxic Reactor

Nitrification can lead to denitrification in the final clarifier sludge blankets which can result in impacted settling and sludge compaction, rising sludge, and increased effluent TSS. For this reason, it is important to have adequate anoxic volume to promote more complete denitrification. Denitrification can offset the increased aeration costs associated with nitrification by providing the denitrification oxygen credit and reduce/eliminate settling problems in the final clarifiers caused by denitrification in the sludge blanket of the final clarifiers.

The primary function of the anoxic zone is to maintain true anoxic conditions (low to no DO and ample soluble cBOD) to promote effective denitrification of the high nitrate internal recycle flow. A secondary function of the anoxic zone is filamentous organism control. This control may be achieved through the reduction of the soluble cBOD that is used in denitrification which reduces the F/M in the downstream aerobic bioreactors and in turn reduces driving forces for filamentous organisms that can cause settling and/or foaming issues.

The nitrogen removal and effluent nitrate-N concentration that can be achieved by a single anoxic system (MLE) is limited by practical limits to mixed liquor recycle (MLR, RAS + IR) flow. Theoretically, the higher the MLR flow, the lower the effluent nitrate-N, but in practice, it has been observed that MLR ratios above 4:1 may be impractical due to high pumping costs, hydraulics, and excessive DO loading to the anoxic reactor. The average RAS flowrate for 2013-2015 was reported as 51% of forward flow. Internal Recycle pumping rate was reported as 41 Hz. It is assumed that this pump speeds correlates to 60 Hz being the highest available IR rate at 300% forward flow. With an average daily flow for this time period of 22.4 mgd, this results in a MLR of 2.56 x average daily flow.

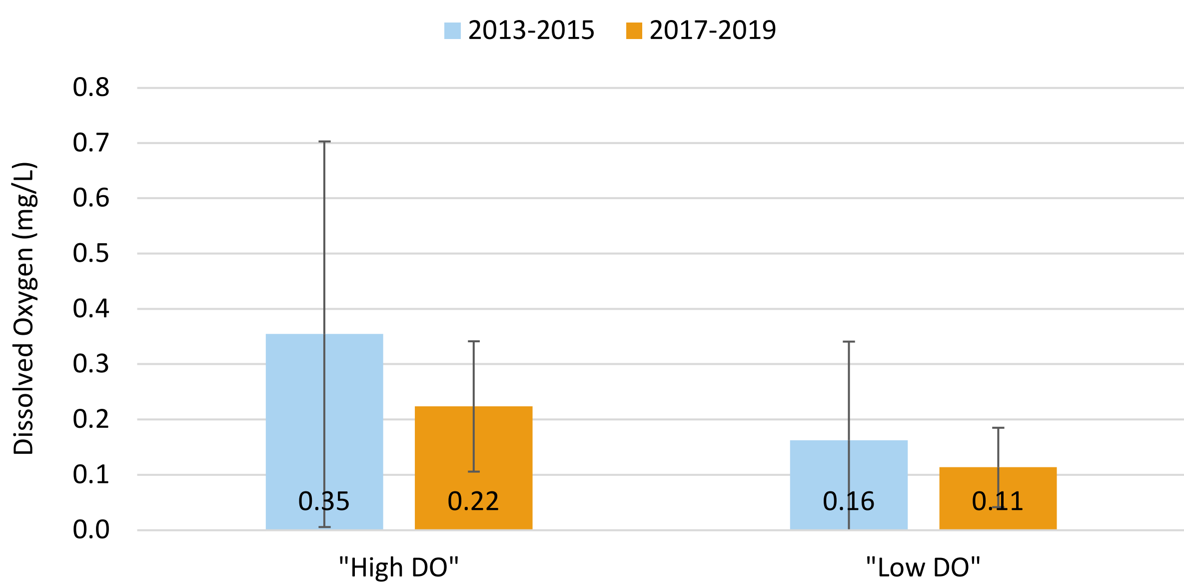
The average RAS flowrate for 2017-2019 was reported as 58% of forward flow. Internal recycle pumping rate was reported as 225% of forward flow. With the average daily flow for this time period of 22.9 mgd, this results in an MLR of 2.83 x average daily flow.

The governing denitrification is based on either the nitrate returned to the pre-anoxic zone via MLR or limited by the biomass' specific denitrification rate (SDNR). The nitrified nitrogen from the system is considered nitrogen available for denitrification when it is recirculated to the pre-anoxic zone. 2013-2015 dataset showed very good nitrification performance, and therefore denitrification was predominantly limited due to the SDNR within the undersized anoxic zone. Conversely, despite the higher MLR carried from 2017-2019 compared to 2013-2015, because the WWTP was not nitrifying year-round, denitrification was predominantly limited based on MLR, as opposed to SDNR.

Anoxic Zone DO

SDNR is impacted by many factors, one of which being DO (either returned from the aerobic zone via IR pumping or entrained oxygen via mixing). As discussed previously, handheld DO probes are used to take DO measurements in each anoxic zone. "High DO" and "Low DO" measurements represent the highest and lowest DO readings from each BNR basin for the day. are reported on MORs. **Figure 16** presents the average "High DO" and "Low DO" in the anoxic zones for each time period. Error bars represent plus and minus one standard deviation.

Figure 16. Average Anoxic Zone "High DO" and "Low DO"



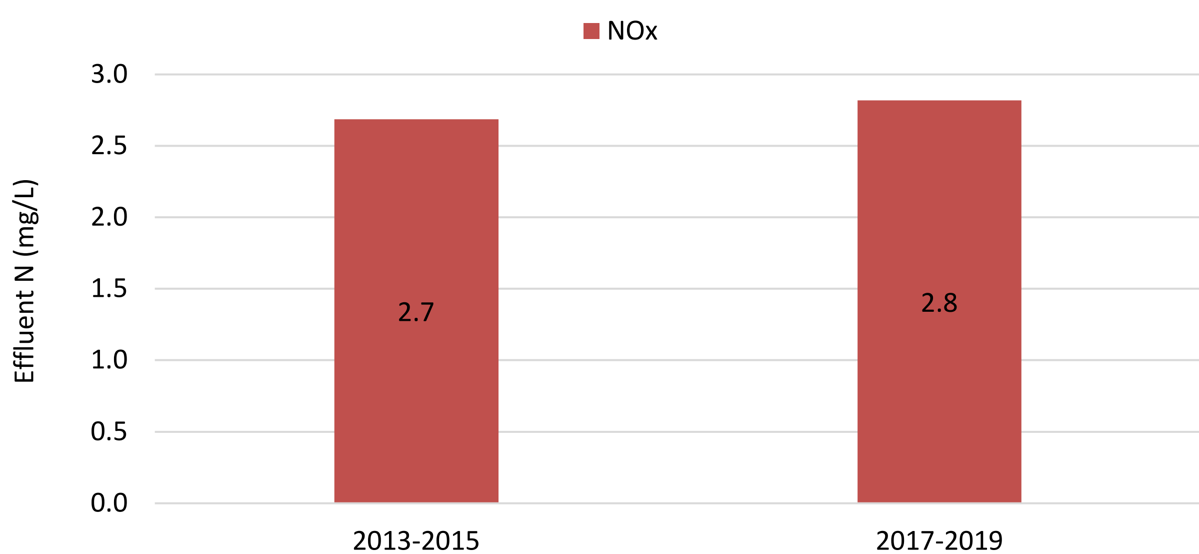
The target DO concentration within anoxic zones is widely understood to be equal to or less than 0.2 mg/L. The average "High DO" reading for the 2013-2015 time period of 0.35 mg/L is greater than the target 0.2 mg/L. The average "High DO" reading for the 2017-2019 time period of 0.22

mg/L is slightly higher than the target 0.2 mg/L. The standard deviations for the 2013-2015 dataset are greater than the standard deviations in the 2017-2019 dataset indicating that the DO within the aerations was better controlled in the 2017-2019 datasets.

Effluent NO_x

Despite the cause of denitrification limitations, the average effluent nitrate concentrations were nearly identical for each of the two datasets. However, because there was better nitrification occurring in 2013-2015 compared to 2017-2019, there was lower nitrate produced, and therefore, less denitrification needed. Based on the higher TKN loading in 2013-2015 coupled with the nitrification performance, denitrification performance was likely better compared to the 2017-2019 period. **Figure 17** shows the effluent NO_x (predominantly nitrate) for the two, time periods. For each dataset, average effluent nitrite was less than 0.1 mg/L, so NO_x shown can be considered nitrate.

Figure 17. Average Effluent NO_x 2013-2015 vs. 2017-2019



Aerobic Volume

Monthly average of each dataset was used to determine required biomass under air for each of the 36 months of data. This method accounts for seasonal variation on cBOD loading and wastewater temperatures. The reported primary effluent removal efficiencies were applied to each month's influent load to determine realistic loads to the secondary system. The biological net yield that was presented in **Table 4** was used.

The aeration volume was determined using monthly cBOD loads and associated wastewater temperatures. Required SRT for nitrification for each month was calculated and a safety factor of 2.5 was applied. Required mass under air was then determined based on the monthly cBOD removed.

In both datasets, the maximum cBOD loading controlled the sizing, rather than the coldest temperature. The second highest maximum cBOD loading was determined to be April for the 2013-2015 dataset which required 268,300 lbs of biomass under air. The second highest maximum cBOD loading was determined to be March for the 2017-2019 dataset which required 363,400 lbs of biomass under air.

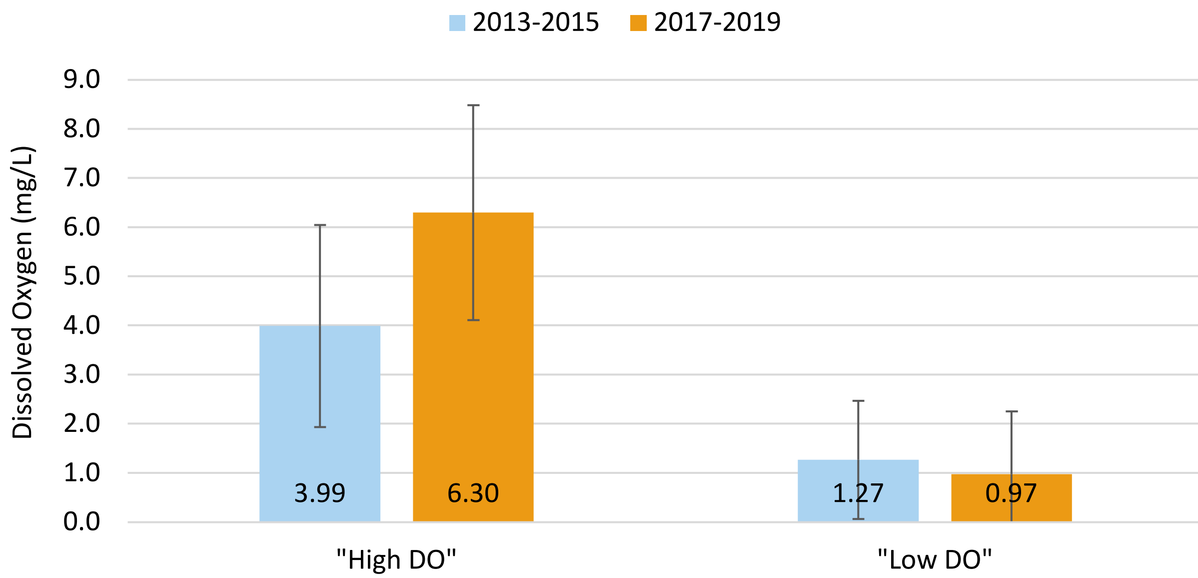
The average operating MLSS concentrations, presented in **Table 6** were used to determine the required aeration tank volume. The 2013-2015 dataset resulted in a required aeration volume of 6.1 MG, which exceeds the existing system's aeration volume of 4.9 MG by 1.2 MG. The 2017-2019 dataset resulted in a greater discrepancy between required aeration volume and existing process volume. The required aeration volume for 2017-2019 data was determined to be 9.9 MG, which is twice the volume of the existing aeration tankage. The increase in cBOD loading coupled with the higher net yield for the 2017-2019 dataset compared to the 2013-2015 dataset resulted in a greater discrepancy between aeration volume requirements.

The WWTP, and the secondary system was initially designed and built for cBOD removal, not biological nitrogen removal. Aerobic SRTs required for cBOD removal are about half of the aerobic SRT required to achieve nitrification. In order to promote nitrogen removal, 25% of the overall aeration volume was converted to anoxic volume, and IR pumps were installed to pump nitrified nitrogen to the anoxic zone. The existing aeration tanks are severely undersized to treat existing primary effluent loads.

Aerobic Zone Dissolved Oxygen

As mentioned previously, operators take DO measurements from each of the BNR basins' aerobic zones with a handheld probe. **Figure 18** presents the average "High DO" which represents the highest DO measurement of each day and the average "Low DO" which represents the lowest DO measurement of each day for the two time periods. Error bars represent plus and minus one standard deviation.

Figure 18. Average "High DO" and "Low DO" within Aeration Zones



Historically for nitrification a minimum design DO concentration of 2 mg/L has been recommended. The "High DO" reading for each time period exceeded the 2 mg/L design DO concentration. The average "High DO" reading for the 2013-2015 time period was lower than the 2017-2019 time period. There is a negative impact of excessive DO in the recycle streams to the anoxic zone. Despite the seemingly higher DO concentrations maintained in the aeration zones in 2017-2019, anoxic zone DO levels presented in **Figure 16** do not seem to show any negative impact via IR pumps.

