CITY OF FORT WORTH, TEXAS

Mary's Creek Water Reclamation Facility

Application for New Texas Pollutant Discharge Elimination System Permit

SUBMITTED TO:

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

MARCH 2018

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

0318-059-01

TEXAS REGISTERED ENGINEERING FIRM F-13
3/8/2018 10:11 AM F:\projects\0318\059-01\2-0 Wrk Prod\2-1 ACAD\FIGURES\Cover_FINAL.dwg Dmay

CITY OF FORT WORTH
MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

TABLE OF CONTENT

DOMESTIC WASTEWATER PERMIT APPLICATION

ADMINSTRATIVE REPORT 1.0

ADMINISTRATIVE REPORT 1.1

SUPPLEMENTAL PERMIT INFORMATION FORM

SPIF-1 USGS Map
SPIF-2 General Location Map
SPIF-3 Structures 50 Years or Older

TECHNICAL REPORT 1.0

TECHNICAL REPORT 1.1

WORKSHEET 2.0

WORKSHEET 2.1

WORKSHEET 6.0

ATTACHMENT	REFERENCE
A. Core Data Form	Admin Report 1.0, Section 3.C
B. USGS Map	Admin Report 1.0, Section 13
C. Affected Landowners Map	Admin Report 1.1, Section 1.A
D. Affected Landowners List	Admin Report 1.1, Section 1.B
E. Photographs	Admin Report 1.1, Section 2
F. Buffer Zone Map	Admin Report 1.1, Section 3.A
G. Treatment Process	Tech Report 1.0, Section 2.A-C
H. Site Drawing	Tech Report 1.0, Section 3
I. Sewage Sludge Solids Management Plan	Tech Report 1.0, Section 9.B and Tech Report 1.1, Section 7
J. Justification of Permit	Tech Report 1.1, Section 1.A
K. Design Calculations and Design Features	Tech Report 1.1, Section 4
L. Wind Rose	Tech Report 1.1, Section 5.B
M. Water Quality Modeling Memo	Worksheet 2.1

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION CHECKLIST

Complete and submit this checklist with the application.

APPLICANT: **City of Fort Worth**

PERMIT NUMBER: **New**

Indicate if each of the following items is included in your application.

	Y	N
Administrative Report 1.0	☒	☐
Administrative Report 1.1	☒	☐
SPIF	☒	☐
Core Data Form	☒	☐
Technical Report 1.0	☒	☐
Technical Report 1.1	☒	☐
Worksheet 2.0	☒	☐
Worksheet 2.1	☒	☐
Worksheet 3.0	☐	☒
Worksheet 3.1	☐	☒
Worksheet 3.2	☐	☒
Worksheet 3.3	☐	☒
Worksheet 4.0	☐	☒
Worksheet 5.0	☐	☒
Worksheet 6.0	☒	☐
Worksheet 7.0	☐	☒

	Y	N
Original USGS Map	☒	☐
Affected Landowners Map	☒	☐
Landowner Disk or Labels	☒	☐
Buffer Zone Map	☒	☐
Flow Diagram	☒	☐
Site Drawing	☒	☐
Original Photographs	☒	☐
Design Calculations	☒	☐
Solids Management Plan	☒	☐
Water Balance	☐	☒

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

APPLICATION FOR A DOMESTIC WASTEWATER PERMIT ADMINISTRATIVE REPORT 1.0

If you have questions about completing this form please contact the Applications Review and Processing Team at 512-239-4671.

Section 1. Application Fees (Instructions Page 29)

Indicate the amount submitted for the application fee (check only one).

Flow	New/Major Amendment	Renewal
<0.05 MGD	$350.00 ☐	$315.00 ☐
≥0.05 but <0.10 MGD	$550.00 ☐	$515.00 ☐
≥0.10 but <0.25 MGD	$850.00 ☐	$815.00 ☐
≥0.25 but <0.50 MGD	$1,250.00 ☐	$1,215.00 ☐
≥0.50 but <1.0 MGD	$1,650.00 ☐	$1,615.00 ☐
≥1.0 MGD	$2,050.00 ☒	$2,015.00 ☐

Minor Amendment (for any flow) $150.00 ☐

Payment Information:

Mailed Check/Money Order Number: 1143410

Check/Money Order Amount: $2,050.00

Name Printed on Check: City of Fort Worth

EPAY Voucher Number: N/A

Copy of Payment Voucher enclosed? Yes ☐ N/A

Section 2. Type of Application (Instructions Page 29)

☒ New TPDES

☐ New TLAP

☐ Major Amendment *with* Renewal

☐ Minor Amendment *with* Renewal

☐ Major Amendment *without* Renewal

☐ Minor Amendment *without* Renewal

☐ Renewal without changes

☐ Minor Modification of permit

For amendments or modifications, describe the proposed changes: **N/A**

For existing permits:

Permit number **N/A** EPA I.D. (TPDES only) TX **N/A**

Section 3. Facility Owner (Applicant) and Co-Applicant Information (Instructions Page 29)

A. The owner of the facility must apply for the permit.

What is the Legal Name of the entity (applicant) applying for this permit?

City of Fort Worth, Texas

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal documents forming the entity.)

If the applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch

CN: **600128862**

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

First/Last Name: Jesus J. Chapa

Title/Prefix: Assistant City Manager Credential: Click here to enter text.

B. Co-applicant information. Complete this section only if another person or entity is required to apply as a co-permittee.

What is the Legal Name of the co-applicant applying for this permit?

N/A

(The legal name must be spelled exactly as filed with the TX SOS, with the County, or in the legal documents forming the entity.)

If the co-applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch:

CN: Click here to enter text.

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

First and Last Name: Click here to enter text.

Title/Prefix: Click here to enter text. Credential: Click here to enter text.

Provide a brief description of the need for a co-permittee:

Click here to enter text.

C. Core Data Form

Complete the Core Data Form for each customer and include as an attachment. If the customer type selected on the Core Data Form is **Individual**, complete **Attachment 1** of Administrative Report 1.0. **Attachment: A**

Section 4. Application Contact Information (Instructions Page 30)

This is the person(s) TCEQ will contact if additional information is needed about this application. Provide a contact for administrative questions and technical questions.

A. First and Last Name: **Stacy Walters** Credential:

Organization Name: **City of Fort Worth** Title/Prefix: **Regulatory Environmental Administrator**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-8203** Ext.: Click here to enter text. Fax No.: **N/A**

E-mail Address: **Stacy.Walters@fortworthtexas.gov**

Check one or both: ☒ Administrative Contact ☒ Technical Contact

B. First and Last Name: **Dennis Runyan** Credential: Click here to enter text.

Organization Name: **Alan Plummer Associates, Inc.** Title/Prefix: **Project Manager**

Mailing Address: **6300 La Calma, Suite 400**

City: **Austin** State: **Texas** ZIP Code: **78752**

Phone No.: **(512) 452-5905** Ext.: Click here to enter text. Fax No.: Click here to enter text.

E-mail Address: **drunyan@apaienv.com**

Check one or both: ☒ Administrative Contact ☒ Technical Contact

Section 5. Permit Contact Information (Instructions Page 30)

Provide two names of individuals that can be contacted throughout the permit term.

A. First and Last Name: **Betsy Price** Credential: Click here to enter text.

Organization Name: **City of Fort Worth** Title/Prefix: **Mayor**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-6118** Ext.: Click here to enter text. Fax No.: Click here to enter text.

E-mail Address: **Betsy.Price@fortworthtexas.gov**

B. First and Last Name:**Jesus Chapa** Credential: Click here to enter text.

Organization Name: **City of Fort Worth** Title/Prefix: **Assistant City Manager**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-5804** Ext.: Click here to enter text. Fax No.: Click here to enter text.

E-mail Address: **Jesus.Chapa@fortworthtexas.gov**

Section 6. Billing Information (Instructions Page 30)

The permittee is responsible for paying the annual fee. The annual fee will be assessed to permits ***in effect on September 1 of each year.*** The TCEQ will send a bill to the address provided in this section. The permittee is responsible for terminating the permit when it is no longer needed (using form TCEQ-20029).

First and Last Name: **Stacy Walters** Credential:

Organization Name: **City of Fort Worth** Title/Prefix: **Regulatory Environmental Administrator**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-8203** Ext.: Click here to enter text. Fax No.: **N/A**

E-mail Address: **Stacy.Walters@fortworthtexas.gov**

Section 7. DMR/MER Contact Information (Instructions Page 31)

Provide the name and complete mailing address of the person delegated to receive and submit Discharge Monitoring Reports (EPA 3320-1) or maintain Monthly Effluent Reports.

First and Last Name: **Stacy Walters** Credential:

Organization Name: **City of Fort Worth** Title/Prefix: **Regulatory Environmental Administrator**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-8203** Ext.: Click here to enter text. Fax No.: **N/A**

E-mail Address: **Stacy.Walters@fortworthtexas.gov**

You can submit DMR data on the TCEQ website at https://www.tceq.texas.gov/field/netdmr/netdmr.html. Establish an electronic reporting account with the permit number.

Section 8. Public Notice Information (Instructions Page 31)

A. Individual Publishing the Notices

First and Last Name: **Mary Gugliuzza** Credential:

Organization Name: **City of Fort Worth** Title/Prefix: **Communications Coordinator**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-8253** Ext.: Click here to enter text. Fax No.: **N/A**

E-mail Address: **Mary.Gugliuzza@fortworthtexas.gov**

B. Method for Receiving Notice of Receipt and Intent to Obtain a Water Quality Permit Package

Indicate by a check mark the preferred method for receiving the first notice and instructions:

☒ E-mail Address **Mary.Gugliuzza@fortworthtexas.gov**

☐ Fax No.:

☐ Regular Mail:

Mailing Address:

City: Click here to enter text. State: Click here to enter text.

ZIP Code: Click here to enter text.

Phone No.: Click here to enter text. Ext.: Click here to enter text.

Fax: Click here to enter text.

C. Contact person to be listed in the Notices

First and Last Name: **Stacy Walters** Credential: Click here to enter text.

Organization Name: **City of Fort Worth** Title/Prefix: **Regulatory Environmental Administrator**

Phone No.: **(817) 392-8203** Ext.: E-mail: **Stacy.Walters@fortworthtexas.gov**

D. Public Viewing Information

If the facility or outfall is located in more than one county, a public viewing place for each county must be provided.

Public building name: **City of Fort Worth Water Department Municipal/City Hall**

Location within the building: **Second Floor**

Physical Address of Building: **200 Texas Street**

City: **Fort Worth** County: **Tarrant**

Contact Name: **Stacy Walters**

Phone No.: **(817) 392-8203** Ext.: Click here to enter text.

E. Bilingual Notice Requirements:

This information **is required** for **new, major amendment, and renewal applications**. It is not required for minor amendment or minor modification applications.

This section of the application is only used to determine if alternative language notices will be

needed. Complete instructions on publishing the alternative language notices will be in your public notice package.

Please call the bilingual/ESL coordinator at the nearest elementary and middle schools and obtain the following information to determine whether an alternative language notices are required.

1. Is a bilingual education program required by the Texas Education Code at the elementary or middle school nearest to the facility or proposed facility?

☒ Yes ☐ No

If **no**, publication of an alternative language notice is not required; **skip to** Section 9 below.

2. Are the students who attend either the elementary school or the middle school enrolled in a bilingual education program at that school?

   ☐ Yes ☒ No

3. Do the students at these schools attend a bilingual education program at another location?

   ☒ Yes ☐ No

4. Would the school be required to provide a bilingual education program but the school has waived out of this requirement under 19 TAC §89.1205(g)?

   ☐ Yes ☒ No

5. If the answer is yes to question 1, 2, 3, or 4, public notices in an alternative language are required. Which language is required by the bilingual program? **Spanish**

Section 9. Regulated Entity and Permitted Site Information (Instructions Page 33)

Search the TCEQ's Central Registry at http://www15.tceq.texas.gov/crpub/index.cfm?fuseaction=regent.RNSearch to determine the RN.

If the site is found, provide the assigned Regulated Entity Number and provide the information for the site to be authorized through this application below.

TCEQ issued Regulated Entity Number (RN): **RN N/A – This is a new facility**

A. State/TPDES Permit No.: **N/A** Expiration Date: **N/A**

EPA Identification No. (TPDES Permits only): TX **N/A**

B. Name of project or site (the name known by the community where located): **Mary's Creek Water Reclamation Facility**

If the facility is located in Bexar, Comal, Hays, Kinney, Medina, Travis, Uvalde, or Williamson County, additional information concerning protection of the Edwards Aquifer may be required.

C. Owner of treatment facility: **City of Fort Worth**

Ownership of Facility: ☒ Public ☐ Private ☐ Both ☐ Federal

D. Owner of land where treatment facility is or will be:

First and Last Name: **City of Fort Worth**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-8203** E-mail Address: **Stacy.Walters@fortworthtexas.gov**

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: **N/A**

E. Owner of effluent disposal site:

First and Last Name: **N/A**

Mailing Address: Click here to enter text.

City: Click here to enter text. State: Click here to enter text.

ZIP Code: Click here to enter text.

Phone No.: Click here to enter text. E-mail Address: Click here to enter text.

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click here to enter text.

F. Owner of sewage sludge disposal site (if authorization is requested for sludge disposal on property owned or controlled by the applicant):

First/Last Name: **N/A**

Mailing Address: Click here to enter text.

City: Click here to enter text. State: Click here to enter text.

ZIP Code: Click here to enter text.

Phone No.: Click here to enter text. E-mail Address: Click here to enter text.

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click here to enter text.

Section 10. TPDES Discharge Information (Instructions Page 34)

A. Is the wastewater treatment facility location in the existing permit accurate?

☐ Yes ☒ No

If **no**, **or a new permit application**, please give an accurate description:

The proposed wastewater treatment facility is approximately one mile northwest of the intersection of IH-30 and TX580/Camp Bowie W. Blvd.

B. Are the point(s) of discharge and the discharge route(s) in the existing permit correct?

☐ Yes ☐ No

If **no**, **or a new or amendment permit application**, provide an accurate description of the point of discharge and the discharge route to the nearest classified segment as defined in 30 TAC Chapter 307:

Discharge is through a pipe into Mary's Creek, thence to the Clear Fork Trinity River, Segment 0829 of the Trinity River Basin.

City nearest the outfall(s): **Fort Worth**

County in which the outfalls(s) is/are located: **Tarrant**

Outfall Latitude: **32.7311** Longitude: **-97.5317**

C. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or a flood control district drainage ditch?

☐ Yes ☒ No

If **yes**, indicate by a check mark if:

☐ Authorization granted ☐ Authorization pending

For **new and amendment** applications, provide copies of letters that show proof of contact and the approval letter upon receipt.

Attachment:

F. For all applications involving an average daily discharge of 5 MGD or more, provide the names of all counties located within 100 statute miles downstream of the point(s) of discharge.

Tarrant, Dallas, Ellis, Kaufman, Navarro, Henderson, Freestone and Anderson

Section 11. TLAP Disposal Information (Instructions Page 36)

A. For TLAPs, is the location of the effluent disposal site in the existing permit accurate?

☐ Yes ☐ No **Not Applicable**

If **no, or a new or amendment permit application**, provide an accurate description of the disposal site location:

N/A

B. City nearest the disposal site: Click here to enter text.

C. County in which the disposal site is located: Click here to enter text.

D. Disposal Site Latitude: Click here to enter text. Longitude: Click here to enter text.

E. For **TLAPs**, describe the routing of effluent from the treatment facility to the disposal site:

Click here to enter text.

F. For **TLAPs**, please identify the nearest watercourse to the disposal site to which rainfall runoff might flow if not contained:

Click here to enter text.

Section 12. Miscellaneous Information (Instructions Page 37)

A. Is the facility located on or does the treated effluent cross American Indian Land?

☐ Yes ☒ No

B. If the existing permit contains an onsite sludge disposal authorization, is the location of the sewage sludge disposal site in the existing permit accurate?

Yes ☐ No ☐ Not Applicable ☒

If No, or if a new onsite sludge disposal authorization is being requested in this permit application, provide an accurate location description of the sewage sludge disposal site.

Click here to enter text.

C. Did any person formerly employed by the TCEQ represent your company and get paid for service regarding this application?

☐ Yes ☒ No

If yes, list each person formerly employed by the TCEQ who represented your company and was paid for service regarding the application:

Click here to enter text.

D. Do you owe any fees to the TCEQ?

☐ Yes ☒ No

If **yes**, provide the following information:

Account number: Click here to enter text. Amount past due:

E. Do you owe any penalties to the TCEQ?

☐ Yes ☒ No

If **yes**, please provide the following information:

Enforcement order number: Click here to enter text. Amount past due:

Section 13. Attachments (Instructions Page 38)

Indicate which attachments are included with the Administrative Report. Check all that apply:

☐ Lease agreement or deed recorded easement, if the land where the treatment facility is located or the effluent disposal site are not owned by the applicant or co-applicant.

☒ Original full-size USGS Topographic Map with the following information:

- Applicant's property boundary **See Attachment B.**
- Treatment facility boundary
- Labeled point of discharge for each discharge point (TPDES only)
- Highlighted discharge route for each discharge point (TPDES only)
- Onsite sewage sludge disposal site (if applicable)
- Effluent disposal site boundaries (TLAP only)
- New and future construction (if applicable)
- 1 mile radius information
- 3 miles downstream information (TPDES only)
- All ponds.

☐ Attachment 1 for Individuals as co-applicants

☒ Other Attachments. Please specify**:**

Attachment A – Core Data Form
Attachment B – USGS Topographic Map
Attachment C – Affected Landowners Map
Attachment D – Affected Landowners List
Attachment E – Photographs
Attachment F – Buffer Zone Map

Section 14. Signature Page (Instructions Page 39)

Permit Number: **NEW**

Applicant: **City of Fort Worth**

Certification:

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 there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code § 305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): Jesus J. Chapa

Signatory title: Assistant City Manager

Signature: Jesus J Chapa Date: 3-20-18

(Use blue ink)

Subscribed and Sworn to before me by the said Jesus J. Chapa

on this 20th day of March, 2018.

My commission expires on the 19th day of December, 2021.

MARIA S. SANCHEZ
My Notary ID # 2256490
Expires December 19, 2021

Maria S. Sanchez
Notary Public

[SEAL]

TARRANT
County, Texas

If co-applicants are necessary, each entity must submit an original, separate signature page.

DOMESTIC ADMINISTRATIVE REPORT 1.1

The following information is required for new and amendment applications.

Section 1. Affected Landowner Information (Instructions Page 41)

A. Indicate by a check mark that the landowners map or drawing, with scale, includes the following information, as applicable: **See Attachment C.**

- ☒ The applicant's property boundaries
- ☒ The facility site boundaries within the applicant's property boundaries
- ☐ The distance the buffer zone falls into adjacent properties and the property boundaries of the landowners located within the buffer zone ***The buffer zone does not fall into adjacent properties**
- ☒ The property boundaries of all landowners surrounding the applicant's property (Note: if the application is a major amendment for a lignite mine, the map must include the property boundaries of all landowners adjacent to the new facility (ponds).)
- ☒ The point(s) of discharge and highlighted discharge route(s) clearly shown for one mile downstream
- ☒ The property boundaries of the landowners located on both sides of the discharge route for one full stream mile downstream of the point of discharge
- ☐ The property boundaries of the landowners along the watercourse for a one-half mile radius from the point of discharge if the point of discharge is into a lake, bay, estuary, or affected by tides
- ☐ The boundaries of the effluent disposal site (for example, irrigation area or subsurface drainfield site) and all evaporation/holding ponds within the applicant's property
- ☐ The property boundaries of all landowners surrounding the effluent disposal site
- ☐ The boundaries of the sludge land application site (for land application of sewage sludge for beneficial use) and the property boundaries of landowners surrounding the applicant's property boundaries where the sewage sludge land application site is located
- ☐ The property boundaries of landowners within one-half mile in all directions from the applicant's property boundaries where the sewage sludge disposal site (for example, sludge surface disposal site or sludge monofill) is located

B. ☒ Indicate by a check mark that a separate list with the landowners' names and mailing addresses cross-referenced to the landowners map has been provided. **See Attachment D.**

C. Indicate by a check mark in which format the landowners list is submitted:

☐ Readable/Writeable CD ☒ Four sets of labels

D. Provide the source of the landowners' names and mailing addresses: **Tarrant County Appraisal District**

E. As required by *Texas Water Code § 5.115*, is any permanent school fund land affected by this application?

☐ Yes ☒ No

If **yes**, provide the location and foreseeable impacts and effects this application has on the land(s):

Click here to enter text.

Section 2. Original Photographs (Instructions Page 44)

Provide original ground level photographs. Indicate with checkmarks that the following information is provided. **See Attachment E.**

☒ At least one original photograph of the new or expanded treatment unit location

☒ At least two photographs of the existing/proposed point of discharge and as much area downstream (photo 1) and upstream (photo 2) as can be captured. If the discharge is to an open water body (e.g., lake, bay), the point of discharge should be in the right or left edge of each photograph showing the open water and with as much area on each respective side of the discharge as can be captured.

☐ At least one photograph of the existing/proposed effluent disposal site

☒ A plot plan or map showing the location and direction of each photograph

Section 3. Buffer Zone Map (Instructions Page 44)

A. Buffer zone map. Provide a buffer zone map on 8.5 x 11-inch paper with all of the following information. The applicant's property line and the buffer zone line may be distinguished by using dashes or symbols and appropriate labels. **See Attachment F.**

- The applicant's property boundary;
- The required buffer zone; and
- Each treatment unit; and
- The distance from each treatment unit to the property boundaries.

B. Buffer zone compliance method. Indicate how the buffer zone requirements will be met.

Check all that apply.

☒ Ownership

☐ Restrictive easement

☒ Nuisance odor control

☐ Variance

C. Unsuitable site characteristics. Does the facility comply with the requirements regarding unsuitable site characteristic found in 30 TAC § 309.13(a) through (d)?

Yes ☒ No ☐

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

SUPPLEMENTAL PERMIT INFORMATION FORM (SPIF)

FOR AGENCIES REVIEWING DOMESTIC TPDES WASTEWATER PERMIT APPLICATIONS

TCEQ USE ONLY:

Application type: _____Renewal _____Major Amendment ____Minor Amendment _____New

County: _____ Segment Number: _____

Admin Complete Date: _____

Agency Receiving SPIF:

_____ Texas Historical Commission _____ U.S. Fish and Wildlife

_____ Texas Parks and Wildlife Department _____ U.S. Army Corps of Engineers

This form applies to TPDES permit applications only. (Instructions, Page 53)

The SPIF must be completed as a separate document. The TCEQ will mail a copy of the SPIF to each agency as required by the TCEQ agreement with EPA. If any of the items are not completely addressed or further information is needed, you will be contacted to provide the information before the permit is issued. Each item must be completely addressed.

Do not refer to a response of any item in the permit application form. Each attachment must be provided with this form separately from the administrative report of the application. The application will not be declared administratively complete without this form being completed in its entirety including all attachments.

The following applies to all applications:

1. Permittee: **City of Fort Worth**

   Permit No. WQ00 **New** EPA ID No. TX **New**

   Address of the project (or a location description that includes street/highway, city/vicinity, and county):

   11091 Chapin Road, Fort Worth, Tarrant County Texas

   Provide the name, address, phone and fax number of an individual that can be contacted to answer specific questions about the property.

First and Last Name: **Stacy Walters** Credential:

Organization Name: **City of Fort Worth** Title/Prefix: **Regulatory Environmental Administrator**

Mailing Address: **200 Texas Street**

City: **Fort Worth** State: **Texas** ZIP Code: **76102**

Phone No.: **(817) 392-8203** Ext.: Click here to enter text. Fax No.: **N/A**

E-mail Address: **Stacy.Walters@fortworthtexas.gov**

2. List the county in which the facility is located: **Tarrant**
3. If the property is publicly owned and the owner is different than the permittee/applicant, please list the owner of the property.

The property is owned by the applicant, which is the City of Fort Worth.

4. Provide a description of the effluent discharge route. The discharge route must follow the flow of effluent from the point of discharge to the nearest major watercourse (from the point of discharge to a classified segment as defined in 30 TAC Chapter 307). If known, please identify the classified segment number.

Discharge is through a pipe into Mary's Creek, thence to the Clear Fork Trinity River, Segment 0829 of the Trinity River Basin.

5. Please provide a separate 7.5-minute USGS quadrangle map with the project boundaries plotted and a general location map showing the project area. Please highlight the discharge route from the point of discharge for a distance of one mile downstream. (This map is required in addition to the map in the administrative report). **See SPIF-1 and SPIF-2.**

   Provide original photographs of any structures 50 years or older on the property. **See SPIF-3**

   Does your project involve any of the following? Check all that apply.

   ☒ Proposed access roads, utility lines, construction easements

   ☐ Visual effects that could damage or detract from a historic property's integrity

   ☒ Vibration effects during construction or as a result of project design

   ☒ Additional phases of development that are planned for the future

   ☐ Sealing caves, fractures, sinkholes, other karst features

   ☒ Disturbance of vegetation or wetlands ***No wetlands will be disturbed.**

6. List proposed construction impact (surface acres to be impacted, depth of excavation, sealing of caves, or other karst features):

The proposed facility boundary for the new water reclamation facility encloses approximately 51.5 acres. Excavation depth will vary, but a maximum depth of approximately 60 feet is required for the raw wastewater pump station. Most of the site will not be excavated to this depth.

7. Describe existing disturbances, vegetation, and land use:

The proposed site is rural, undeveloped land with unpaved roads and no agriculture.

THE FOLLOWING ITEMS APPLY ONLY TO APPLICATIONS FOR NEW TPDES PERMITS AND MAJOR AMENDMENTS TO TPDES PERMITS

8. List construction dates of all buildings and structures on the property:

There is one building on the property. The pump house pictured in SPIF-3 is at least 50 years old, based on historical aerial photographs. However, the actual build date is unknown.

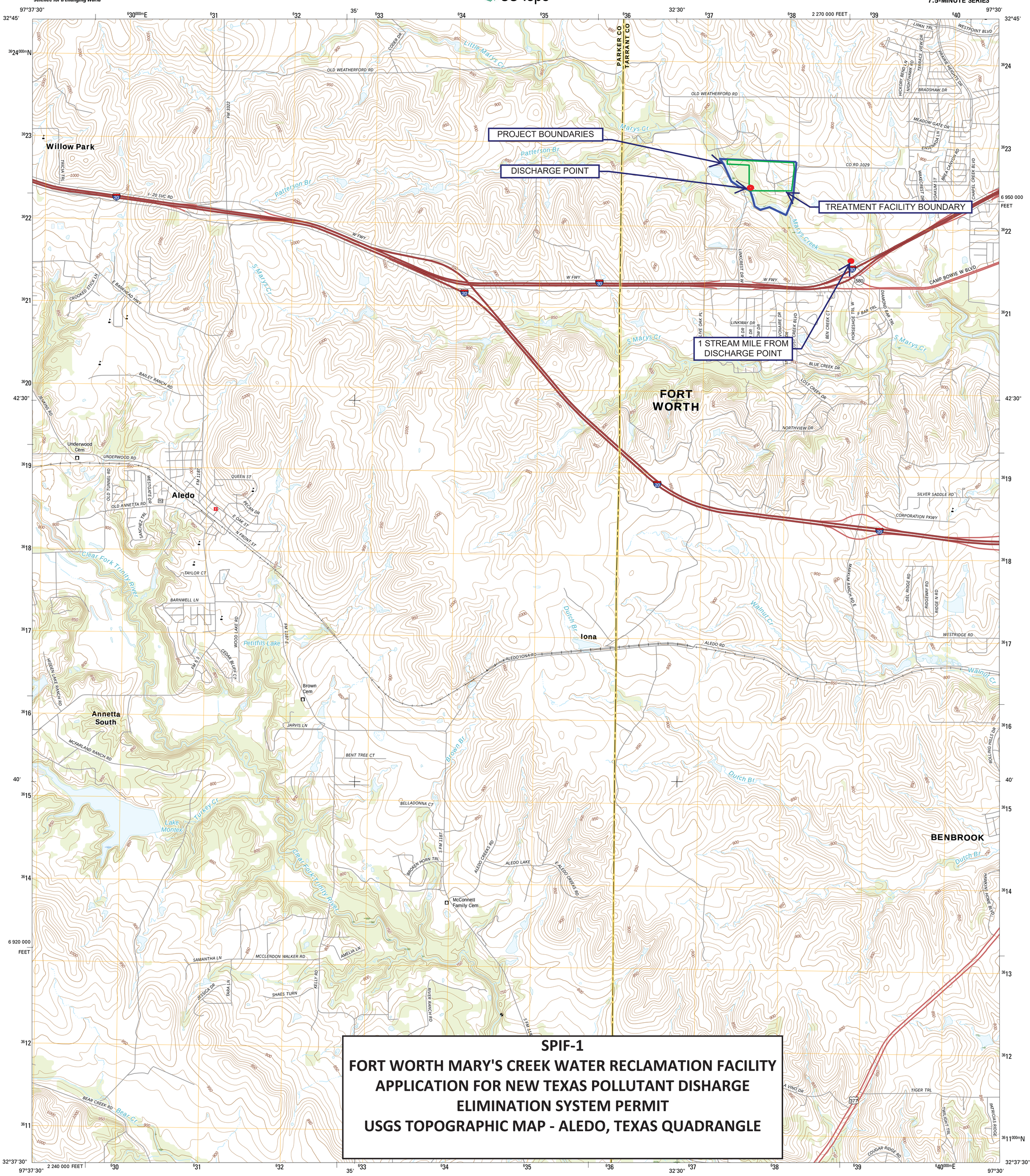
9. Provide a brief history of the property, and name of the architect/builder, if known.

The property was used as pasture for grazing animals.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

ALEDO QUADRANGLE
TEXAS
7.5-MINUTE SERIES



SPIF-1
FORT WORTH MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISHARGE ELIMINATION SYSTEM PERMIT
USGS TOPOGRAPHIC MAP - ALEDO, TEXAS QUADRANGLE

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 14S
10 000-foot ticks: Texas Coordinate System of 1983 (north central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, July 2014
Roads..... U.S. Census Bureau, 2014 - 2015
Names.....GNIS, 2015
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2004
Boundaries.....Multiple sources; see metadata file 1972 - 2015

Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN
GN
3° 58′ 70 MILS
0° 47′ 14 MILS

UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
PB
Grid Zone Designation 14S

SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

TEXAS
QUADRANGLE LOCATION

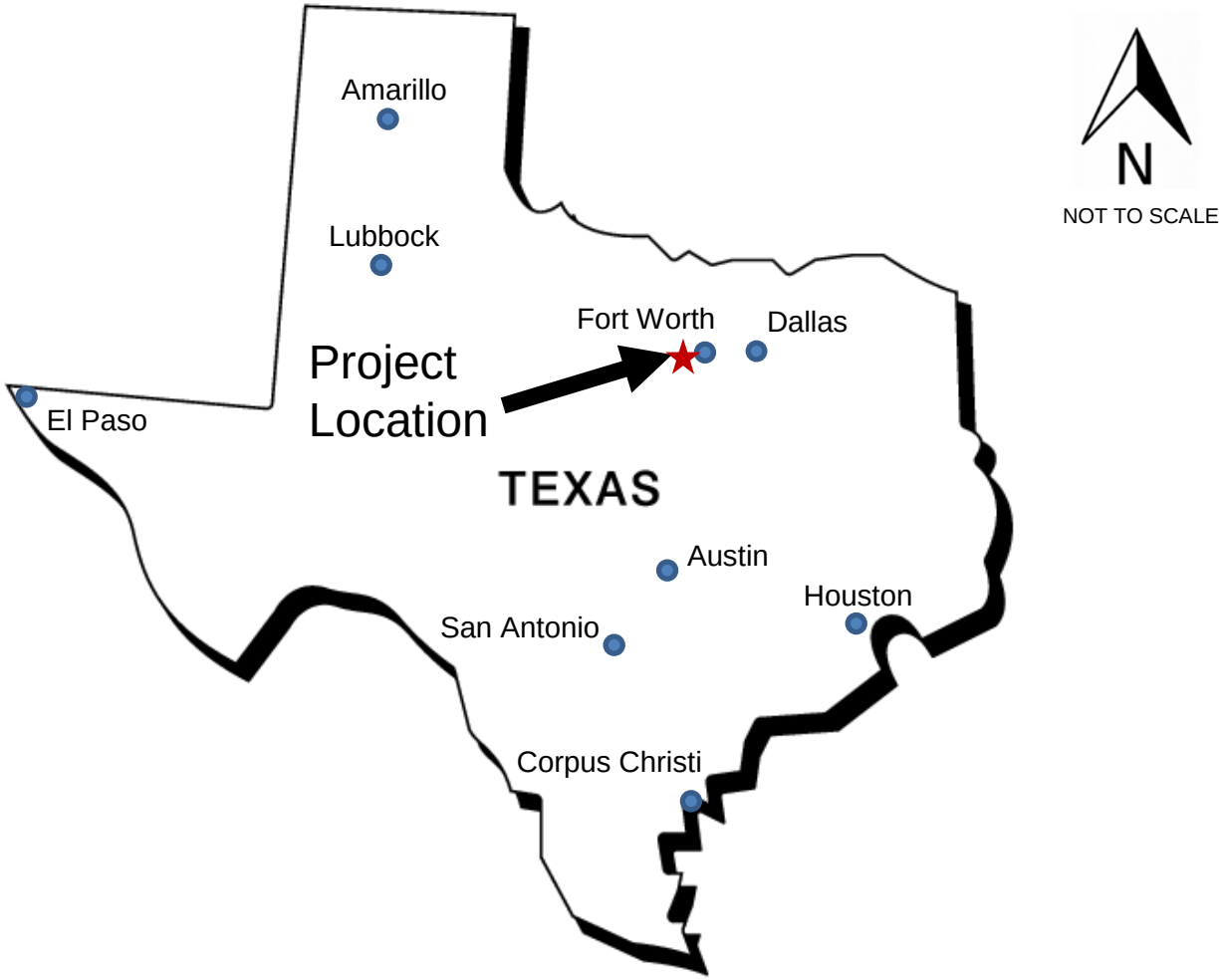
1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Lake Weatherford
2 Springtown SE
3 Lake Worth
4 Annetta
5 Benbrook
6 Chapin
7 Cresson
8 Primrose

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

ALEDO, TX
2016

NSN. 7643016394798
NGA REF NO. USGSX24K488



SPIF-2

CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

GENERAL LOCATION MAP

SPIF-3

CITY OF FORT WORTH
MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

STRUCTURES 50 YEARS OR OLDER ON THE PROPERTY

Pump House – Unknown Build Date

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION

DOMESTIC TECHNICAL REPORT 1.0

The Following Is Required For All Applications

Renewal, New, And Amendment

Section 1. Permitted or Proposed Flows (Instructions Page 51)

A. Existing/Interim I Phase

Design Flow (MGD): **10**

2-Hr Peak Flow (MGD): **20**

Estimated construction start date: **1/1/2023**

Estimated waste disposal start date: **1/1/2025**

B. Interim II Phase

Design Flow (MGD):

2-Hr Peak Flow (MGD): Click here to enter text.

Estimated construction start date: Click here to enter text.

Estimated waste disposal start date: Click here to enter text.

C. Final Phase

Design Flow (MGD): **15**

2-Hr Peak Flow (MGD): **30**

Estimated construction start date: **1/1/2028**

Estimated waste disposal start date: **1/1/2030**

D. Current operating phase: Facility has not been constructed.

Provide the startup date of the facility: Click here to enter text.

Section 2. Treatment Process (Instructions Page 51)

A. Treatment process description

Provide a detailed description of the treatment process. **Include the type of**

treatment plant, mode of operation, and all treatment units. Start with the plant's head works and finish with the point of discharge. Include all sludge processing and drying units. **If more than one phase exists or is proposed in the permit, a description of *each phase* must be provided**. Process description:

See Attachment G.1

Port or pipe diameter at the discharge point, in inches: **36 inches**

B. Treatment Units

In Table 1.0(1), provide the treatment unit type, the number of units, and dimensions (length, width, depth) **of each treatment unit, accounting for *all* phases of operation**.

Table 1.0(1) – Treatment Units

Treatment Unit Type	Number of Units	Dimensions (L x W x D)
See Attachment G.2		

C. Process flow diagrams

Provide flow diagrams for the existing facilities and **each** proposed phase of construction.

Attachment: **G.3**

Section 3. Site Drawing (Instructions Page 52)

Provide a site drawing for the facility that shows the following:

- The boundaries of the treatment facility;
- The boundaries of the area served by the treatment facility;
- If land disposal of effluent, the boundaries of the disposal site and all storage/holding ponds; and
- If sludge disposal is authorized in the permit, the boundaries of the land application or disposal site.

Attachment: **H.**

Provide the name and a description of the area served by the treatment facility.

Treatment facility will serve residential and commercial customers on the west side of the City of Fort Worth, both inside and outside the city limits, and in the City of Benbrook.

Section 4. Unbuilt Phases (Instructions Page 52)

Is the application for a renewal of a permit that contains an unbuilt phase or phases?

Yes ☐ No ☒

If yes, does the existing permit contain a phase that has not been constructed within five years of being authorized by the TCEQ?

Yes ☐ No ☐

If yes, provide a detailed discussion regarding the continued need for the unbuilt phase. Failure to provide sufficient justification may result in the Executive Director recommending denial of the unbuilt phase or phases.

Click here to enter text.

Section 5. Closure Plans (Instructions Page 53)

Have any treatment units been taken out of service permanently, or will any units be taken out of service in the next five years?

Yes ☐ No ☒

If yes, was a closure plan submitted to the TCEQ?

Yes ☐ No ☐

If yes, provide a brief description of the closure and the date of plan approval.

Click here to enter text.

Section 6. Permit Specific Requirements (Instructions Page 53)

For applicants with an existing permit, check the *Other Requirements* or *Special Provisions* of the permit.

A. Summary transmittal

Have plans and specifications been approved for the existing facilities and each proposed phase?

Yes ☐ No ☒

If yes, provide the date(s) of approval for each phase: Click here to enter text.

Provide information, including dates, on any actions taken to meet a requirement or provision pertaining to the submission of a summary transmittal letter. Provide a copy of an approval letter from the TCEQ, if applicable.

Click here to enter text.

B. Buffer zones

Have the buffer zone requirements been met?

Yes ☒ No ☐

Provide information below, including dates, on any actions taken to meet the conditions of the buffer zone. If available, provide any new documentation

relevant to maintaining the buffer zones.

Click here to enter text.

C. Other actions required by the current permit

Does the *Other Requirements* or *Special Provisions* section in the existing permit require submission of any other information or other required actions? Examples include Notification of Completion, progress reports, soil monitoring data, etc.

Yes ☐ No ☐ **Not Applicable – New Permit**

If yes, provide information below on the status of any actions taken to meet the conditions of an *Other Requirement* or *Special Provision*.

Click here to enter text.

D. Grit and grease treatment

1. Acceptance of grit and grease waste

Does the facility have a grit and/or grease processing facility onsite that treats and decants or accepts transported loads of grit and grease waste that are discharged directly to the wastewater treatment plant prior to any treatment?

Yes ☐ No ☒

If No, stop here and continue with Subsection E. Stormwater Management.

2. Grit and grease processing

Describe below how the grit and grease waste is treated at the facility. In your description, include how and where the grit and grease is introduced to the treatment works and how it is separated or processed. Provide a flow diagram showing how grit and grease is processed at the facility.

Click here to enter text.

3. Grit disposal

Does the facility have a Municipal Solid Waste (MSW) registration or permit for grit disposal?

Yes ☐ No ☐

If No, contact the TCEQ Municipal Solid Waste team at 512-239-0000. Note: A registration or permit is required for grit disposal. Grit shall not be combined with treatment plant sludge. See the instruction booklet for additional information on grit disposal requirements and restrictions.

Describe the method of grit disposal.

Click here to enter text.

4. Grease and decanted liquid disposal

Note: A registration or permit is required for grease disposal. Grease shall not be combined with treatment plant sludge. For more information, contact the TCEQ Municipal Solid Waste team at 512-239-0000.

Describe how the decant and grease are treated and disposed of after grit separation.

Click here to enter text.

E. Stormwater management

1. Applicability

Does the facility have a design flow of 1.0 MGD or greater in any phase?

Yes ☒ No ☐

Does the facility have an approved pretreatment program, under 40 CFR Part 403?

Yes ☐ No ☒

If no to both of the above, then skip to Subsection F, Other Wastes Received.

2. MSGP coverage

Is the stormwater runoff from the WWTP and dedicated lands for sewage disposal currently permitted under the TPDES Multi-Sector General Permit (MSGP), TXR050000?

Yes ☐ No ☒

If yes, please provide MSGP Authorization Number and skip to Subsection F, Other Wastes Received:

TXR05 Click here to enter text or TXRNE Click here to enter text

If no, do you intend to seek coverage under TXR050000?

Yes ☒ No ☐

3. Conditional exclusion

Alternatively, do you intend to apply for a conditional exclusion from permitting based TXR050000 (Multi Sector General Permit) Part II B.2 or TXR050000 (Multi Sector General Permit) Part V, Sector T 3(b)?

Yes ☐ No ☒

If yes, please explain below then proceed to Subsection F, Other Wastes Received:

Click here to enter text

4. Existing coverage in individual permit

Is your stormwater discharge currently permitted through this individual TPDES or TLAP permit?

Yes ☐ No ☒

If yes, provide a description of stormwater runoff management practices at the site that are authorized in the wastewater permit then skip to Subsection F, Other Wastes Received.

Click here to enter text.

5. Zero stormwater discharge

Do you intend to have no discharge of stormwater via use of evaporation or other means?

Yes ☐ No ☒

If yes, explain below then skip to Subsection F. Other Wastes Received.

Click here to enter text.

Note: If there is a potential to discharge any stormwater to surface water in the state as the result of any storm event, then permit coverage is required under the MSGP or an individual discharge permit. This requirement applies to all areas of facilities with treatment plants or systems that treat, store, recycle, or reclaim domestic sewage, wastewater or sewage sludge (including dedicated lands for sewage sludge disposal located within the onsite property boundaries) that meet the applicability criteria of above. You have the option of obtaining coverage under the MSGP for direct discharges, (recommended), or obtaining coverage under this individual permit.

6. Request for coverage in individual permit

Are you requesting coverage of stormwater discharges associated with your treatment plant under this individual permit?

Yes ☐ No ☒

If yes, provide a description of stormwater runoff management practices at the site for which you are requesting authorization in this individual wastewater permit and describe whether you intend to comingle this discharge with your treated effluent or discharge it via a separate dedicated stormwater outfall. Please also indicate if you intend to divert stormwater to the treatment plant headworks and indirectly discharge it to water in the state.

Click here to enter text.

Note: Direct stormwater discharges to waters in the state authorized through this individual permit will require the development and implementation of a stormwater pollution prevention plan (SWPPP) and will be subject to additional monitoring and reporting requirements. Indirect discharges of stormwater via headworks recycling will require compliance with all individual permit requirements including 2-hour peak flow limitations. All stormwater discharge authorization requests will require additional information during the technical review of your application.

F. Discharges to the Lake Houston Watershed

Does the facility discharge in the Lake Houston watershed?
Yes ☐ No ☒

If yes, a Sewage Sludge Solids Management Plan is required. See Example 5 in the instructions.

G. Other wastes received including sludge from other WWTPs and septic waste

1. Acceptance of sludge from other WWTPs

Does the facility accept or will it accept sludge from other treatment plants at the facility site?
Yes ☐ No ☒

If yes, attach sewage sludge solids management plan. See Example 5 of the instructions.

In addition, provide the date that the plant started accepting sludge or is anticipated to start accepting sludge, an estimate of monthly sludge acceptance (gallons or millions of gallons), an estimate of the BOD_5 concentration of the sludge, and the design BOD_5 concentration of the influent from the collection system. Also note if this information has or has not changed since the last permit action.

Click here to enter text.

Note: Permits that accept sludge from other wastewater treatment plants may be required to have influent flow and organic loading monitoring.

2. Acceptance of septic waste

Is the facility accepting or will it accept septic waste?

Yes ☐ No ☒

If yes, does the facility have a Type V processing unit?

Yes ☐ No ☐

If yes, does the unit have a Municipal Solid Waste permit?

Yes ☐ No ☐

If yes to any of the above, provide a the date that the plant started accepting septic waste, or is anticipated to start accepting septic waste, an estimate of monthly septic waste acceptance (gallons or millions of gallons), an estimate of the BOD_5 concentration of the septic waste, and the design BOD_5 concentration of the influent from the collection system. Also note if this information has or has not changed since the last permit action.

Click here to enter text.

Note: Permits that accept sludge from other wastewater treatment plants may be required to have influent flow and organic loading monitoring.

3. Acceptance of other wastes (not including septic, grease, grit, or RCRA, CERCLA or as discharged by IUs listed in Worksheet 6)

Is the facility accepting or will it accept wastes that are not domestic in nature excluding the categories listed above?

Yes ☐ No ☒

If yes, provide the date that the plant started accepting the waste, an estimate how much waste is accepted on a monthly basis (gallons or millions of gallons), a description of the entities generating the waste, and any distinguishing chemical or other physical characteristic of the waste. Also note if this information has or has not changed since the last permit action.

Click here to enter text.

Section 7. Pollutant Analysis of Treated Effluent (Instructions Page 58)

Is the facility in operation?

Yes ☐ No ☒

If no, this section is not applicable. Proceed to Section 8.

If yes, provide effluent analysis data for the listed pollutants. ***Wastewater treatment facilities*** complete Table 1.0(2). **W*ater treatment facilities*** discharging filter backwash water, complete Table 1.0(3).

Note: The sample date must be within 1 year of application submission.

Table 1.0(2) - Pollutant Analysis for Wastewater Treatment Facilities

Pollutant	**Average Conc.**	**Max Conc.**	**No. of Samples**	**Sample Type**	**Sample Date/Time**
$CBOD_5$, mg/l					
Total Suspended Solids, mg/l					
Ammonia Nitrogen, mg/l					
Nitrate Nitrogen, mg/l					
Total Kjeldahl Nitrogen, mg/l					
Sulfate, mg/l					
Chloride, mg/l					
Total Phosphorus, mg/l					
pH, standard units					
Dissolved Oxygen*, mg/l					
Chlorine Residual, mg/l					
E.coli (CFU/100ml) freshwater					
Entercocci (CFU/100ml)					

Pollutant	Average Conc.	Max Conc.	No. of Samples	Sample Type	Sample Date/Time
saltwater					
Total Dissolved Solids, mg/l					
Electrical Conductivity, µmohs/cm, †					
Oil & Grease, mg/l					
Alkalinity ($CaCO_3$)*, mg/l					

*TPDES permits only

†TLAP permits only

Table 1.0(3) - Pollutant Analysis for Water Treatment Facilities

Pollutant	Average Conc.	Max Conc.	No. of Samples	Sample Type	Sample Date/Time
Total Suspended Solids, mg/l					
Total Dissolved Solids, mg/l					
pH, standard units					
Fluoride, mg/l					
Aluminum, mg/l					
Alkalinity ($CaCO_3$), mg/l					

Section 8. Facility Operator (Instructions Page 60)

Facility Operator Name: **Jerry Pressley**

Facility Operator's License Classification and Level: **Wastewater Treatment Operator A**

Facility Operator's License Number: **WW0042541**

Section 9. Sewage Sludge Management and Disposal (Instructions Page 60)

A. Sludge disposal method

Identify the current or anticipated sludge disposal method or methods from the following list. Check all that apply.

- ☒ Permitted landfill
- ☐ Permitted or Registered land application site for beneficial use
- ☐ Land application for beneficial use authorized in the wastewater permit
- ☐ Permitted sludge processing facility
- ☐ Marketing and distribution as authorized in the wastewater permit
- ☐ Composting as authorized in the wastewater permit
- ☐ Permitted surface disposal site (sludge monofill)
- ☐ Surface disposal site (sludge monofill) authorized in the wastewater permit
- ☐ Transported to another permitted wastewater treatment plant or permitted sludge processing facility. If you selected this method, a written statement or contractual agreement from the wastewater treatment plant or permitted sludge processing facility accepting the sludge must be included with this application.
- ☐ Other:

B. Sludge disposal site

See Attachment I.

Disposal site name:

TCEQ permit or registration number: Click here to enter text.

County where disposal site is located: Click here to enter text.

C. Sludge transportation method

Method of transportation (truck, train, pipe, other): **Truck**

Name of the hauler: **The hauler will be identified prior to construction.**

Hauler registration number:

Sludge is transported as a:

Liquid ☐ semi-liquid ☐ semi-solid ☒ solid ☐

Section 10. Permit Authorization for Sewage Sludge Disposal (Instructions Page 60)

A. Beneficial use authorization

Does the existing permit include authorization for land application of sewage sludge for beneficial use?

Yes ☐ No ☒

If yes, are you requesting to continue this authorization to land apply sewage sludge for beneficial use?

Yes ☐ No ☐

If yes, is the completed **Application for Permit for Beneficial Land Use of Sewage Sludge (TCEQ Form No. 10451)** attached to this permit application (see the instructions for details)?

Yes ☐ No ☐

B. Sludge processing authorization

Does the existing permit include authorization for any of the following sludge processing, storage or disposal options?

Sludge Composting	Yes ☐	No ☒
Marketing and Distribution of sludge	Yes ☐	No ☒
Sludge Surface Disposal or Sludge Monofill	Yes ☐	No ☒
Temporary storage in sludge lagoons	Yes ☐	No ☒

If yes to any of the above sludge options and the applicant is requesting to continue this authorization, is the completed **Domestic Wastewater Permit Application: Sewage Sludge Technical Report (TCEQ Form No. 10056)** attached to this permit application?

Yes ☐ No ☐

Section 11. Sewage Sludge Lagoons (Instructions Page 61)

Does this facility include sewage sludge lagoons?

Yes ☐ No ☒

If yes, complete the remainder of this section. If no, proceed to Section 12.

A. Location information

The following maps are required to be submitted as part of the application. For each map, provide the Attachment Number.

- Original General Highway (County) Map:

  Attachment: Click here to enter text.

- USDA Natural Resources Conservation Service Soil Map:

  Attachment: Click here to enter text.

- Federal Emergency Management Map:

  Attachment: Click here to enter text.

- Site map:

  Attachment: Click here to enter text.

Discuss in a description if any of the following exist within the lagoon area.

Check all that apply.

☐ Overlap a designated 100-year frequency flood plain

☐ Soils with flooding classification

☐ Overlap an unstable area

☐ Wetlands

☐ Located less than 60 meters from a fault

☐ None of the above

Attachment: Click here to enter text.

If a portion of the lagoon(s) is located within the 100-year frequency flood plain, provide the protective measures to be utilized including type and size of protective structures:

Click here to enter text.

B. Temporary storage information

Provide the results for the pollutant screening of sludge lagoons. These results are in addition to pollutant results in Section 7 of Technical Report 1.0.

Nitrate Nitrogen, mg/kg: Click here to enter text.

Total Kjeldahl Nitrogen, mg/kg: Click here to enter text.

Total Nitrogen (=nitrate nitrogen + TKN), mg/kg: Click here to enter text.

Phosphorus, mg/kg: Click here to enter text.

Potassium, mg/kg: Click here to enter text.

pH, standard units: Click here to enter text.

Ammonia Nitrogen mg/kg: Click here to enter text.

Arsenic: Click here to enter text.

Cadmium: Click here to enter text.

Chromium: Click here to enter text.

Copper: Click here to enter text.

Lead: Click here to enter text.

Mercury: Click here to enter text.

Molybdenum: Click here to enter text.

Nickel: Click here to enter text.

Selenium: Click here to enter text.

Zinc: Click here to enter text.

Total PCBs: Click here to enter text.

Provide the following information:

Volume and frequency of sludge to the lagoon(s): Click here to enter text.

Total dry tons stored in the lagoons(s) per 365-day period: Click here to enter text.

Total dry tons stored in the lagoons(s) over the life of the unit: Click here to enter text.

C. Liner information

Does the active/proposed sludge lagoon(s) have a liner with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec?

Yes ☐ No ☐

If yes, describe the liner below. Please note that a liner is required.

Click here to enter text.

D. Site development plan

Provide a detailed description of the methods used to deposit sludge in the lagoon(s):

Click here to enter text.

Attach the following documents to the application.

- Plan view and cross-section of the sludge lagoon(s)

  Attachment: Click here to enter text.

- Copy of the closure plan

  Attachment: Click here to enter text.

- Copy of deed recordation for the site

  Attachment: Click here to enter text.

- Size of the sludge lagoon(s) in surface acres and capacity in cubic feet and gallons

  Attachment: Click here to enter text.

- Description of the method of controlling infiltration of groundwater and surface water from entering the site

  Attachment: Click here to enter text.

- Procedures to prevent the occurrence of nuisance conditions

  Attachment: Click here to enter text.

E. Groundwater monitoring

Is groundwater monitoring currently conducted at this site, or are any wells

available for groundwater monitoring, or are groundwater monitoring data otherwise available for the sludge lagoon(s)?

Yes ☐ No ☐

If groundwater monitoring data are available, provide a copy. Provide a profile of soil types encountered down to the groundwater table and the depth to the shallowest groundwater as a separate attachment.

Attachment: Click here to enter text.

Section 12. Authorizations/Compliance/Enforcement (Instructions Page 63)

A. Additional authorizations

Does the permittee have additional authorizations for this facility, such as reuse authorization, sludge permit, etc?

Yes ☐ No ☒

If yes, provide the TCEQ authorization number and description of the authorization:

Click here to enter text.

B. Permittee enforcement status

Is the permittee currently under enforcement for this facility?

Yes ☐ No ☒

Is the permittee required to meet an implementation schedule for compliance or enforcement?

Yes ☐ No ☒

If yes to either question, provide a brief summary of the enforcement, the implementation schedule, and the current status:

Click here to enter text.

Section 13. RCRA/CERCLA Wastes (Instructions Page 63)

A. RCRA hazardous wastes

Has the facility received in the past three years, does it currently receive, or will it receive RCRA hazardous waste?

Yes ☐ No ☒

B. Remediation activity wastewater

Has the facility received in the past three years, does it currently receive, or will it receive CERCLA wastewater, RCRA remediation/corrective action wastewater or other remediation activity wastewater?

Yes ☐ No ☒

C. Details about wastes received

If yes to either Subsection A or B above, provide detailed information concerning these wastes with the application.

Attachment: Click here to enter text

Section 14. Laboratory Accreditation (Instructions Page 64)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*, which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review *30 TAC Chapter 25* for specific requirements.

The following certification statement shall be signed and submitted with every application. See the *Signature Page* section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:	**Not Applicable – This is an application for a new facility that has not been constructed. Therefore, no analytical data were submitted.**

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: Jesus J. Chapa

Title: Asst. City Manager

Signature: _____

Date: 3-20-18

DOMESTIC TECHNICAL REPORT 1.1

The following is required for new and amendment applications

Section 1. Justification for Permit (Instructions Page 66)

A. Justification of permit need

Provide a detailed discussion regarding the need for any phase(s) not currently permitted. Failure to provide sufficient justification may result in the Executive Director recommending denial of the proposed phase(s) or permit.

See Attachment J.

B. Regionalization of facilities

Provide the following information concerning the potential for regionalization of domestic wastewater treatment facilities:

1. Municipally incorporated areas

If the applicant is a city, then Item 1 is not applicable. Proceed to Item 2 Utility CCN areas. **Not Applicable**

Is any portion of the proposed service area located in an incorporated city?

Yes ☐ No ☐ Not Applicable ☒

If yes, within the city limits of:

If yes, attach correspondence from the city.

Attachment: Click here to enter text.

If consent to provide service is available from the city, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the city versus the cost of the proposed facility or expansion attached.

Attachment: Click here to enter text.

2. Utility CCN areas

Is any portion of the proposed service area located inside another utility's CCN area?

Yes ☒ No ☐

If yes, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the CCN facilities versus the cost of the proposed facility or expansion.

Attachment: **A portion of the proposed Mary's Creek service area is within the Benbrook Water Authority CCN, which is provided wastewater services by the City of Fort Worth**.

3. Nearby WWTPs or collection systems

Are there any domestic permitted wastewater treatment facilities or collection systems located within a three-mile radius of the proposed facility?

Yes ☐ No ☒

If yes, attach a list of these facilities that includes the permittee's name and permit number, and an area map showing the location of these facilities.

Attachment: Click here to enter text.

If yes, attach copies of your certified letters to these facilities **and** their response letters concerning connection with their system.

Attachment: Click here to enter text.

Does a permitted domestic wastewater treatment facility or a collection system located within three (3) miles of the proposed facility currently have the capacity to accept or is willing to expand to accept the volume of wastewater proposed in this application?

Yes ☐ No ☐

If yes, attach an analysis of expenditures required to connect to a permitted wastewater treatment facility or collection system located within 3 miles versus the cost of the proposed facility or expansion.

Attachment: Click here to enter text.

Section 2. Organic Loading (Instructions Page 67)

Is this facility in operation?

Yes ☐ No ☒

If no, proceed to Item B, Proposed Organic Loading.

If yes, provide organic loading information in Item A, Current Organic Loading

A. Current organic loading

Facility Design Flow (flow being requested in application): Click here to enter text.

Average Influent Organic Strength or BOD_5 Concentration in mg/l: Click here to enter text.

Average Influent Loading (lbs/day = total average flow X average BOD_5 conc. X 8.34): Click here to enter text.

Provide the source of the average organic strength or BOD_5 concentration.

Click here to enter text.

B. Proposed organic loading

This table must be completed if this application is for a facility that is not in operation or if this application is to request an increased flow that will impact organic loading.

Table 1.1(1) – Design Organic Loading

Source	Total Average Flow (MGD) Interim/Final	Influent BOD_5 Concentration (mg/l)
Municipality	10/15	250
Subdivision		
Trailer park – transient		
Mobile home park		
School with cafeteria and showers		
School with cafeteria, no		

Source	Total Average Flow (MGD)	Influent BOD_5 Concentration (mg/l)
showers		
Recreational park, overnight use		
Recreational park, day use		
Office building or factory		
Motel		
Restaurant		
Hospital		
Nursing home		
Other		
TOTAL FLOW from all sources	**Interim/Final 10/15**	
AVERAGE BOD_5 from all sources		**250**

Section 3. Proposed Effluent Quality and Disinfection (Instructions Page 68)

A. Existing/Interim I Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: **5**

Total Suspended Solids, mg/l: **15**

Ammonia Nitrogen, mg/l: **2**

Total Phosphorus, mg/l: **1**

Dissolved Oxygen, mg/l: **6**

Other: Click here to enter text.

B. Interim II Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: Click here to enter text.

Total Suspended Solids, mg/l: Click here to enter text.

Ammonia Nitrogen, mg/l: Click here to enter text.

Total Phosphorus, mg/l: Click here to enter text.

Dissolved Oxygen, mg/l: Click here to enter text.

Other: Click here to enter text.

C. Final Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: **5**

Total Suspended Solids, mg/l: **15**

Ammonia Nitrogen, mg/l: **2**

Total Phosphorus, mg/l: **1**

Dissolved Oxygen, mg/l: **6**

Other: Click here to enter text.

D. Disinfection Method

Identify the proposed method of disinfection.

☐ Chlorine: Click here to enter text. mg/l after Click here to enter text. minutes detention time at peak flow

Dechlorination process: Click here to enter text.

☐ Ultraviolet Light: Click here to enter text. seconds contact time at peak flow

☒ Other: Ultraviolet light system will be designed to deliver a dose of 35 mJ/cm2

Section 4. Design Calculations (Instructions Page 68)

Attach design calculations and plant features for each proposed phase. Example 4 of the instructions includes sample design calculations and plant features.

Attachment: **K.**

Section 5. Facility Site (Instructions Page 68)

A. 100-year floodplain

Will the proposed facilities be located above the 100-year frequency flood level?

Yes ☒ No ☐

If no, describe measures used to protect the facility during a flood event. Include a site map showing the location of the treatment plant within the 100-year frequency flood level. If applicable, provide the size and types of protective structures.

Click here to enter text.

Provide the source(s) used to determine 100-year frequency flood plain.

FEMA map 48439C0260K

For a new or expansion of a facility, will a wetland or part of a wetland be filled?

Yes ☐ No ☒

If yes, has the applicant applied for a US Corps of Engineers 404 Dredge and Fill Permit?

Yes ☐ No ☐

If yes, provide the permit number: Click here to enter text.

If no, provide the approximate date you anticipate submitting your application to the Corps: Click here to enter text.

B. Wind rose

Attach a wind rose. **Attachment**: **L.**

Section 6. Permit Authorization for Sewage Sludge Disposal (Instructions Page 69)

A. Beneficial use authorization

Are you requesting to include authorization to land apply sewage sludge for beneficial use on property located adjacent to the wastewater treatment facility under the wastewater permit?

Yes ☐ No ☒

If yes, attach the completed Application for Permit for Beneficial Land Use of Sewage Sludge (TCEQ Form No. 10451)

Attachment: Click here to enter text.

B. Sludge processing authorization

Identify the sludge processing, storage or disposal options that will be conducted at the wastewater treatment facility:

☐ Sludge Composting

☐ Marketing and Distribution of sludge

☐ Sludge Surface Disposal or Sludge Monofill

If any of the above sludge options are selected, attach a completed DOMESTIC WASTEWATER PERMIT APPLICATION: SEWAGE SLUDGE TECHNICAL REPORT (TCEQ Form No. 10056).

Attachment: Click here to enter text.

Section 7. Sewage Sludge Solids Management Plan (Instructions Page 69)

Attach a solids management plan to the application.

Attachment: **I.**

The sewage sludge solids management plan must contain the following information:

- Treatment units and processes dimensions and capacities
- Solids generated at 100, 75, 50, and 25 percent of design flow
- Mixed liquor suspended solids operating range at design and projected actual flow
- Quantity of solids to be removed and a schedule for solids removal
- Identification and ownership of the ultimate sludge disposal site
- For facultative lagoons, design life calculations, monitoring well locations and depths, and the ultimate disposal method for the sludge from the facultative lagoon

An example of a sewage sludge solids management plan has been included as Example 5 of the instructions.

DOMESTIC TECHNICAL REPORT WORKSHEET 2.0

RECEIVING WATERS

The following is required for all TPDES permit applications

Section 1. Domestic Drinking Water Supply (Instructions Page 73)

Is there a surface water intake for domestic drinking water supply located within 5 miles downstream from the point or proposed point of discharge?

Yes ☐ No ☒

If yes, provide the following:
Owner of the drinking water supply: Click here to enter text.

Distance and direction to the intake: Click here to enter text.

Attach a USGS map that identifies the location of the intake.

Attachment: Click here to enter text.

Section 2. Discharge into Tidally Affected Waters (Instructions Page 73)

Does the facility discharge into tidally affected waters?

Yes ☐ **No** ☐ **Not Applicable**

If yes, complete the remainder of this section. If no, proceed to Section 3.

A. Receiving water outfall

Width of the receiving water at the outfall, in feet: Click here to enter text.

B. Oyster waters

Are there oyster waters in the vicinity of the discharge?

Yes ☐ No ☐

If yes, provide the distance and direction from outfall(s).

Click here to enter text.

C. Sea grasses

Are there any sea grasses within the vicinity of the point of discharge?

Yes ☐ No ☐

If yes, provide the distance and direction from the outfall(s).

Click here to enter text

Section 3. Classified Segments (Instructions Page 73)

Is the discharge directly into (or within 300 feet of) a classified segment?

Yes ☐ No ☒

If yes, this Worksheet is complete.

If no, complete Sections 4 and 5 of this Worksheet.

Section 4. Description of Immediate Receiving Waters (Instructions Page 75)

Name of the immediate receiving waters: **Mary's Creek**

A. Receiving water type

Identify the appropriate description of the receiving waters.

☒ Stream

☐ Freshwater Swamp or Marsh

☐ Lake or Pond

Surface area, in acres: Click here to enter text

Average depth of the entire water body, in feet: Click here to enter text

Average depth of water body within a 500-foot radius of discharge point, in feet: Click here to enter text

☐ Man-made Channel or Ditch

☐ Open Bay

☐ Tidal Stream, Bayou, or Marsh

☐ Other, specify: Click here to enter text.

B. Flow characteristics

If a stream, man-made channel or ditch was checked above, provide the following. For existing discharges, check one of the following that best characterizes the area *upstream* of the discharge. For new discharges, characterize the area *downstream* of the discharge (check one).

☐ Intermittent - dry for at least one week during most years

☒ Intermittent with Perennial Pools - enduring pools with sufficient habitat to maintain significant aquatic life uses

☐ Perennial - normally flowing

Check the method used to characterize the area upstream (or downstream for new dischargers).

☐ USGS flow records

☐ Historical observation by adjacent landowners

☒ Personal observation

☒ Other, specify: **Historical satellite imagery**

C. Downstream perennial confluences

List the names of all perennial streams that join the receiving water within three miles downstream of the discharge point.

South Mary's Creek.

D. Downstream characteristics

Do the receiving water characteristics change within three miles downstream of the discharge (e.g., natural or man-made dams, ponds, reservoirs, etc.)?

Yes ☒ No ☐

If yes, discuss how.

There are several small man-made dams.

E. Normal dry weather characteristics

Provide general observations of the water body during normal dry weather conditions.

Mary's Creek was slowly flowing. The water was slightly brown in color with little turbidity. Minimal aquatic life was observed in deeper runs.

Date and time of observation: **August 9, 2017 @ 0955.**

Was the water body influenced by stormwater runoff during observations?

Yes ☐ No ☒

Section 5. General Characteristics of the Waterbody (Instructions Page 74)

A. Upstream influences

Is the immediate receiving water upstream of the discharge or proposed discharge site influenced by any of the following? Check all that apply.

- ☐ Oil field activities
- ☐ Urban runoff
- ☐ Upstream discharges
- ☒ Agricultural runoff
- ☐ Septic tanks
- ☐ Other(s), specify Click here to enter text

B. Waterbody uses

Observed or evidences of the following uses. Check all that apply.

- ☐ Livestock watering
- ☐ Contact recreation
- ☐ Irrigation withdrawal
- ☐ Non-contact recreation
- ☐ Fishing
- ☐ Navigation

☐ Domestic water supply ☐ Industrial water supply

☐ Park activities ☒ Other(s), specify **None observed**

C. Waterbody aesthetics

Check one of the following that best describes the aesthetics of the receiving water and the surrounding area.

☐ Wilderness: outstanding natural beauty; usually wooded or unpastured area; water clarity exceptional

☒ Natural Area: trees and/or native vegetation; some development evident (from fields, pastures, dwellings); water clarity discolored

☐ Common Setting: not offensive; developed but uncluttered; water may be colored or turbid

☐ Offensive: stream does not enhance aesthetics; cluttered; highly developed; dumping areas; water discolored

DOMESTIC WORKSHEET 2.1

STREAM PHYSICAL CHARACTERISTICS

Required for new applications, major facilities, and applications adding an outfall

Worksheet 2.1 is not required for discharges to intermittent streams or discharges directly to (or within 300 feet of) a classified segment.

Section 1. General Information (Instructions Page 75)

Date of study: **August 9, 2017** Time of study: **0955**

Stream name: **Mary's Creek**

Location: **Proposed Outfall 001**

See Attachment M for additional information.

Type of stream upstream of existing discharge or downstream of proposed discharge (check one).