In addition to unwanted DO entrainment in IR streams being pumped to anoxic zones, there are energy saving opportunities for the WWTP to operate at a lower DO concentrations within the aeration zones. The standard deviations for the 2013-2015 dataset are greater than the standard deviations in the 2017-2019 dataset indicating that the DO within the aeration basins was better controlled in the 2017-2019 dataset.

The average "High DO" was determined to be statistically significantly different than the average "Low DO" in the 2017-2019 dataset but was not found to be statistically significantly different in the 2013-2015 dataset. This significant difference between the DO measurements suggests that there are discrete portions of the aerobic zones that are more anoxic-like environments than true aerobic zones. This difference in DO content within the aerobic basins could allow for both nitrification and denitrification to occur simultaneously (simultaneous nitrification/denitrification, or SND) within the same reactor.

Conclusions

It is generally recognized that for a typical municipal wastewater, a single anoxic reactor configuration, or MLE process configuration, cannot reliably achieve an effluent total nitrogen limit lower than about 7-8 mg/L. The plant was performing exceptionally well from 2013 to 2015. The primary difference between the effluent nitrogen discharged between the two time periods can be primarily attributed to higher effluent ammonia concentrations in the 2017-2019 time period, as shown on **Figure 17.** The difference between the two average ammonia concentrations is greater than 2.4 mg/L. Average effluent NO_x, or nitrate are nearly identical, despite the higher influent TKN load during the 2013-2015 time period compared to the 2017-2019 time period. The better nitrification performance in 2013-2015 coupled with the higher influent TKN loads indicate that denitrification performance was likely better in 2013-2015 as well, compared to 2017-2019. effluent organic nitrogen was found to be 0.3 mg/L higher in the 2017-2019 dataset, compared to 2013-2015 data, also contributing to the higher effluent total nitrogen.

Figure 17. Effluent Nitrogen Species 2013-2015 vs. 2017-2019

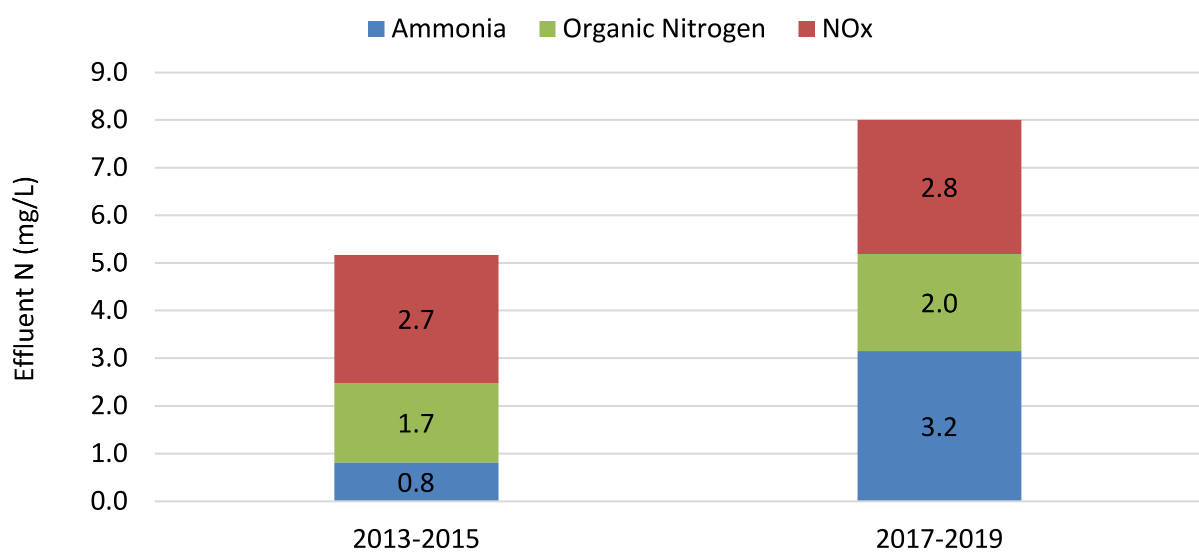


Table 8 presents observations from each time period's dataset and how those observations would have likely impacted the WWTP's performance in comparison to the other time period. Fields that are highlighted in green indicate that the finding is favorable and should have favored performance, fields highlighted in red indicate that the observation is unfavorable with respect to process performance, and yellow indicates a neutral finding that should have no impact on plant performance.

Recommendations

Based on the observations presented in **Table 8**, the list below details some short-term modifications that must be considered to improve process performance within the WWTP's existing tankage.

- CDM Smith operations specialist should visit the WWTP and meet with plant operators to understand standard operating procedures.

- Increase sampling of septage. Increasing septage loading can contribute to the higher primary effluent loads that are stressing the secondary process.
- Review with CDM Smith operations specialists DO and MLSS sampling procedures and locations. An improved protocol should be developed after this meeting.
- Regular microscopic analysis of biomass should be implemented to first characterize the existing biomass and then use microscopic analyses to understand how the population reacts to changing conditions.
- The new rotary drum thickener (RDT) should be brought online as soon as possible to increase solids capture and remove captured solids from the system.
- Scum should be regularly removed from the tanks to avoid recycling the scum throughout the system.
- Wasting practices should be better understood and monitored. Flowmeters should be installed on RAS and WAS lines.
- Review, and modify as necessary, procedures for step feed operation (e.g. turn off IR pump when in step feed mode).
- Assess DO return in internal recycle and make modifications if excessive.
- Concurrent collection systems modeling, not covered within this memorandum, have theorized that potentially 2 mgd of seawater is flowing into the collection system through malfunctioning tide gates at high tide. This sea water is contributing salinity to the wastewater which may be negatively impacting the plant's sludge settleability and could be stressing the biomass' health at fluctuating salinity levels.

Table 8. Audit Observations and Impact on Process Performance: 2013-2015 vs. 2017-2019

Parameter	2013-2015	2017-2019	Description
Influent Flow	22.4 mgd	22.06 mgd	Totalized daily flows were very similar for the two datasets.
Septage Receiving	35,000 gpd	40,200 gpd	Accepting additional septage without characterizing the added load can have a negative impact on process performance.
Influent cBOD Loading	26,000 lbs/day	28,200 lbs/day	Influent cBOD loading was very similar in each dataset. 2017-2019 cBOD loading was about 8% higher than the loading during 2013-2015 which might have favored BNR performance with regard to carbon available for denitrification.
Influent TSS Loading	50,900 lbs/day	43,400 lbs/day	Higher influent TSS loads require increased solids removal to achieve an effluent TSS goal. 2013-2015 influent TSS loading was about 17% greater than 2017-2019 TSS loading.
Influent TKN Loading	7,000 lbs/day	4,500 lbs/day	Higher influent nitrogen loads require added level of treatment to achieve the same effluent goal. 2017-2019 influent TKN loads were about 56% less than 2013-2015 influent TKN loading. The higher cBOD:TKN ratio favors BNR (denitrification).
Aerobic SRT	14.2 days	15 days	Operating SRTs of 15 days and higher favors nuisance filamentous bacteria that can cause problems and contribute to solids loss. It is possible than an objective of current operations is to minimize solids production. Operating at long SRT's will result in less sludge production. Effective SRT for nitrification may be lower than calculated due to excessive primary effluent solids recirculating in the plant.
Net Yield	0.95 lbs TSS/lbs BOD removed	1.2 lbs TSS/lbs BOD removed	Operating at this large of a net yield requires more frequent wasting to make sure solids are not accumulating in system to potentially be washed out into the effluent. Likely due to low functioning primary clarifier.

Table 8. Audit Observations and Impact on Process Performance: 2013-2015 vs. 2017-2019 (*continued)*

Parameter	2013-2015	2017-2019	Description
Sidestream Management	GT overflow and GBT supernatant had been pumped to primary effluent (captured in primary effluent composite sampler).	GBT is out of service. GT overflow sent by gravity upstream of headworks (downstream of influent composite sampler).	Without the GBT in service, there is no thickening conducted at the plant which would minimize sidestream return flows and loads. There is no data available to characterize sidestream load contributions. Directing WAS to GTs is likely impacting GT and primary clarifier performance.
Primary Removal Efficiencies	cBOD: 1% TSS: 33% TKN: 29%	cBOD: -14% TSS: -64% TKN: 0%	The existing primary settling tanks are not currently functional. Sidestreams are recirculated throughout the plant. The plant's primary clarifiers are currently undersized. High primary effluent TSS loading, likely poor/spent solids/inert solids, is negatively impacting secondary system performance.
98^{th} Percentile SVI	100 mL/g	180 mL/g	Higher SVI indicates sludge that doesn't settle as well. Higher SVI results in decreased secondary clarifier capacity, which would theoretically negatively impact nitrogen removal. This high SVI indicates that the bugs are likely stressed.
Maximum Allowable MLSS vs. Average MLSS	3,600 mg/L vs. 5,300 mg/L	2,600 mg/L vs. 4,400 mg/L	Operating at MLSS concentrations exceeding maximum allowable based on SVI, peak flows, and secondary clarifier capacities make the process susceptible to solids washout.
Effluent TSS	10 mg/L	22 mg/L	Loss of solids to the effluent results in higher effluent pollutant loading (e.g. particulate organic nitrogen) and loss of system biomass. This difference in TSS equates to approximately 136 lbs/day of effluent nitrogen.
Mixed Liquor Return Rate	2.6 x Forward Flow	2.8 x Forward Flow	Despite adequate return rates reported, IR pumps have been reported to be unreliable and frequently malfunction. To maintain denitrification throughout
Aeration Volume Deficit	-1.2 MG	-5.0 MG	Without adequate aeration volume it is difficult to achieve reliable nitrogen removal.

East Side WWTP

Technical Memorandum

Project: *Bridgeport, Connecticut Wastewater Treatment Plant Facilities Planning*

From: *CDM Smith*

Date: *September 14, 2020*

Subject: *East Side Wastewater Treatment Plant Process Audit*

Purpose

It is our understanding that the WPCA is a party to a Wastewater Treatment System Service Agreement ("Agreement") with its operator, Inframark ("Operator"). Pursuant to that agreement, the WPCA is permitted to inspect, sample and test the system to determine if the Operator is operating the WWTP in compliance with the requirements of the agreement, including meeting all applicable technical requirements. This memorandum will serve to memorialize our findings with respect to the operations at the WWTP.

This memorandum compares operational data from the Bridgeport Water Pollution Control Authority (WPCA)'s East Side Wastewater Treatment Plant (WWTP) for two time periods: 2013-2015 and 2017-2019. Influent flow and loading conditions coupled with process observations are used to examine and compare plant performance during each of these time periods to identify operational strategies in play and those that may promote better process performance in comparison to operational strategies that may inhibit process performance.

Executive Summary

Conclusions

There are issues with the current data that call into question whether the East Side WWTP is operating in full compliance with the Agreement between the WPCA and its Operator. These issues include:

- Gaps throughout the datasets for each time period require this analysis to incorporate numerous assumptions regarding plant operation which could compromise the efficacy of the results including;
  - Sidestream flow rates and characteristic data,
  - Sidestream discharge location, e.g. upstream of headworks vs. to primary effluent channel,

- Internal recycle flowrates,
- Return activated sludge (RAS) solids concentrations,
- Waste activated sludge (WAS) pumping rates and solids concentrations,
- Time periods when plant is operating in step feed mode, and
- Mixed liquor volatile suspended solids (VSS) concentrations.

- Reliability of the given data is in question;
  - Daily Dissolved Oxygen (DO) field measurements and mixed liquor suspended solids (MLSS) grab sample concentrations may not be representative and DO reported sometimes exceeds saturation concentration putting data into question.
- The plant has recently performed remarkably well, particularly for a single-anoxic stage, MLE configuration achieving an annual average TN of 5.1 mg/L.
- The plant is operated at a high MLSS concentration, which exceeds the secondary clarifier capacity. The challenge with operating at a high MLSS concentration is the risk of solids washout during diurnal, seasonal and wet weather peak flow conditions.
- Maintaining the MLSS concentration required for nitrogen removal and avoiding solids washout during high wet weather flow events are competing objectives that must be balanced
- Influent flow in the more recent data set is one mgd (15%) lower than the older dataset. BOD loads across the two data sets was consistent, however influent TSS loads were higher and TKN loads were lower in the recent dataset.
- Higher primary effluent cBOD:TKN ratios likely promoted enhanced denitrification (nitrate removal) performance in the more recent dataset.
- The plant is operating with a high aerobic SRT throughout the year, similar to aerobic digestion conditions in the secondary process, which promote the growth of nuisance filamentous bacteria that can cause foaming and scum accumulation. Nitrifiers may preferentially accumulate in foam and scum which can impact nitrification performance particularly during colder periods. It is likely that this long SRT is maintained to reduce sludge production.
- Sludge Volume Index (SVI), used to describe the solids settling characteristics of secondary sludge, has improved significantly, presumably due to the use of continuous chlorine feed to RAS to control filaments that impact solids settling. Chlorine feed can impact nitrification performance.