☐ Perennial ☒ Intermittent with perennial pools

Section 2. Data Collection (Instructions Page 75)

Number of stream bends that are well defined: **3**

Number of stream bends that are moderately defined: **0**

Number of stream bends that are poorly defined: **0**

Number of riffles: **8**

Evidence of flow fluctuations (check one):

☐ Minor ☒ moderate ☐ severe

Indicate the observed stream uses and if there is evidence of flow fluctuations or channel obstruction/modification.

Eroded banks indicated moderate flow fluctuation.

Stream transects

In the table below, provide the following information for each transect downstream of the existing or proposed discharges. Use a separate row for each transect.

Table 2.1(1) - Stream Transect Records

Stream type at transect Select riffle, run, glide, or pool. See Instructions, Definitions section.	**Transect location**	**Water surface width (ft)**	**Stream depths (ft)** at 4 to 10 points along each transect from the channel bed to the water surface. Separate the measurements with commas.
glide	**Proposed Outfall 001 location**	**42'**	**0.42, 0.58, 0.42, 0.58, 0.75, 0.83, 0.92, 1.1, 1.3, 1.2**
glide	**Downstream 328' from Transect 1**	**61'**	**0.58, 0.67, 0.67, 0.83, 1.3, 1.3, 0.83, 0.33, 0.42, 0.33**
glide	**Downstream 328' from Transect 2**	**42'**	**0.83, 1.3, 0.5, 2.0, 2.7, 2.9, 2.8, 2.8, 2.3, 1.5**
glide	**Downstream 328' from Transect 3**	**28'**	**1.2, 1.4, 1.2, 1.1, 1.2, 1.1, 1.0, 0.83**
run	**Downstream 328' from Transect 4**	**38'**	**0.25, 0.08, 0.25, 0.50, 0.58, 0.58, 0.75, 0.75, 0.83, 1.0**
run	**Downstream 328' from Transect 5**	**18'**	**0.08, 0.33, 0.42, 0.75, 0.67, 0.75, 0.67**
riffle	**Downstream 394' from Transect 6**	**39'**	**0.08, 0.08, 0.04, 0.04, 0.17, 0.17, 0.17, 0.17, 0.08, 0.08**
riffle	**Downstream 246' from Transect 7**	**33'**	**0.17, 0.08, 0.33, 0.25, 0.33, 0.33, 0.25, 0.25, 0.08**
Choose an item.			
Choose an item.			

Section 3. Summarize Measurements (Instructions Page 76)

Streambed slope of entire reach, from USGS map in feet/feet: **0.42 ft./100 ft.**

Approximate drainage area above the most downstream transect (from USGS map or county highway map, in square miles): **27 square miles**

Length of stream evaluated, in feet: **2,280 ft.**

Number of lateral transects made: **8**

Average stream width, in feet: **37.6 ft.**

Average stream depth, in feet: **0.77 ft.**

Average stream velocity, in feet/second: **0.38 ft./s**

Instantaneous stream flow, in cubic feet/second: **4.1 cfs**

Indicate flow measurement method (type of meter, floating chip timed over a fixed distance, etc.): **Floating chip**

Size of pools (large, small, moderate, none): **none**

Maximum pool depth, in feet: **N/A**

DOMESTIC WORKSHEET 6.0

INDUSTRIAL WASTE CONTRIBUTION

The following is required for all publicly owned treatment works (POTWs)

Section 1. All POTWs (Instructions Page 99)

A. Industrial users

Provide the number of each of the following types of industrial users (IUs) that discharge to your POTW and the daily flows from each user. See the Instructions for definitions of Categorical IUs, Significant IUs – non-categorical, and Other IUs.

If there are no users, enter 0 (zero).

Categorical IUs:

Number of IUs: **0**

Average Daily Flows, in MGD: **0**

Significant IUs – non-categorical:

Number of IUs: **0**

Average Daily Flows, in MGD: **0**

Other IUs:

Number of IUs: **0**

Average Daily Flows, in MGD: **0**

B. Treatment plant interference

In the past three years, has your POTW experienced treatment plant interference (see instructions)?

Yes ☐ No ☒

This application is for a proposed facility that has not been constructed.

If yes, identify the dates, duration, description of interference, and probable cause(s) and possible source(s) of each interference event. Include the names of the IUs that may have caused the interference.

C. Treatment plant pass through

In the past three years, has your POTW experienced pass through (see instructions)?

Yes ☐ No ☒

If yes, identify the dates, duration, a description of the pollutants passing through the treatment plant, and probable cause(s) and possible source(s) of each pass through event. Include the names of the IUs that may have caused pass through.

Click here to enter text.

D. Pretreatment program

Does your POTW have an approved pretreatment program?

Yes ☐ No ☒

If yes, complete Section 2 only of this Worksheet.

Is your POTW required to develop an approved pretreatment program?

Yes ☐ No ☒

If yes, complete Section 2.c. and 2.d. only, and skip Section 3.

If no to either question above, skip Section 2 and complete Section 3 for each significant industrial user and categorical industrial user.

Section 2. POTWs with Approved Programs or Those Required to Develop a Program (Instructions Page 100)

A. Substantial modifications

Have there been any **substantial modifications** to the approved pretreatment program that have not been submitted to the TCEQ for approval according to *40 CFR §403.18*?

Yes ☐ No ☐

If yes, identify the modifications that have not been submitted to TCEQ, including the purpose of the modification.

Click here to enter text.

B. Non-substantial modifications

Have there been any **non-substantial modifications** to the approved pretreatment program that have not been submitted to TCEQ for review and acceptance?

Yes ☐ No ☐

If yes, identify all non-substantial modifications that have not been submitted to TCEQ, including the purpose of the modification.

Click here to enter text.

C. Effluent parameters above the MAL

In Table 6.0(1), list all parameters measured above the MAL in the POTW's effluent monitoring during the last three years. Submit an attachment if necessary.

Table 6.0(1) – Parameters Above the MAL

Pollutant	Concentration	MAL	Units	Date

D. Industrial user interruptions

Has any SIU, CIU, or other IU caused or contributed to any problems (excluding interferences or pass throughs) at your POTW in the past three years?

Yes ☐ No ☐

If yes, identify the industry, describe each episode, including dates, duration, description of the problems, and probable pollutants.

Click here to enter text.

Section 3. Significant Industrial User (SIU) Information and Categorical Industrial User (CIU) (Instructions Page 100)

A. General information

Company Name: Click here to enter text.

SIC Code: Click here to enter text.

Telephone number: Click here to enter text. Fax number: Click here to enter text.

Contact name: Click here to enter text.

Address: Click here to enter text.

City, State, and Zip Code: Click here to enter text.

B. Process information

Describe the industrial processes or other activities that affect or contribute to the SIU(s) or CIU(s) discharge (i.e., process and non-process wastewater).

C. Product and service information

Provide a description of the principal product(s) or services performed.

Click here to enter text.

D. Flow rate information

See the Instructions for definitions of "process" and "non-process wastewater."

Process Wastewater:

Discharge, in gallons/day: Click here to enter text.

Discharge Type: ☐ Continuous ☐ Batch ☐ Intermittent

Non-Process Wastewater:

Discharge, in gallons/day: Click here to enter text.

Discharge Type: ☐ Continuous ☐ Batch ☐ Intermittent

E. Pretreatment standards

Is the SIU or CIU subject to technically based local limits as defined in the instructions?

Yes ☐ No ☐

Is the SIU or CIU subject to categorical pretreatment standards found in *40 CFR Parts 405-471*?

Yes ☐ No ☐

If subject to categorical pretreatment standards, indicate the applicable category and subcategory for each categorical process.

Category: Click here to enter text.
Subcategories: Click here to enter text.

Category: Click here to enter text.
Subcategories: Click here to enter text.

Category: Click here to enter text.
Subcategories: Click here to enter text.

Category: Click here to enter text.
Subcategories: Click here to enter text.

Category: Click here to enter text.
Subcategories: Click here to enter text.

F. Industrial user interruptions

Has the SIU or CIU caused or contributed to any problems (e.g., interferences, pass through, odors, corrosion, blockages) at your POTW in the past three years?

Yes ☐ No ☐

If yes, identify the SIU, describe each episode, including dates, duration, description of problems, and probable pollutants.

Click here to enter text.

CITY OF FORT WORTH
MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

TABLE OF ATTACHMENTS

	ATTACHMENT	REFERENCE
A.	Core Data Form	Admin Report 1.0, Section 3.C
B.	USGS Map	Admin Report 1.0, Section 13
C.	Affected Landowners Map	Admin Report 1.1, Section 1.A
D.	Affected Landowners List	Admin Report 1.1, Section 1.B
E.	Photographs	Admin Report 1.1, Section 2
F.	Buffer Zone Map	Admin Report 1.1, Section 3.A
G.	Treatment Process	Tech Report 1.0, Section 2.A-C
H.	Site Drawing	Tech Report 1.0, Section 3
I.	Sewage Sludge Solids Management Plan	Tech Report 1.0, Section 9.B and Tech Report 1.1, Section 7
J.	Justification of Permit	Tech Report 1.1, Section 1.A
K.	Design Calculations and Design Features	Tech Report 1.1, Section 4
L.	Wind Rose	Tech Report 1.1, Section 5.B
M.	Water Quality Modeling Memo	Worksheet 2.1

ATTACHMENT A

CORE DATA FORM

ADMIN REPORT 1.0, SECTION 3.C

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission *(If other is checked please describe in space provided.)*

☒ New Permit, Registration or Authorization (*Core Data Form should be submitted with the program application.)*

☐ Renewal *(Core Data Form should be submitted with the renewal form)* ☒ Other **Update mailing address for CN**

2. Customer Reference Number *(if issued)*		3. Regulated Entity Reference Number *(if issued)*
CN **600128862**	Follow this link to search for CN or RN numbers in Central Registry**	RN

SECTION II: Customer Information

4. General Customer Information	5. Effective Date for Customer Information Updates (mm/dd/yyyy)	08/01/2017

☐ New Customer ☒ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).

6. Customer Legal Name *(If an individual, print last name first: eg: Doe, John)*	*If new Customer, enter previous Customer below:*
City of Fort Worth	

7. TX SOS/CPA Filing Number	8. TX State Tax ID (11 digits)	9. Federal Tax ID (9 digits)	10. DUNS Number *(if applicable)*

11. Type of Customer:	☐ Corporation	☐ Individual	Partnership: ☐ General ☐ Limited
Government: ☒ City ☐ County ☐ Federal ☐ State ☐ Other		☐ Sole Proprietorship	☐ Other:

12. Number of Employees	13. Independently Owned and Operated?
☐ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☒ 501 and higher	☐ Yes ☐ No

14. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following:*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other:

15. Mailing Address:	City of Fort Worth						
	200 Texas Street						
	City	Fort Worth	State	TX	ZIP	76102	ZIP + 4

16. Country Mailing Information *(if outside USA)*	17. E-Mail Address *(if applicable)*
	Stacy.Walters@fortworthtexas.gov

18. Telephone Number	19. Extension or Code	20. Fax Number *(if applicable)*
(817) 392-8203		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information *(If 'New Regulated Entity" is selected below this form should be accompanied by a permit application)*

☒ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC.)

22. Regulated Entity Name *(Enter name of the site where the regulated action is taking place.)*

Mary's Creek Water Reclamation Facility

23. Street Address of the Regulated Entity: *(No PO Boxes)*	City of Fort Worth							
	11091 Chapin Road							
	City	Fort Worth	State	TX	ZIP	76108	ZIP + 4	
24. County	Tarrant							

Enter Physical Location Description if no street address is provided.

25. Description to Physical Location:					
26. Nearest City			State		Nearest ZIP Code
Fort Worth			TX		76108
27. Latitude (N) In Decimal:	32.7312		28. Longitude (W) In Decimal:	-97.5300	
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

29. Primary SIC Code (4 digits)	30. Secondary SIC Code (4 digits)	31. Primary NAICS Code (5 or 6 digits)	32. Secondary NAICS Code (5 or 6 digits)
4952		321320	

33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)*

Treatment of wastewater from domestic sources

34. Mailing Address:	City of Fort Worth							
	200 Texas Street							
	City	Fort Worth	State	TX	ZIP	76102	ZIP + 4	
35. E-Mail Address:	Stacy.Walters@fortworthtexas.gov							

36. Telephone Number	37. Extension or Code	38. Fax Number *(if applicable)*
(817) 392-8203		( ) -

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☒ Waste Water	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:
	New Facility			

SECTION IV: Preparer Information

40. Name:	Stacy Walters	41. Title:	Regulatory-Enviromental Coordinat

42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(817) 392-8203		( ) -	Stacy.Walters@fortworthtexas.gov

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:	City of Fort Worth	Job Title:	Assistant City Manager
Name*(In Print)* :	Jesus J. Chapa	Phone:	(817) 392-5804
Signature:		Date:	4-20-18

ATTACHMENT B

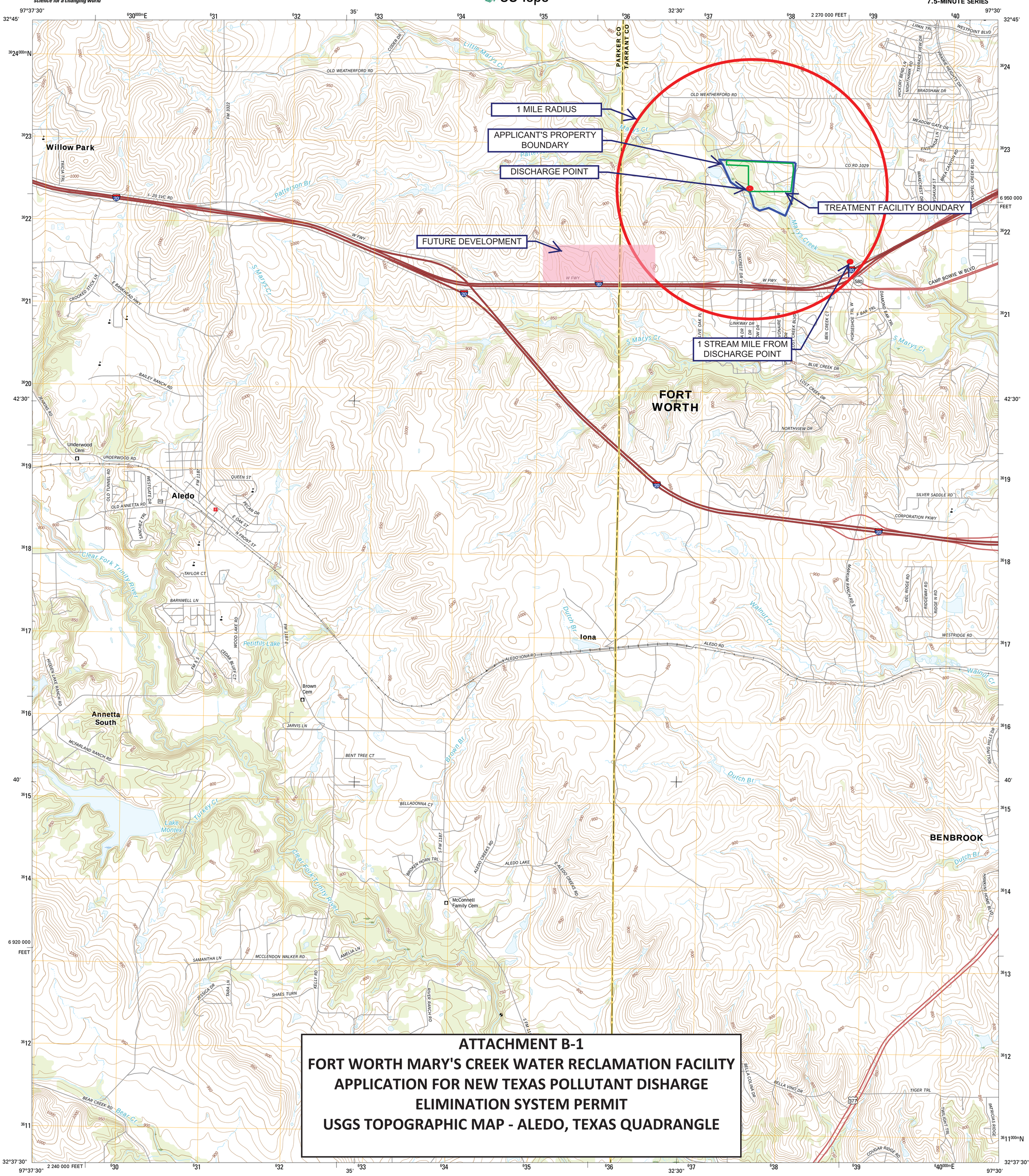
USGS MAP

ADMIN REPORT 1.0, SECTION 13

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

ALEDO QUADRANGLE
TEXAS
7.5-MINUTE SERIES



ATTACHMENT B-1
FORT WORTH MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISHARGE ELIMINATION SYSTEM PERMIT
USGS TOPOGRAPHIC MAP - ALEDO, TEXAS QUADRANGLE

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 14S
10 000-foot ticks: Texas Coordinate System of 1983 (north central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, July 2014
Roads..... U.S. Census Bureau, 2014 - 2015
Names.....GNIS, 2015
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2004
Boundaries.....Multiple sources; see metadata file 1972 - 2015

Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN
GN
3° 58′ 70 MILS
0° 47′ 14 MILS
UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
PB
Grid Zone Designation 14S

SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

TEXAS
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Lake Weatherford
2 Springtown SE
3 Lake Worth
4 Annetta
5 Benbrook
6 Chapin
7 Cresson
8 Primrose

ADJOINING QUADRANGLES

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

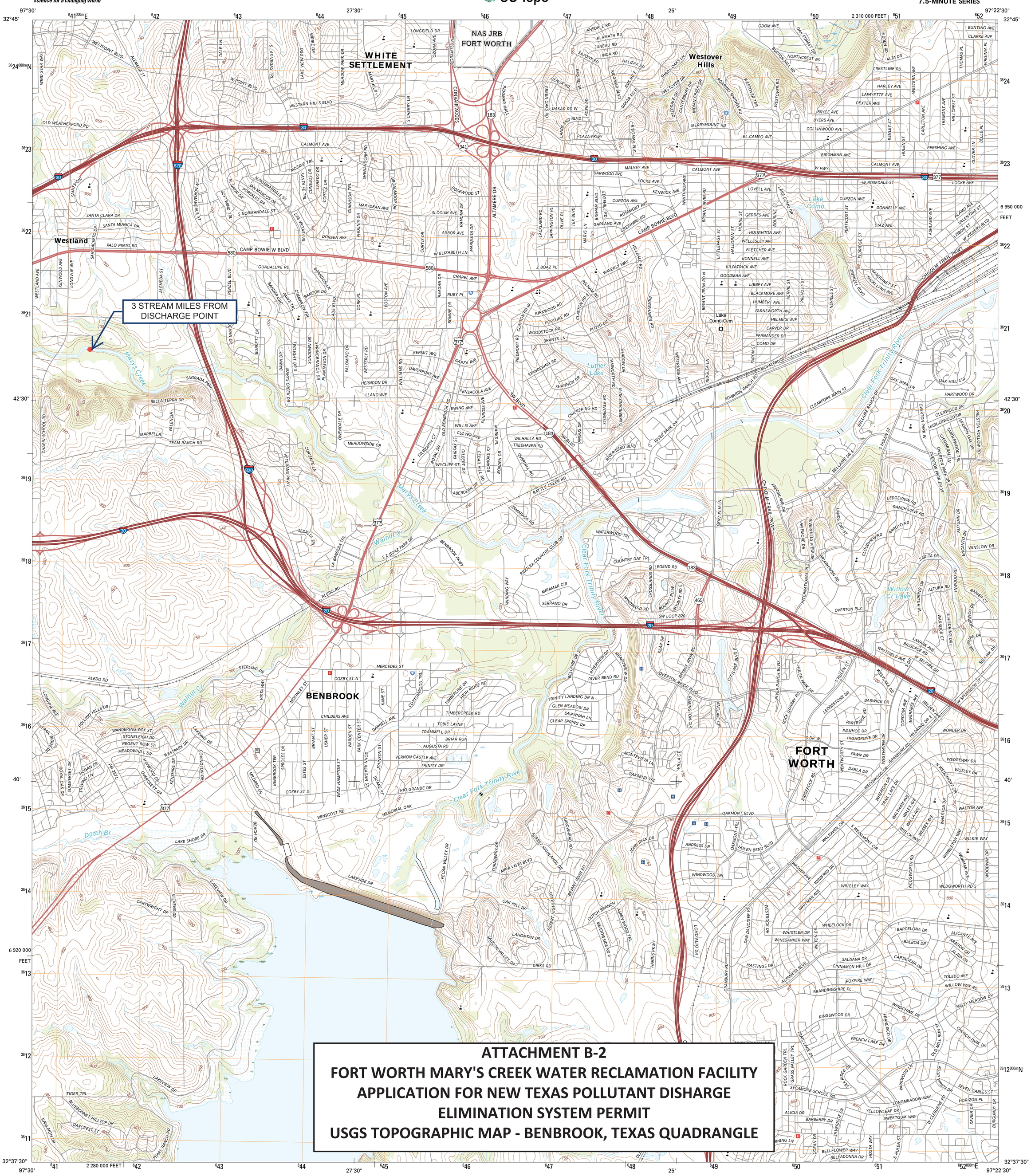
ALEDO, TX
2016

NSN. 7643016394798
NGA REF NO. USGSX24K488

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

BENBROOK QUADRANGLE
TEXAS-TARRANT CO.
7.5-MINUTE SERIES



ATTACHMENT B-2
FORT WORTH MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISHARGE ELIMINATION SYSTEM PERMIT
USGS TOPOGRAPHIC MAP - BENBROOK, TEXAS QUADRANGLE

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 14S
10 000-foot ticks: Texas Coordinate System of 1983 (north central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, July 2014
Roads..... U.S. Census Bureau, 2014 - 2015
Names.....GNIS, 2015
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2003
Boundaries.....Multiple sources; see metadata file 1972 - 2015

Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN
GN
3° 53´ 69 MILS
0° 51´ 15 MILS
UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
PB
Grid Zone Designation
14S

SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

TEXAS
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Springtown SE
2 Lake Worth
3 Haltom City
4 Aledo
5 Fort Worth
6 Cresson
7 Primrose
8 Burleson

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

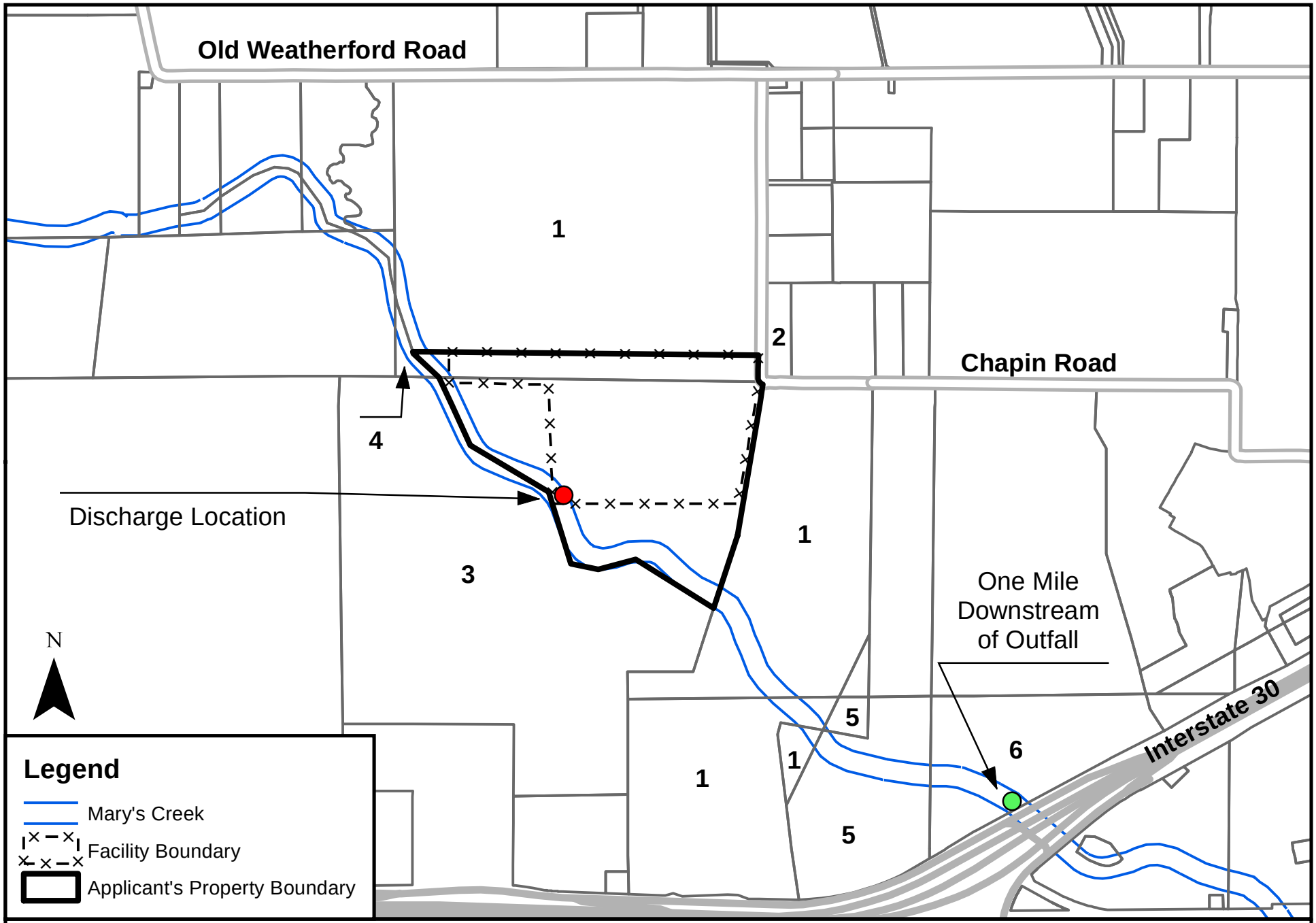
BENBROOK, TX
2016

NSN. 7643016395038
NGA REF NO. USGSX24K72666

ATTACHMENT C

AFFECTED LANDOWNERS MAP

ADMIN REPORT 1.1, SECTION 1.A



ATTACHMENT C
CITY OF FORT WORTH - MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
AFFECTED LANDOWNER MAP

ALAN PLUMMER ASSOCIATES, INC.

ATTACHMENT D

AFFECTED LANDOWNERS LIST

ADMIN REPORT 1.1, SECTION 1.B

ATTACHMENT D

CITY OF FORT WORTH
MARYS CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISHARGE ELIMINATION SYSTEM PERMIT

AFFECTED LANDOWNERS LIST

1 BASS LEE M TR
Attention: THE 820 MANAGEMENT TRUST
201 MAIN ST
FORT WORTH TX 76102-3105

2 CHASE HUBERT L
11090 CHAPIN RD
ALEDO TX 76008-3006

3 WESTSIDE LANDFILL
PO BOX 1450
CHICAGO IL 60690-1450

4 WASTE MANAGEMENT OF TEXAS INC
PO BOX 1450
CHICAGO IL 60690-1450

5 WELLMAN MARY L TR
2120 RIDGMAR BLVD STE 14
FORT WORTH TX 76116-2200

6 WELLMAN MARY L TR #967
PO BOX 2050
FORT WORTH TX 76113-2050

ATTACHMENT E

PHOTOGRAPHS

ADMIN REPORT 1.1, SECTION 2

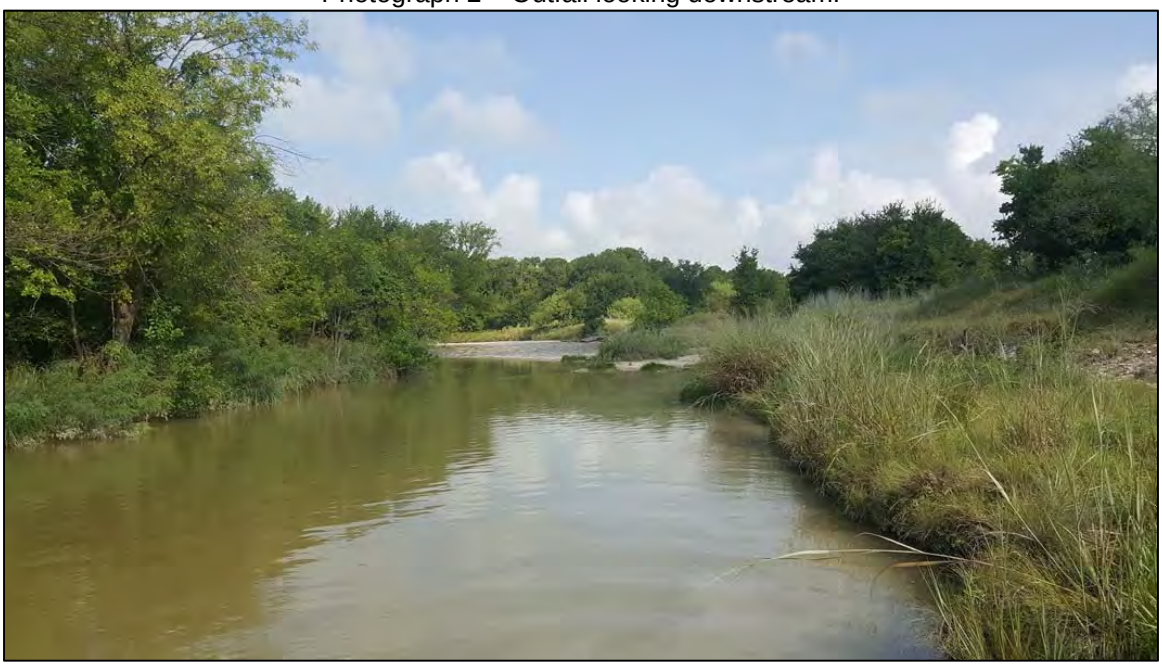
ATTACHMENT E

CITY OF FORT WORTH
MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

PHOTOGRAPHS

Photograph 1 – Outfall looking upstream.

Photograph 2 – Outfall looking downstream.

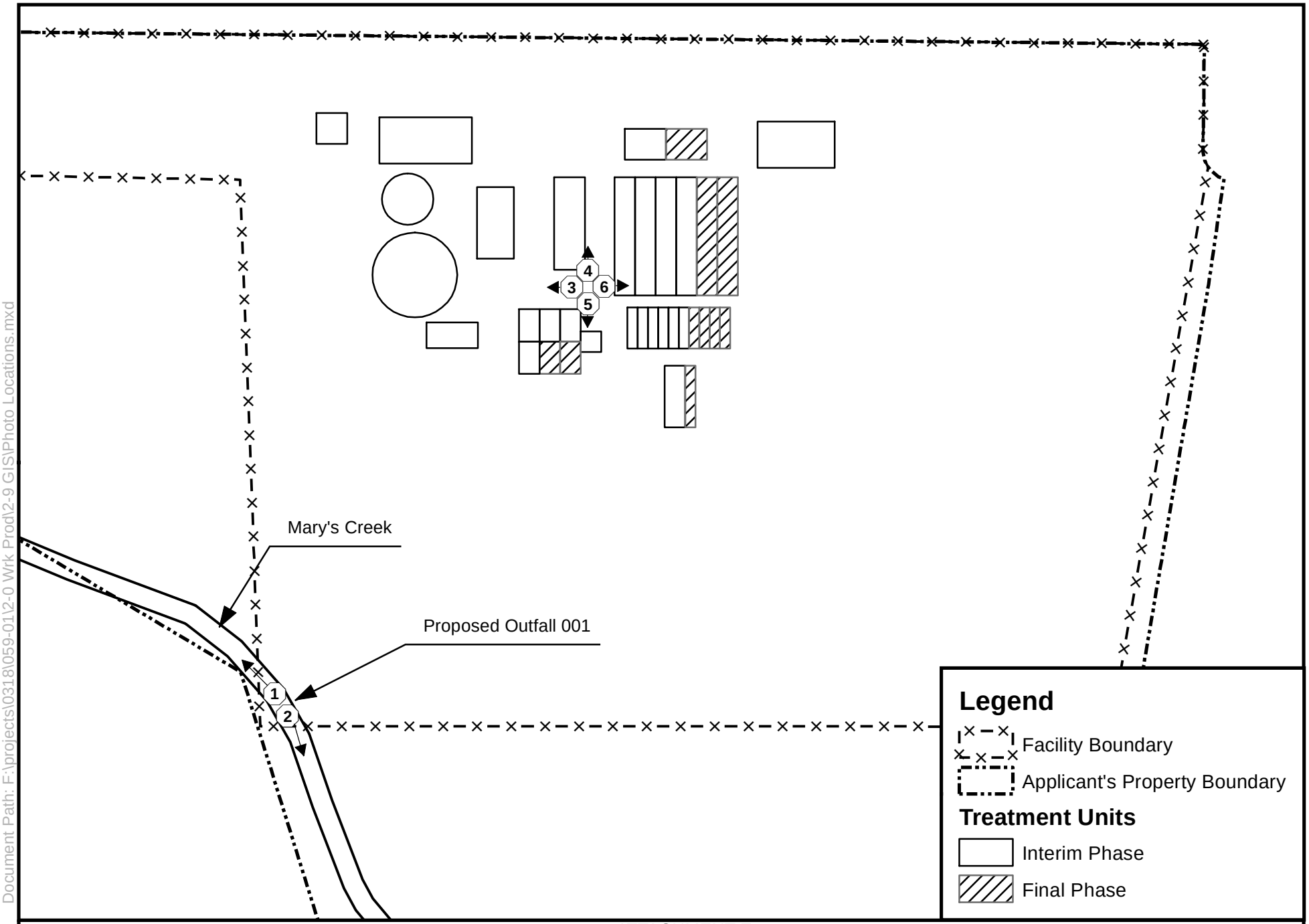


Photograph 3 – Proposed facility site looking west.

Photograph 4 – Proposed facility site looking north.

Photograph 5 – Proposed facility site looking south.

Photograph 6 – Proposed facility site looking west.



0 125 250 Feet

N

ATTACHMENT E
CITY OF FORT WORTH - MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
PHOTOGRAPH LOCATION MAP

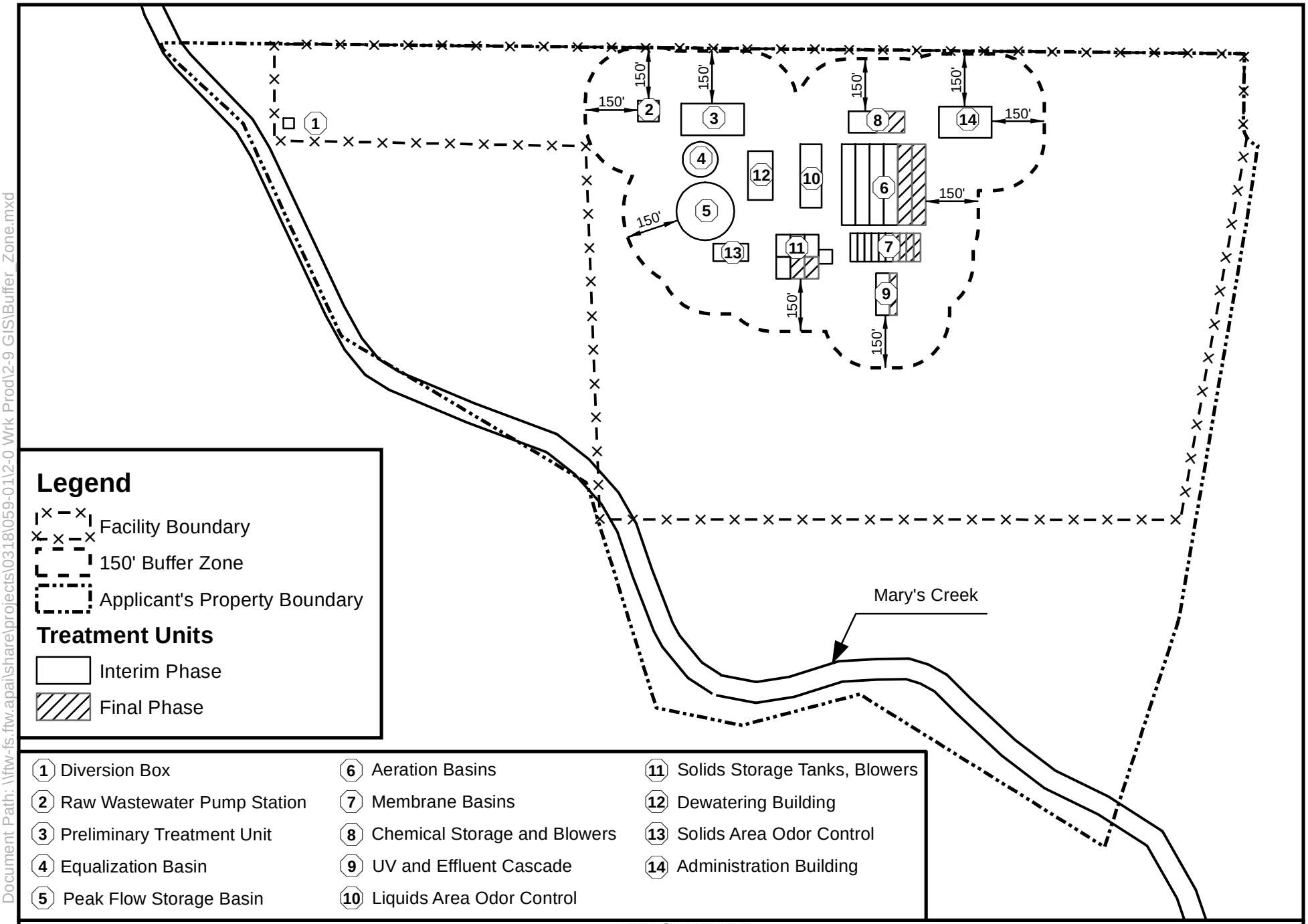
ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS • DESIGNERS • SCIENTISTS

Document Path: F:\projects\0318\059-01\2-0 Wrk Prod\2-9 GIS\Photo Locations.mxd

ATTACHMENT F

BUFFER ZONE MAP

ADMIN REPORT 1.1, SECTION 3.A



ATTACHMENT F
CITY OF FORT WORTH - MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
BUFFER ZONE MAP - INTERIM AND FINAL PHASES

ALAN PLUMMER ASSOCIATES, INC.

Document Path: \\ftw-fs.ftw.apai\share\projects\0318\059-01\2-0 Wrk Prod\2-9 GIS\Buffer_Zone.mxd

ATTACHMENT G

TREATMENT PROCESS

TECH REPORT 1.0, SECTION 2.A-C

ATTACHMENT G.1
CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
TREATMENT PROCESS DESCRIPTION

The City of Fort Worth (City) is proposing the construction of a new wastewater treatment facility, the Mary's Creek Water Reclamation Facility (MCWRF). Construction of the proposed MCWRF consists of two phases: an Interim Phase and a Final Phase. Descriptions of the proposed treatment units for both phases are presented in this attachment. The treatment units presented below are preliminary and may be refined during the design phase of MCWRF.

INTERIM PHASE

The MCWRF will be designed for an annual average flow of 10 MGD and a 2-hour peak discharge flow of 20 MGD during the Interim Phase. Units upstream of the secondary treatment system at the MCWRF will be designed to handle a 2-hour peak influent flow of 40 MGD. A 2-hour peak influent flow factor of 4.0 was assumed in the absence of site specific data, as specified by 30 TAC 217.32(a)(2). The secondary treatment system, and downstream units, will be sized to handle the 2-hour peak discharge flow of the Interim Phase (20 MGD).

Equalization (EQ) and peak flow storage (PFS) basins will be used to equalize daily flows, limit maximum daily flows to the secondary treatment system to a peaking factor of 2 (relative to the annual average flow of the Interim Phase), and store peak flows during wet-weather events.

The proposed MCWRF will be a membrane bioreactor (MBR) plant utilizing an activated sludge process combined with membrane filters. Biological treatment will be accomplished upstream of the membrane filters through a combination of selector zones and an aerobic zone using diffused air. The proposed MCWRF will remove nutrients biologically using a combination of anoxic and anaerobic zones upstream of the aerobic zone. The preliminary treatment units, EQ basin, PFS basin, fine screen units, biological reactors, membrane system, disinfection, and odor control system are described below. Handling practices for the solids generated at the MCWRF are also described.

Preliminary Treatment Units

Raw wastewater flows will be pumped from an on-site raw wastewater pump station (RWWPS) to the preliminary treatment unit (PTU). Raw wastewater will also be pumped from a lift station further downstream in the collection system up to MCWRF and will enter the plant upstream of the PTU. The PTU will consist of a coarse screening system, grit removal system, and fine screening system.

The coarse screening system will consist of two automatic screens and a manual bar screen. Each automatic coarse screen will operate in a separate channel with a dedicated washer/compactor to process screenings prior to disposal. The third channel will contain the manual bar screen and will be provided for overflow protection. This coarse screening arrangement will provide a total screening capacity of 60 MGD and a firm capacity of 40 MGD (20 MGD per screen). Washed/compacted screenings from the PTU will be hauled to a landfill for disposal.

The grit removal system will utilize two units sized hydraulically for 20 MGD each, 40 MGD total. Each grit removal unit will be associated with a companion grit pump and a classifier unit that will separate solids from liquids. Dewatered grit from the PTU will be hauled to a landfill while the liquids will be recycled into the plant flow. Overflows from the PTU will be routed to the EQ basin.

Equalization Basin

The equalization (EQ) basin will maintain a constant flow rate into the secondary treatment units by buffering against normal diurnal changes in influent wastewater flow. The EQ basin will include an intermittent air mixing system designed to prevent solids from settling inside the basin, while not significantly increasing the dissolved oxygen (DO) in the waste stream ahead of the anoxic zone. Additionally, the EQ basin will be covered and vented to an odor control unit to capture nuisance odors.

Peak Flow Storage Basin

The peak flow storage (PFS) basin will be a separate storage basin, hydraulically connected to the EQ basin, which will store additional flow entering the plant during a wet weather event. The EQ basin will be designed to overflow into the PFS basin when a certain level in the EQ basin is reached.

Relift Pump Station

Wastewater from the grit removal system will flow into a relift pump station (RPS). The RPS will operate at a set flow rate and will pump degritted wastewater to the fine screening system. Flows greater than the pumped flow rate will overflow into the EQ basin. When the flow to the RPS is less than the set flow rate, stored wastewater from the EQ basin will be sent to the RPS as needed to achieve the set flow rate. The RPS will be designed to pump the peak 2-hour effluent flow of 20 MGD with the largest pump out of service (firm capacity).

Fine Screening System

From the RPS, wastewater will be conveyed to the fine screening system, which will consist of rotary drum screens. Three screens will be installed with a daily average capacity of 10 MGD, each. The fine screens will be sized to meet the 2-hour peak discharge flow of 20 MGD with one screen out of service. The fine screening system will be designed to divert flows to the EQ basin if a screen becomes blinded by solids.

Secondary Treatment Units

Following the fine screening system, wastewater will flow to the secondary treatment units, which will be an activated sludge process paired with membrane separation, also known as a membrane bioreactor (MBR) system. The secondary treatment units will consist of selector zones, an aerobic basin with diffused air, and a membrane basin for solids separation. The secondary treatment unit basin configuration is intended to facilitate (*i*) the treatment of organics, (*ii*) nitrification, (*iii*) denitrification, and (*iv*) phosphorus removal.

Selector Zones

The Selector Zones will consist of Anaerobic and Anoxic zones. These zones will remove phosphorus biologically by promoting the growth of phosphorus accumulating organisms and removing nitrates, which can inhibit phosphorus release.

Aerobic Zone

Following the selector zones, wastewater will flow into the Aerobic Zone where wastewater is aerated using a diffused air system. A nearby blower building will contain the blowers providing air into the aerobic zone.

The Selector Zones and Aerobic Zone for the Interim Phase will be sized for the organic and ammonia loadings at the 10 MGD design flow. The interim phase will contain four parallel trains, sized for a design flow of 2.5 MGD each.

Membrane Basins

Mixed liquor from the aerobic zones will flow to the membrane basins. Flat sheet style membrane units are proposed. However, a cost evaluation comparing different types of membranes should be completed during design. An air scour system will be included in the MBR package system to reduce the potential clogging through agitating the membrane surface. The air requirements for the MBR system will be based on equipment cleaning requirements.

A total of eight membrane basins will be constructed, including one empty basin to hold membranes while membrane equipment is being serviced (seven duty, one empty). Each membrane basin will be designed to treat 1.43 MGD average flow and 2.86 MGD at peak flow conditions. The total MBR system flow will be 10 MGD at design and 20 MGD at peak conditions for the Interim Phase.

Disinfection

Effluent from the membrane basin will be conveyed to the ultraviolet (UV) disinfection system. The UV disinfection system will consist of an open-channel layout with two parallel channels. Two banks of vertical or horizontal lamp modules will be installed in each channel. The UV disinfection system will be sized for the Interim Phase 2-hour peak discharge flow of 20 MGD. An additional module will be furnished to satisfy the redundancy requirement in 30 TAC 217.293(a).

A portion of the disinfected effluent will flow to the plant-water pump station. Sodium hypochlorite will be added to the portion used for plant water to provide a chlorine residual. The water will be used on-site, as needed, for equipment/structure wash down and irrigation.

Post-Aeration and Outfall

Effluent from the disinfection system will travel by gravity through a 36 inch pipeline to a cascade aerator prior to discharge into Mary's Creek. The cascade aerator, located downstream

of the UV disinfection system will be designed to treat the peak 2-hour effluent flow for the Final Phase (30 MGD).

Solids Processing and Disposal

The solids processing and disposal complex will consist of sludge storage tanks and a solids handling building. Waste activated sludge (WAS) from the membrane basin will be pumped into one of four aerated storage tanks. Sludge in the storage tanks will be mixed and aerated using a coarse bubble diffuser system. The WAS storage tanks will be covered and vented to the odor control system to reduce nuisance odors. The combined capacity of the tanks will be sized to provide three days of WAS storage during the Interim Phase.

Following storage, sludge will be pumped to one of two rotary drum thickeners (RDTs) on the second floor of the solids handling building. The RDTs will have a thickening capacity of 350 gallons per minute (gpm), each, and will be vented to the odor control system.

Thickened sludge will flow by gravity into one of two thickened sludge aerated holding tanks on the first floor of the solids handling building while filtrate will be sent back to the PTU. The thickened sludge aerated holding tanks will be mixed with a jet-mix system that will also include aeration from a blower. The holding tanks will be covered and vented to the odor control system.

Thickened sludge will be pumped from the holding tanks on the first floor to the second floor for the dewatering process. Three screw presses will be installed in the Interim Phase to accomplish dewatering. Each unit will have a capacity of 32 gpm and will be vented to the odor control system. Filtrate from the dewatering process will be combined with filtrate from the thickening process and sent back to the PTU. Mechanical conveyors will deposit the dewatered cake into a 20-cubic yard container located on the first floor of the building in an enclosed truck loading bay. Periodically, a truck will enter the loading bay and replace the container. The truck loading bay will be enclosed and vented to the odor control system. The Sewage Sludge Solids Management Plan contains additional details concerning the quantity of solids processed and the ultimate destination of dewatered cake.

Odor Control System

An odor control system for the liquids and solids streams will be constructed to abate nuisance odors. For the liquid stream, all of the PTUs and their ancillary equipment will have full covers.

Foul air from the RWWPS, coarse screens, grit removal units, fine screens, EQ basin, and the RPS will be vented to a tower-type bio-scrubber and treated. For the solid stream, foul air from the WAS storage tanks, RDTs, thickened sludge holding tanks, screw presses, and truck loading bay will be vented to a separate bio-scrubber. Treated air from the odor control system will be released to the atmosphere.

FINAL PHASE

The MCWRF will be designed for an annual average flow of 15 MGD and a 2-hour peak discharge flow of 30 MGD during the Final Phase. The 2-hour peak influent flow will be 60 MGD.

The proposed treatment processes from the Interim Phase will remain in service for the Final Phase. The additional treatment facilities to be placed in operation for the Final Phase are as follows:

1. Pumping capacity in the RWWPS and the RPS,
2. One coarse screen,
3. One grit removal unit,
4. One fine screen,
5. Two aeration basins,
6. Four membrane basins,
7. One UV channel
8. Two WAS storage tanks,
9. One RDT, and
10. One screw press.

No changes to the EQ basin, PFS basin, post-aeration, or odor control system are proposed for the Final Phase.

<u>Pump Stations</u>

Additional pumping capacity will be added to the RWWTP and the RPS in the Final Phase. The firm capacity of the RWWTP will be increased from 40 MGD to 60 MGD, and the firm capacity of the RPS will be increased from 20 MGD to 30 MGD. Both pump station structures will be designed in the Interim Phase to accommodate the equipment expansion required in the Final Phase.

Preliminary Treatment Units

One coarse screen, grit removal unit, and fine screen will be added in the Final Phase. The firm capacity of the coarse screens will increase from 40 MGD to 60 MGD, the total capacity of the grit removal units will increase from 40 MGD to 60 MGD, and the firm capacity of the fine screens will increase from 20 MGD to 30 MGD. The PTU building will be constructed in the Interim Phase to accommodate all future equipment required in the Final Phase.

Selector Zones and Aeration Basins

Two additional trains of selector zones and aeration basins will be constructed for the Final Phase. Each train will be sized for design flow of 2.5 MGD. Additional blowers will be added to meet minimum aeration requirements. A second blower building will be constructed to house the additional blowers required for the aeration basins and membrane basins in the Final Phase.

Membrane Basins

Four additional membrane basins will be constructed, including an additional empty basin, for a total of 12 basins (10 duty, and 2 empty). Each membrane basin will operate at an average capacity of 1.5 MGD and a peak capacity of 3 MGD, based on the Final Phase design flow of 15 MGD and a peak flow of 30 MGD.

Disinfection Process

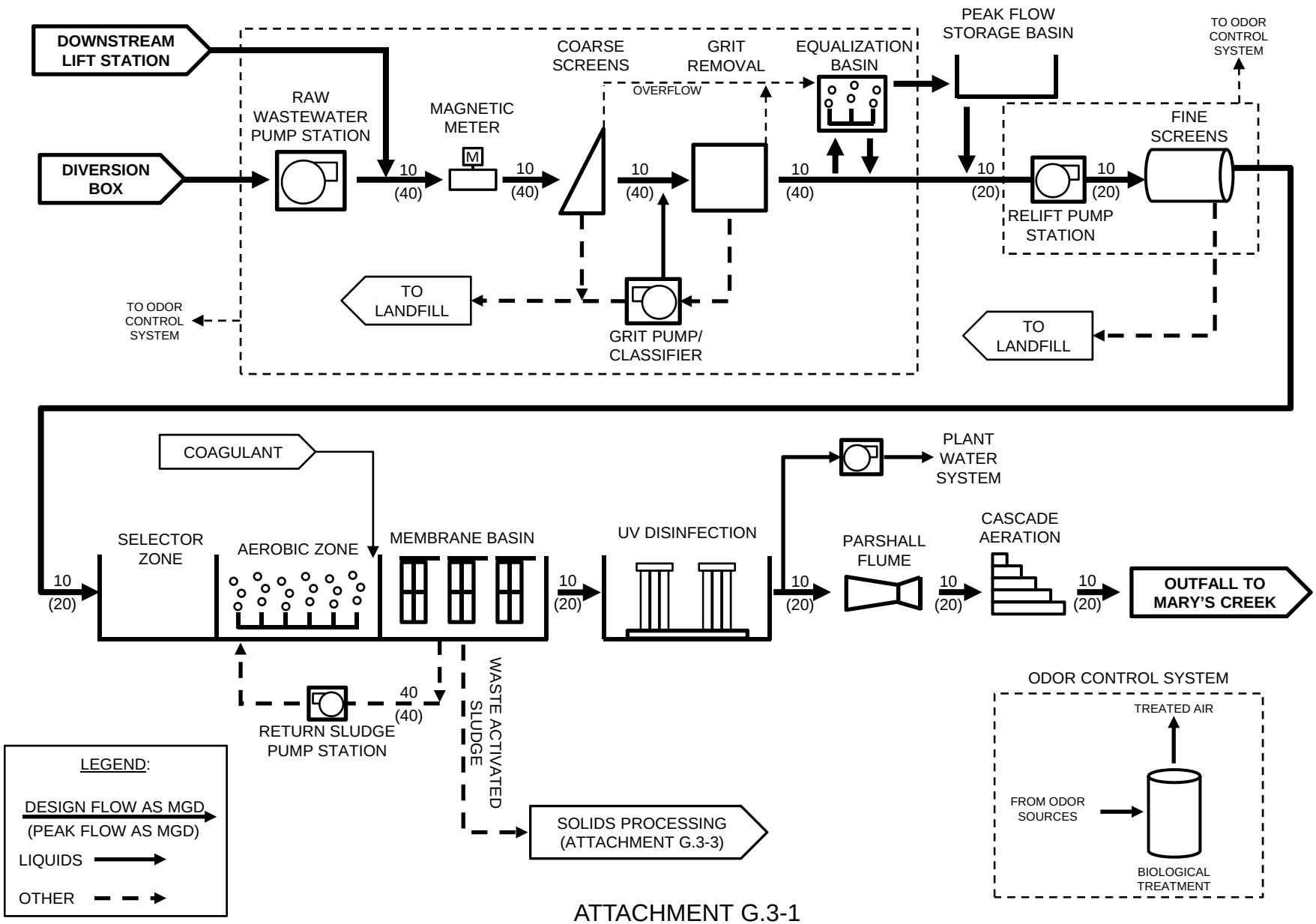
For the Final Phase, an additional UV channel will be constructed to increase the capacity of the UV system by 10 MGD. Two banks will be installed in the new channel. The UV configuration for the Final Phase will be sized for a peak flow of 30 MGD; 10 MGD per channel.

Solids Processing and Disposal

Two additional WAS storage tanks, identical in size to the first four constructed in the Interim Phase, will be added in the Final Phase for a total of 6 storage tanks. One additional RDT and one screw press, identical to the units installed in the Interim Phase, will be added in the solids handling building during the Final Phase.

ATTACHMENT G.2
CITY OF FORT WORTH - MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
LIST OF TREATMENT UNITS

Treatment Unit	Total Quantity		
	Interim Phase	Final Phase	Size, each
Raw Wastewater Pump Station Structure	1	1	60 ft x 60 ft x 60 ft deep
Coarse Screens	3	4	8 ft (L) x 3 ft (W) x 18 ft (D)
Grit Removal Units	2	3	17 ft diameter x 22 ft (D)
Equalization Basin	1	1	100 ft diameter, 30 ft SWD
Peak Flow Storage Basin	1	1	165 ft diameter, 30 ft SWD
Rotary Drum Fine Screens	3	4	20 ft (L), 7 ft (DIA)
Aeration Basin/Membrane Bioreactor			
Anaerobic Zone	4	6	31.3 ft (L) x 40 ft (W) x 20 ft (SWD)
Anoxic Zone	4	6	45.3 ft (L) x 40 ft (W) x 20 ft (SWD)
Aerobic Zone	4	6	150.4 ft (L) x 40 ft (W) x 20 ft (SWD)
Membrane Basin	8	12	65 ft (L) x 20 ft (W) x 20 ft (SWD)
UV Disinfection System	2 Channels; 2 Banks per Channel	3 Channels; 2 Banks per Channel	35 ft (L) x 2 ft (W) x 5 ft (D)
Effluent Cascade Aeration	1	1	60 ft (L) x 30 ft (W) x 11 ft (D)
Aerated WAS Storage Tank	4	6	63 ft (L) x 40 ft (W) x 15 ft (SWD)
Rotary Drum Thickeners	2	3	23 ft (L), 6 ft (DIA)
Thickened Solids Holding Tank	2	2	26 ft (L) x 10 ft (W) x 15 ft (SWD)
Dewatering Screw Presses	3	4	26 ft (L), 6 ft (DIA)



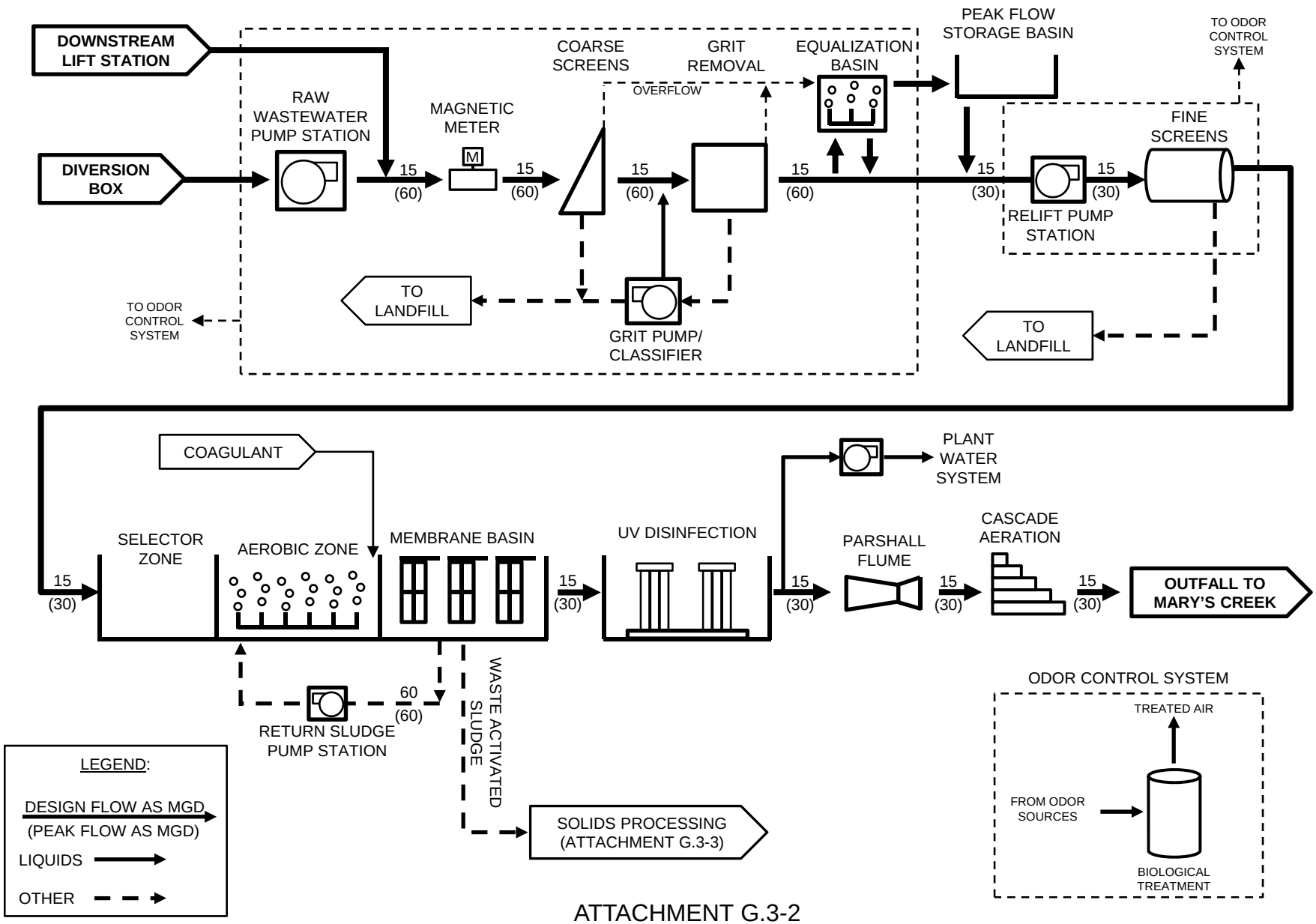
ATTACHMENT G.3-1

CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY

APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

LIQUID PROCESS FLOW DIAGRAM – INTERIM PHASE

F:\projects\0318\059-01\2-0 Wrk Prod\2-10 GRAPHICS_PHOTOS\Liquid_PFD_ver4.pptx



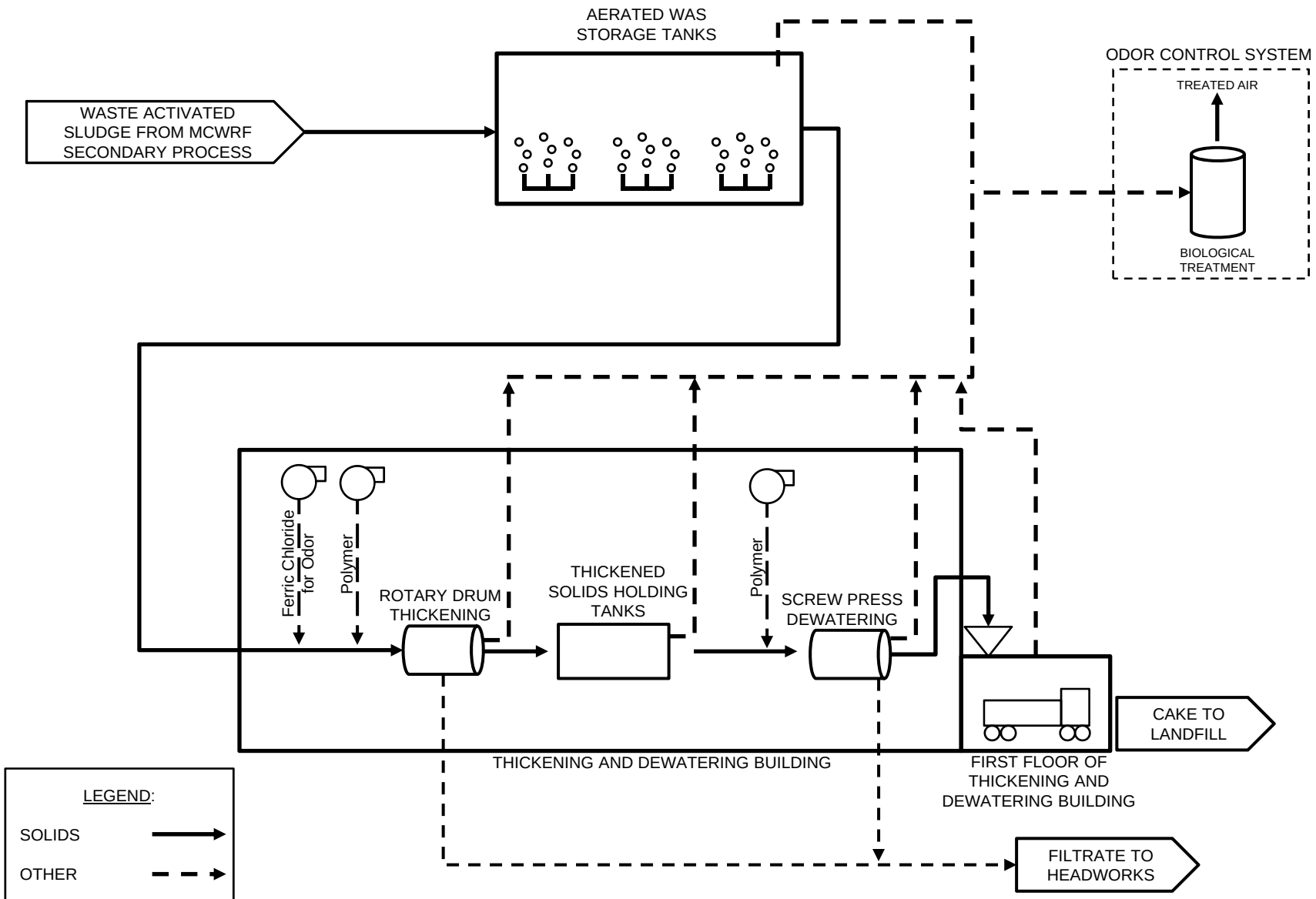
ATTACHMENT G.3-2

CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY

APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

LIQUID PROCESS FLOW DIAGRAM – FINAL PHASE

F:\projects\0318\059-01\2-0 Wrk Prod\2-10 GRAPHICS_PHOTOS\Liquid_PFD_ver4.pptx



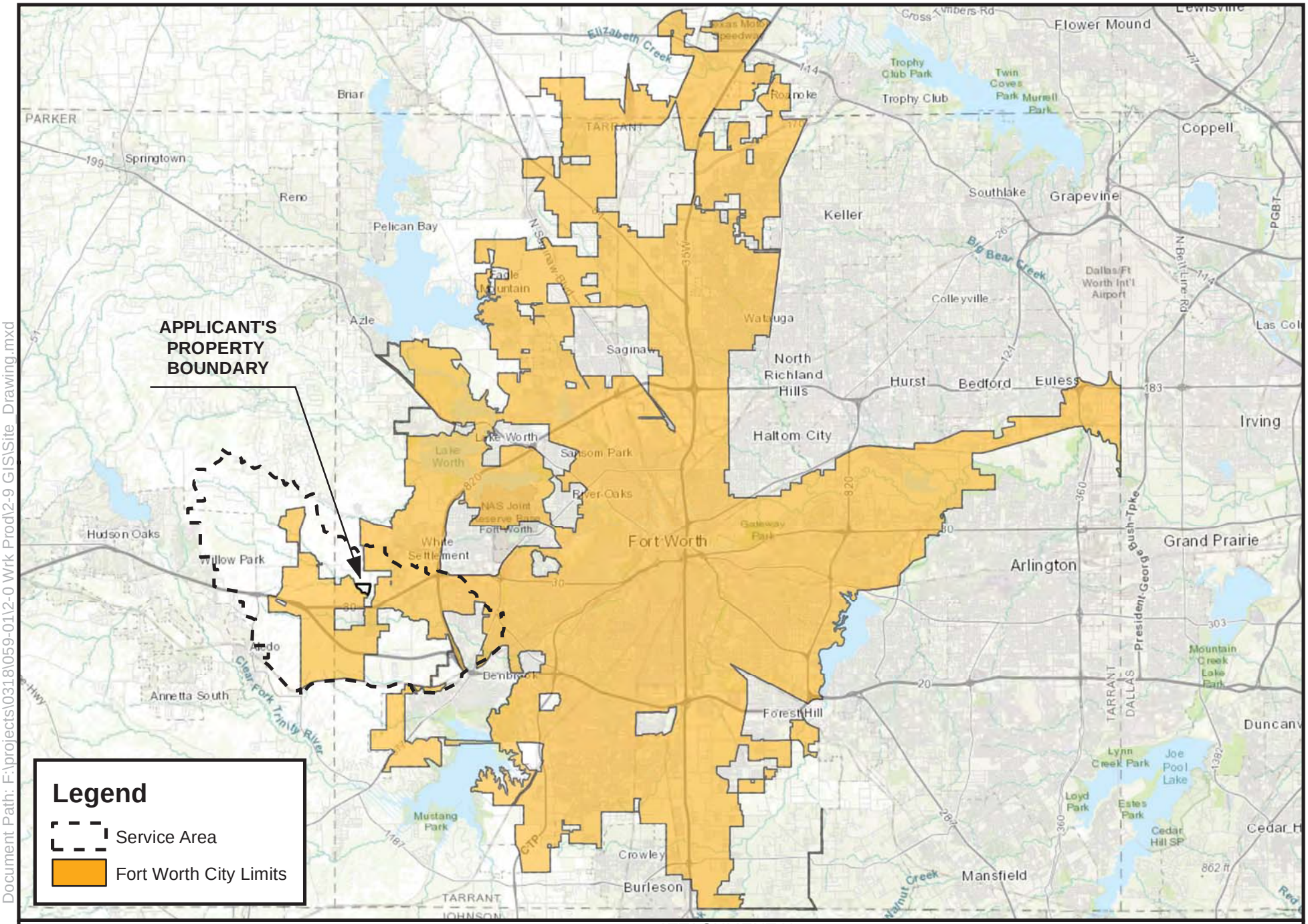
ATTACHMENT G.3-3
CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
SOLIDS PROCESSING AND DEWATERING

F:\projects\0318\059-01\2-0 Wrk Prod\2-10 GRAPHICS_PHOTOS\Liquid_PFD_ver4.pptx

ATTACHMENT H

SITE DRAWING

TECH REPORT 1.0, SECTION 3



0 2.5 5 Miles

N

ATTACHMENT H
CITY OF FORT WORTH - MARYS' CREEK WATER RECLAMATION FACILITY
NEW TPDES PERMIT APPLICATION
SITE DRAWING

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS • DESIGNERS • SCIENTISTS

ATTACHMENT I

SEWAGE SLUDGE SOLIDS MANAGEMENT PLAN

TECH REPORT 1.1, SECTION 7

ATTACHMENT I
CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
SEWAGE SLUDGE SOLIDS MANAGEMENT PLAN

The solids management plan for Mary's Creek Water Reclamation Facility (WRF) includes the following elements:

- Solids generation rates
- Operating range for mixed liquor suspended solids
- Quantity and schedule for solids removal
- Sludge processing units dimensions and capacities
- Disposal site identification and documentation procedures
- Procedures for solids removal

The application for Mary's Creek Wastewater Treatment Plant permit includes the following phases of operation:

Interim Phase: Annual Average Daily Flow (AADF) = 10 million gallons per day (MGD)
Maximum Week Daily Flow = 15 MGD
Influent Design BOD Concentration = 250 mg/L

Final Phase: Annual Average Daily Flow (AADF) = 15 MGD
Maximum Week Daily Flow = 22.5 MGD
Influent Design BOD Concentration = 250 mg/L

Solids Generation Rates

The amount of dry solids generated for operations at 100%, 75%, 50% and 25% at annual average daily flow are shown in Table 1. The calculations for determining the amount of solids produced from the liquids treatment process are given in the Design Calculations (Attachment J.1).