Recommendations

- CDM Smith operations specialist should visit the WWTP and meet with plant operators.
- Review with CDM Smith operations specialists DO and MLSS sampling procedures and locations. An improved protocol should be developed after this meeting.
- Regular microscopic analysis of biomass should be implemented to first characterize the existing biomass and then be used microscopic analyses to understand how the population reacts to changing conditions.
- Reducing the SRT, particularly during the summer months, summertime could improve the health of the biomass, help to reduce foaming which could reduce the need to chlorinate the RAS daily. This adjustment to a lower SRT would be needed to be balanced with BNR performance.
- As chlorine feed can impact nitrification performance, alternative root-cause preventive measures using process control approaches to reduce filament abundance should be explored.
- Scum should be regularly removed from the tanks to avoid recycling the scum throughout the system, especially when the plant receives scum from the West WWTP.
- Review, and modify as necessary, standard operating procedures for step feed operation (e.g. turn off IR pump when in step feed mode).
- Assess DO return in internal recycle and make modifications to minimize if determined to be excessive.

Introduction

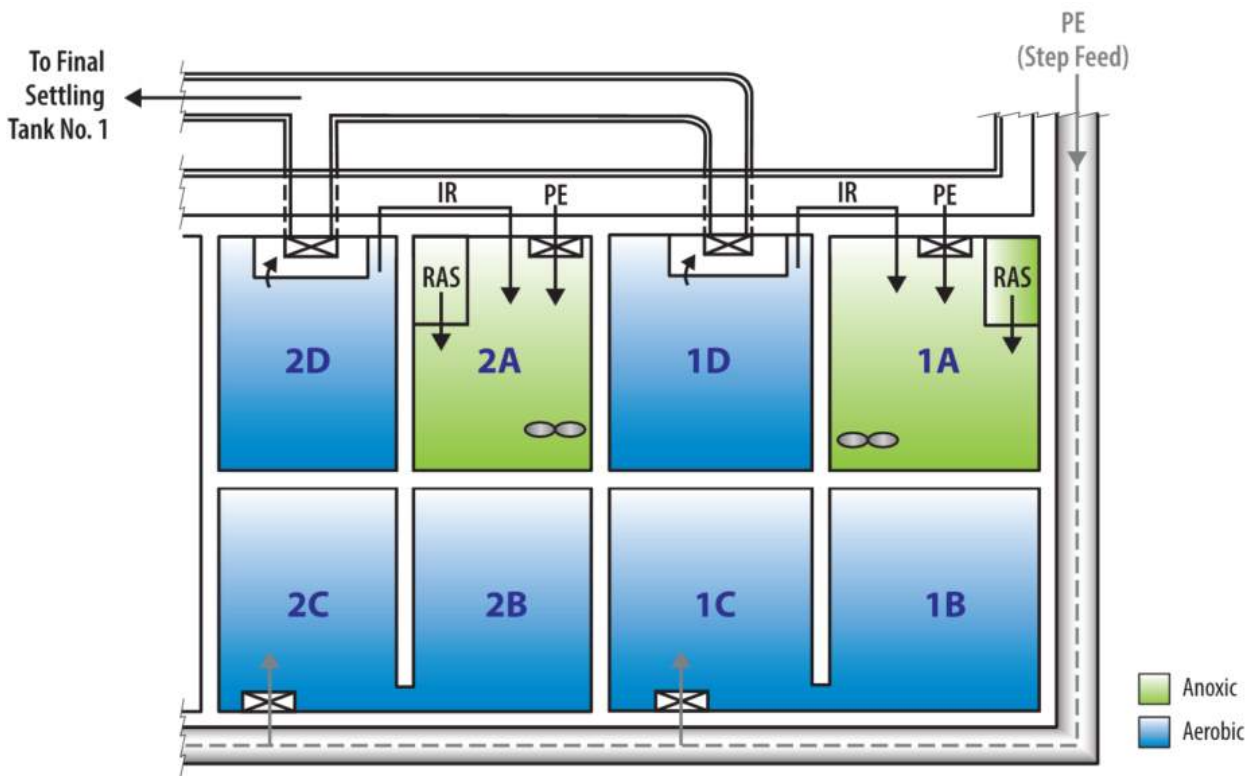
Bridgeport WPCA owns two wastewater treatment plants WWTPs: the East Side WWTP and the West Side WWTP in Bridgeport, CT. Each plant is currently operated by Inframark, under contract. This memorandum presents the evaluation of the East Side WWTP.

The original activated sludge process was designed to treat an average daily flow of 10 mgd and a maximum daily flow of 24 mgd to achieve conventional secondary treatment standards. A secondary treatment bypass exists to direct flow in excess of 24 mgd from the primary effluent channel directly to the chlorine contact tanks. The activated sludge process is currently operated as three individual treatment trains, each consisting of two bioreactors and one secondary clarifier. Each treatment train has a dedicated Return Activated Sludge (RAS) pumping systems from its designated secondary clarifier, and waste activated sludge (WAS) is removed from each train separately. Each bioreactor is divided into four, evenly sized compartmentalized cells referred to as zones “A” through “D”, Fine bubble diffused aeration was incorporated in the early 1990’s.

The bioreactors were again modified in 2002 to operate in a Modified Ludzack-Ettinger (MLE) process configuration to achieve some level of nitrogen removal. Zone A was converted to an anoxic zone for denitrification with mechanical mixing and internal recycle pumping to pump return nitrate from the end of the aerobic zone to the anoxic zone as shown in **Figure 1**. Each bioreactor is comprised of a one-stage anoxic zone (A), followed by a three-stage aerobic zone (B, C, and D). The six bioreactors have a total volume of approximately 2 MG (0.33 MG per bioreactor). Each anoxic zone has two submersible mechanical mixers. Internal recycle pumps are designed to provide a recycle of up to three times the average design flow.

The aeration basins and influent channels are configured such that it is possible to operate in step feed mode for wet weather management by introducing a portion of the primary effluent to Zone B, C, or D. When the WWTF flow exceeds 12 to 15 mgd, the plant is operated in step-feed mode by directing 50% of the primary effluent to Zone C, as shown in **Figure 1.**

Figure 1. Schematic of the WPCA's Existing MLE Process: Bioreactors No. 1 and No. 2



Historically, the East Side WWTP had not performed well with regards to effluent nitrogen loading and had to purchase nitrogen credits to comply with the General Permit limits. Currently, the WWTP performs exceptionally well and receives credits for discharging below the effluent nitrogen limit.

The first purpose of this memorandum is to discuss the differences between two datasets:

- **2013-2015:** Three years of data when the plant was not performing well. During this time period, the plant exceeded its annual effluent nitrogen loading limit in 2013 and 2014, but achieved the limit in 2015. The plant achieved an average effluent total nitrogen of 7.1 mg/L.
- **2017-2019:** Three years of data when the plant was performing well and achieving effluent nitrogen loading limits. The plant achieved an average effluent total nitrogen of 5.1 mg/L.

The second purpose of this memorandum is to make recommendations for process improvements to the East Side WWTP.

NPDES Permit and General Permit for Nitrogen Discharges

The East Side WWTP is regulated by its own NPDES permits (#CT0101010) issued by the Connecticut Department of Energy and Environmental Protection (CT DEEP). The permits authorize the discharge of effluent from the East Side WWTP to the Bridgeport Harbor which flows to the Long Island Sound.

In addition to the WWTP's NPDES permit, the plant has an annual nitrogen discharge limit established by the General Permit, for Nitrogen Discharges, issued by CT DEEP. This permit establishes the WWTP's limit at 362 pounds per day of Total Nitrogen (TN) on an annual average basis. Note that the General Permit had a phased implementation therefore, limit for 2013 was 370 lbs/day TN before being lowered to the 2014 limit where it has remained.

Figure 2 shows the effluent nitrogen discharged from the East Side WWTP in comparison to its permit from 2013-2019. **Table 1** presents the monetized results of the annual effluent total nitrogen discharges.

Figure 2. Effluent Total Nitrogen Discharges at the East Side WWTP

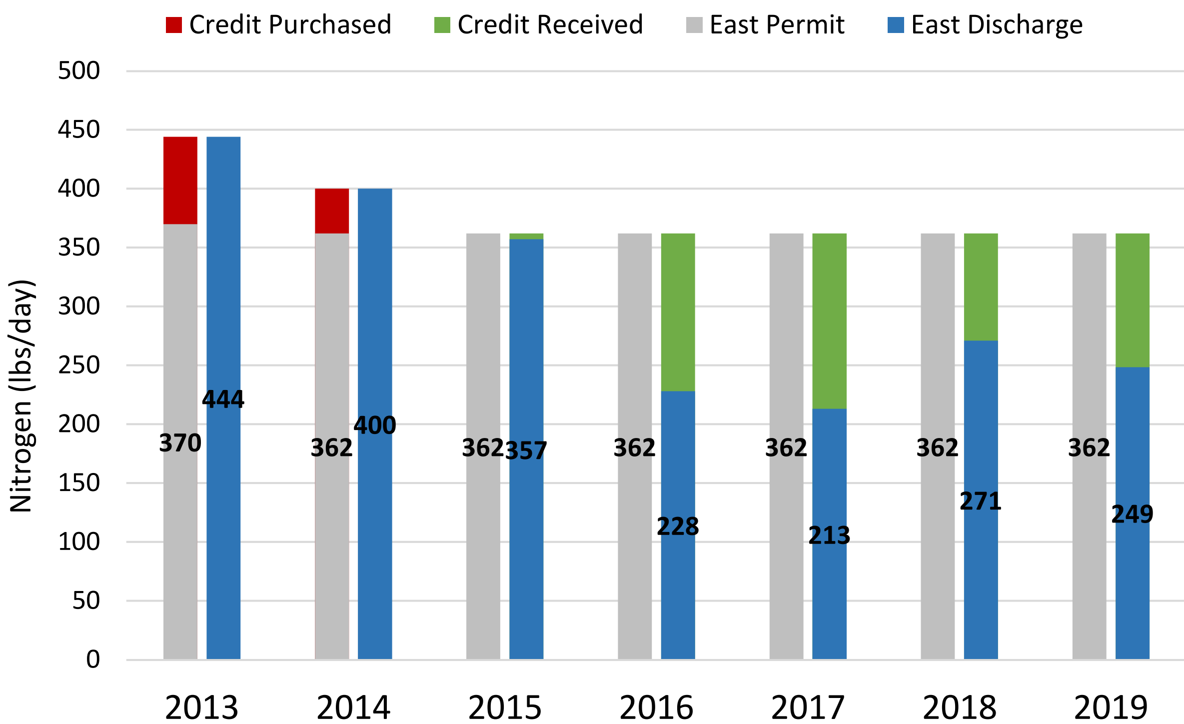


Figure 2 illustrates that WWTP exceeded its effluent discharge limit in 2013 and 2014, which required the WPCA to purchase nitrogen credits. Since 2015, the plant performance has significantly improved, and the plant has since achieved its effluent TN permit. The WWTP's improved performance has allowed the WPCA to sell unused TN credits for more than $300,00 in 2018 as shown in **Table 1**.

Table 1. Monetized Effluent Total Nitrogen Discharges at East Side WWTP

Reporting Year	Purchased/Received Credit $ (rounded)
2013	Purchased $128,800 of Credits
2014	Purchased $76,280 of Credits
2015	Received Credit of $11,080
2016	Received Credit of $110,900
2017	Received Credit of $119,700
2018	Received Credit of $308,900
2019*	Received Credit of $385,300*

***Note: 2019 selling and purchased credit value not yet established. Cost based on 2018 credit value.**

Influent Flow and Loading Conditions

Flow Data

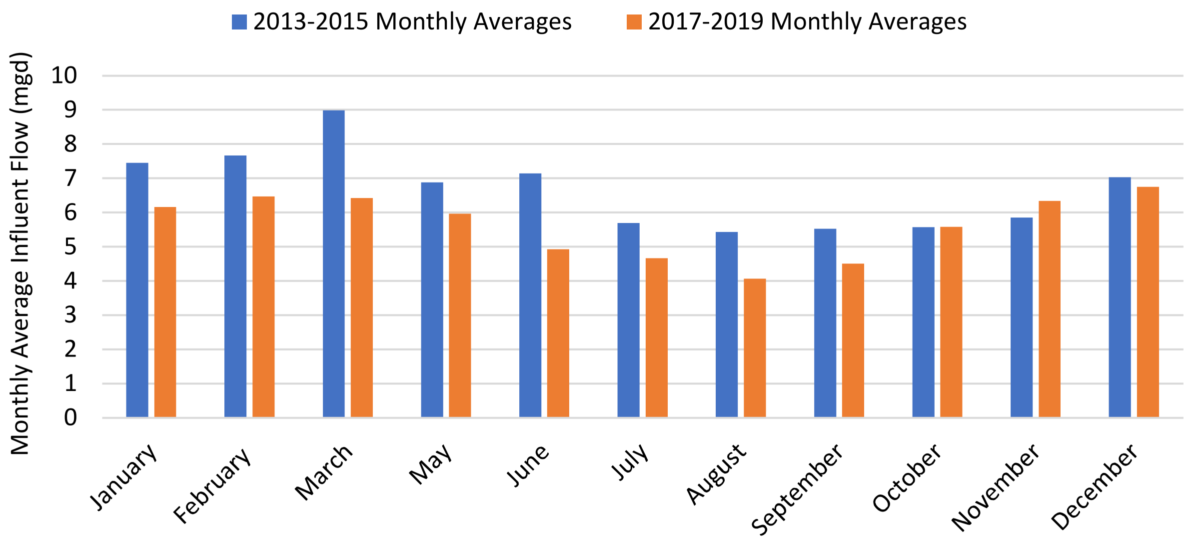
The WPCA records daily influent flow measurements utilizing a Parshall Flume located upstream of the Primary Clarifiers, as shown on the Process Flow Diagram included as **Appendix A**. This flow measurement includes gravity belt thickener filtrate and scum/skimmings decant water but does not include gravity thickener overflow (gravity thickener overflow is returned to the primary effluent channel). RAS pumping rates are reported on monthly operating reports (MORs).