Table 1: Mary's Creek WRF Solids Production Rates (AADF)

Operation Levels	Interim Phase Solids Generation, AADF (Dry Lbs/day)			Final Phase Solids Generation, AADF (Dry Lbs/day)		
	WAS + Chemical Solids	Thickened	Dewatered	WAS + Chemical Solids	Thickened	Dewatered
100% Design	20,900	19,900	18,900	31,300	29,800	28,300
75% Design	15,700	14,900	14,100	23,500	22,300	21,200
50% Design	10,400	9,900	9,400	15,700	14,900	14,100
25% Design	5,200	5,000	4,700	7,800	7,400	7,100

Table 2 displays the amount of dry solids generated at a maximum week flow (MWF) of 1.5 times the AADF. The solids processing and dewatering equipment is based on the amount of solids produced using MWF.

Table 2: Mary's Creek WRF Solids Production Rates (MWF)

Operation Levels	Interim Phase Solids Generation, AADF (Dry Lbs/day)			Final Phase Solids Generation, AADF (Dry Lbs/day)		
	WAS + Chemical Solids	Thickened	Dewatered	WAS + Chemical Solids	Thickened	Dewatered
100% Design	31,000	30,000	28,000	47,000	45,000	42,000
75% Design	23,000	22,000	21,000	35,000	33,000	32,000
50% Design	16,000	15,000	14,000	24,000	22,000	21,000
25% Design	8,000	7,000	7,000	12,000	11,000	11,000

Operating Range for Mixed Liquor Suspended Solids

The typical operating range for the mixed liquor suspended solids (MLSS) in the aeration basins may range from 8,000 mg/L to 10,000 mg/L depending on influent loads, wastewater temperature and sludge retention time maintained by plant staff.

Quantity and Schedule for Solids Removal

The quantities of solids to be removed are summarized in Tables 1 and 2. Waste activated sludge (WAS) will typically be wasted from the membrane basins on a continuous basis. The removal of phosphorus can be enhanced by feeding chemical into the aerobic zone of the aeration basins, and the additional solids generated by the chemical addition will be wasted together with the WAS. The chemical quantities are included in the Table 1 and 2 solids production values.

Sludge Processing Units Dimensions and Capacities

Mary’s Creek WRF design calculations for process sizing and equipment selection are presented in Table 3, based on the 100% Design Condition, Maximum Week Flow (MWF). The Aerated WAS Storage Tanks are sized to provide 3 days of storage during max-week conditions. The thickening and dewatering units are sized to provide a firm capacity adequate for max week conditions, with a spare unit equal in capacity to the others. The thickened solids holding tanks are sized for 12 hrs of storage under max week conditions.

Table 3: Design Calculations, Mary's Creek WRF, 100% Design Condition, Maximum Week Flow (MWF)

		Interim Phase	Final Phase
Aerated WAS Storage Tanks	100% Design Flow (MWF), gpd	376,000	564,000
	100% Solids Load (MWF), dry lbs/d	31,000	47,000
	Target HRT, Days	3	3
	Volume Required, MG	1.1	1.7
Thickening Equipment	100% Design Flow (MWF), gpm	261	391
	100% Solids Load (MWF), dry lbs/d	31,000	47,000
	Flowrate per Unit, gpm	350	350
	# Operating Units Required	1	2
	# Standby Units	1	1
Thickened Solids Holding Tank	100% Design Flow (MWF), gpd	71,400	107,100
	100% Solids Load (MWF), dry lbs/d	30,000	45,000
	Target HRT, Days	0.5	0.5
	Volume Required, MG	0.04	0.05
Dewatering Equipment	100% Design Flow (MWF), gpm	50	74
	100% Solids Load (MWF), dry lbs/d	30,000	45,000
	Flowrate per Unit, gpm	32	32
	# Operating Units Required	2	3
	# Standby Units	1	1

The selected process dimensions and equipment details are summarized in Table 4. Table 4 demonstrates that the planned unit processes will meet the design requirements in Table 3. The thickening and dewatering equipment has a firm throughput capacity to accommodate MWF conditions, operating 24 hours per day and 7 days per week, with one spare unit. The Aerated WAS Storage Tanks provide 3-days of MWF storage in case a shut-down of thickening or dewatering is required.

Disposal Site Identification and Documentation Procedures

Dewatered sludge from MCWRF could be disposed at one of two landfill sites:

Southeast Landfill
6288 Salt Road
Fort Worth, TX 76140
Tarrant County
Permit Number: 218C

or

Turkey Creek Landfill
IESI
9100 South I-35W
Alvarado, TX 76009
Johnson County
Permit Number: 1417D

The plant operator will maintain written records of the dewatered solids removed by truck (via 20-cubic-yard roll-off boxes). Solids will be transported by registered hauler to be determined at a future date. The trucks will be weighed at the landfill site. There will be approximately 12 truckloads per week of residuals when the WRF commences discharging. As the WRF increases flows during the Interim Phase AADF to 10 MGD, there will be approximately 25

truckloads per week of residuals. There will be approximately 38 truckloads per week at the Final Phase AADF of 15 MGD. Inclusion of grit and screenings removed from the headworks will increase the number of truckloads per week in each phase; however, the number cannot be estimated at this time.

Table 4: Solids Handling Units for Mary's Creek WRF (Designed to accommodate MWF)

	Interim Phase	Final Phase
Aerated WAS Storage Tanks		
Capacity (All Basins), MG	1.2	1.7
Quantity	Four	Six
Dimensions (each)	63 ft x 40 ft x 15 ft (SWD)	63 ft x 40 ft x 15 ft (SWD)
Mixing	Course Bubble Diffusers	Course Bubble Diffusers
Minimum air supply, scfm/1000 cf	30	30
Minimum air supply, scfm	4,540	6,800
# Duty Blowers	2	3
# Standby Blowers	1	1
Capacity per Blower, scfm	2,270	2,270
% Solids	1	1
Rotary Drum Thickener (RDT)		
Quantity	Two	Three
Operating Time Design Basis	24/7	24/7
Dimensions (each)	23 ft x 6 ft	23 ft x 6 ft
Influent % solids	1	1
Capacity per Unit, gpm	350	350
Effluent % solids	5	5
Thickened Solids Holding Tanks		
Capacity (All Basins), MG	0.06	0.06
Quantity	Two	Two
Dimensions (each)	26 ft x 10 ft x 15 ft (SWD)	26 ft x 10 ft x 15 ft (SWD)
Mixing	Jet Mix	Jet Mix
# Mix Pumps	3	3
Mix Pump Capacity, hp	4	4
Minimum air supply, scfm/1000 cf	30	30
Minimum air supply, scfm	234	234
# Duty Blowers	1	1
# Standby Blowers	1	1
Capacity per Blower, scfm	237	237
% Solids	5	5
Dewatering Screw Presses (SP)		
Quantity	Three	Four
Operating Time Design Basis	24/7	24/7
Dimensions (each)	26 ft x 6 ft	26 ft x 6 ft
Influent % solids	5	5
Capacity per Unit, gpm	32	32
Effluent % solids	17	17

Procedures for Solids Removal

Solids will be removed from the treatment process via membrane separation. The waste activated sludge (WAS) will be pumped into one of the six Aerated WAS Storage Tanks. The Aerated WAS Storage Tanks will have an equipment building to house blowers, electrical equipment, and transfer pumps to move solids from one Aerated WAS Storage Tank to another. Thickening feed pumps will pump solids from the Aerated WAS Storage Tanks to the solids handling building's rotary drum thickeners.

The rotary drum thickeners will capture approximately 95% of the solids load. The thickened solids have an approximate total solids (TS) concentration of 5%. The solids will then flow by gravity into one of the Thickened Solids Holding Tanks, which will be mixed with a jet-mix system. From the Thickened Solids Holding Tanks, the solids will be pumped to the dewatering screw presses. The dewatering screw presses are expected to capture approximately 95% of the solids, and produce sludge with 17% TS concentration. Mechanical conveyors will deposit the dewatered solids into trucks inside the building's enclosed truck loading bay for ultimate disposal.

The sidestream filtrates from both thickening and dewatering processes will be combined into a wet-well inside the solids handling building, and pumped back to the headworks of the wastewater treatment plant. Foul air from the holding tanks, thickening and dewatering equipment, and truck loading facility will be captured and treated. Other areas will be ventilated by forced air.

ATTACHMENT J

JUSTIFICATION OF PERMIT

TECH REPORT 1.1, SECTION 1.A

ATTACHMENT J
CITY OF FORT WORTH
MARY'S CREEK WATER RECLAMATION FACILITY
TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
APPLICATION FOR NEW PERMIT

JUSTIFICATION OF PERMIT AND PHASES

The City of Fort Worth (City) is proposing to construct a new water reclamation facility (WRF) to provide wastewater treatment services to the residential population and commercial establishments west of the City. The fastest growing area for the City is in the western portion of the City. In addition, the population of the City of Benbrook, which is west of the City and in the City's current service area is increasing. Numerous planned developments also are proposed in the unincorporated area just west of the City's limits. All will need wastewater treatment services.

The location of the proposed WRF is on Mary's Creek approximately 12 miles west of the downtown area of the City. Figure 1 is a location map. The proposed WRF site and the boundaries of the service area are presented.

To serve the population in the proposed service area, a permit with two phases of operation is requested. The annual average flows for the requested permit are 10 million gallons per day (MGD) for an Interim phase and 15 MGD for a Final phase.

This document presents justification for the permit and phases. Described are the following:

- Data used for developing the population projections and flow estimates for the service area.
- Feasibility study conducted on alternatives for services in the area west of the City.
- Anticipated schedule for the requested permit phases.

POPULATION PROJECTIONS

The existing and projected residential and non-residential/employed populations in the Mary's Creek service area, not including Benbrook, were developed by Freese and Nichols, Inc., (FNI). The sources of information used were the City's water billings, the North Texas Council of Government (NTCOG) traffic zone survey, and an impact fee study conducted by the City's Planning and Development Department.

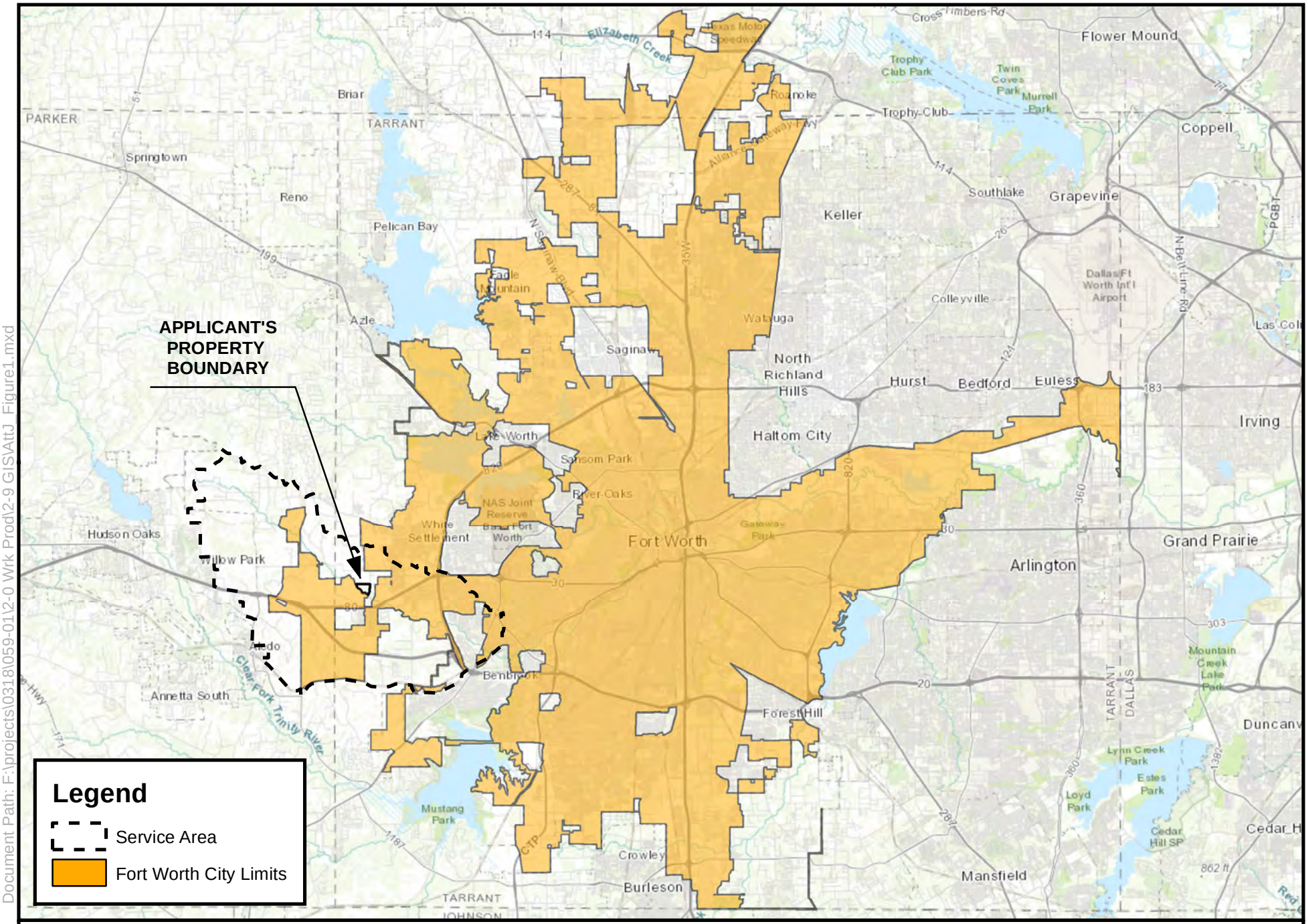


FIGURE 1 - LOCATION MAP
CITY OF FORT WORTH - MARYS' CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS • DESIGNERS • SCIENTISTS

Document Path: F:\projects\0318\059-01\2-0 Wrk Prod\2-9 GIS\Att_Figure1.mxd

Based on NTCOG data, the existing population in the proposed service area is predominantly within the city limits, which is provided wastewater treatment by the City's Village Creek Wastewater Treatment Facility. FNI used both the City's water billing data and NTCOG traffic zone survey data to estimate the existing residential and employment population.

The future population was based on growth within the City and by adding the population anticipated for nine new developments planned outside of the City's limits. The growth rates used to project the population within the City were obtained from the City's Impact Fee study and NTCOG. The anticipated populations for the planned developments were based on information provided by developers. Table 1 presents the buildout population for nine known developments planned within the proposed service area.

Table 1
City of Fort Worth
Mary's Creek Water Reclamation Facility
Population Projections for Known Developments

Development	Full Build-Out Population
Beggs Ranch	13,358
Boswell Dean Ranch – South	5,275
Chapel Creek	2,871
Crestview	4,732
Dean Business Centre North	2,009
Dean Ranch Estates	5,660
Morning Star	8,503
Palmilla Springs	834
Walsh Ranch	47,667
Total	90,909

The total build-out population of the new developments was distributed evenly over the planning period of 2017 to 2060 and added to the projected population within the City limits to estimate the population in that portion of the proposed service area outside of Benbrook. These existing and projected residential and nonresidential populations are summarized in Table 2.

Table 2
City of Fort Worth
Mary's Creek Water Reclamation Facility
Population and Wastewater Flow Projections

Year	Mary's Creek WRF Population	Residential Average Day Flow* (MGD)	Mary's Creek WRF Employment	Nonresidential Average Day Flow** (MGD)	Benbrook Total Average Flow (MGD)	Total WRF Average Day (MGD)
2017	32,628	3.26	9,797	0.39	0.43	4.08
2018	37,260	3.73	9,976	0.40	0.45	4.58
2019	41,903	4.19	10,159	0.41	0.46	5.06
2020	46,557	4.66	10,345	0.41	0.47	5.54
2021	51,222	5.12	10,535	0.42	0.50	6.04
2022	55,898	5.59	10,728	0.43	0.52	6.54
2023	60,585	6.06	10,925	0.44	0.55	7.05
2024	65,285	6.53	11,125	0.45	0.57	7.54
2025	69,996	7.00	11,329	0.45	0.60	8.05
2026	74,720	7.47	11,533	0.46	0.61	8.54
2027	79,339	7.93	11,741	0.47	0.61	9.01
2028	83,967	8.40	11,952	0.48	0.62	9.49
2029	88,604	8.86	12,167	0.49	0.63	9.98
2030	93,249	9.32	12,386	0.50	0.63	10.45
2031	97,904	9.79	12,609	0.50	0.64	10.93
2032	102,569	10.26	12,836	0.51	0.65	11.42
2033	107,242	10.72	13,067	0.52	0.65	11.90
2034	111,926	11.19	13,302	0.53	0.66	12.38
2035	116,619	11.66	13,542	0.54	0.67	12.87
2036	121,321	12.13	13,785	0.55	0.67	13.35
2037	126,034	12.60	14,033	0.56	0.68	13.84
2038	130,757	13.08	14,224	0.57	0.69	14.33
2039	135,490	13.55	14,458	0.58	0.69	14.82
2040	139,999	14.00	14,674	0.59	0.70	15.29
2050	184,986	18.50	17,030	0.68	0.70	19.88
2060	226,966	22.70	19,764	0.79	0.70	24.19

* Assumes a residential per capita of 100 per capita per day.
** Assumes a nonresidential per capita of 40 gallons per employee per day.

WASTEWATER FLOW PROJECTIONS

The wastewater generated by the residential population in Table 2 was estimated to be one hundred gallons per capita per day. This assumption is consistent with the flow rates for residential-type users specified in Title 30 Texas Administrative Code Chapter 217, Design Criteria for Domestic Wastewater Systems. The wastewater flow rates for the non-residential group was based on an evaluation conducted using water meter billing data. Forty gallons per employee per day of wastewater for the nonresidential group was estimated in the evaluation and used in the wastewater flow projection calculations. The projected wastewater flows from the users within the City of Benbrook were based on data from the Benbrook Water Utilities Master Plan. These flows were summed to estimate the total flow to Mary's Creek WRF for each year of the planning period.

FEASIBILITY STUDY

A feasibility study was conducted to evaluate alternatives for serving the anticipated population growth and projected wastewater flows generated in the Mary's Creek Basin. A hydraulic model was constructed. The potential interceptor upgrades that would be needed to handle future flows generated within the City and those generated within the Mary's Creek WRF service area were identified. Three alternatives were identified for a 20-year planning horizon. The alternatives identified are as follows:

- Option A1 – Upgrade gravity interceptors to convey flows from the Mary's Creek basin to the Village Creek Wastewater Treatment Facility (WWTF).
- Option A2 – Construct a pumping system that will divert the Mary's Creek basin flows around the downtown corridor to the Village Creek WWTF to avoid construction in high traffic areas.
- Option B - Construct the Mary's Creek WRF, but also include the necessary upgrades to interceptors for increased wastewater flows to Village Creek WWTF that are not generated in the Mary's Creek basin.

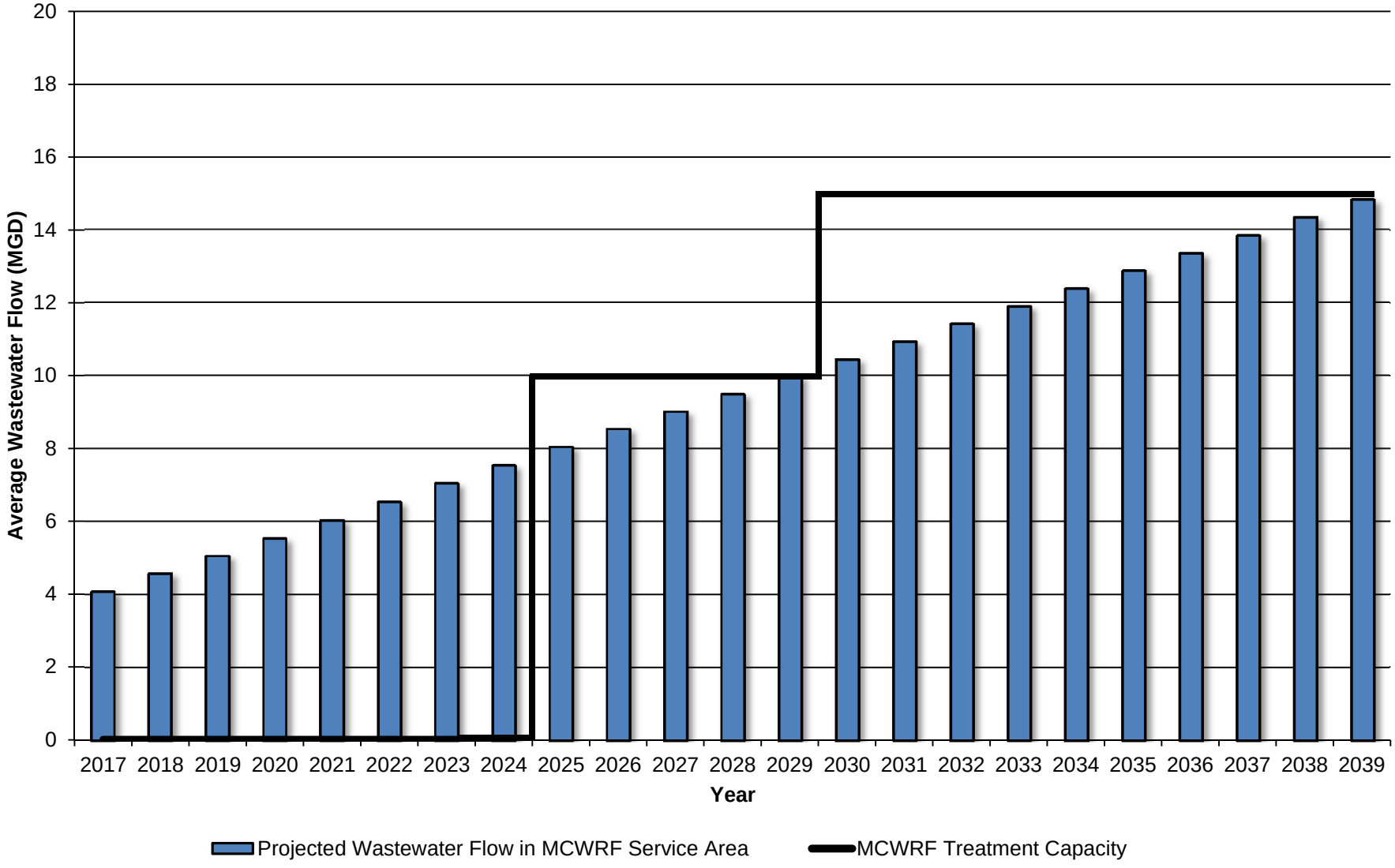
Based on the evaluation of the three alternatives it was concluded that the City's long-term costs would be reduced by the construction of the Mary's Creek WRF (Option B). Benefits of the Option B include the delay in increasing the treatment capacity of the City's Village Creek

WWTF and construction of fewer and smaller-diameter interceptor improvements through the central portion of the City.

ANTICIPATED SCHEDULE FOR PERMIT PHASES

The City's goal is to ensure that customers in the areas west of the City are provided reliable and continuous wastewater treatment services when needed. The projected wastewater flows and the proposed phases for the permit to achieve the City's goal are presented in Figure 2. The construction of the Initial phase is anticipated to begin in 2023 with commencement of discharge in 2025. The construction of the facilities for the Final phase is anticipated to begin in 2028 with the commencement of discharge in 2030.

Figure 2
City of Fort Worth Mary's Creek WRF
Projected Average Day Wastewater Flows



ATTACHMENT K

DESIGN CALCULATIONS AND DESIGN FEATURES

TECH REPORT 1.1, SECTION 4

ATTACHMENT K.1
CITY OF FORT WORTH - MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
DESIGN CALCULATIONS

Design Flows	**Interim Phase**	**Final Phase**
Annual Average Daily Flow, MGD	10	15
Peak 2 Hour Influent, MGD	40	60
Peak 2 Hour Effluent, MGD	20	30

Raw Wastewater Constituents	**Design**	**Max Day**
BOD5, mg/L	250	262
TSS, mg/L	280	384
NH3, mg/L as N	35	42
TP, mg/L as P	7	

Design Loadings	**Interim Phase**	**Final Phase**
BOD_5 Design Load, lb/day	20,850	31,275
TSS Design Load, lb/day	23,352	35,028
NH_3 Design Load, lb/day	2,922	4,384

Treatment Process	**Interim Phase**		**Final Phase**		**Reference**
	TCEQ Requires	**Actual Provided**	**TCEQ Requires**	**Actual Provided**	
Raw Wastewater Pump Station					
Firm Pumping Capacity (Largest Pump out of Service), MGD	40	40	60	60	
Coarse Screens					
Number of Screens	2	3	2	4	30 TAC 217.121(b)
Firm Capacity (Largest Screen out of Service), MGD	-	40	-	60	
Minimum Mechanical Screen Opening, inches	0.25	0.25	0.25	0.25	30 TAC 217.121(e)(2)
Minimum Manual Screen Opening, inches	0.50	0.50	0.50	0.50	30 TAC 217.121(e)(1)
Grit Removal Units					
Number of Units	2	2	2	3	30 TAC 217.124(c)
Total Capacity of Units, MGD	-	40	-	60	30 TAC 217.124(c)
Equalization Basin					
Volume of EQ Basin, MG	-	1.8	-	1.8	30 TAC 217.128(e)
EQ Basin Mixing System	Air Mixing System	Air Mixing System	Air Mixing System	Air Mixing System	30 TAC 217.128(c)
Minimum DO Concentration in EQ Basin, mg/L	1	1	1	1	30 TAC 217.128(c)
Peak Flow Storage Basin					
Volume of PFS Basin, MG	-	5.2	-	5.2	
Relift Pump Station					
Firm Pumping Capacity (Largest Pump out of Service), MGD	-	20	-	30	
Fine Screening					30 TAC 217.157(d)(1)(A)
Minimum Number of Fine Screens	2	3	2	4	30 TAC 217.157(d)(1)(A)(iv)
Firm Screening Capacity (Largest Screen out of Service), MGD	20	20	30	30	30 TAC 217.157(d)(1)(A)(v)
Aeration Basin Requirements					
Minimum Number of Aeration Basins	2	4	2	6	30 TAC 217.153(c)(1)
Design HRT - Anaerobic Zone, hr	-	1.8	-	1.8	
Design HRT - Anoxic Zone, hr	-	2.6	-	2.6	
Design HRT - Aerobic Zone, hr	-	8.6	-	8.6	
Design Volume, each - Anaerobic Zone, ft3	-	25,067	-	25,067	
Design Volume, each - Anoxic Zone, ft3	-	36,208	-	36,208	
Design Volume, each - Aerobic Zone, ft3	-	120,302	-	120,281	
Minimum Aerobic Zone Solids Retention Time, days	10	13	10	13	30 TAC 217.157(d)(2)(B)
Minimum MLSS in Aeration Zone, mg/L	4,000	8,000	4,000	8,000	30 TAC 217.157(d)(2)(C)(i)
Maximum MLSS in Aeration Zone, mg/L	10,000	8,000	10,000	8,000	30 TAC 217.157(d)(2)(C)(i)
Design Wastewater Temperature, ^{o}C	-	15	-	15	
Design SRT - Anaerobic Zone, days	-	1.2	-	1.2	
Design SRT - Anoxic Zone, days	-	2.6	-	2.6	
Design SRT - Aerobic Zone, days	-	13.0	-	13.0	
Aeration Requirements					
Oxygen Requirement for BOD5, lb O2/lb BOD5	1.2	1.2	1.2	1.2	30 TAC §217.155.(a).(3)
Oxygen Requirement for NH3-N, lb O2/lb NH3-N	4.3	4.3	4.3	4.3	30 TAC §217.155.(a).(3)
Design DO in Aeration Basin	2.0	2.0	2.0	2.0	30 TAC §217.155.(a).(1)
Minimum O2R Loading, O2R lb/lb BOD5	2.2	2.2	2.2	2.2	30 TAC §217.155.(a).(3)
Minimum O2 Required, ppd O2	45,870	45,870	68,805	68,805	30 TAC §217.155.(a).(3)
Wastewater Oxygen Transfer Efficiency, %	-	9.1%	-	12.2%	
Density of Air, Standard Conditions (lb/cf)	0.075	0.075	0.075	0.075	30 TAC §217.155(b)(2)(C)
Percent Oxygen in Air @ Standard Conditions	23%	23%	23%	23%	30 TAC §217.155(b)(2)(C)
Diffuser Submergence, ft	-	19	-	19	
Required Airflow (Unadjusted for Submergence), scfm	20,227	20,227	22,769	22,769	30 TAC §217.155(b)(2)(C)
Airflow Rate Correction Factor	0.685	0.685	0.685	0.685	30 TAC §217.155(b)(2)(D)
Required Airflow (Adjusted for Submergence), scfm	13,855	13,855	15,597	15,597	30 TAC §217.155(b)(2)(D)

Treatment Process	Interim Phase		Final Phase		Reference
	TCEQ Requires	Actual Provided	TCEQ Requires	Actual Provided	
Membrane Basin Requirements					
Total Number of Membrane Basins	-	8	-	12	
Number of Empty Membrane Basins	-	1	-	2	30 TAC 217.157(d)(9)(A)
Membrane Basin Volume, each, ft3	-	24,586	-	24,586	
Minimum MLSS in membrane tank, mg/L	4,000	10,000	4,000	10,000	30 TAC 217.157(d)(2)(C)(ii)
Maximum MLSS in membrane tank, mg/L	14,000	10,000	14,000	10,000	30 TAC 217.157(d)(2)(C)(ii)
Maximum Average Daily Net Flux Rate, gfd	15	10.2	15	10.2	30 TAC 217.157(d)(7)(A)(i)
Maximum Two-Hour Peak Net Flux Rate, gfd	22.5	20.5	22.5	20.5	30 TAC 217.157(d)(7)(A)(iii)
Design HRT - Membrane Basin, hr	-	3.1	-	2.9	
Design SRT - Membrane Basin, days	-	5.8	-	5.5	
Minimum Combined SRT, days	10	22.6	10	22.4	30 TAC §217.157(d)(2)(B)
Maximum Combined SRT, days	25	22.6	25	22.4	30 TAC §217.157(d)(2)(B)
Sludge Production Rate					
Heterotrophic Yield, g-VSS/g-bCOD	-	0.4	-	0.4	
BOD_5/UBOD	-	0.68	-	0.68	
Heterotrophic Endogenous Decay Coefficient, d^{-1}	-	0.099	-	0.099	
Fraction of Cell Mass Remaining as Cell Debris	-	0.15	-	0.15	
bCOD/BOD_5	-	1.61	-	1.61	
Nitrifier Yield, g-VSS/g-NOX	-	0.12	-	0.12	
Concentration of Nitrified Ammonia, mg/L as N	-	27.3	-	26.8	
Biomass VSS : TSS Ratio	-	0.85	-	0.85	
Heterotrophic Biomass Total Sludge Production, lb-TSS/d	-	6,911	-	10,367	
Cell Debris Total Sludge Production, lb-TSS/d	-	1,329	-	1,994	
Influent Inert Solids Sludge Production, lb-TSS/d	-	3,503	-	5,254	
Nitrifier Total Sludge Production, lb-TSS/d	-	173	-	255	
Influent Non-Biodegradable VSS Volatile Sludge Production, lb-TSS/d	-	6,550	-	9,825	
Total Waste Activated Sludge Production, lb-TSS/d	-	18,467	-	27,695	
Additional Chemical Sludge Produced, lb-TSS/d	-	2,419	-	3,628	
Total WAS plus Chemical Sludge Produced, lb-TSS/d	-	20,885	-	31,324	
UV Disinfection					
Number of Channels	-	2	-	3	
Number of Banks per Channel	2	2	2	2	30 TAC §217.293(a)
Number of Modules per Bank	-	2	-	2	
Total Number of Modules	-	8	-	12	
Design Dosage, mJ/cm^2	-	35	-	35	
Design Transmissivity, %	-	65%	-	65%	
Effluent Cascade Aeration					
Influent DO Concentration, mg/L	-	2	-	2	
Required Effluent DO Concentration, mg/L	-	6	-	6	
Deficit Ratio	-	3.48	-	3.48	
Summer Water Temperature, ^oC	-	30	-	30	
Required Total Cascade Height, ft	-	11	-	11	
Aerated WAS Storage Tank					
Number of Tanks	-	4	-	6	
Tank Volume, each, ft3	-	37,800	-	37,800	
Mixing System	-	Coarse Bubble	-	Coarse Bubble	
Design HRT, days	-	3	-	3	
Minimum Air Supply, scfm/1000 cf	-	30	-	30	
Total Minimum Air Supplied, scfm	-	4,536	-	6,804	
Percent Solids in Tank, %	-	1%	-	1%	
Rotary Drum Thickeners					
Number of Units	2	2	2	3	30 TAC §217.248(a)(2)(B)
Capacity per Unit, gpm	-	350	-	350	
Influent Percent Solids, %	-	1%	-	1%	
Thickened Percent Solids, %	-	5%	-	5%	
Thickened Solids Holding Tank					
Number of Tanks		2		2	
Tank Volume, each, ft3		3,900		3,900	
Minimum HRT, days		0.5		0.5	
Mixing System		Jet Mix		Jet Mix	
Minimum Air Supply, scfm/1000 cf		30		30	
Total Minimum Air Supplied, scfm		234		234	
Percent Solids in Tank, %		5%		5%	
Dewatering Screw Presses					
Number of Units	2	3	2	4	30 TAC §217.250(c)(3)(A)
Capacity per Unit, gpm	-	32	-	32	
Influent Percent Solids, %	-	5%	-	5%	
Dewatered Percent Solids, %	-	17%	-	17%	

ATTACHMENT K.2
CITY OF FORT WORTH – MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
PLANT DESIGN FEATURES

The design features and functional arrangements to prevent bypassing or overflows of untreated wastewater are proposed in the design of the Mary's Creek Water Reclamation Facility (MCWRF). The design features and functional arrangements for the Interim and Final Phases are as follows:

INTERIM PHASE

The Interim Phase for the MCWRF will include the following design features:

1. Emergency Power Backup Generator: In accordance with 30 TAC 217.36, the treatment facility will incorporate two on-site automatically starting generators capable of continuously operating all critical wastewater treatment system units. The fuel tanks will be sized for a run time of 24 hours. The generators will provide sufficient power for the following equipment:

    a. Firm Capacity of raw wastewater pump station (RWWPS)
    b. 2 - Automatic coarse screens
    c. 2 - Grit removal pumps
    d. 2 - Grit dewatering classifiers
    e. Firm Capacity of relift pump station (RPS)
    f. 2 - Fine screens
    g. Aeration Basin Blowers
    h. Membrane biological reactor (MBR) blowers
    i. MBR valves
    j. Firm capacity of return activated sludge pump station (RASPS)
    k. 4 - Banks of the UV disinfection system
    l. Effluent metering station
    m. Plant water pumps
    n. Lighting Panels and Control Equipment
2. Alarm Features: The plant will be equipped with a Supervisory Control and Data Acquisition (SCADA) system to monitor the operation of all critical treatment units. The control room will include a computer with graphic display of the treatment units that will

indicate status and alarm conditions. The SCADA system will be monitored by operators 24 hours a day. The computer system will include an autodialer to alert plant personnel of the following conditions:

a. Power outage
b. Raw wastewater pump station wet well high level
c. Coarse screen channel high level
d. Equalization/Peak Flow Storage Basin high level
e. Equipment failure
f. Membrane filtrate turbidity detection

3. Design Features for Reliability and Operating Flexibility:

a. A diversion box will be designed to split flows between the MCWRF and the Village Creek Water Reclamation Facility (VCWRF). The diversion box allows the flexibility in operations to regulate/limit the flows to the MCWRF.

b. The Raw Wastewater Pump Station will be designed with a firm capacity for the peak 2-hour flow using a peaking factor of 4 times the modeled annual average daily flow. The Pump Station has level switches to turn pumps on and off, and the pumps have variable frequency drive (VFDs) for adjusting pumped flow.

c. The coarse screen system will have a diversion channel that contains a manual, redundant screen. There will also be overflow pipes to the Equalization (EQ) basin. Slide gates will be used to isolate each coarse screen channel.

d. The grit removal units will overflow into the EQ basin. Slide gates will allow each grit unit to be isolated for maintenance and repair. Both units would be needed to meet peak flow capacity, but only one would be required to treat annual average daily flow.

e. The Peak Flow Storage Basin will be sized for the Final Phase peak 2-year, 24-hour storm event.

f. An extra pump will be provided in the relift pump station (RPS). The RPS will have a firm capacity equal to the 2-hour peak effluent flow for the Interim Phase (20 MGD).

g. The MBR system will be designed for continuous operation. The plant in the Interim Phase will be designed such that one MBR basin may be taken out of service.