The average influent flow for each of the datasets were:

- **2013-2015:** 6.73 mgd
- **2017-2019:** 5.71 mgd

Figure 3 presents the monthly average flows calculated from each of the three-year datasets for comparison.

Figure 3. Monthly Average Influent Flow: 2013-2015 vs. 2017-2019



The monthly influent flow to the East Side WWTP was consistently higher in the 2013-2015 data compared to the 2017-2019, averaging 1 MGD greater in the 2013-2015 dataset. Note that when the Gravity Thickener overflow pump is out of service the flow is directed to the influent pump station and is "double counted" in the influent flow measurement. It is unclear from the data provided how often this situation occurred during the data sets that were evaluated.

Analytical Data

CDM Smith received the following analytical data from 1/1/2017 through 12/31/2019:

- Influent samples from a composite sampler located at the influent junction box to the WWTP reported three days per week that include: 5-day biochemical oxygen demand (BOD5, or carbonaceous BOD, cBOD), total suspended solids (TSS), total nitrogen (TN), Total Kjeldahl Nitrogen (TKN), ammonia, nitrate, pH, and temperature.

- Primary effluent samples from a composite sampler located downstream of the primary settling tanks in the primary effluent channel that include: cBOD, TSS, TKN, ammonia, nitrate, pH, and alkalinity.

- Daily effluent samples from a composite sampler located downstream of the chlorine contact tanks that include: cBOD, TSS, TN, TKN, ammonia, nitrate, pH, alkalinity, temperature, fecal coliform and E. coli.

- Daily measurements (from a handheld probe) of high and low dissolved oxygen (DO) within aeration basins.

There was no available data for volatile suspended solids (VSS).

CDM Smith received the same analytical data for the 2013-2015 time period as the 2017-2019 dataset except for certain nitrogen species. Only monthly concentrations for the following parameters were provided for 1/1/2013 to 10/21/2015:

- Influent ammonia, nitrate, and TN,
- Primary effluent TKN, ammonia, nitrate,
- Final effluent ammonia and nitrate.

The data gaps make the detailed analysis, presented herein, more difficult to validate.

Table 2 presents the average raw influent concentrations of cBOD, TSS, and TKN for the two datasets.

Table 2. Raw Influent Concentrations: 2013-2015 vs. 2017-2019

Parameter	2013-2015	2017-2019
cBOD	103 mg/L	121 mg/L
TSS	95 mg/L	136 mg/L
TKN	28 mg/L	26 mg/L

cBOD concentrations were about 20 mg/L greater in 2017-2019 compared to 2013-2015 data. Influent TSS was about 40 mg/L greater in 2017-2019, compared to 2013-2015. Influent TKN concentrations were very similar in each dataset. With the decreased flow (less wastewater dilution) in 2017-2019 compared to 2013-2015, one would predict that cBOD, TSS and TKN concentrations would all increase. Because TKN concentrations did not increase similarly to cBOD and TSS concentrations, the lower flows are likely not the cause of these concentration changes. **Figures 4, Figure 5,** and **Figure 6** presents monthly average influent loads for cBOD, TSS, and TKN for the 2013-2015 dataset and the 2017-2019 dataset.

Figure 4. Monthly Average Influent BOD5 Load: 2013-2015 vs. 2017-2019

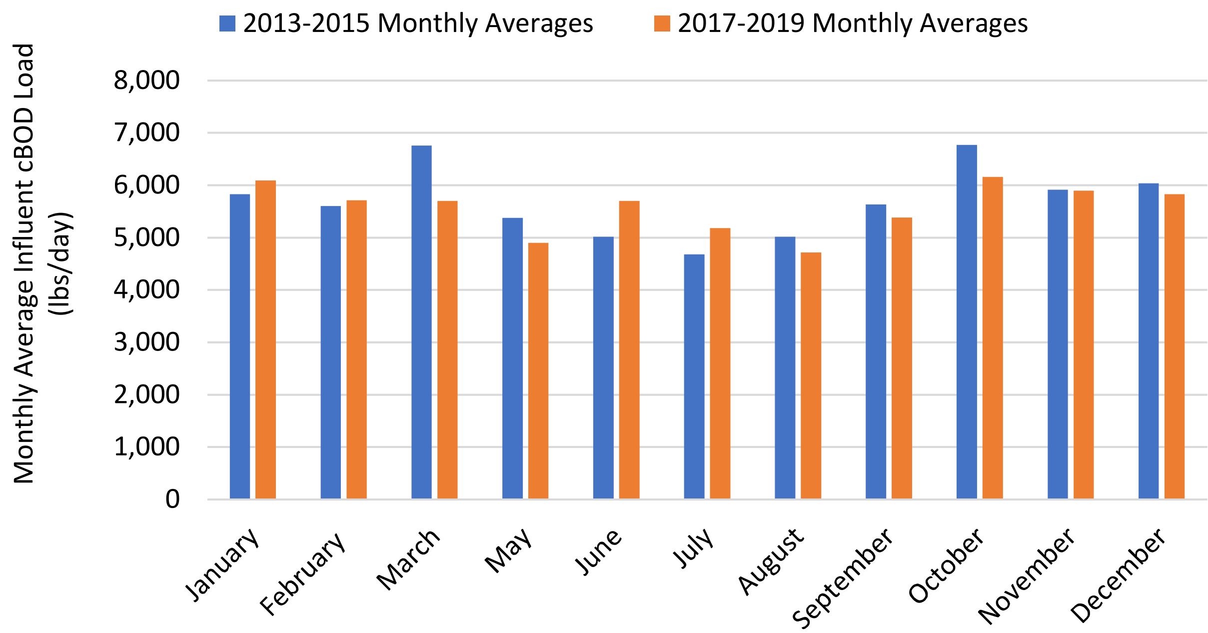


Figure 5. Monthly Average Influent TSS Load: 2013-2015 vs. 2017-2019

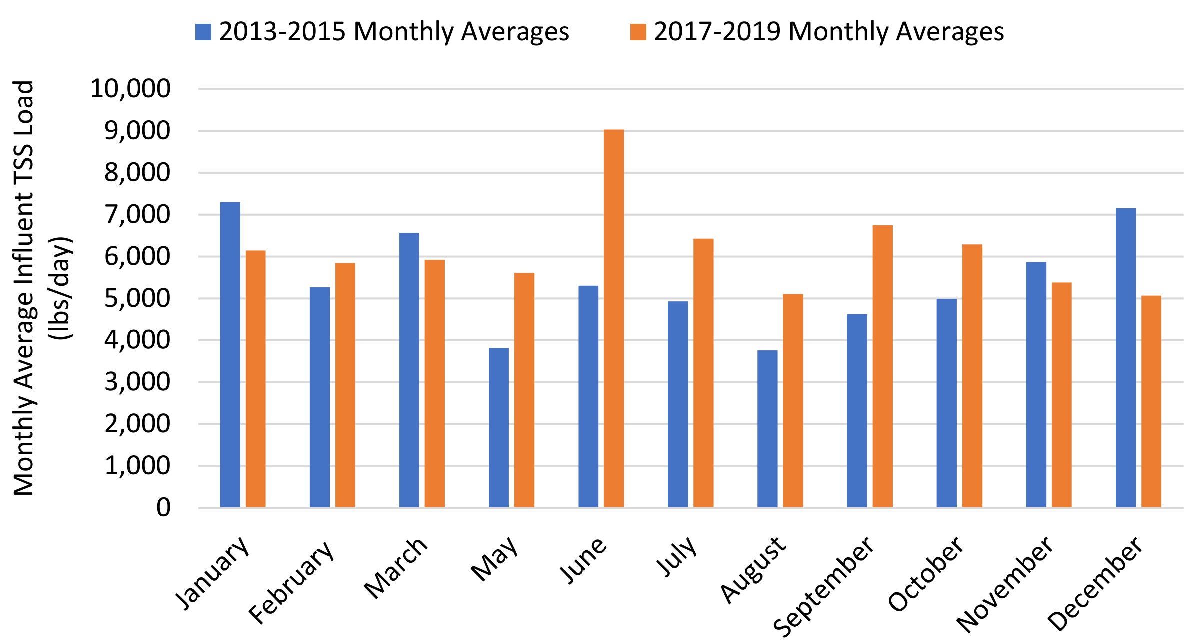
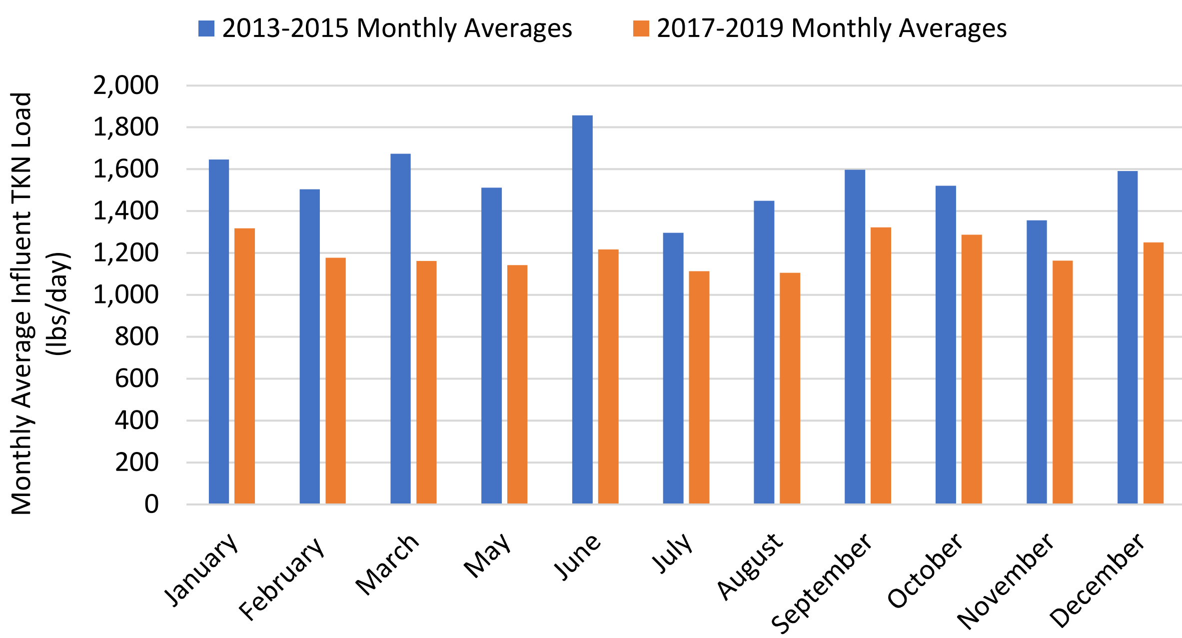


Figure 6. Monthly Average Influent TKN Load: 2013-2015 vs. 2017-2019



Raw influent cBOD loads were very similar within each dataset. The average raw influent cBOD load was slightly higher in 2013-2015 compared to 2017-2019 (about 2%, or 100 lbs/day).

Raw influent TSS loads were higher in the 2017-2019 dataset compared to 2013-2015, by about 15%, despite the decreased flow in the most recent dataset. Increased loads are driven by the dramatic increase in raw influent TSS concentrations, as shown in **Table 2.**

Raw influent TKN loads in 2017-2019 were consistently lower than 2013-2015 influent loads by about 300 lbs (or 25% lower). The higher cBOD:TKN ratio for 2017-2019 is more favorable for dentification performance compared to the 2013-2015 ratio. This more favorable cBOD:TKN ratio should have resulted in improved overall BNR performance.

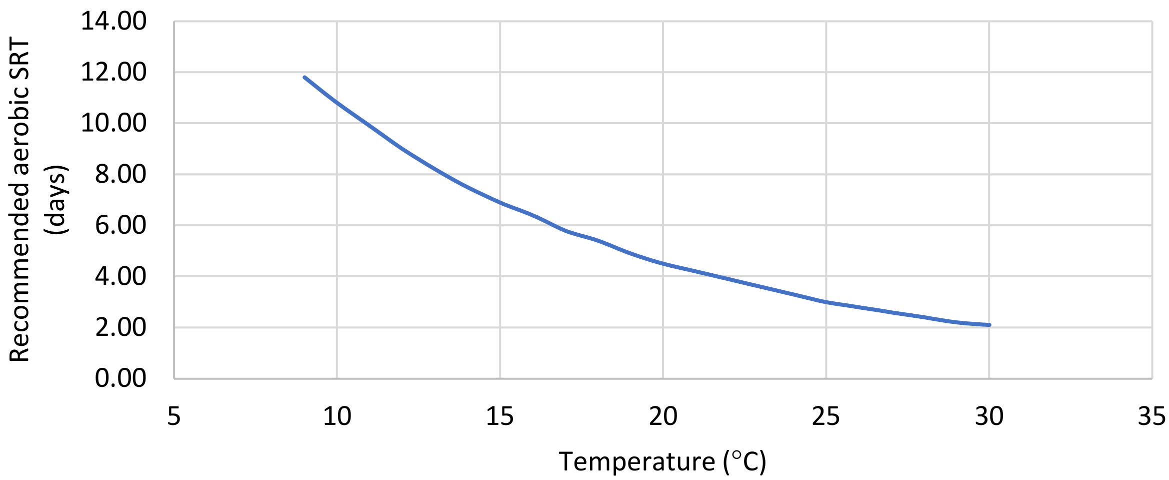
Operational Parameters

During each time period, the WWTP utilized the same infrastructure, tankage and equipment. The change in effluent performance is either attributed to influent flows and loading characteristics, primary clarifier performance, operational parameters, and most likely, it is attributed to a unique combination of the three.

Aerobic SRT and Nitrification

For nitrification to occur, the aerobic SRT must be greater than the growth rate of the nitrifying organisms. Nitrification is adversely impacted by low temperatures and requires a relatively long SRT to maintain nitrification at winter temperatures; conversely, nitrification can be maintained with a relatively short SRT at higher temperatures. The recommended SRT is 2.5x the washout SRT to include a factor of safety against washout. The recommended SRT shown in **Figure 7** includes this safety factor.

Figure 7. Recommended aerobic SRT as a Function of Temperature



With all size aeration tanks in service, aerobic SRT, in days, can be calculated using the following formula:

$$SRT = \frac{Total\ Mass\ of\ Solids\ in\ the\ Aerobic\ Cells}{Total\ Mass\ of\ Suspended\ Solids\ leaving\ the\ System}$$
$$= \frac{\sum V_{Aer} * X_T * 8.34}{Q_{EFF} * X_{EFF} * 8.34 + Q_{WAS} * X_{WAS} * 8.34}$$

Where:

V_{AER} = Aerobic Basin volume, 4.92 MG

X_T = Oxic Cell MLSS, mg/l

Q_{EFF} = Final Effluent flow, MGD

X_{EFF} = Secondary Clarifier effluent TSS, mg/l

$Q_{WAS} * X_{WAS} * 8.34$ = WAS, pounds

A comparison of the average aerobic SRT's for the two datasets are shown in **Table 3.**

Table 3. Average Calculated Aerobic SRT

Parameter	2013-2015	2017-2019
Average Aerobic SRT	8.9 days	22.1 days

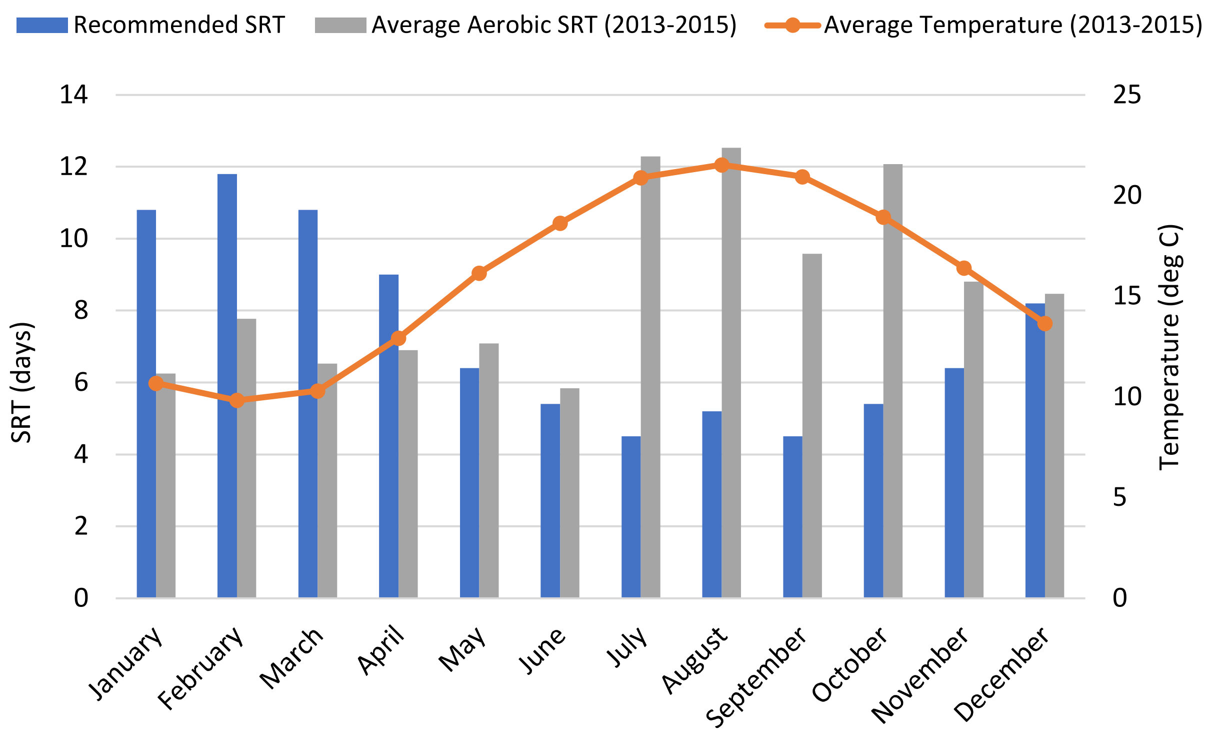
It should be noted that without VSS characterization data available, the calculated aerobic SRT values assume that the MLSS measurements taken from each bioreactor represent the active biomass.

The average aerobic SRT calculated for the 2017-2019 dataset is representative of an aerobic digestion SRT. This long of an aerobic SRT promotes endogenous respiration and the release of more cBOD for denitrification. Despite the potential positive impacts on BNR performance, higher SRTs can promote filaments that can impact settling and cause excess foaming. Finding the appropriate balance and fine-tuning SRT is critical for improving the stability and reliability of BNR performance.

Wastewater temperatures fluctuate throughout the year, particularly in New England. Monthly average wastewater temperatures ranged from 8.8 degrees C to 22 degrees C in the 2013-2015 data set and ranged from 10.7 degrees C to 22 degrees C in the 2017-2019 dataset. It becomes difficult to maintain nitrification when temperatures fall below 10 degrees C, which is why it is critical to maintain a long enough SRT to avoid wasting or washing out the slow growing nitrifiers from the system. If nitrification is lost in the winter months, it typically cannot be re-established until the temperatures rise.

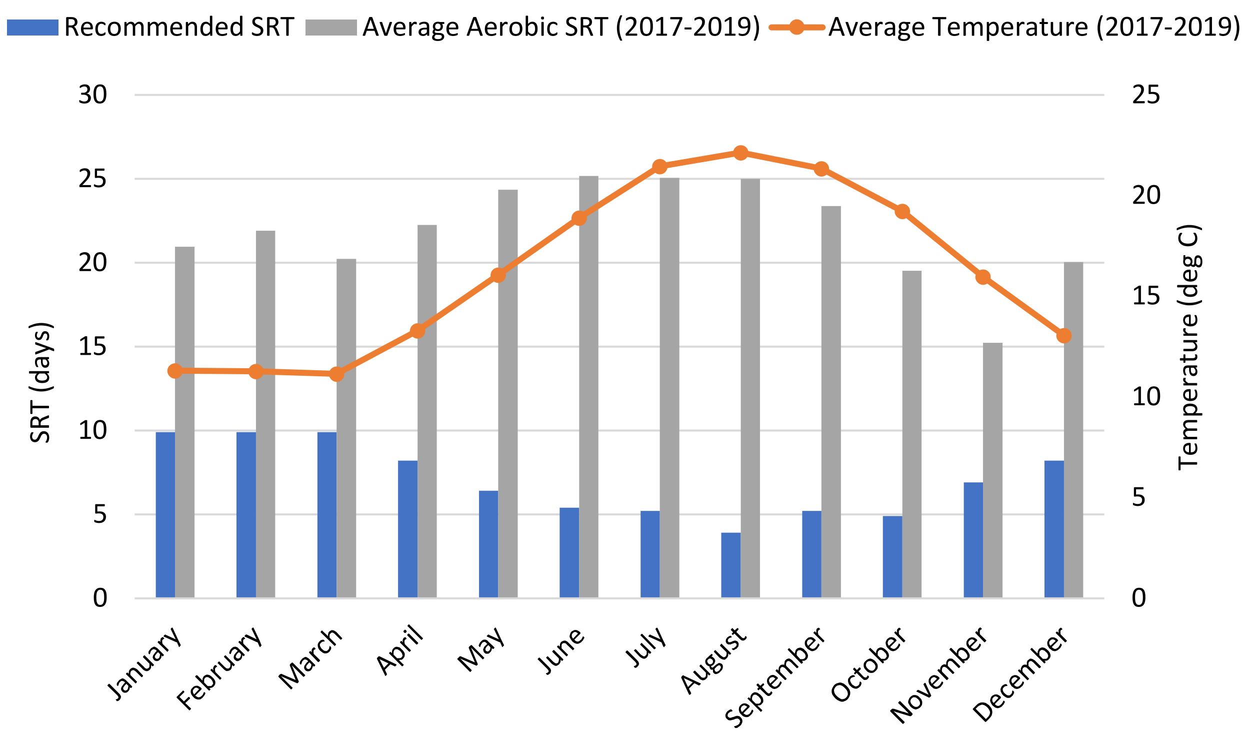
Figure 8 and **Figure 9** present the average monthly temperature over each of the three-year datasets along with the recommended aerobic SRT and the average monthly aerobic SRT maintained at the WWTP.

Figure 8. 2013 to 2015: Monthly Average Temperatures and Recommended Aerobic SRTs vs. Average Aerobic SRT



The WWTP appears to have failed to maintain an adequate SRT to maintain nitrification during the months of January to April for each of the three years to maintain nitrification. The average SRT over the course of the 3-year dataset was 8.9 days, which is consistent with an SRT for conventional activated sludge processes (3-15 days). There is a dramatic difference between the average SRT maintained in June compared to the SRT maintained during July. It is uncommon to maintain a longer SRT in warm summer months compared to cold winter months.

Figure 9. 2017-2019: Monthly Average Temperatures and Recommended Aerobic SRT vs. Average Aerobic SRT



Unlike the previous dataset, the 2017-2019 dataset shows that the WWTP consistently operated at a SRT much higher than the recommended SRT required to maintain nitrification. It is uncommon to maintain a longer SRT in warm summer months compared to cold winter months.

The average SRT over the 2017-2019 timeframe was determined to be 22 days, which is considered a long SRT. One benefit of operating at a long SRT is decreased solids production. However, long SRTs require significantly greater bioreactor volumes and/or clarifier surface areas. Additionally, long SRT's favor predomination of nuisance foaming organisms. As a result of various site visits and discussions with operators, the East Side WWTP has suffered from excessive foaming and scum accumulation. Existing scum removal provisions circulate secondary scum to the head of the plant instead of removing the scum, with exacerbates foaming and scum problems. In addition to the East Side WWTP scum, the plant accepts scum from the West Side WWTP. Skimmed/collected scum should be permanently removed from the treatment train.

Excessive foaming can remove slow-growing nitrifiers from the active MLSS in solution. This can be a big issue for nitrification at lower temperatures, as the nitrifier population can be preferentially removed from the active biomass and into the floating foam. **Figure 10** shows floating foam in the aeration tanks at the East Side Plant.