4. Overflow Prevention

   a. The plant will be designed to handle the peak 2-year, 24-hour storm event.

   b. The design will be based on a peaking factor of 4 for adequate hydraulic capacity in the absence of site specific data, as specified by 30 TAC 217.32(a)(2).

   c. The RWWPS will be designed to pump the peak 2-hour flow with the largest single pump out of service.

FINAL PHASE

The Final Phase for the MCWRF will include the following design features:

1. Emergency Power Backup Generator: In accordance with 30 TAC 217.36, the treatment facility will incorporate two on-site automatically starting generators capable of continuously operating all critical wastewater treatment system units. The fuel tanks will be sized for a run time of 24 hours. The generators will provide sufficient power for the following equipment:

   a. Firm Capacity of the RWWPS
   b. 3 - Automatic coarse screens
   c. 3 - Grit removal pumps
   d. 3 - Grit dewatering classifiers
   e. Firm Capacity of the RPS
   f. 3 - Fine screens
   g. Aeration Basin Blowers
   h. Membrane biological reactor (MBR) blowers
   i. MBR valves
   j. Firm capacity of the RASPS
   k. 6 - Banks of the UV disinfection system
   l. Effluent metering station
   m. Plant water pumps

n. Lighting Panels and Control Equipment

2. Alarm Features: The plant will be equipped with a Supervisory Control and Data Acquisition (SCADA) system to monitor the operation of all critical treatment units. The control room will include a computer with graphic display of the treatment units that will indicate status and alarm conditions. The SCADA system will be monitored by operators 24 hours a day. The computer system will include an autodialer to alert plant personnel of the following conditions:

    a. Power outage
    b. Raw wastewater pump station wet well high level
    c. Coarse screen channel high level
    d. Equalization/Peak Flow Storage Basin high level
    e. Equipment failure
    f. Membrane filtrate turbidity detection

3. Design Features for Reliability and Operating Flexibility:

    a. Additional pumping capacity will be provided in the Final Phase to the Raw Wastewater Pump Station such that it will have a firm capacity of the peak 2-hour inflow. The Pump Station has level switches to turn pumps on and off, and the pumps have variable frequency drive (VFDs) for adjusting pumped flow.

    b. An additional coarse screen will be added in the Final Phase to maintain firm capacity equal to the peak 2-hour inflow. The coarse screen system will have a diversion channel that contains a manual, redundant screen. There will also be overflow pipes to the EQ basin. Slide gates will be used to isolate each coarse screen channel.

    c. The grit removal units will overflow into the EQ basin. Slide gates will allow each grit unit to be isolated for maintenance and repair. A third unit will be added in the Final Phase to maintain a total capacity equal to the peak 2-hour inflow. Only two of the grit units will be required to treat annual average daily flow.

    d. An extra pump will be provided in the relift pump station (RPS). The RPS will have a firm capacity equal to the 2-hour peak effluent flow for the Interim Phase (20 MGD).

e. The MBR system will be designed for continuous operation. The plant in the Final Phase will be designed such that two MBR basins may be taken out of service.

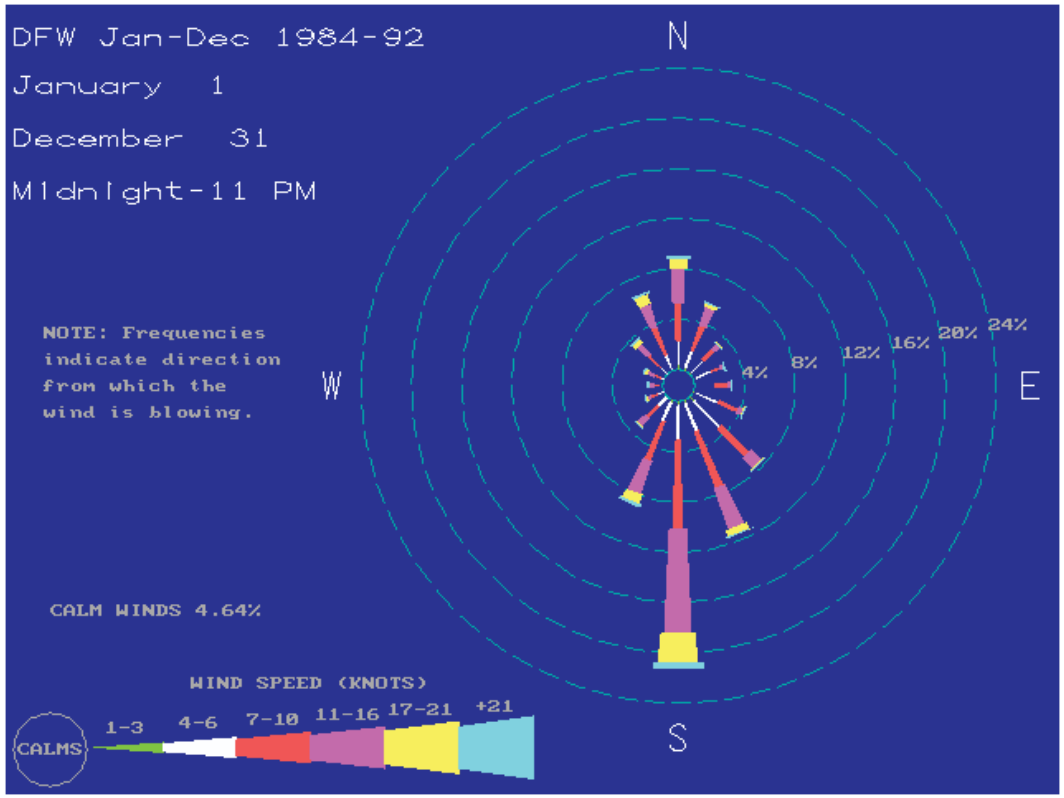
4. Overflow Prevention

a. No changes from the Interim Phase. The PTU will be designed to overflow into the EQ and PFS basins when treatment capacity is exceeded during storm events or equipment failures.

ATTACHMENT L

WIND ROSE

TECH REPORT 1.1, SECTION 5.B



ATTACHMENT L
CITY OF FORT WORTH
MARY'S CREEK WATER RECLAMATION FACILITY
APPLICATION FOR NEW
TEXAS POLLUTANT DISHARGE ELIMINATION SYSTEM PERMIT
WIND ROSE

ATTACHMENT M

WATER QUALITY MODELING MEMO

WORKSHEET 2.1

City of Fort Worth

Mary's Creek Water Reclamation Facility
QUAL-TX Model of Discharge to Mary's Creek

Prepared by

Alan Plummer Associates, Inc.
TBPE Registration No. 13

November 13, 2017

Brian K. McDonald

Digitally signed by Brian K. McDonald
DN: cn=Brian K. McDonald, o, ou, email=bmcdonald@apaienv.com, c=US
Date: 2017.11.13 09:10:24 -06'00'

Table of Contents

Page

List of Appendices ii
List of Tables iii
List of Figures iv
List of Abbreviations v

1 Introduction 1-1
2 QUAL-TX Model Development 2-1
2.1 Data Availability 2-1
2.2 Model Segmentation 2-1
2.3 Simulated Variables 2-4
2.4 Model Water Temperature 2-4
2.5 Model Flows and Quality 2-4
2.6 Site-Specific Hydraulic Parameters 2-5
2.6.1 Free-Flowing Reaches 2-5
2.6.2 Dammed or Pooled Reaches 2-5
2.7 Dispersion 2-6
2.8 Kinetic Parameters 2-6
2.9 Dam Aeration 2-6
2.10 Initial Conditions 2-8
3 No-Load Model Initialization 3-1
4 Evaluation of Potential Effluent Limits 4-1
5 Conclusion 5-1

LIST OF APPENDICES

Appendix A Photographs of Mary's Creek Dams

Appendix B 10 MGD QUAL-TX Input File

Appendix C 10 MGD QUAL-TX Output File

Appendix D 15 MGD QUAL-TX Input File

Appendix E 15 MGD QUAL-TX Output File

LIST OF TABLES

No. **Description** **Page**

Table 1: Dam Aeration Coefficients in the Mary's Creek QUAL-TX Model 2-7

LIST OF FIGURES

No. **Description** **Page**

Figure 1: General Location Map 1-2
Figure 2: Cross-Sections for Site-Specific Geometry 2-2
Figure 3: HEC-RAS Water Surface Profile for Headwater Flow in Mary's Creek with Annotated Dams and Pools 2-3
Figure 4: Dam 4 Looking Upstream 2-4
Figure 5: Projected DO, CBOD5, and Ammonia Nitrogen Concentrations with a 10 MGD Discharge at 5 mg/L CBOD5, 2 mg/L NH3-N, and 6 mg/L DO 4-2
Figure 6: Projected DO, CBOD5, and Ammonia Nitrogen Concentrations with a 15 MGD Discharge at 5 mg/L CBOD5, 2 mg/L NH3-N, and 6 mg/L DO 4-3

LIST OF ABBREVIATONS

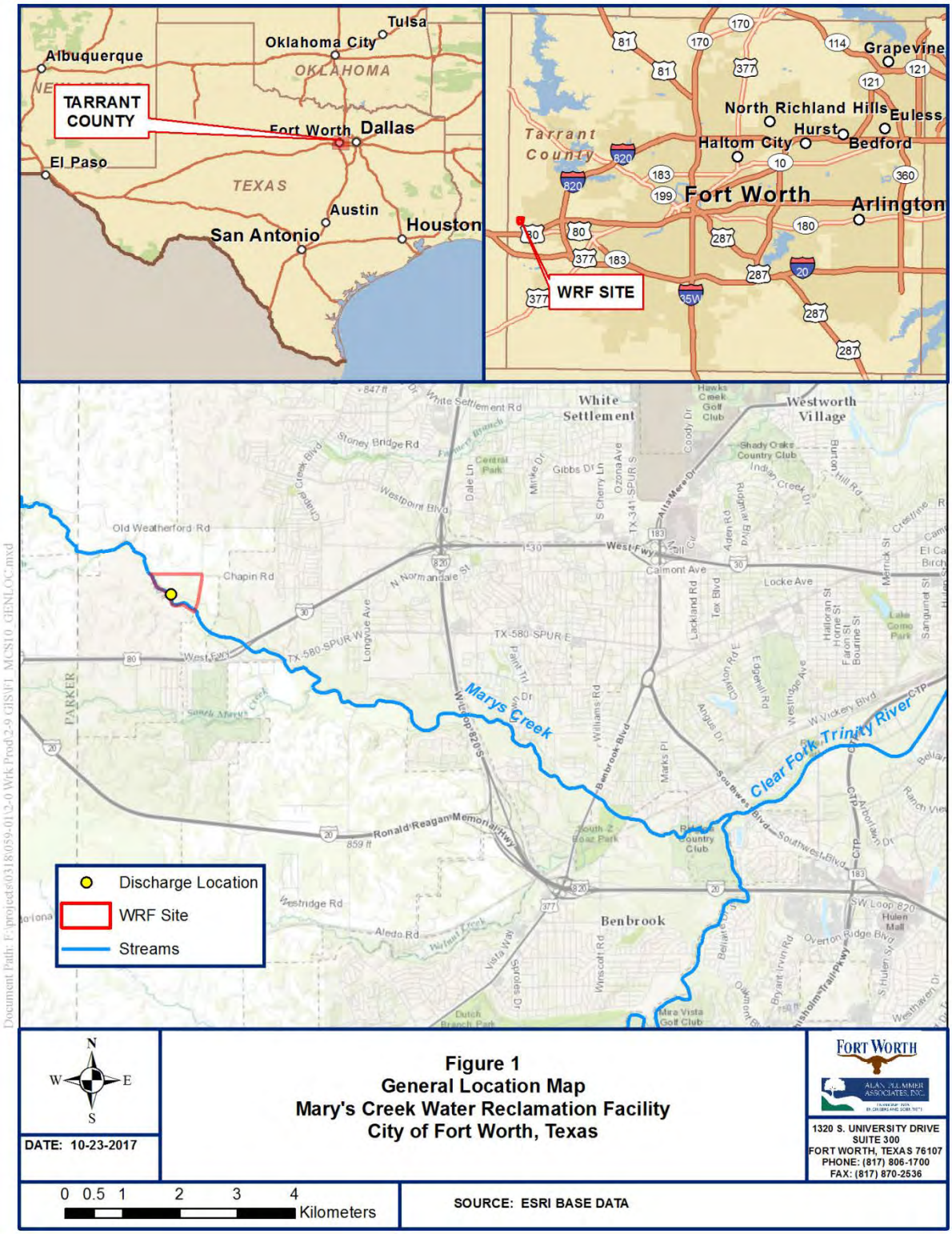
APAI	Alan Plummer Associates, Inc.
CBOD5	Five-Day Carbonaceous Biochemical Oxygen Demand
cfs	Cubic Feet per Second
CSTR	Continuous Stirred Tank Reactor
DO	Dissolved Oxygen
$g/m^2/day$	Grams per Square Meter per Day
km	Kilometers
MGD	Million Gallons per Day
NH3	Ammonia Nitrogen
mg/L	Milligrams per Liter
SOD	Sediment Oxygen Demand
SWQM	Surface Water Quality Monitoring
TCEQ	Texas Commission on Environmental Quality
WRF	Water Reclamation Facility
µg/L	Micrograms per Liter

1 Introduction

To serve a growing need for wastewater treatment in its service area, the City of Fort Worth is considering construction of a new Mary's Creek Water Reclamation Facility (WRF) that would discharge treated wastewater effluent to Mary's Creek approximately 13.2 stream kilometers (km) upstream of the confluence with the Clear Fork Trinity River (Figure 1). Mary's Creek is an unclassified stream and does not have an individual ambient dissolved oxygen (DO) standard. In this case, if a stream is perennial, the Texas Commission on Environmental Quality (TCEQ) applies the default assumption that the stream supports high aquatic life use, and a dissolved oxygen (DO) standard of 5 milligrams per liter (mg/L) is applied.

This report describes development and initialization of an uncalibrated QUAL-TX model and use of this model to establish proposed WRF effluent limits that are protective of the creek DO standard.

Figure 1: General Location Map



2 QUAL-TX Model Development

The TCEQ uses the QUAL-TX modeling software to predict the impacts of a potential discharge of treated wastewater on DO concentrations in streams. QUAL-TX is a steady-state, one-dimensional model. During the model development process, Alan Plummer Associates, Inc., (APAI) worked with TCEQ staff to ensure that the model was developed in accordance with agency standards.

This section will characterize the data (bathymetric and water quality) available for use in developing the model of Mary's Creek, describe the segmentation of the QUAL-TX model, and describe and explain the choice of all other input parameters to the model, including simulated variables, temperature, flows, site-specific hydraulic parameters, dispersion coefficients, kinetic parameters, dam aeration, and initial conditions. Later sections describe how the TCEQ's no-load initialization procedure was used to initialize the QUAL-TX model and present results from the evaluation of effluent limits.

2.1 DATA AVAILABILITY

Water quality data were obtained from the Surface Water Quality Monitoring (SWQM) database. APAI did not identify any water quality monitoring data for Mary's Creek, but water quality data were available for Segment 0829 Clear Fork Trinity River below Benbrook Lake.

The City sponsored a project to develop a HEC-RAS hydraulic model of Mary's Creek. In 2010 and 2012, 131 cross sections and 30 structures were surveyed as part of this effort, which provided site-specific stream geometry data (Figure 2).

2.2 MODEL SEGMENTATION

Based on aerial photographs, survey notes and photographs, and HEC-RAS model results, APAI identified 10 dams on Mary's Creek and another 8 natural pools. In addition, there are 15 free-flowing sections of the creek. Each dammed pond, natural pool, and free-flowing section was treated as a separate reach in the QUAL-TX model. Figure 3 shows HEC-RAS projected water surface elevation for the headwater flow, the locations of dams and pools, and the locations of bridges over the creek.

Each dammed or pooled reach was modeled as a continuous stirred tank reactor (CSTR) - which in QUAL-TX is represented as a single element reach. The largest pond, upstream of Dam 4, has a surface area of approximately 3.03 acres (Figure 4). Therefore all pond elements meet the TCEQ size limit of ten acres for CSTR segments. For the free-flowing reaches, multiple elements were used. The maximum element length in the free-flowing reaches is 0.0514 km in Reach 21.

Figure 2: Cross-Sections for Site-Specific Geometry

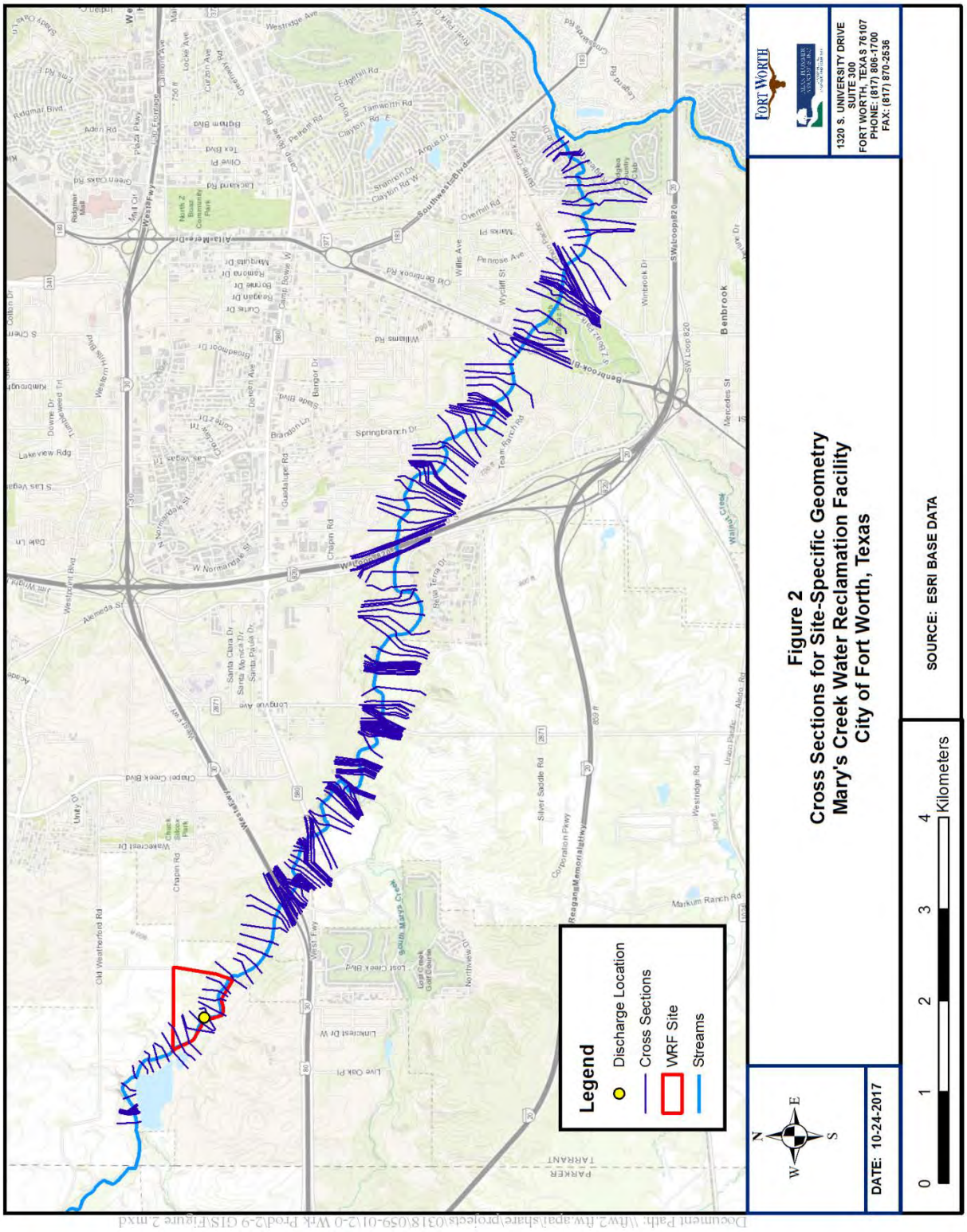


Figure 3: HEC-RAS Water Surface Profile for Headwater Flow in Mary's Creek with Annotated Dams and Pools

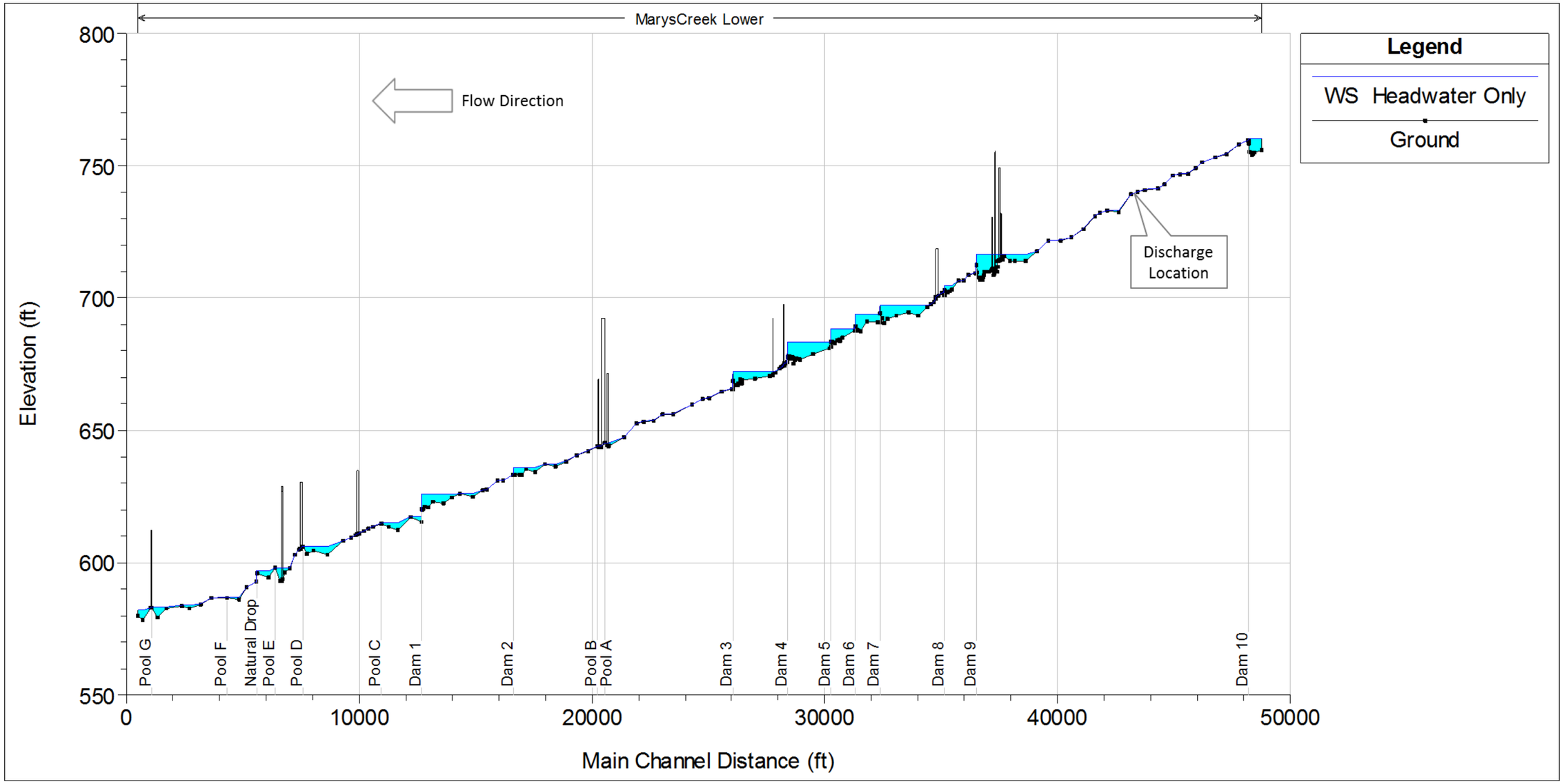


Figure 4: Dam 4 Looking Upstream

2.3 SIMULATED VARIABLES

DO, five-day carbonaceous biochemical oxygen demand (CBOD5), and the nitrogen species are simulated in the model. Because the purpose of the QUAL-TX model is to determine effluent impacts on DO and not algal population growth, algal dynamics are not simulated. In addition, the chlorophyll-a concentration in each reach is held constant at zero.

2.4 MODEL WATER TEMPERATURE

Based on summer water temperature data collected in Segment 0829, the daily average water temperature used in the model is the average plus one standard deviation, or 31.1˚C. For the water temperature and quality data, "summer" is defined as June, July, and August.

2.5 MODEL FLOWS AND QUALITY

A headwater flowrate of 0.1 cubic feet per second (cfs) was introduced into the model. Constituent concentrations in the headwater flow are CBOD5 of 1.3 mg/L, ammonia of 0.05 mg/L, and a site-specific DO calculated from summer water quality data collected in Segment 0829. The site-specific DO is the DO saturation concentration at the model water temperature multiplied by the median summer DO saturation percentage (7.42 mg/L * 96 percent = 7.14 mg/L). These concentrations are assumed to represent background water quality in the absence of a significant waste load.

The waste load flows represent the interim phase (10 million gallons per day, or MGD) and final phase (15 MGD) flowrates in the WRF permit application. Constituent concentrations in the waste load flows are as follows:

- The same as the headwater concentrations if the model is being used for no-load initialization or
- The effluent limits if the model is being used to evaluate effluent limits.

2.6 SITE-SPECIFIC HYDRAULIC PARAMETERS

For each reach in the QUAL-TX model, velocities and water depths are defined by the following equations:

$$V = aQ^b$$

$$D = dQ^e + f$$

where V is velocity (meters per second), Q is flowrate (cubic meters per second), D is water depth (meters), and a, b, d, e, and f are advective hydraulic coefficients that are inputs to the QUAL-TX model (Data Type 9). The flowrate in each reach is calculated from the specified headwater and waste load flowrates (Data Types 20 and 24).

2.6.1 Free-Flowing Reaches

In the absence of site-specific data, the TCEQ requires usage of the following coefficients for free-flowing reaches:

$$a = 0.131, \qquad b = 0.5, \qquad d = 0.720, \qquad e = 0.4, \qquad f = 0$$

However, the City sponsored surveying of site-specific stream geometry data at 131 cross sections and 30 structures on Mary's Creek to support development of a HEC-RAS model (Figure 2). The average cross section densities are 14.2 cross sections per mile. APAI used the HEC-RAS model to simulate water depths and velocities at the headwater flowrate (0.1 cfs) plus various discharge flowrates (0, 5, 10, and 15 MGD). For each free-flowing reach in the model, APAI fit power curves to the results to determine velocity coefficients *a* and *b* and depth coefficients *d* and *e*.

2.6.2 Dammed or Pooled Reaches

For dammed or pooled reaches, the average depth and average width are assumed to be constant, regardless of the flowrate. Under this assumption, proposed coefficients are:

$$a = \frac{1}{A}, \qquad b = 1, \qquad d = 0, \qquad e = 0, \qquad f = H$$

where *A* is the average cross section area in square meters and *H* is the average water depth in meters.

2.7 DISPERSION

Dispersion is set to zero in each model reach.

2.8 KINETIC PARAMETERS

Per TCEQ requirements, the aerobic CBOD5 decay rate (Kd) is 0.10 per day, the CBOD5 settling rate (Ks) is zero meters per day, and the ammonia-nitrogen oxidation rate (Kn) is 0.30 per day.

In free-flowing reaches, the sediment oxygen demand (SOD) is 0.35 grams per square meter per day (g/m^2/day). In the dammed or pooled reaches, SOD is determined using the TCEQ's no-load initialization procedure described in Chapter 3.

The Texas equation is used to calculate reaeration rates in the free-flowing reaches. In dammed or pooled reaches, a reaeration rate constant is calculated for each model segment using the following equation:

$$K_2 = \frac{K_L}{H}$$

where K_2 is the reaeration rate constant (per day), K_L is the oxygen transfer rate across the water surface (1 meter per day at 20°C), and H is the average reach depth in meters.

2.9 DAM AERATION

The QUAL-TX model offers several equations that can be used to model aeration of the flow over each dam. APAI used the Butts and Evans equation:

$$\frac{C_s - C_u}{C_s - C_d} = 1 + 0.38abH(1 - 0.11H)(1 + 0.046T)$$

where C_s is the saturation DO concentration, C_u is the DO concentration upstream of the dam, C_d is the DO concentration downstream of the dam, *a* is a water quality factor, *b* is an aeration coefficient that depends on the dam type, *H* is the static head over the dam (in meters), and *T* is the water temperature upstream of the dam (in ˚C).

As described in Section 2.4, the water temperature, *T*, is fixed at 31.1˚C, which also fixes the saturation DO concentration, C_s, at 7.42 mg/L. The upstream DO concentration, C_u, is calculated within the QUAL-TX model. APAI specified the static head over each dam using the HEC-RAS model results.

The QUAL-TX manual provides the following guidance for selecting the water quality factor (*a*) and the dam aeration coefficient (*b*):[1]

[1] Bruce L. Wiland, Wiland Consulting, Inc., "QUAL-TX for WINDOWS USER'S MANUAL, Model Version 9.32 (July 8, 2014)," Manual Rev. B, prepared for the Texas Commission on Environmental Quality, Austin, Texas.