Figure 10. Floating Scum in Aeration Tanks at the East Side WWTP

Figure 11 and **Figure 12** show the effluent nitrogen species in relation to the wastewater temperatures for each dataset

Figure 11. 2013-2015: Effluent Nitrogen Species and Wastewater Temperature

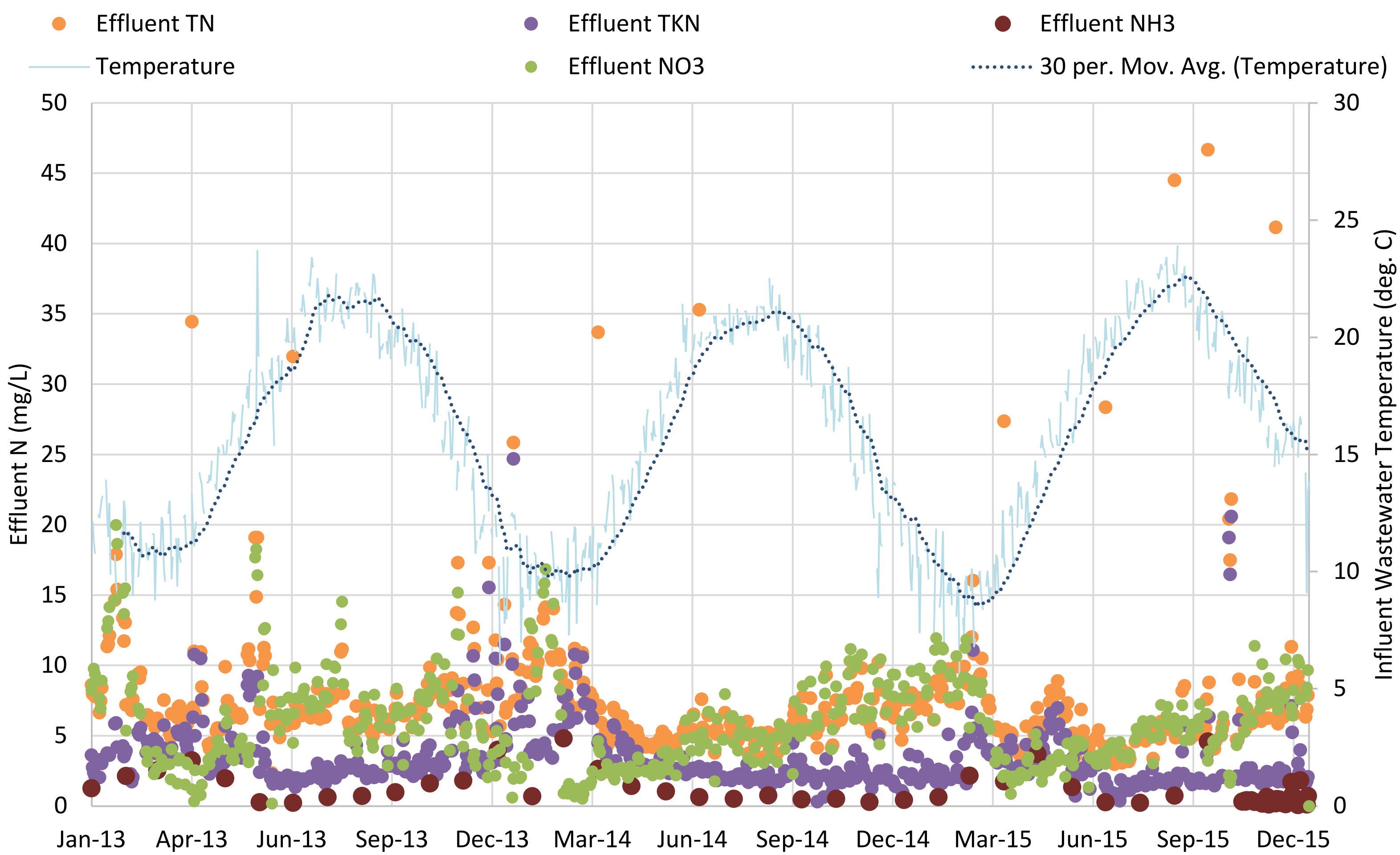


Figure 12. 2017-2019: Effluent Nitrogen Species and Temperature

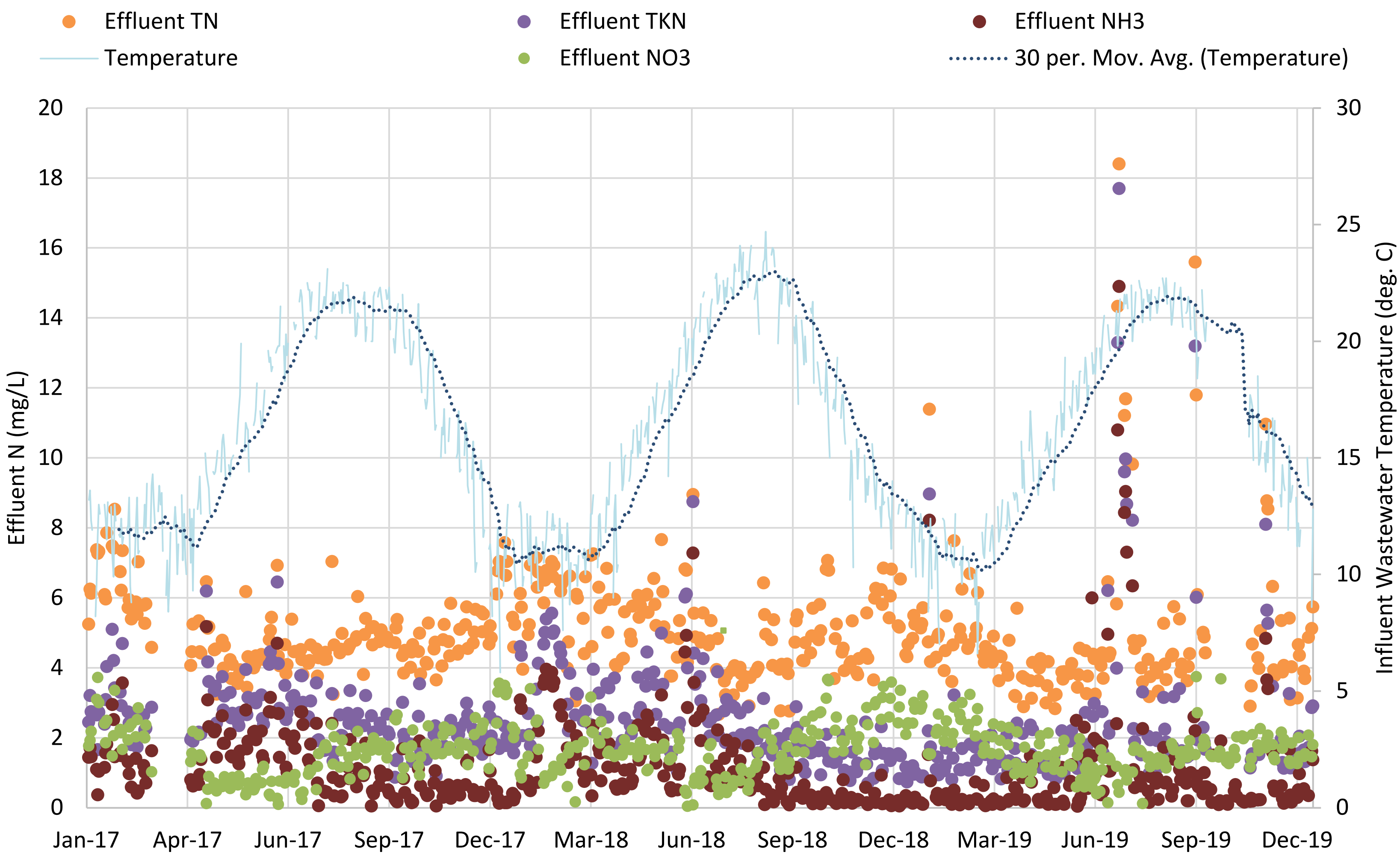


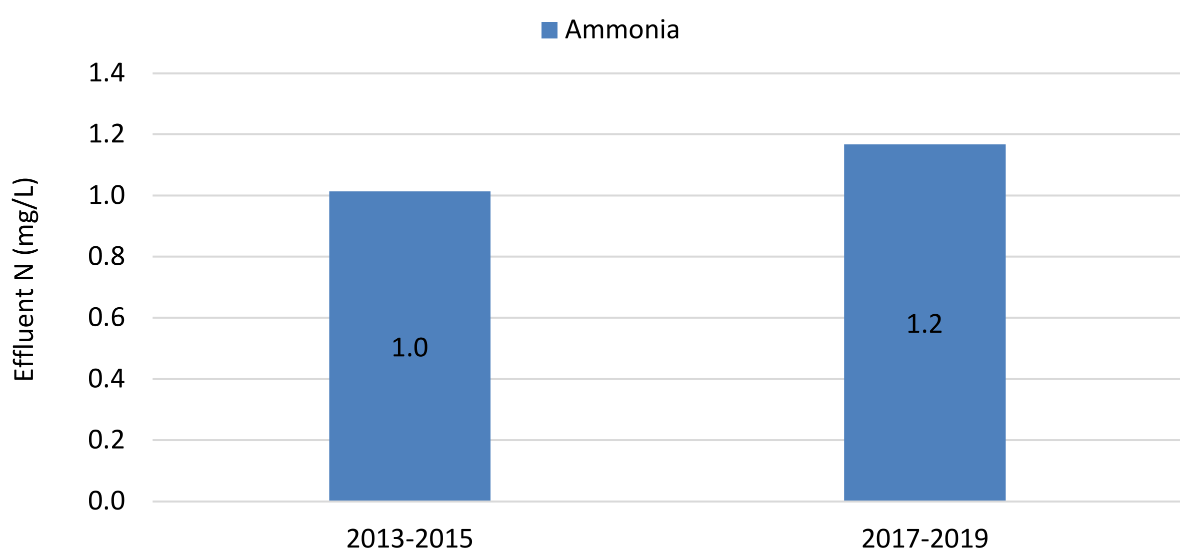
Figure 11 shows that the secondary system had difficulty maintaining nitrification through the winter months. Despite the limited dataset, the average effluent ammonia concentrations exceed 5 mg/L during the cold winter months each year. Data indicates that when nitrification was lost, it was not recovered until May-June until wastewater temperatures increased. Throughout the three-year dataset there are many high effluent spikes of effluent total nitrogen exceeding 30 mg/ L

There were few instances of high effluent nitrogen in the 2017-2019 dataset compared to the 2013-215, as shown in **Figure 12**. Effluent nitrate concentrations exceeded 5 mg/L during periods where primary effluent cBOD:TKN ratios fell below 4:1. The stability of the WWTP's performance with regards to nitrogen removal from a conventional MLE process is impressive, particularly through the winter of 2018.

Effluent NH_3

Figure 13 presents the average effluent ammonia concentrations for the two datasets. The average effluent ammonia concentration of the 2013-2015 dataset was 1.0 mg/L. It should be noted that this is based on a very limited effluent ammonia data (monthly average data, only). This is very similar to the average effluent ammonia concentration of the 2017-2019 dataset, which was about 1.2 mg/L.

Figure 13. Average Effluent Ammonia: 2013-2015 vs. 2017-2019



Net Yield

Average net yield values were calculated for each of the three-year datasets using the Pitter and Chudoba (1990) equation as a function of SRT and primary effluent TSS/BOD ratios. The average calculated net yields are presented in **Table 4** along with typical net yields for low rate, nitrifying activated sludge processes

Table 4. Average Calculated Net Yield Values

Parameter	2013-2015	2017-2019
Primary Effluent TSS/BOD	0.53	0.48
Average Net Yield	0.69 lbs TSS/lbs BOD removed	0.52 lbs TSS/lbs BOD removed
Typical Net Yield for Low rate, nitrifying (SRT > 7 days) with primary settling tanks	*0.5-0.8 lbs TSS/lbs BOD removed*	

Primary effluent TSS:cBOD ratios for each dataset are quite low. Calculated net yield values for each dataset are within reported typical net yields for low rate nitrifying plants with primary settling tanks. The lower calculated net yield in 2017-2019 is likely attributed to the longer SRT maintained throughout the dataset, compared to the 2013-2015. Operating at longer (aerobic digestion-type) SRT's results in less sludge production.

Primary Effluent

Primary effluent loads were calculated based on the primary effluent composite sampler. **Table 5** presents primary effluent loads along with raw influent loads which were used to estimate primary removal efficiencies across the primary settling tanks.

Table 5. Influent, Primary Effluent, and Primary Removal Efficiencies

Parameter	2013-2015	2017-2019
cBOD		
Raw Influent, lbs/day	5,700	5,600
Primary Effluent, lbs/day	4,900	4,700
TSS		
Raw Influent, lbs/day	5,300	6,200
Primary Effluent, lbs/day	2,700	2,200
TKN		
Raw Influent, lbs/day	1,500	1,200
Primary Effluent, lbs/day	1,500	1,000
Primary Removal Efficiencies		
BOD	14%	16%
TSS	49%	65%
TKN	0%	17%

The primary removal efficiencies were consistently higher in the 2017-2019 dataset compared to 2013-2015. The higher primary effluent cBOD:TKN ratio in 2017-2019 (4.7) compared to 2013-

2015 (3.3) is more favorable for denitrification. The WWTP only operates two of the three primary settling tanks to increase the F:M ratio entering into the secondary system.

Solids Inventory and Settleability

Solids flux analyses is a tool used to define critically loaded conditions for secondary clarifiers based on solids loading, hydraulic loading, mixed liquor suspended solids (MLSS) concentrations, and settleability (sludge volume index, SVI). For each of the datasets, the secondary system's capacity (or peak hour flow) of 24 mgd dictates the maximum allowable MLSS to be maintained within the secondary process.

SVI is typically measured from each aeration tank daily. A conservative (98th percentile) SVI of 200 mL/g was used to establish the maximum allowable MLSS concentration within the secondary process for the 2013-2015 data. The 2017-2019 98th percentile SVI value is significantly less than the 2013-2015 dataset. It was determined to be 87 mL/g. This lower SVI of 87 mL/g indicates that the sludge at the East Side WWTP settles extremely well.

This decrease in SVI resulted in higher secondary clarifier capacity for the 2017-2019 dataset, compared to the 2013-2015 dataset. **Table 6** presents the data used to determine maximum allowable MLSS concentrations for the two datasets.

Table 6. Solids Flux Analyses Parameters

Parameter	2013-2015	2017-2019
Total Clarifier Surface Area (3)	6,720 ft^2	6,720 ft^2
98th Percentile SVI	200 mL/g	87 mL/g
Peak Hour Flow	24 mgd	24 mgd
Maximum Allowable MLSS	2,400 mg/L	3,900 mg/L
Average MLSS	4,700 mg/L	5,100 mg/L

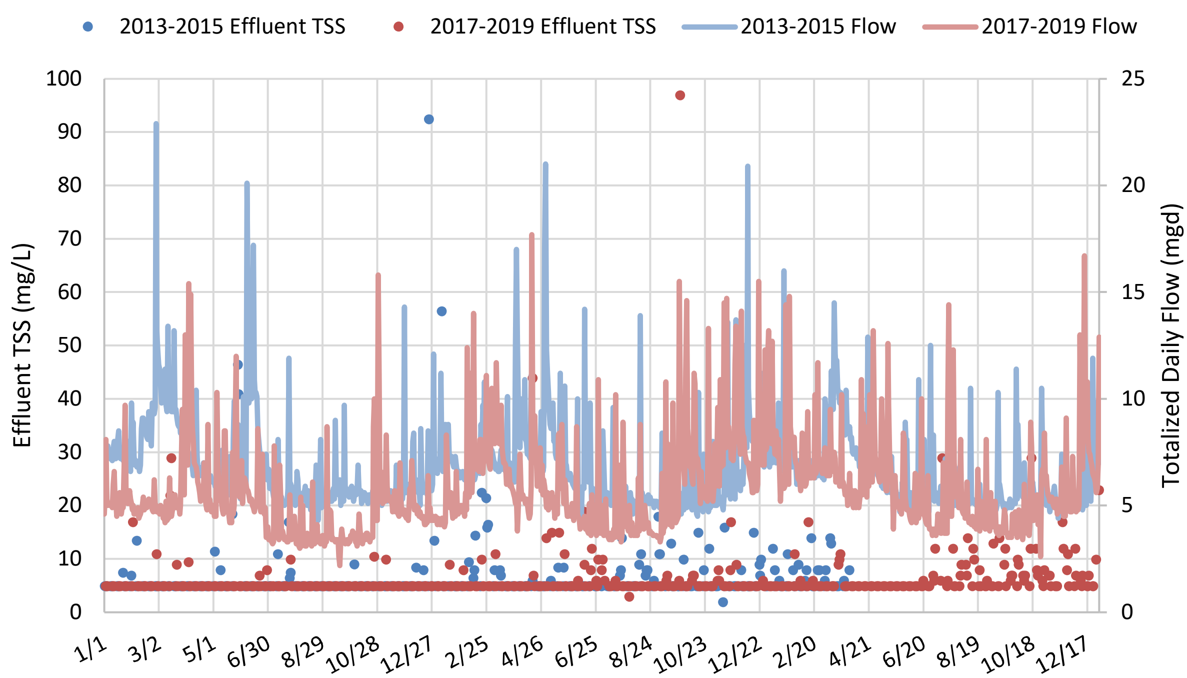
Due to the improved SVI, the maximum allowable MLSS for the 2017-2019 data was 3,900 mg/L, 1,500 mg/L more than the maximum allowable MLSS for the 2013-2015.

Both data sets show that the plant has continually operated at higher MLSS concentrations (4,700 mg/L and 5,100 mg/L for the 2013-2015 and 2017-2019 datasets respectively) than the capacity of the secondary clarifiers. Operating at higher SRT/MLSS appears to promote more stable operations and reliable BNR performance across all seasons. However, operating at elevated MLSS leaves the facility susceptible to solids washout. The calculated max allowable MLSS of 2,400 mg/L is less than the 1st percentile of the MLSS concentrations reported within the 2013-2015 database. Accordingly, the calculated max allowable MLSS of 3,900 mg/L is less than the 5th percentile of MLSS concentrations reported within the 2017-2019 dataset, meaning that the clarifiers were solids overloaded throughout each time period 95% of the time.

As shown, SVI is a critical condition for clarifier capacity and resulting performance. The dramatic change in SVI over each of the datasets indicates a major shift in settling characteristics . Operators have noted that they have been continuously dosing chlorine to RAS to prevent sludge bulking and growth of filamentous organisms since 2016. The continued use of chlorine to RAS is atypical in municipal wastewater treatment. Chlorine is typically used as a tool during intermittent periods of increased sludge bulking, but seldom used continuously.

Figure 14 shows effluent TSS and flows for the two datasets.

Figure 14. Effluent TSS and Totalized Daily Flow



Note: April-December 2015 effluent TSS data was unavailable.

The WWTP experienced elevated effluent TSS concentrations throughout both data sets under somewhat different scenarios. Throughout 2013-2015, SRT and MLSS were lower and the SVI was higher; while in 2017-2019, the SRT and MLSS were higher and the SVI was lower. Each resulted in periods of high effluent TSS particularly caused by periods of high flows. **Table 7** presents the number of days with effluent TSS exceeding 50 mg/L (permitted maximum day effluent TSS) and the corresponding flowrates for these washout events.

Table 7. High Effluent TSS and Flows

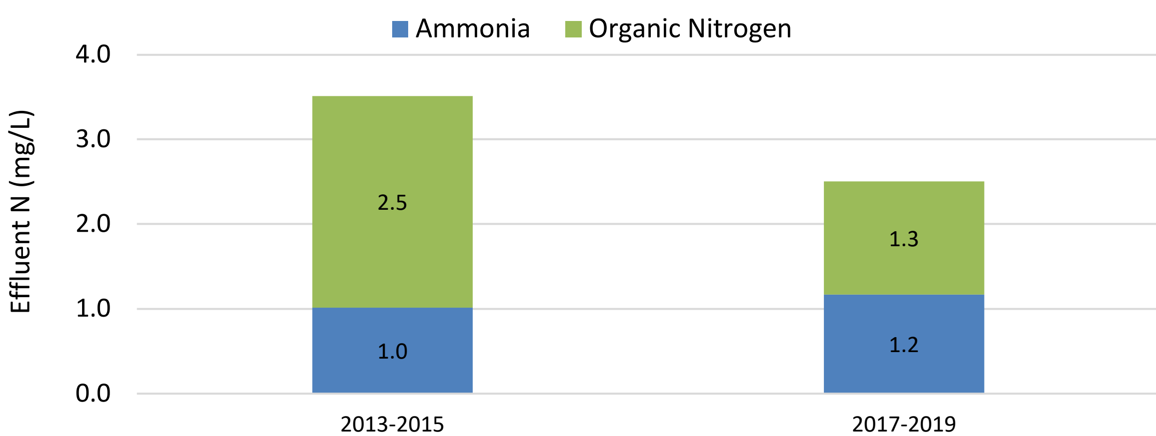
Parameter	2013-2015	2017-2019
Average Effluent TSS	7.5 mg/L	6.7 mg/L
Maximum Effluent TSS	264 mg/L	109 mg/L
Days Exceeding 50 mg/L Effluent TSS	3	2
▪ Average Totalized Daily Flow	6.9 mgd	8.9 mgd
▪ Average Maximum Daily Flow	9.5 mgd	18 mgd

The average effluent TSS from 2013-2015 was 7.5 mg/L which is slightly higher than the 2017-2019 average effluent TSS, calculated to be 6.7 mg/L. The maximum effluent TSS in the 2013-2015 was nearly 300 mg/L, and daily effluent TSS values exceeded 50 mg/L 3 times. The average flow on days where effluent TSS exceeded 30 mg/L was 6.9 mgd. The maximum effluent TSS in the 2017-2019 dataset was about 100 mg/L and the plant exceeded 50 mg/L effluent TSS on 2 days. The average flow on the days where effluent TSS exceeded 50 mg/L was 8.9 mgd. The maximum effluent TSS was likely greater in 2013-2015 time period compared to the 2017-2019 time period due to the higher SVI value.

Effluent TKN

Figure 15 presents the average effluent TKN concentrations broken out into organic nitrogen and ammonia concentrations (previously presented) for the two datasets. The average effluent organic nitrogen concentration from the 2013-2015 dataset was 2.5 mg/L. The average effluent organic nitrogen concentration from 2017-2019 was 1.3 mg/L. The lower organic fraction of the TSS is likely due to the elevated SRT which promotes aerobic digestion-like conditions reducing the organic content of the TSS.

Figure 15. Average Effluent Ammonia and Organic Nitrogen (TKN): 2013-2015 vs. 2017-2019



Pre-Anoxic Reactor

Nitrification can lead to denitrification in the final clarifier sludge blankets which can result in impacted settling and sludge compaction, rising sludge, and increased effluent TSS. For this reason, it is important to have adequate anoxic volume to promote more complete denitrification. Denitrification can offset the increased aeration costs associated with nitrification by providing the denitrification oxygen credit and reduce/eliminate settling problems in the final clarifiers caused by denitrification in the sludge blanket of the final clarifiers.

The primary function of the anoxic zone is to maintain true anoxic conditions (low to no DO and ample soluble cBOD) to promote effective denitrification of the high nitrate internal recycle flow. A secondary function of the anoxic zone is filamentous organism control. This control may be achieved through the reduction of the soluble cBOD that is used in denitrification which reduces the F/M in the downstream aerobic bioreactors and in turn reduces driving forces for filamentous organisms that can cause settling and/or foaming issues.

The nitrogen removal and effluent nitrate-N concentration that can be achieved by a single anoxic system (MLE) is limited by practical limits to mixed liquor recycle (MLR) flow. Theoretically, the higher the MLR flow, the lower the effluent nitrate-N, but in practice, it has been observed that MLR ratios above 4:1 may be impractical due to high pumping costs, hydraulics, and excessive DO loading to the anoxic reactor. The average RAS flowrate for 2013-2015 was reported as 55% of forward flow. There was no internal recycle (IR) pumping rates reported for the WWTP, so it assumed that during this time the IR pumps were operated at a similar rate to the West Side WWTP's IR pumps of 41 Hz. It is assumed that this pump speeds correlates to 60 Hz being the highest available IR rate at 300% forward flow. With an average daily flow for this time period of 6.7 mgd, this results in a MLR of 2.6 x average daily flow.

The average RAS flowrate for 2017-2019 was reported as 58% of forward flow. As is the case with the 2013-2015 dataset, there were no IR pumping rates reported. It was assumed that the IR pumps were operated similarly to the pumping rate reported at the West Side WWTP, of 225% of forward flow. With the average daily flow of 5.7 mgd, this results in a MLR of 2.8 x average daily flow.

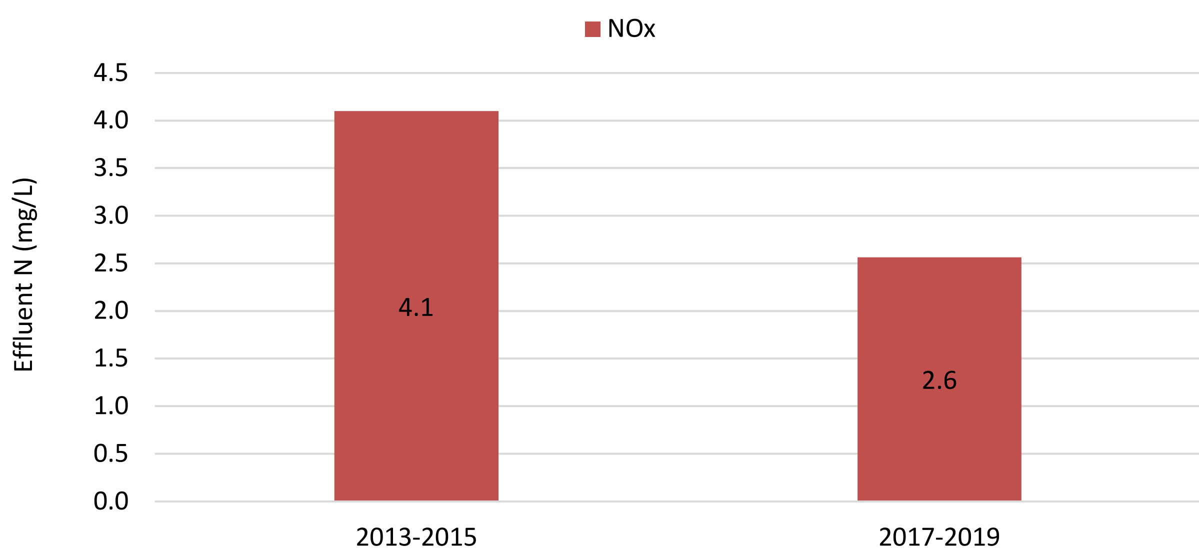
The governing denitrification is based on either the nitrate returned to the pre-anoxic zone via MLR or limited by the biomass' specific denitrification rate (SDNR). The nitrified nitrogen from the system is considered nitrogen available for denitrification when it is recirculated to the pre-anoxic zone. If the IR pumps were operated similarly to the West Side WWTP's IR pumps, the suspected higher MLR carried during the 2017-2019 dataset likely resulted in better denitrification performance compared to 2013-2015.

Effluent NO_x

The effluent nitrate concentrations from the two datasets are dramatically different. **Figure 16** shows the effluent NO_x (predominantly nitrate) for the two-time periods added to the TKN nitrogen components (presented previously). For each dataset, average effluent nitrite was less than 0.1 mg/L, so NO_x shown can be considered nitrate. The average effluent nitrate concentration for the

2013-2015 dataset was 4.1 mg/L and the average effluent nitrate concentration for the 2017-2019 dataset was 2.6 mg/ L. This is likely due to higher SRT (endogenous cBOD release, aerobic digestion-type SRT) and more favorable (higher) primary effluent cBOD:TKN in 2017-2019 compared to 2013-2015.