- Water quality factor
  - Grossly polluted, *a* = 0.65
  - Moderately polluted, *a* = 1.00
  - Slightly polluted, *a* = 1.60
  - Clean, *a* = 1.80
- Dam aeration coefficient
  - Flat broad-crested regular step, *b* = 0.70
  - Flat broad-crested irregular step, *b* = 0.80
  - Flat broad-crested vertical face, *b* = 0.80
  - Flat broad-crested straight slope face, *b* = 0.90
  - Flat broad-crested curved face, *b* = 0.75
  - Round broad-crested curved face, *b* = 0.60
  - Sharp-crested straight slope face, *b* = 1.05
  - Sharp-crested vertical slope face, *b* = 0.80
  - Sluice gates with submerged discharge, *b* = 0.05

Although most of the water cresting each dam in this model will be highly treated wastewater effluent, APAI selected a conservative water quality factor reflecting moderately polluted water (*a* = 1.00). APAI also examined photographs of each dam (Appendix A), categorized them according to crest type and face configuration, and selected the corresponding dam aeration coefficient (*b*) from the model guidance (Table 1).

Table 1: Dam Aeration Coefficients in the Mary's Creek QUAL-TX Model

Dam*	Crest	Face	Dam Aeration Coefficient, *b*
Dam 9	Round broad-crested	Curved face	0.60
Dam 8	Flat broad-crested	Vertical face	0.14**
Dam 7	Flat broad-crested	Vertical face	0.80
Dam 6	Flat broad-crested	Vertical face***	0.80
Dam 5	Flat broad-crested	Vertical face	0.80
Dam 4	Flat broad-crested	Vertical face***	0.80
Dam 3	Flat broad-crested	Curved face	0.75
Dam 2	Flat broad-crested	Straight-slope face	0.90
Dam 1	Flat broad-crested	Vertical face	0.80

* No dam aeration was included at Dam 10, since it is upstream of the discharge location.

** Erosion allows some of the flow to bypass the dam. In addition, the dam crest appears to have a gradual slope. At 10 MGD, the HEC-RAS model projects that water would flow over only 18 percent of the length of the dam. Therefore the effective dam aeration coefficient used in the model is the nominal dam aeration coefficient (0.80) multiplied by 0.18. This is more conservative than using the final phase (15 MGD) conditions, because the HEC-RAS model projects that water would flow over 32 percent of the length of the dam during the final phase.

*** The face is actually slightly sloping, but it is conservative to treat this as a vertical face.

2.10 INITIAL CONDITIONS

Water temperatures and chlorophyll-a concentrations for each reach are specified as an initial condition. Since these are not simulated in the model, they are held constant at the initial condition (31.1˚C for water temperature and 0 micrograms per liter (µg/L) for chlorophyll-a).

Initial conditions for the DO, CBOD5, and nitrogen species do not influence the steady-state model results, so the choice of values for these initial conditions is not important.

3 No-Load Model Initialization

The TCEQ requires a model initialization process that "is intended to create a model that predicts reasonable background levels of DO in the absence of a significant waste load input."[2] Since the TCEQ requires that the SOD in free-flowing segments be 0.35 grams per square meter per day ($g/m^2/day$), the main purpose of this process is to identify reasonable sediment oxygen demand values in dammed or pooled reaches.

As per TCEQ modeling guidance, separate no-load model initializations are performed for each non-contiguous dammed or pooled reach. For each dammed or pooled reach, the discharge flowrate is set to the final phase flowrate in the permit application (15 MGD), the discharge water quality is set to background concentrations (described in Section 2.5), and the discharge location is set to the upstream end of the reach. The SOD in the reach is adjusted until the predicted DO in the reach closely matches the background DO concentration. The TCEQ finds SOD values (at 20˚C) in the range of 0.5 to 2.0 $g/m^2/day$ to be acceptable in dammed or pooled reaches.

In each dammed or pooled reach, the minimum acceptable SOD value of 0.5 $g/m^2/day$ produced a predicted DO concentration that was somewhat less than the background DO of 7.14 mg/L. Since a lower SOD would be required to match the background DO and since a lower SOD is not acceptable, an SOD value of 0.5 $g/m^2/day$ was selected for each dammed or pooled reach.

[2] Texas Commission on Environmental Quality Water Quality Assessment Team, "Evaluating TPDES Permit Applications Using a Continuously Stirred Tank Reactor (CSTR) Model," updated by M. Rudolph, June 18, 2012.

4 Evaluation of Potential Effluent Limits

Upon completion of model initialization, the discharge flowrate was applied at the proposed location (stream km 13.2, model element 44), the discharge water quality was set to CBOD5 of 5 mg/L, ammonia nitrogen of 2 mg/L, and DO of 6 mg/L, and the model was used to predict the impact on DO in Mary's Creek.

As described in Chapter 1, the DO standard for Mary's Creek is 5 mg/L. To account for uncertainties in sample analysis and modeling techniques, the TCEQ typically assumes that maintaining a concentration of 4.8 mg/L or greater constitutes compliance with the standard when it determines permit limits.

For the initial phase flowrate of 10 MGD, the projected DO immediately downstream of the discharge is 6.00 mg/L (Figure 5). The DO is projected to increase to 6.09 mg/L over the remainder of Reach 2, and the flow then enters the pond upstream of Dam 9. In this pond, the projected DO decreases to a minimum concentration of 4.80 mg/L. Upon flowing over Dam 9, the flow is aerated to a projected concentration of 6.00 mg/L. From there, the cycle of increasing DO in free-flowing reaches, decreasing DO in dammed or pooled reaches, and increased DO over dams continues downstream. The DO is projected to be greater than or equal to 4.80 mg/L at all locations. Input and output files for the 10 MGD model run are presented in Appendices B and C.

For the final phase flowrate of 15 MGD, the projected DO immediately downstream of the discharge is 6.00 mg/L (Figure 6). The DO is projected to increase to 6.07 mg/L over the remainder of Reach 2, and the flow then enters the pond upstream of Dam 9. In this pond, the projected DO decreases to a minimum concentration of 5.07 mg/L. Upon flowing over Dam 9, the flow is aerated to a projected concentration of 6.14 mg/L. From there, the cycle of increasing DO in free-flowing reaches, decreasing DO in dammed or pooled reaches, and increased DO over dams continues downstream. The DO is projected to be greater than or equal to 5.07 mg/L at all locations. Input and output files for the 15 MGD model run are presented in Appendices D and E.

Figure 5: Projected DO, CBOD5, and Ammonia Nitrogen Concentrations with a 10 MGD Discharge at 5 mg/L CBOD5, 2 mg/L NH3-N, and 6 mg/L DO

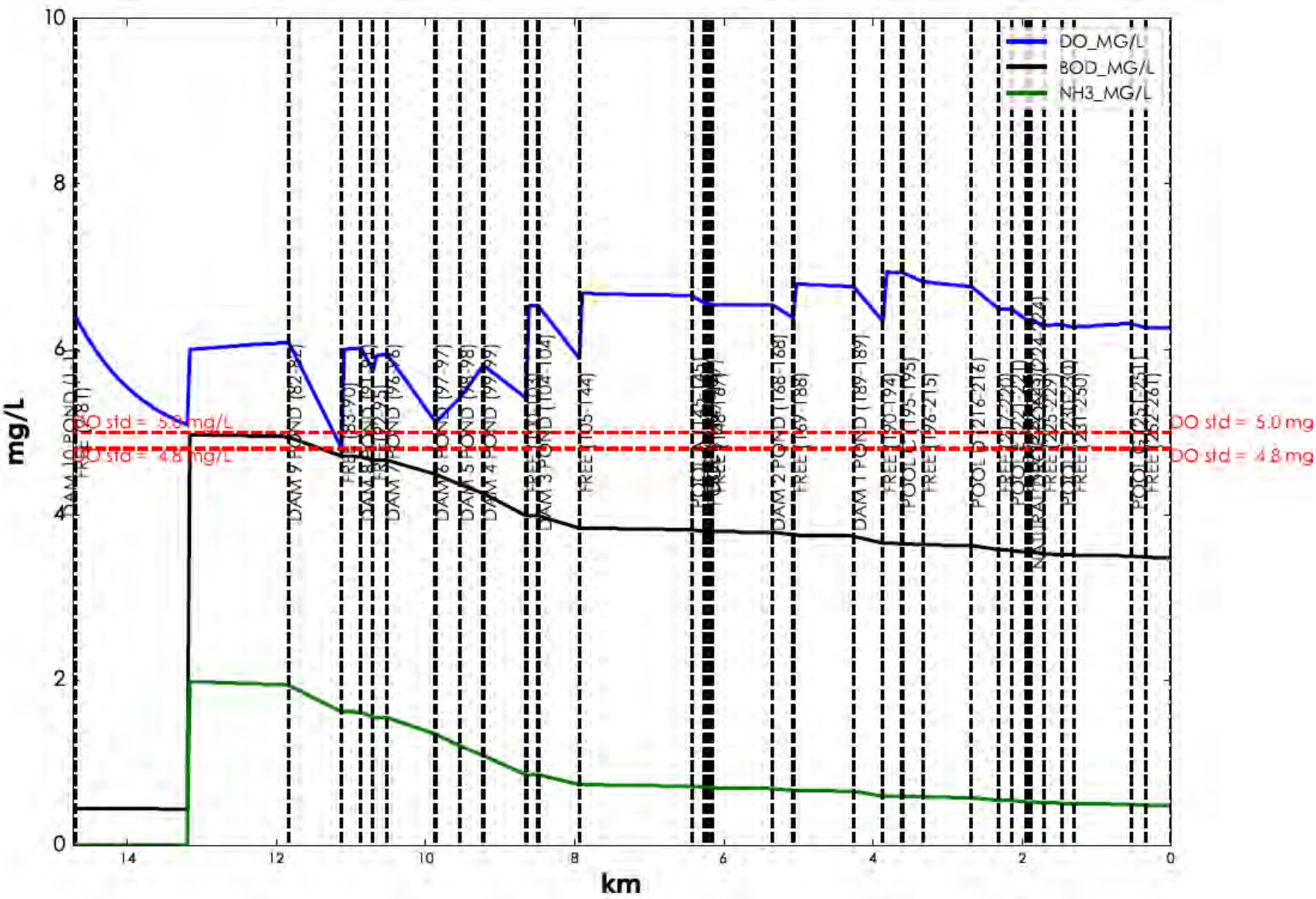
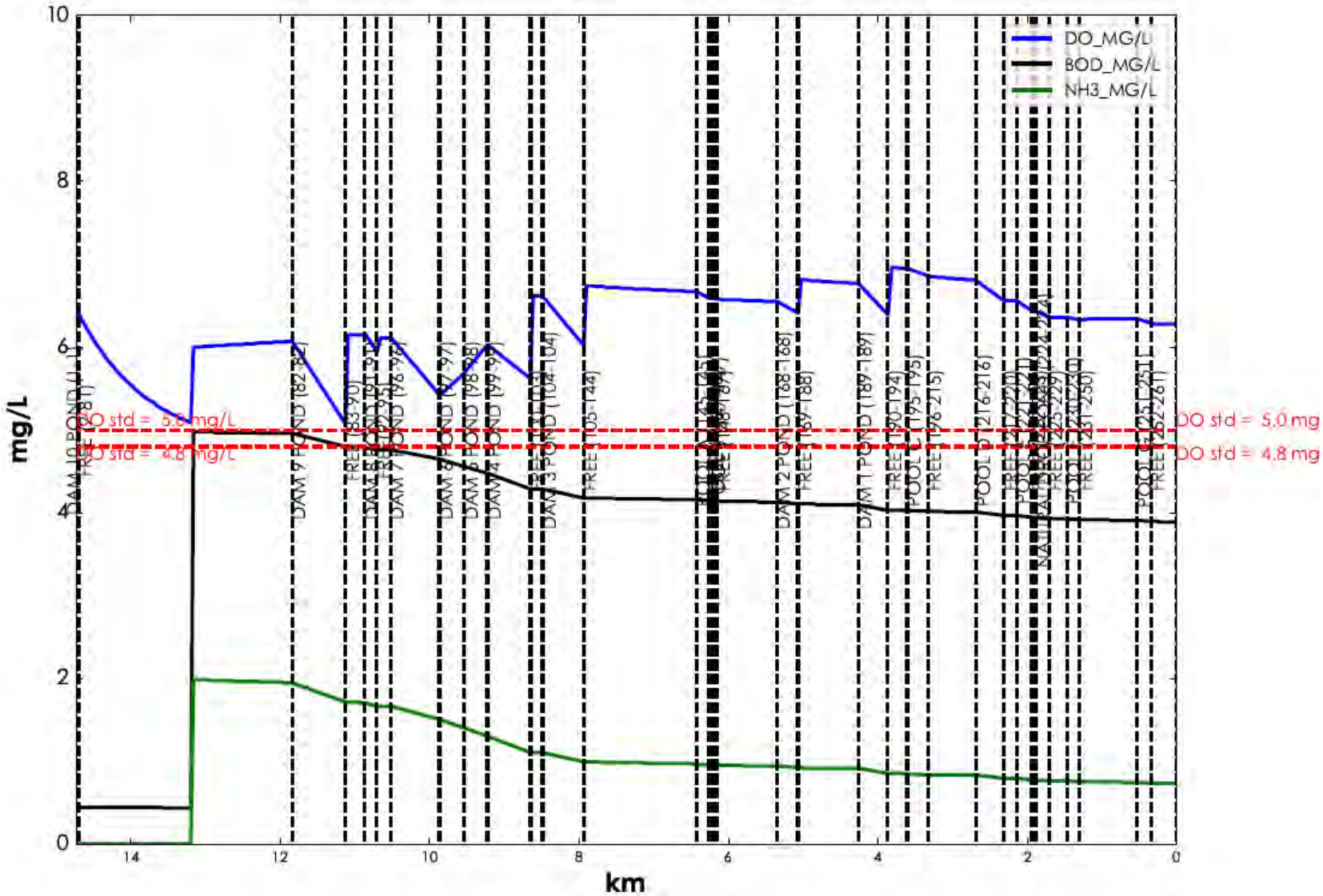


Figure 6: Projected DO, CBOD5, and Ammonia Nitrogen Concentrations with a 15 MGD Discharge at 5 mg/L CBOD5, 2 mg/L NH3-N, and 6 mg/L DO



5 Conclusion

Based on the model results, effluent limits of 5 mg/L CBOD5, 2 mg/L ammonia nitrogen, and 6 mg/L DO are projected to ensure compliance with the DO standard in Mary's Creek for a discharge of up to 15 MGD of treated effluent from the proposed Mary's Creek WRF.

Appendix A: Photographs of Mary's Creek Dams

Dam 9

Dam 8

Dam 7

Dam 6

Dam 5

Dam 4

Dam 3

Dam 2

Dam 1

Appendix B: 10 MGD QUAL-TX Input File

```
CNTROL01     FORT WORTH, MARY'S CREEK
CNTROL02     10/5/2017 SUMMER, 10 MGD Discharge @ 5/2/6
CNTROL03 YES ECHO DATA INPUT
CNTROL04  NO INTERMEDIATE SUMMARY
CNTROL05 YES CAPSULE SUMMARY
CNTROL06 YES LOADING SUMMARY
CNTROL07 YES FINAL REPORT
CNTROL08  NO LINE PRINTER PLOT
CNTROL09  NO GRAPHICS CAPABILITY
CNTROL10 YES METRIC UNITS
CNTROL11 YES OXYGEN DEPENDENT RATES
CNTROL12  NO SENSITIVITY ANALYSIS
CNTROL13 YES SPECIAL REPORT
ENDATA01
MODOPT01  NO TEMPERATURE
MODOPT02  NO SALINITY
MODOPT03  NO CONSERVATIVE MATERIAL  I = CONDUCTIVITY (UMHOS/CM)
MODOPT04  NO CONSERVATIVE MATERIAL II = CHLORIDE  (MG/L)
MODOPT05 YES DISSOLVED OXYGEN
MODOPT06 YES BIOCHEMICAL OXYGEN DEMAND
MODOPT07 YES NITROGEN
MODOPT08  NO PHOSPHORUS
MODOPT09  NO CHLOROPHYLL A
MODOPT10  NO MACROPHYTES
MODOPT11  NO COLIFORM
MODOPT12  NO NONCONSERVATIVE MATERIAL =
ENDATA02
PROGRAM  BOD OXYGEN UPTAKE RATE             =  2.3
PROGRAM  MAXIMUM ITERATION LIMIT            =  500.
PROGRAM  K2 MAXIMUM                         =  10.
PROGRAM  LOGICAL UNIT NUMBER FOR SEQUENCING =  33
ENDATA03
ENDATA04
ENDATA05
ENDATA06
ENDATA07
REACH ID    1     DAM 10 POND (1-1)                  14.870    14.701   0.169
REACH ID    2     FREE (2-81)                        14.701    11.841   0.03575
REACH ID    3     DAM 9 POND (82-82)                 11.841    11.126   0.715
REACH ID    4     FREE (83-90)                       11.126    10.866   0.0325
REACH ID    5     DAM 8 POND (91-91)                 10.866    10.708   0.158
REACH ID    6     FREE(92-95)                        10.708    10.516   0.048
REACH ID    7     DAM 7 POND (96-96)                 10.516     9.866   0.65
REACH ID    8     DAM 6 POND (97-97)                  9.866     9.545   0.321
REACH ID    9     DAM 5 POND (98-98)                  9.545     9.227   0.318
REACH ID   10     DAM 4 POND (99-99)                  9.227     8.655   0.572
REACH ID   11     FREE (100-103)                      8.655     8.493   0.0405
REACH ID   12     DAM 3 POND (104-104)                8.493     7.939   0.554
REACH ID   13     FREE (105-144)                      7.939     6.431   0.0377
REACH ID   14     POOL A (145-145)                    6.431     6.263   0.168
REACH ID   15     FREE (146-146)                      6.263     6.217   0.046
REACH ID   16     POOL B (147-147)                    6.217     6.163   0.054
REACH ID   17     FREE (148-167)                      6.163     5.350   0.04065
REACH ID   18     DAM 2 POND (168-168)                5.350     5.068   0.282
REACH ID   19     FREE (169-188)                      5.068     4.262   0.0403
REACH ID   20     DAM 1 POND (189-189)                4.262     3.866   0.396
REACH ID   21     FREE (190-194)                      3.866     3.609   0.0514
REACH ID   22     POOL C (195-195)                    3.609     3.335   0.274
REACH ID   23     FREE (196-215)                      3.335     2.682   0.03265
REACH ID   24     POOL D (216-216)                    2.682     2.314   0.368
REACH ID   25     FREE (217-220)                      2.314     2.144   0.0425
REACH ID   26     POOL E (221-221)                    2.144     1.944   0.2
```

```
REACH ID   27     FREE (222-223)                        1.944     1.878   0.033
REACH ID   28     NATURAL DROP POND (224-224)           1.878     1.711   0.167
REACH ID   29     FREE (225-229)                        1.711     1.472   0.0478
REACH ID   30     POOL F (230-230)                      1.472     1.312   0.16
REACH ID   31     FREE (231-250)                        1.312     0.527   0.03925
REACH ID   32     POOL G (251-251)                      0.527     0.335   0.192
REACH ID   33     FREE (252-261)                        0.335     0.000   0.0335
ENDATA08
HYDR-1      1.     .0614     1.000     0.000     0.000     1.103  0.035
HYDR-1      2.     .5995     .2582     .1626     .3275     0.000  0.035
HYDR-1      3.     .0624     1.000     0.000     0.000     0.967  0.035
HYDR-1      4.     .6076     .2766     .1507     .4307     0.000  0.035
HYDR-1      5.     .0767     1.000     0.000     0.000     0.793  0.035
HYDR-1      6.     .6439     .2206     .1888     .2452     0.000  0.035
HYDR-1      7.     .0772     1.000     0.000     0.000     0.891  0.035
HYDR-1      8.     .0503     1.000     0.000     0.000     0.960  0.035
HYDR-1      9.     .0534     1.000     0.000     0.000     0.804  0.035
HYDR-1     10.     .0376     1.000     0.000     0.000     1.241  0.035
HYDR-1     11.     .4816     .3115     .1239     .2568     0.000  0.035
HYDR-1     12.     .0630     1.000     0.000     0.000     0.820  0.035
HYDR-1     13.     .5712     .2688     .1868     .4475     0.000  0.035
HYDR-1     14.     .1821     1.000     0.000     0.000     0.360  0.035
HYDR-1     15.     .7610     .2640     .1242     .1527     0.000  0.035
HYDR-1     16.     .3737     1.000     0.000     0.000     0.205  0.035
HYDR-1     17.     .5270     .2359     .2139     .1591     0.000  0.035
HYDR-1     18.     .1479     1.000     0.000     0.000     0.545  0.035
HYDR-1     19.     .6290     .2494     .1949     .2053     0.000  0.035
HYDR-1     20.     .0723     1.000     0.000     0.000     0.753  0.035
HYDR-1     21.     .8538     .2634     .5106     .1169     0.000  0.035
HYDR-1     22.     .2797     1.000     0.000     0.000     0.372  0.035
HYDR-1     23.     .5815     .2627     .1390     .4770     0.000  0.035
HYDR-1     24.     .1090     1.000     0.000     0.000     0.594  0.035
HYDR-1     25.     .6822     .2753     .1030     .3065     0.000  0.035
HYDR-1     26.     .1104     1.000     0.000     0.000     0.751  0.035
HYDR-1     27.     .9424     .1390     .0666     .2545     0.000  0.035
HYDR-1     28.     .1470     1.000     0.000     0.000     0.399  0.035
HYDR-1     29.     .3808     .2349     .2383     .1380     0.000  0.035
HYDR-1     30.     .3145     1.000     0.000     0.000     0.390  0.035
HYDR-1     31.     .5050     .2004     .2591     .2721     0.000  0.035
HYDR-1     32.     .1830     1.000     0.000     0.000     0.441  0.035
HYDR-1     33.     .3578     .2772     .3594     .0619     0.000  0.035
ENDATA09
HYDR-2      1.   0.0    0.0
HYDR-2      2.   0.0    0.0
HYDR-2      3.   0.0    0.0
HYDR-2      4.   0.0    0.0
HYDR-2      5.   0.0    0.0
HYDR-2      6.   0.0    0.0
HYDR-2      7.   0.0    0.0
HYDR-2      8.   0.0    0.0
HYDR-2      9.   0.0    0.0
HYDR-2     10.   0.0    0.0
HYDR-2     11.   0.0    0.0
HYDR-2     12.   0.0    0.0
HYDR-2     13.   0.0    0.0
HYDR-2     14.   0.0    0.0
HYDR-2     15.   0.0    0.0
HYDR-2     16.   0.0    0.0
HYDR-2     17.   0.0    0.0
HYDR-2     18.   0.0    0.0
HYDR-2     19.   0.0    0.0
HYDR-2     20.   0.0    0.0
```

```
HYDR-2     21.   0.0    0.0
HYDR-2     22.   0.0    0.0
HYDR-2     23.   0.0    0.0
HYDR-2     24.   0.0    0.0
HYDR-2     25.   0.0    0.0
HYDR-2     26.   0.0    0.0
HYDR-2     27.   0.0    0.0
HYDR-2     28.   0.0    0.0
HYDR-2     29.   0.0    0.0
HYDR-2     30.   0.0    0.0
HYDR-2     31.   0.0    0.0
HYDR-2     32.   0.0    0.0
HYDR-2     33.   0.0    0.0
ENDATA10
INITIAL     1.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     2.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     3.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     4.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     5.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     6.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     7.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     8.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL     9.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    10.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    11.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    12.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    13.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    14.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    15.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    16.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    17.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    18.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    19.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    20.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    21.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    22.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    23.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    24.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    25.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    26.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    27.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    28.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    29.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    30.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    31.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    32.     31.1  0.0       7.14    0.05     0.0      0.       0.
INITIAL    33.     31.1  0.0       7.14    0.05     0.0      0.       0.
ENDATA11
COEF-1      1.   1.  0.906                .50    0.1   0.0     1.0   0.00
COEF-1      2.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1      3.   1.  1.034                .50    0.1   0.0     1.0   0.00
COEF-1      4.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1      5.   1.  1.261                .50    0.1   0.0     1.0   0.00
COEF-1      6.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1      7.   1.  1.123                .50    0.1   0.0     1.0   0.00
COEF-1      8.   1.  1.042                .50    0.1   0.0     1.0   0.00
COEF-1      9.   1.  1.243                .50    0.1   0.0     1.0   0.00
COEF-1     10.   1.  0.806                .50    0.1   0.0     1.0   0.00
COEF-1     11.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1     12.   1.  1.219                .50    0.1   0.0     1.0   0.00
COEF-1     13.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1     14.   1.  2.777                .50    0.1   0.0     1.0   0.00
```

```
COEF-1     15.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     16.   1.  4.888                 .50    0.1   0.0     1.0   0.00
COEF-1     17.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     18.   1.  1.835                 .50    0.1   0.0     1.0   0.00
COEF-1     19.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     20.   1.  1.329                 .50    0.1   0.0     1.0   0.00
COEF-1     21.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     22.   1.  2.686                 .50    0.1   0.0     1.0   0.00
COEF-1     23.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     24.   1.  1.683                 .50    0.1   0.0     1.0   0.00
COEF-1     25.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     26.   1.  1.331                 .50    0.1   0.0     1.0   0.00
COEF-1     27.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     28.   1.  2.508                 .50    0.1   0.0     1.0   0.00
COEF-1     29.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     30.   1.  2.566                 .50    0.1   0.0     1.0   0.00
COEF-1     31.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     32.   1.  2.270                 .50    0.1   0.0     1.0   0.00
COEF-1     33.  11.  0.                    .35    0.1   0.0     1.0   0.00
ENDATA12
COEF-2      1.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      2.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      3.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      4.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      5.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      6.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      7.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      8.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2      9.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     10.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     11.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     12.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     13.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     14.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     15.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     16.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     17.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     18.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     19.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     20.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     21.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     22.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     23.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     24.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     25.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     26.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     27.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     28.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     29.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     30.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     31.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     32.    0.00    0.0    1.0    0.3     0.      0.   0.00
COEF-2     33.    0.00    0.0    1.0    0.3     0.      0.   0.00
ENDATA13
ENDATA14
ENDATA15
ENDATA16
ENDATA17
ENDATA18
ENDATA19
HDWTR-1     1. HEADWATER                 0.00283    31.1      0.
ENDATA20
```

```
HDWTR-2     1.      7.14      1.3     0.00     0.05     0.00
ENDATA21
ENDATA22
ENDATA23
WSTLD-1    44. MCWWTP DSCH           0.43813     31.1
ENDATA24
WSTLD-2    44.      6.00      5.0                   2.00
ENDATA25
ENDATA26
LOWER BC TEMPERATURE                          = 31.1
LOWER BC SALINITY                             = 0.0
LOWER BC CONSERVATIVE MATERIAL I              = 0.0
LOWER BC CONSERVATIVE MATERIAL II             = 0.0
LOWER BC DISSOLVED OXYGEN                     = 7.14
LOWER BC BIOCHEMICAL OXYGEN DEMAND            = 1.3
LOWER BC ORGANIC NITROGEN                     = 0.0
LOWER BC AMMONIA NITROGEN                     = 0.05
LOWER BC NITRATE + NITRITE NITROGEN           = 0.0
LOWER BC PHOSPHORUS                           = 0.0
LOWER BC CHLOROPHYLL A                        = 0.0
LOWER BC COLIFORM                             = 0.0
LOWER BC NONCONSERVATIVE MATERIAL             = 0.0
ENDATA27
         83    Dam 9                 1     1.00    0.60    1.94
         92    Dam 8                 1     1.00    0.14    1.12
         97    Dam 7                 1     1.00    0.80    1.04
         98    Dam 6                 1     1.00    0.80    1.63
         99    Dam 5                 1     1.00    0.80    1.55
         100   Dam 4                 1     1.00    0.80    2.29
         105   Dam 3                 1     1.00    0.75    1.97
         169   Dam 2                 1     1.00    0.90    0.89
         190   Dam 1                 1     1.00    0.80    2.27
ENDATA28
ENDATA29
ENDATA30
ENDATA31
_
```

Appendix C: 10 MGD QUAL-TX Output File

```
QUAL-TX Version 9.32
Texas Commission on Environmental Quality

Input file is F:31859-01-0 Wrk Prod-8 MODELSTX0171005 Revised Mary's CreekRuns0 MGD_10MGD_x_5_BOD5_2_NH3_6_DO_10MGD_x_5_BOD5_2_NH3_6_DO.IN
Running in steady-state mode using TX defaults
Output produced at 12:46 on 10/25/2017

$$$ DATA TYPE 1 (TITLES AND CONTROL CARDS) $$$

CARD TYPE       CONTROL TITLES

TITLE01         FORT WORTH, MARY'S CREEK
TITLE02         10/5/2017 SUMMER, 10 MGD Discharge @ 5/2/6
CNTROL03  YES   ECHO DATA INPUT             <Notice: Obsolete control card - line  3 ignored>
CNTROL04   NO   INTERMEDIATE SUMMARY        <Notice: Obsolete control card - line  4 ignored>
CNTROL05  YES   CAPSULE SUMMARY             <Notice: Obsolete control card - line  5 ignored>
CNTROL06  YES   LOADING SUMMARY             <Notice: Obsolete control card - line  6 ignored>
CNTROL07  YES   FINAL REPORT                <Notice: Obsolete control card - line  7 ignored>
CNTROL08   NO   LINE PRINTER PLOT           <Notice: Obsolete control card - line  8 ignored>
CNTROL09   NO   GRAPHICS CAPABILITY         <Notice: Obsolete control card - line  9 ignored>
CNTROL10  YES   METRIC UNITS
CNTROL11  YES   OXYGEN DEPENDENT RATES      <Notice: Obsolete control card - line 11 ignored>
CNTROL12   NO   SENSITIVITY ANALYSIS        <Notice: Obsolete control card - line 12 ignored>
CNTROL13  YES   SPECIAL REPORT              <Notice: Obsolete control card - line 13 ignored>
ENDATA01

$$$ DATA TYPE 2 (MODEL OPTIONS) $$$

CARD TYPE       MODEL OPTION

MODOPT01   NO   TEMPERATURE
MODOPT02   NO   SALINITY
MODOPT03   NO   CONSERVATIVE MATERIAL  I = CONDUCTIVITY (UMHOS/CM)
MODOPT04   NO   CONSERVATIVE MATERIAL II = CHLORIDE  (MG/L)
MODOPT05  YES   DISSOLVED OXYGEN
MODOPT06  YES   BIOCHEMICAL OXYGEN DEMAND
MODOPT07  YES   NITROGEN
MODOPT08   NO   PHOSPHORUS
MODOPT09   NO   CHLOROPHYLL A
MODOPT10   NO   MACROPHYTES
MODOPT11   NO   COLIFORM
MODOPT12   NO   NONCONSERVATIVE MATERIAL =
ENDATA02

$$$ DATA TYPE 3 (PROGRAM CONSTANTS) $$$

CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

PROGRAM         BOD OXYGEN UPTAKE RATE             =         2.30000 mg O/mg BOD
PROGRAM         MAXIMUM ITERATION LIMIT            =       500.00000
PROGRAM         K2 MAXIMUM                         =        10.00000 per day
PROGRAM         LOGICAL UNIT NUMBER FOR SEQUENCING =        33.00000
ENDATA03

$$$ DATA TYPE 4 (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

 CARD TYPE     RATE CODE     THETA VALUE

ENDATA04

$$$ CONSTANTS TYPE 5 (TEMPERATURE DATA) $$$
```

```
CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

ENDATA05

$$$ DATA TYPE 6 (PHYTOPLANKTON CONSTANTS) $$$

CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

ENDATA06

$$$ DATA TYPE 7 (PERIPHYTON CONSTANTS) $$$

CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

ENDATA07

$$$ DATA TYPE 8 (REACH IDENTIFICATION DATA) $$$
```