Figure 16. Average Effluent NO_x 2013-2015 vs. 2017-2019



Aerobic Volume

Monthly average of each datasets three years was used to determine required biomass under air for each of the resulting 36 months of data. This method accounts for seasonal variation on cBOD loading and wastewater temperatures. The reported primary effluent removal efficiencies were applied to each month's influent load to determine realistic loads to the secondary system. The biological net yield that was presented in **Table 5** was used.

The aeration volume was determined using monthly cBOD loads and associated wastewater temperatures. Required SRT for nitrification for each month was calculated and a safety factor of 2.5 was applied. Required mass under air was then determined based on the monthly cBOD removed.

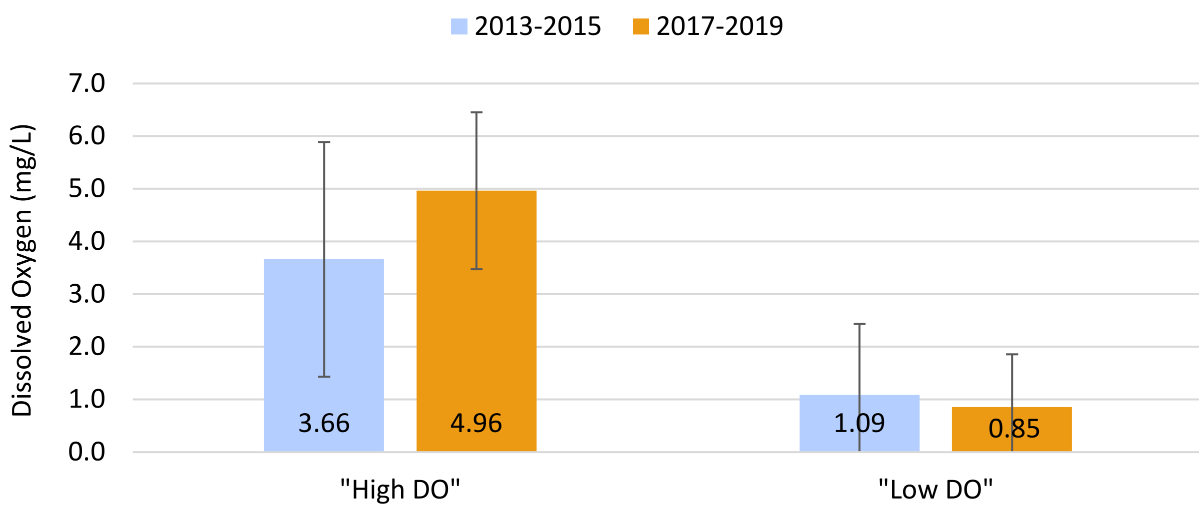
For the 2013-2015 dataset the maximum cBOD loading controlled the sizing, rather than the coldest temperature. The highest maximum cBOD loading was determined to be March for the 2013-2015 dataset which required 46,700 lbs of biomass under air. The coldest monthly temperature controlled the required aeration volume for the 2017-2019 dataset. The coldest temperature was January, which required maximum cBOD loading was determined to be January which required 31,000 lbs of biomass under air.

The average operating MLSS concentrations, presented in **Table 6** were used to determine the required aeration tank volume. The 2013-2015 dataset resulted in a required aeration volume of 1.2 MG, which is the volume of about 4 of the existing six aeration tanks. The 2017-2019 dataset resulted in a required aeration volume of 0.73 MG, which is the volume of about 3 aeration tanks. The WWTP had adequate aeration volume capacity to handle the influent flows and loads for each of the datasets.

Aerobic Zone Dissolved Oxygen

As mentioned previously, operators take DO measurements from each of the BNR basins' aerobic zones with a handheld probe. **Figure 17** presents the average "High DO" which represents the highest DO measurement of each day and the average "Low DO" which represents the lowest DO measurement of each day for the two time periods. Error bars represent plus and minus one standard deviation.

Figure 17. Average "High DO" and "Low DO" within Aeration Zones



Historically, for nitrification a minimum design DO concentration of 2 mg/L has been recommended. The "High DO" reading for each time period exceeded the 2 mg/L design DO concentration. The average "High DO" reading for the 2013-2015 time period was lower than the 2017-2019 time period. There is a negative impact of excessive DO in the recycle streams to the anoxic zone. In addition to unwanted DO entrainment in IR streams being pumped to anoxic zones, there are energy saving opportunities for the WWTP to operate at a lower DO concentrations within the aeration zones. The standard deviations for the 2013-2015 dataset are greater than the standard deviations in the 2017-2019 dataset indicating that the DO within the aeration basins was better controlled in the 2017-2019 dataset.

The average "High DO" was determined to be statistically significantly different than the average "Low DO" in the 2017-2019 dataset but was not found to be statistically significantly different in the

2013-2015 dataset. This significant difference between the DO measurements suggests that there are discrete portions of the aerobic zones that are more anoxic-like environments than true aerobic zones. This difference DO content within the aerobic basins could allow for both nitrification and denitrification to occur simultaneously (simultaneous denitrification, or SND) within the same reactor.

Conclusions

It is generally recognized that for a typical municipal wastewater, a single anoxic reactor configuration, or MLE process configuration, cannot reliably achieve an effluent total nitrogen limit lower than about 7-8 mg/L. The plant was performing as to be expected from 2013-2015, but performance has since improved by achieving an average effluent TN achieved 2017-2019 of 5.1 mg/L. The two biggest differences between the total effluent nitrogen during the two-time periods can be attributed to the organic nitrogen and nitrate components, as shown on **Figure 18.** The difference between the average organic nitrogen component of effluent nitrogen for each time period is greater than 1 mg/L. The difference between the 2013-2015 and 2017-2019 effluent nitrate components is greater than 1.5 mg/L, indicating that organic nitrogen reduction and denitrification performance significantly improved leading to increased nitrogen credits to WPCA.

Figure 18. Effluent Nitrogen Species 2013-2015 vs. 2017-2019

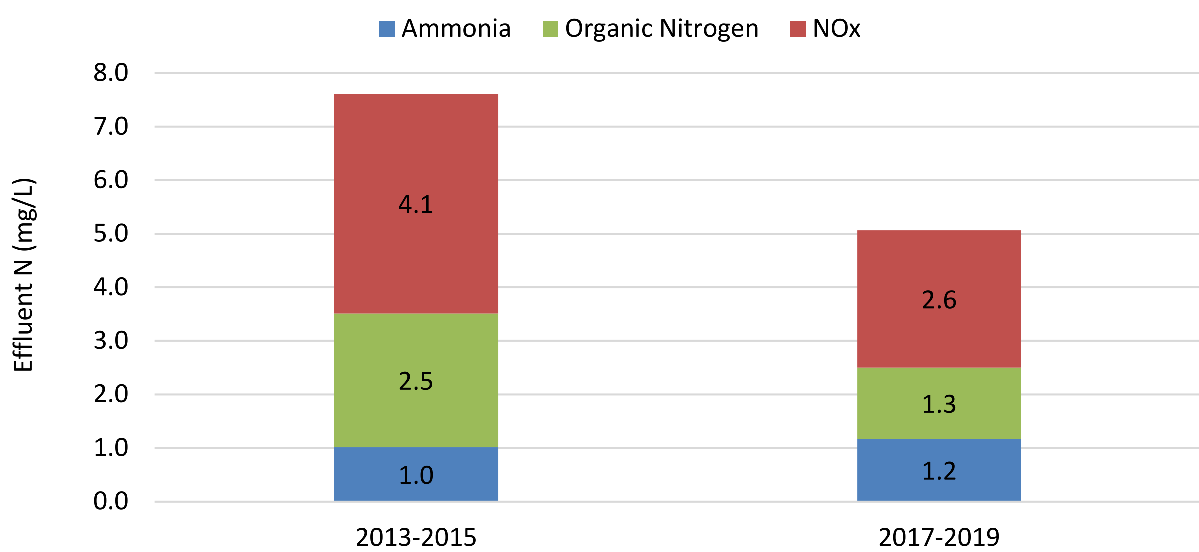


Table 8 presents observations from each time period's dataset and how those observations would have likely impacted the WWTP's performance in comparison to the other time period. Fields that are highlighted in green indicate that the finding is favorable and should have favored performance, fields highlighted in red indicate that the observation is unfavorable with respect to process performance, and yellow indicates a neutral finding that should have no impact on plant performance.

Recommendations

Based on the observations presented in **Table 8**, the list below details some short-term modifications that should be considered to improve process performance within the WWTP's existing tankage.

- CDM Smith operations specialist should visit the WWTP and meet with plant operators.
- Review with CDM Smith operations specialists DO and MLSS sampling procedures and locations. An improved protocol should be developed after this meeting.
- Regular microscopic analysis of biomass should be implemented to first characterize the existing biomass and then be used microscopic analyses to understand how the population reacts to changing conditions (e.
- Reducing the SRT, particularly during the summer months, summertime could improve the health of the biomass, help to reduce foaming which could reduce the need to chlorinate the RAS daily. This adjustment to a lower SRT would be needed to be balanced with BNR performance.
- As chlorine feed can impact nitrification performance, alternative root-cause preventive measures using process control approaches to reduce filament abundance should be explored.
- Scum should be regularly removed from the tanks to avoid recycling the scum throughout the system, especially when the plant receives scum from the West WWTP.
- Review, and modify as necessary, standard operating procedures for step feed operation (e.g. turn off IR pump when in step feed mode).
- Assess DO return in internal recycle and make modifications to minimize if determined to be excessive.

Table 8. Audit Observations and Impact on Process Performance: 2013-2015 vs. 2017-2019

Parameter	2013-2015	2017-2019	Description
Influent Flow	6.73 mgd	5.71 mgd	Totalized daily flows were about 1 MGD higher in the 2013-2015 dataset compared to the 2015-2017 dataset.
Influent cBOD Loading	5,700 lbs/day	5,600 lbs/day	Raw influent cBOD loading was very similar in each dataset.
Influent TSS Loading	5,300 lbs/day	6,200 lbs/day	Higher influent TSS loads require increased solids removal to achieve an effluent TSS goal. 2017-2019 raw influent TSS loading was about 15% greater than 2013-2015 TSS loads.
Influent TKN Loading	1,500 lbs/day	1,200 lbs/day	Higher influent nitrogen loads require added level of treatment to achieve the same effluent goal. 2017-2019 influent TKN loads were about 20% less than 2013-2015 influent TKN loading.
Aerobic SRT	8.9 days	22.1 days	Throughout 2013-2015 dataset, the plant did not maintain a long enough SRT during January-April months to maintain nitrification. Despite maintaining long enough SRT's in the 2017-2019 dataset, operating SRTs of 15 days and higher (aerobic digester-like SRT) favors nuisance filamentous bacteria that can contribute to settling and foaming conditions that leads to nitrification impacts and solids loss.
Net Yield	0.69 lbs TSS/lbs BOD removed	0.52 lbs TSS/lbs BOD removed	Net Yield values are quite low for both 2013-2015 and 2017-2019 datasets. Net Yield for the 2017-2019 dataset is lower due to the WWTP operating at a high SRT, like an aerobic digester.
Primary Removal Efficiencies	cBOD: 14% TSS: 49% TKN: 0%	cBOD: 16% TSS: 65% TKN: 17%	Primary removal efficiencies have increased in the more recent dataset, compared to the older dataset. The lower influent TKN load coupled with greater TKN removal across the primaries result in a higher primary effluent cBOD:TKN ratio which is more favorable for denitrification.

Table 8. Audit Observations and Impact on Process Performance: 2013-2015 vs. 2017-2019 (*continued)*

Parameter	2013-2015	2017-2019	Description
98^{th} Percentile SVI	200 mL/g	87 mL/g	Higher SVI indicates sludge that doesn't settle as well. Higher SVI results in decreased secondary clarifier capacity, which would theoretically negatively impact nitrogen removal. The dramatic change in SVI in 2017-2019 dataset is likely due to the continuous RAS chlorination. Chlorination may at times impact nitrification performance.
Maximum Allowable MLSS vs. Average MLSS	2,400 mg/L vs. 4,700 mg/L	3.900 mg/L vs. 5,100 mg/L	Operating at MLSS concentrations exceeding maximum allowable based on SVI, peak flows, and secondary clarifier capacities make the process susceptible to solids washout. Higher TSS results in higher organic-N loading and overall TN discharges.
Effluent TSS	7.5 mg/L	6.7 mg/L	Loss of solids to the effluent results in higher effluent pollutant loading (e.g. particulate organic nitrogen) and loss of system biomass. This difference in TSS equates to approximately 67 lbs/day of effluent nitrogen at the design average daily flow of 10 mgd.
Mixed Liquor Return Rate	2.6 x Forward Flow	2.8 x Forward Flow	If IR pumping rates were increased significantly in the 2017-2019 dataset compared to the 2013-2015 dataset, the increased MLR increased denitrification performance. Despite adequate return rates reported, IR pumps have been reported to be unreliable and frequently malfunction.
Aeration Volume	Adequate	Adequate	The WWTP has adequate aeration volume to nitrify throughout the years of each dataset.