CARD TYPE	REACH ID	NAME	BEGIN REACH km		END REACH km	ELEM LENGTH km	REACH LENGTH km	BEGIN REACH mi		END REACH mi	ELEM LENGTH mi	REACH LENGTH mi	ELEMS PER RCH	BEGIN ELEM NUM	END ELEM NUM
REACH ID	1	DAM 10 POND (1-1)	14.87	to	14.70	0.1690	0.17	9.24	to	9.14	0.1050	0.11	1	1	1
REACH ID	2	FREE (2-81)	14.70	to	11.84	0.0358	2.86	9.14	to	7.36	0.0222	1.78	80	2	81
REACH ID	3	DAM 9 POND (82-82)	11.84	to	11.13	0.7150	0.71	7.36	to	6.91	0.4444	0.44	1	82	82
REACH ID	4	FREE (83-90)	11.13	to	10.87	0.0325	0.26	6.91	to	6.75	0.0202	0.16	8	83	90
REACH ID	5	DAM 8 POND (91-91)	10.87	to	10.71	0.1580	0.16	6.75	to	6.66	0.0982	0.10	1	91	91
REACH ID	6	FREE(92-95)	10.71	to	10.52	0.0480	0.19	6.66	to	6.54	0.0298	0.12	4	92	95
REACH ID	7	DAM 7 POND (96-96)	10.52	to	9.87	0.6500	0.65	6.54	to	6.13	0.4040	0.40	1	96	96
REACH ID	8	DAM 6 POND (97-97)	9.87	to	9.54	0.3210	0.32	6.13	to	5.93	0.1995	0.20	1	97	97
REACH ID	9	DAM 5 POND (98-98)	9.54	to	9.23	0.3180	0.32	5.93	to	5.73	0.1976	0.20	1	98	98
REACH ID	10	DAM 4 POND (99-99)	9.23	to	8.65	0.5720	0.57	5.73	to	5.38	0.3555	0.36	1	99	99
REACH ID	11	FREE (100-103)	8.65	to	8.49	0.0405	0.16	5.38	to	5.28	0.0252	0.10	4	100	103
REACH ID	12	DAM 3 POND (104-104)	8.49	to	7.94	0.5540	0.55	5.28	to	4.93	0.3443	0.34	1	104	104
REACH ID	13	FREE (105-144)	7.94	to	6.43	0.0377	1.51	4.93	to	4.00	0.0234	0.94	40	105	144
REACH ID	14	POOL A (145-145)	6.43	to	6.26	0.1680	0.17	4.00	to	3.89	0.1044	0.10	1	145	145
REACH ID	15	FREE (146-146)	6.26	to	6.22	0.0460	0.05	3.89	to	3.86	0.0286	0.03	1	146	146
REACH ID	16	POOL B (147-147)	6.22	to	6.16	0.0540	0.05	3.86	to	3.83	0.0336	0.03	1	147	147
REACH ID	17	FREE (148-167)	6.16	to	5.35	0.0406	0.81	3.83	to	3.33	0.0253	0.51	20	148	167
REACH ID	18	DAM 2 POND (168-168)	5.35	to	5.07	0.2820	0.28	3.33	to	3.15	0.1753	0.18	1	168	168
REACH ID	19	FREE (169-188)	5.07	to	4.26	0.0403	0.81	3.15	to	2.65	0.0250	0.50	20	169	188
REACH ID	20	DAM 1 POND (189-189)	4.26	to	3.87	0.3960	0.40	2.65	to	2.40	0.2461	0.25	1	189	189
REACH ID	21	FREE (190-194)	3.87	to	3.61	0.0514	0.26	2.40	to	2.24	0.0319	0.16	5	190	194
REACH ID	22	POOL C (195-195)	3.61	to	3.33	0.2740	0.27	2.24	to	2.07	0.1703	0.17	1	195	195
REACH ID	23	FREE (196-215)	3.33	to	2.68	0.0327	0.65	2.07	to	1.67	0.0203	0.41	20	196	215
REACH ID	24	POOL D (216-216)	2.68	to	2.31	0.3680	0.37	1.67	to	1.44	0.2287	0.23	1	216	216
REACH ID	25	FREE (217-220)	2.31	to	2.14	0.0425	0.17	1.44	to	1.33	0.0264	0.11	4	217	220
REACH ID	26	POOL E (221-221)	2.14	to	1.94	0.2000	0.20	1.33	to	1.21	0.1243	0.12	1	221	221
REACH ID	27	FREE (222-223)	1.94	to	1.88	0.0330	0.07	1.21	to	1.17	0.0205	0.04	2	222	223
REACH ID	28	NATURAL DROP POND (224-224)	1.88	to	1.71	0.1670	0.17	1.17	to	1.06	0.1038	0.10	1	224	224
REACH ID	29	FREE (225-229)	1.71	to	1.47	0.0478	0.24	1.06	to	0.91	0.0297	0.15	5	225	229
REACH ID	30	POOL F (230-230)	1.47	to	1.31	0.1600	0.16	0.91	to	0.82	0.0994	0.10	1	230	230
REACH ID	31	FREE (231-250)	1.31	to	0.53	0.0393	0.79	0.82	to	0.33	0.0244	0.49	20	231	250
REACH ID	32	POOL G (251-251)	0.53	to	0.34	0.1920	0.19	0.33	to	0.21	0.1193	0.12	1	251	251
REACH ID	33	FREE (252-261)	0.34	to	0.00	0.0335	0.34	0.21	to	0.00	0.0208	0.21	10	252	261

```
ENDATA08

$$$ DATA TYPE 9 (ADVECTIVE HYDRAULIC COEFFICIENTS) $$$

CARD TYPE  REACH  ID       VELOCITY       VELOCITY          DEPTH          DEPTH          DEPTH        MANNINGS          EVAP
                              "a"            "b"            "d"            "e"            "f"            "n"
                           coeff.(m)      exp.of Q       coeff.(m)      exp.of Q       const.(m)                        cm/d
```

```
HYDR-1        1          0.06140000         1.0000         0.0000         0.0000         1.1030          0.035        0.00000
HYDR-1        2          0.59950000         0.2582         0.1626         0.3275         0.0000          0.035        0.00000
HYDR-1        3          0.06240000         1.0000         0.0000         0.0000         0.9670          0.035        0.00000
HYDR-1        4          0.60759997         0.2766         0.1507         0.4307         0.0000          0.035        0.00000
HYDR-1        5          0.07670000         1.0000         0.0000         0.0000         0.7930          0.035        0.00000
HYDR-1        6          0.64389998         0.2206         0.1888         0.2452         0.0000          0.035        0.00000
HYDR-1        7          0.07720000         1.0000         0.0000         0.0000         0.8910          0.035        0.00000
HYDR-1        8          0.05030000         1.0000         0.0000         0.0000         0.9600          0.035        0.00000
HYDR-1        9          0.05340000         1.0000         0.0000         0.0000         0.8040          0.035        0.00000
HYDR-1       10          0.03760000         1.0000         0.0000         0.0000         1.2410          0.035        0.00000
HYDR-1       11          0.48159999         0.3115         0.1239         0.2568         0.0000          0.035        0.00000
HYDR-1       12          0.06300000         1.0000         0.0000         0.0000         0.8200          0.035        0.00000
HYDR-1       13          0.57120001         0.2688         0.1868         0.4475         0.0000          0.035        0.00000
HYDR-1       14          0.18210000         1.0000         0.0000         0.0000         0.3600          0.035        0.00000
HYDR-1       15          0.76099998         0.2640         0.1242         0.1527         0.0000          0.035        0.00000
HYDR-1       16          0.37369999         1.0000         0.0000         0.0000         0.2050          0.035        0.00000
HYDR-1       17          0.52700001         0.2359         0.2139         0.1591         0.0000          0.035        0.00000
HYDR-1       18          0.14790000         1.0000         0.0000         0.0000         0.5450          0.035        0.00000
HYDR-1       19          0.62900001         0.2494         0.1949         0.2053         0.0000          0.035        0.00000
HYDR-1       20          0.07230000         1.0000         0.0000         0.0000         0.7530          0.035        0.00000
HYDR-1       21          0.85380000         0.2634         0.5106         0.1169         0.0000          0.035        0.00000
HYDR-1       22          0.27970001         1.0000         0.0000         0.0000         0.3720          0.035        0.00000
HYDR-1       23          0.58149999         0.2627         0.1390         0.4770         0.0000          0.035        0.00000
HYDR-1       24          0.10900000         1.0000         0.0000         0.0000         0.5940          0.035        0.00000
HYDR-1       25          0.68220001         0.2753         0.1030         0.3065         0.0000          0.035        0.00000
HYDR-1       26          0.11040000         1.0000         0.0000         0.0000         0.7510          0.035        0.00000
HYDR-1       27          0.94239998         0.1390         0.0666         0.2545         0.0000          0.035        0.00000
HYDR-1       28          0.14700000         1.0000         0.0000         0.0000         0.3990          0.035        0.00000
HYDR-1       29          0.38080001         0.2349         0.2383         0.1380         0.0000          0.035        0.00000
HYDR-1       30          0.31450000         1.0000         0.0000         0.0000         0.3900          0.035        0.00000
HYDR-1       31          0.50500000         0.2004         0.2591         0.2721         0.0000          0.035        0.00000
HYDR-1       32          0.18300000         1.0000         0.0000         0.0000         0.4410          0.035        0.00000
HYDR-1       33          0.35780001         0.2772         0.3594         0.0619         0.0000          0.035        0.00000
ENDATA09

$$$ DATA TYPE 10 (DISPERSIVE HYDRAULIC COEFFICIENTS) $$$

CARD TYPE  REACH  ID     TIDAL     DISPERSION     DISPERSION     DISPERSION     DISPERSION
                         RANGE        "a"            "b"            "c"            "d"
                       frac(0-1)  const.(m²/s)

HYDR-2        1           0.00        0.000          0.000          0.000          0.000
HYDR-2        2           0.00        0.000          0.000          0.000          0.000
HYDR-2        3           0.00        0.000          0.000          0.000          0.000
HYDR-2        4           0.00        0.000          0.000          0.000          0.000
HYDR-2        5           0.00        0.000          0.000          0.000          0.000
HYDR-2        6           0.00        0.000          0.000          0.000          0.000
HYDR-2        7           0.00        0.000          0.000          0.000          0.000
HYDR-2        8           0.00        0.000          0.000          0.000          0.000
HYDR-2        9           0.00        0.000          0.000          0.000          0.000
HYDR-2       10           0.00        0.000          0.000          0.000          0.000
HYDR-2       11           0.00        0.000          0.000          0.000          0.000
HYDR-2       12           0.00        0.000          0.000          0.000          0.000
HYDR-2       13           0.00        0.000          0.000          0.000          0.000
HYDR-2       14           0.00        0.000          0.000          0.000          0.000
HYDR-2       15           0.00        0.000          0.000          0.000          0.000
HYDR-2       16           0.00        0.000          0.000          0.000          0.000
HYDR-2       17           0.00        0.000          0.000          0.000          0.000
HYDR-2       18           0.00        0.000          0.000          0.000          0.000
HYDR-2       19           0.00        0.000          0.000          0.000          0.000
HYDR-2       20           0.00        0.000          0.000          0.000          0.000
HYDR-2       21           0.00        0.000          0.000          0.000          0.000
```

```
HYDR-2       22          0.00        0.000         0.000         0.000         0.000
HYDR-2       23          0.00        0.000         0.000         0.000         0.000
HYDR-2       24          0.00        0.000         0.000         0.000         0.000
HYDR-2       25          0.00        0.000         0.000         0.000         0.000
HYDR-2       26          0.00        0.000         0.000         0.000         0.000
HYDR-2       27          0.00        0.000         0.000         0.000         0.000
HYDR-2       28          0.00        0.000         0.000         0.000         0.000
HYDR-2       29          0.00        0.000         0.000         0.000         0.000
HYDR-2       30          0.00        0.000         0.000         0.000         0.000
HYDR-2       31          0.00        0.000         0.000         0.000         0.000
HYDR-2       32          0.00        0.000         0.000         0.000         0.000
HYDR-2       33          0.00        0.000         0.000         0.000         0.000
ENDATA10

$$$ DATA TYPE 11 (INITIAL CONDITIONS) $$$

CARD TYPE      REACH  ID     TEMP    SALIN       DO    NH3-N    NO3-N    PO4-P    CHL A    PERIP     BOD1     BOD2    ORG-N    ORG-P     COLI      NCM     CM-1     CM-2
                             deg C      ppt     mg/L     mg/L     mg/L     mg/L      µg/L    g/m²     mg/L     mg/L     mg/L     mg/L  #/100mL

INITIAL          1          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          2          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          3          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          4          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          5          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          6          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          7          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          8          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          9          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         10          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         11          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         12          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         13          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         14          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         15          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         16          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         17          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         18          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         19          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         20          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         21          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         22          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         23          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         24          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         25          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         26          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         27          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         28          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         29          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         30          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         31          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         32          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         33          31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
ENDATA11

$$$ DATA TYPE 12 (REAERATION, SEDIMENT OXYGEN DEMAND, BOD COEFFICIENTS) $$$
                                                                    AEROB                  SETTLD     ANAER     AEROB                          ANAER      BOD2
CARD     RCH  RCH  K2                      K2        K2        K2    BKGRND       BOD       BOD       SOD       BOD      BOD2      BOD2                BOD2   HYDR TO
TYPE     NUM   ID  OPT                    "a"       "b"       "c"       SOD     DECAY      SETT     AVAIL     DECAY     DECAY      SETT               DECAY      BOD1
                                                                     g/m²/d   per day       m/d      frac   per day   per day       m/d            per day   per day

COEF-1     1        1 K2=a             0.906     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     2       11 TEXAS            0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
```

```
COEF-1     3        1 K2=a            1.034     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     4       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     5        1 K2=a            1.261     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     6       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     7        1 K2=a            1.123     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     8        1 K2=a            1.042     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     9        1 K2=a            1.243     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    10        1 K2=a            0.806     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    11       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    12        1 K2=a            1.219     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    13       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    14        1 K2=a            2.777     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    15       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    16        1 K2=a            4.888     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    17       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    18        1 K2=a            1.835     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    19       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    20        1 K2=a            1.329     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    21       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    22        1 K2=a            2.686     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    23       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    24        1 K2=a            1.683     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    25       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    26        1 K2=a            1.331     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    27       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    28        1 K2=a            2.508     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    29       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    30        1 K2=a            2.566     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    31       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    32        1 K2=a            2.270     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1    33       11 TEXAS           0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
ENDATA12

$$$ DATA TYPE 13 (NITROGEN AND PHOSPHORUS COEFFICIENTS) $$$
                                          SETTLD                BKGRND    BKGRND                                        SETTLD
CARD TYPE      REACH  ID       ORG-N     ORG-N      ORGN       NH3       NH3       PO4     DENIT      ORGP      ORGP      ORGP
                                DECA      SETT     AVAIL      DECA      SRCE      SRCE      RATE      DECA      SETT     AVAIL
                             per day       m/d      frac   per day    g/m²/d    g/m²/d   per day   per day       m/d      frac

COEF-2           1            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           2            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           3            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           4            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           5            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           6            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           7            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           8            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2           9            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          10            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          11            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          12            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          13            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          14            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          15            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          16            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          17            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          18            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          19            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          20            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          21            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          22            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          23            0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
```

```
COEF-2          24          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          25          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          26          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          27          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          28          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          29          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          30          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          31          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          32          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          33          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
ENDATA13

$$$ DATA TYPE 14 (ALGAE PHYTOPLANKTON AND PERIPHYTON COEFFICIENTS) $$$
                                                                  MAX                                   MAX
CARD TYPE      REACH  ID      SECCHI    CHL A:     PHYTO     PHYTO     PHYTO     PHYTO     PERIP     PERIP     PERIP      BANK
                              DEPTH     ALGAE      SETT     DEATH      GROW      RESP     DEATH      GROW      RESP   SHADING
                                  m      frac       m/d   per day   per day   per day   per day   per day   per day      frac

ENDATA14

$$$ DATA TYPE 15 (COLIFORM AND NONCONSERVATIVE COEFFICIENTS) $$$

CARD TYPE      REACH  ID    COLIFORM       NCM       NCM
                            DIE-OFF     DECAY      SETT
                            per day   per day       m/d

ENDATA15

$$$ DATA TYPE 16 (INCREMENTAL DATA FOR FLOW, TEMPERATURE, SALINITY, AND CONSERVATIVES) $$$

CARD TYPE      REACH  ID      OUTFLOW      OUTFLOW      INFLOW      INFLOW      TEMP     SALIN      CM-1      CM-2  OUT/DIST  OUT/DIST   IN/DIST   IN/DIST
                                m³/s         cfs         m³/s         cfs     deg C       ppt                          cms/km    cfs/mi    cms/km    cfs/mi

ENDATA16

$$$ DATA TYPE 17 (INCREMENTAL DATA FOR DO, BOD, AND NITROGEN) $$$

CARD TYPE      REACH  ID          DO      BOD1     ORG-N     NH3-N     NO3-N      BOD2
                              mg/L      mg/L      mg/L      mg/L      mg/L      mg/L

ENDATA17

$$$ DATA TYPE 18 (INCREMENTAL DATA FOR PHOSPHORUS, PHYTOPLANKTON, COLIFORM, AND NONCONSERVATIVES) $$$
                                     PHYTO
 CARD TYPE      REACH  ID        PO4     CHL A      COLI       NCM      ORGP
                              mg/L      µg/L   #/100mL                mg/L

ENDATA18

$$$ DATA TYPE 19 (NONPOINT SOURCE DATA) $$$

CARD TYPE      REACH  ID        BOD1     ORG-N      COLI       NCM        DO      BOD2     ORG-P       NH3       NO3       PO4
                              kg/d      kg/d     #/day                kg/d      kg/d      kg/d      kg/d      kg/d      kg/d

ENDATA19

$$$ DATA TYPE 20 (HEADWATER FOR FLOW, TEMPERATURE, SALINITY AND CONSERVATIVES) $$$
                                                                                                                  HDW DISP
CARD TYPE     ELEMENT   NAME                  UNIT     FLOW       FLOW    TEMP    SALIN      CM-1      CM-2     EXCHG
                                                        m³/s        cfs   deg C      ppt                          frac

HDWTR-1           1     HEADWATER               0   0.00283    0.09994   31.10     0.00     0.000     0.000     0.000
```

```
ENDATA20

$$$ DATA TYPE 21 (HEADWATER DATA FOR DO, BOD, AND NITROGEN) $$$

CARD TYPE     ELEMENT   NAME                        DO      BOD1     ORG-N     NH3-N     NO3-N      BOD2
                                                   mg/L      mg/L      mg/L      mg/L      mg/L      mg/L

HDWTR-2           1     HEADWATER                 7.14      1.30      0.00      0.05      0.00      0.00
ENDATA21

$$$ DATA TYPE 22 (HEADWATER DATA FOR PHOSPHORUS, PHYTOPLANKTON, COLIFORM, AND NONCONSERVATIVES) $$$
                                                            PHYTO
CARD TYPE     ELEMENT   NAME                     PO4-P     CHL A      COLI       NCM     ORG-P
                                                  mg/L      µg/L   #/100mL                mg/L

ENDATA22

$$$ DATA TYPE 23 (JUNCTION DATA) $$$

CARD TYPE   JUNCTION   UPSTRM     RIVER     NAME
             ELEMENT  ELEMENT     KILOM

ENDATA23

$$$ DATA TYPE 24 (WASTELOAD DATA FOR FLOW, TEMPERATURE, SALINITY, AND CONSERVATIVES) $$$

CARD TYPE  ELEMENT    RKILO  NAME                    FLOW       FLOW     FLOW    TEMP    SALIN      CM-1      CM-2
                                                     m³/s        cfs      MGD   deg C      ppt

WSTLD-1       44      13.20  MCWWTP DSCH           0.43813   15.47233   10.000   31.10     0.00     0.000     0.000
ENDATA24

$$$ DATA TYPE 25 (WASTELOAD DATA FOR DO, BOD, AND NITROGEN) $$$

CARD TYPE     ELEMENT   NAME                        DO      BOD1     % BOD     ORG-N     NH3-N       %       NO3-N      BOD2
                                                   mg/L      mg/L      RMVL      mg/L      mg/L    NITRIF      mg/L      mg/L

WSTLD-2          44     MCWWTP DSCH                6.00      5.00      0.00      0.00      2.00      0.00      0.00      0.00
ENDATA25

$$$ DATA TYPE 26 (WASTELOAD DATA FOR PHOSPHORUS, PHYTOPLANTON, COLIFORM, AND NONCONSERVATIVES) $$$
                                                            PHYTO
CARD TYPE     ELEMENT   NAME                     PO4-P     CHL A      COLI       NCM     ORG-P
                                                  mg/L      µg/L   #/100mL                mg/L

ENDATA26

$$$ DATA TYPE 27 (LOWER BOUNDARY CONDITIONS) $$$

CARD TYPE    CONSTITUENT                    CONCENTRATION

LOWER BC     TEMPERATURE                       =     31.100     deg C
LOWER BC     SALINITY                          =      0.000     ppt
LOWER BC     CONSERVATIVE MATERIAL I           =      0.000
LOWER BC     CONSERVATIVE MATERIAL II          =      0.000
LOWER BC     DISSOLVED OXYGEN                  =      7.140     mg/L
LOWER BC     BIOCHEMICAL OXYGEN DEMAND         =      1.300     mg/L
LOWER BC     ORGANIC NITROGEN                  =      0.000     mg/L
LOWER BC     AMMONIA NITROGEN                  =      0.050     mg/L
LOWER BC     NITRATE + NITRITE NITROGEN        =      0.000     mg/L
LOWER BC     PHOSPHORUS                        =      0.000     mg/L
LOWER BC     CHLOROPHYLL A                     =      0.000     µg/L
```

```
LOWER BC     COLIFORM                          =      0.000     #/100 mL
LOWER BC     NONCONSERVATIVE MATERIAL          =      0.000
ENDATA27

$$$ DATA TYPE 28 (DAM DATA) $$$

CARD TYPE     ELEMENT   DAM NAME              DAM REAERATION EQUATION       "a"       "b"       "H"

                 83     Dam 9                1 BUTTS-EVANS (1983)        1.000     0.600     1.940
                 92     Dam 8                1 BUTTS-EVANS (1983)        1.000     0.140     1.120
                 97     Dam 7                1 BUTTS-EVANS (1983)        1.000     0.800     1.040
                 98     Dam 6                1 BUTTS-EVANS (1983)        1.000     0.800     1.630
                 99     Dam 5                1 BUTTS-EVANS (1983)        1.000     0.800     1.550
                100     Dam 4                1 BUTTS-EVANS (1983)        1.000     0.800     2.290
                105     Dam 3                1 BUTTS-EVANS (1983)        1.000     0.750     1.970
                169     Dam 2                1 BUTTS-EVANS (1983)        1.000     0.900     0.890
                190     Dam 1                1 BUTTS-EVANS (1983)        1.000     0.800     2.270
ENDATA28

$$$ DATA TYPE 29 (SENSITIVITY ANALYSIS DATA) $$$

CARD TYPE       PARAMETER     COL 1     COL 2     COL 3     COL 4     COL 5     COL 6     COL 7     COL 8

ENDATA29

$$$ DATA TYPE 30 (PLOT CONTROL CARDS) $$$

ENDATA30

$$$ DATA TYPE 31 (OVERLAY PLOT DATA) $$$

ENDATA31


CONCENTRATION ADJUSTMENTS RESULTING FROM USING EFFECTIVE CONCENTRATIONS

  ELEM  HEADWATER NAME           CHL A  EBOD1   BOD1  EBOD2   BOD2  EORGN   ORGN  EORGP   ORGP

     1  HEADWATER                  0.0   1.30   1.30   0.00   0.00   0.00   0.00   0.00   0.00
   LBC                              0.0   1.30   1.30   0.00   0.00   0.00   0.00   0.00   0.00



     .....NO FATAL ERRORS DETECTED IN INPUT DATA
     .....MODEL CONTAINS   1 HEADWATERS,  33 REACHES,  261 ELEMENTS, AND   1 WASTELOADS
     .....HYDRAULIC CALCULATIONS COMPLETED
     .....TRIDIAGONAL MATRIX TERMS INITIALIZED
     .....OXYGEN DEPENDENT RATES CONVERGENT IN    8 ITERATIONS
     .....CONSTITUENT CALCULATIONS COMPLETED
     .....CONCENTRATIONS IN LAST ELEMENT WRITTEN TO UNIT 33
_
CAPSULE SUMMARY FOR HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
```

6	2	14.522	0.003	0.100	31.10	0.0	6.12	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
7	2	14.486	0.003	0.100	31.10	0.0	6.07	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
8	2	14.451	0.003	0.100	31.10	0.0	6.02	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
9	2	14.415	0.003	0.100	31.10	0.0	5.97	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
10	2	14.379	0.003	0.100	31.10	0.0	5.93	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
11	2	14.343	0.003	0.100	31.10	0.0	5.88	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
12	2	14.308	0.003	0.100	31.10	0.0	5.84	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
13	2	14.272	0.003	0.100	31.10	0.0	5.80	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
14	2	14.236	0.003	0.100	31.10	0.0	5.76	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
15	2	14.200	0.003	0.100	31.10	0.0	5.72	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
16	2	14.165	0.003	0.100	31.10	0.0	5.69	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
17	2	14.129	0.003	0.100	31.10	0.0	5.65	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
18	2	14.093	0.003	0.100	31.10	0.0	5.62	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
19	2	14.057	0.003	0.100	31.10	0.0	5.59	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
20	2	14.022	0.003	0.100	31.10	0.0	5.56	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
21	2	13.986	0.003	0.100	31.10	0.0	5.53	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
22	2	13.950	0.003	0.100	31.10	0.0	5.50	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
23	2	13.914	0.003	0.100	31.10	0.0	5.47	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
24	2	13.879	0.003	0.100	31.10	0.0	5.44	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
25	2	13.843	0.003	0.100	31.10	0.0	5.42	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
26	2	13.807	0.003	0.100	31.10	0.0	5.39	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
27	2	13.771	0.003	0.100	31.10	0.0	5.37	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
28	2	13.736	0.003	0.100	31.10	0.0	5.35	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
29	2	13.700	0.003	0.100	31.10	0.0	5.33	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
30	2	13.664	0.003	0.100	31.10	0.0	5.30	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
31	2	13.628	0.003	0.100	31.10	0.0	5.28	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
32	2	13.593	0.003	0.100	31.10	0.0	5.26	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
33	2	13.557	0.003	0.100	31.10	0.0	5.24	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
34	2	13.521	0.003	0.100	31.10	0.0	5.23	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
35	2	13.485	0.003	0.100	31.10	0.0	5.21	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
36	2	13.450	0.003	0.100	31.10	0.0	5.19	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
37	2	13.414	0.003	0.100	31.10	0.0	5.18	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
38	2	13.378	0.003	0.100	31.10	0.0	5.16	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
39	2	13.342	0.003	0.100	31.10	0.0	5.14	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
40	2	13.307	0.003	0.100	31.10	0.0	5.13	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
41	2	13.271	0.003	0.100	31.10	0.0	5.12	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
42	2	13.235	0.003	0.100	31.10	0.0	5.10	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
43	2	13.199	0.003	0.100	31.10	0.0	5.09	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
WASTELOAD # 044 (MCWWTP DSCH) ENTERS HERE																														
44	2	13.164	0.441	15.572	31.10	0.0	6.00	4.97	0.00	0.00	1.99	0.00	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
45	2	13.128	0.441	15.572	31.10	0.0	6.00	4.97	0.00	0.00	1.98	0.00	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
46	2	13.092	0.441	15.572	31.10	0.0	6.00	4.97	0.00	0.00	1.98	0.00	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
47	2	13.056	0.441	15.572	31.10	0.0	6.01	4.97	0.00	0.00	1.98	0.00	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
48	2	13.021	0.441	15.572	31.10	0.0	6.01	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
49	2	12.985	0.441	15.572	31.10	0.0	6.01	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
50	2	12.949	0.441	15.572	31.10	0.0	6.01	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
51	2	12.913	0.441	15.572	31.10	0.0	6.02	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
52	2	12.878	0.441	15.572	31.10	0.0	6.02	4.96	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
53	2	12.842	0.441	15.572	31.10	0.0	6.02	4.96	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
54	2	12.806	0.441	15.572	31.10	0.0	6.02	4.96	0.00	0.00	1.97	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
55	2	12.770	0.441	15.572	31.10	0.0	6.03	4.96	0.00	0.00	1.97	0.01	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
56	2	12.735	0.441	15.572	31.10	0.0	6.03	4.96	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
57	2	12.699	0.441	15.572	31.10	0.0	6.03	4.96	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
58	2	12.663	0.441	15.572	31.10	0.0	6.03	4.96	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
59	2	12.627	0.441	15.572	31.10	0.0	6.04	4.96	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
60	2	12.592	0.441	15.572	31.10	0.0	6.04	4.96	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
61	2	12.556	0.441	15.572	31.10	0.0	6.04	4.96	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
62	2	12.520	0.441	15.572	31.10	0.0	6.04	4.96	0.00	0.00	1.96	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
63	2	12.484	0.441	15.572	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
64	2	12.449	0.441	15.572	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.02	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
65	2	12.413	0.441	15.572	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
66	2	12.377	0.441	15.572	31.10	0.0	6.05	4.95	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
67	2	12.341	0.441	15.572	31.10	0.0	6.06	4.95	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
68	2	12.306	0.441	15.572	31.10	0.0	6.06	4.95	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
69	2	12.270	0.441	15.572	31.10	0.0	6.06	4.95	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
70	2	12.234	0.441	15.572	31.10	0.0	6.06	4.95	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
71	2	12.198	0.441	15.572	31.10	0.0	6.06	4.95	0.00	0.00	1.95	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
72	2	12.163	0.441	15.572	31.10	0.0	6.07	4.95	0.00	0.00	1.95	0.03	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77

CAPSULE SUMMARY FOR HEADWATER

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
73	2	12.127	0.441	15.572	31.10	0.0	6.07	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
74	2	12.091	0.441	15.572	31.10	0.0	6.07	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
75	2	12.055	0.441	15.572	31.10	0.0	6.07	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
76	2	12.020	0.441	15.572	31.10	0.0	6.07	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
77	2	11.984	0.441	15.572	31.10	0.0	6.08	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
78	2	11.948	0.441	15.572	31.10	0.0	6.08	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
79	2	11.912	0.441	15.572	31.10	0.0	6.08	4.95	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
80	2	11.877	0.441	15.572	31.10	0.0	6.08	4.94	0.00	0.00	1.94	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
81	2	11.841	0.441	15.572	31.10	0.0	6.09	4.94	0.00	0.00	1.94	0.04	1.99	0.00	0.00	0.0	0.0	0.12	7.3	0.485258	0.485258	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
82	3	11.126	0.441	15.572	31.10	0.0	4.80	4.71	0.00	0.00	1.62	0.37	1.99	0.00	0.00	0.0	0.0	0.97	16.6	0.027516	0.027516	7.417	1.268	0.17	0.00	0.00	0.00	0.66	1.10
	DAM # 083 (Dam 9) IS LOCATED HERE RAISING DO BY 1.20 MG/L																												
83	4	11.094	0.441	15.572	31.10	0.0	6.00	4.71	0.00	0.00	1.62	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
84	4	11.061	0.441	15.572	31.10	0.0	6.00	4.71	0.00	0.00	1.62	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
85	4	11.028	0.441	15.572	31.10	0.0	6.01	4.71	0.00	0.00	1.62	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
86	4	10.996	0.441	15.572	31.10	0.0	6.01	4.71	0.00	0.00	1.62	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
87	4	10.963	0.441	15.572	31.10	0.0	6.01	4.71	0.00	0.00	1.62	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
88	4	10.931	0.441	15.572	31.10	0.0	6.01	4.70	0.00	0.00	1.61	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
89	4	10.898	0.441	15.572	31.10	0.0	6.02	4.70	0.00	0.00	1.61	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
90	4	10.866	0.441	15.572	31.10	0.0	6.02	4.70	0.00	0.00	1.61	0.37	1.99	0.00	0.00	0.0	0.0	0.11	8.6	0.484461	0.484461	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
91	5	10.708	0.441	15.572	31.10	0.0	5.74	4.66	0.00	0.00	1.56	0.43	1.99	0.00	0.00	0.0	0.0	0.79	16.4	0.033822	0.033822	7.417	1.546	0.17	0.00	0.00	0.00	0.69	1.10
	DAM # 092 (Dam 8) IS LOCATED HERE RAISING DO BY 0.19 MG/L																												
92	6	10.660	0.441	15.572	31.10	0.0	5.93	4.66	0.00	0.00	1.55	0.43	1.99	0.00	0.00	0.0	0.0	0.15	5.3	0.537493	0.537493	7.417	10.569	0.17	0.00	0.00	0.00	0.69	0.77
93	6	10.612	0.441	15.572	31.10	0.0	5.93	4.66	0.00	0.00	1.55	0.43	1.99	0.00	0.00	0.0	0.0	0.15	5.3	0.537493	0.537493	7.417	10.569	0.17	0.00	0.00	0.00	0.69	0.77
94	6	10.564	0.441	15.572	31.10	0.0	5.94	4.66	0.00	0.00	1.55	0.44	1.99	0.00	0.00	0.0	0.0	0.15	5.3	0.537493	0.537493	7.417	10.569	0.17	0.00	0.00	0.00	0.69	0.77
95	6	10.516	0.441	15.572	31.10	0.0	5.94	4.66	0.00	0.00	1.55	0.44	1.99	0.00	0.00	0.0	0.0	0.15	5.3	0.537493	0.537493	7.417	10.569	0.17	0.00	0.00	0.00	0.69	0.77
96	7	9.866	0.441	15.572	31.10	0.0	5.12	4.49	0.00	0.00	1.35	0.64	1.99	0.00	0.00	0.0	0.0	0.89	14.5	0.034042	0.034042	7.417	1.377	0.17	0.00	0.00	0.00	0.67	1.10
	DAM # 097 (Dam 7) IS LOCATED HERE RAISING DO BY 0.93 MG/L																												
97	8	9.545	0.441	15.572	31.10	0.0	5.41	4.37	0.00	0.00	1.21	0.78	1.99	0.00	0.00	0.0	0.0	0.96	20.7	0.022180	0.022180	7.417	1.277	0.17	0.00	0.00	0.00	0.68	1.10
	DAM # 098 (Dam 6) IS LOCATED HERE RAISING DO BY 1.00 MG/L																												
98	9	9.227	0.441	15.572	31.10	0.0	5.81	4.26	0.00	0.00	1.09	0.89	1.99	0.00	0.00	0.0	0.0	0.80	23.3	0.023547	0.023547	7.417	1.524	0.17	0.00	0.00	0.00	0.69	1.10
	DAM # 099 (Dam 5) IS LOCATED HERE RAISING DO BY 0.78 MG/L																												
99	10	8.655	0.441	15.572	31.10	0.0	5.41	3.99	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	1.24	21.4	0.016580	0.016580	7.417	0.988	0.17	0.00	0.00	0.00	0.68	1.10
	DAM # 100 (Dam 4) IS LOCATED HERE RAISING DO BY 1.12 MG/L																												
100	11	8.615	0.441	15.572	31.10	0.0	6.53	3.99	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	0.10	11.8	0.373179	0.373179	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
101	11	8.574	0.441	15.572	31.10	0.0	6.53	3.99	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	0.10	11.8	0.373179	0.373179	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
102	11	8.534	0.441	15.572	31.10	0.0	6.53	3.99	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	0.10	11.8	0.373179	0.373179	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
103	11	8.493	0.441	15.572	31.10	0.0	6.53	3.99	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	0.10	11.8	0.373179	0.373179	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
104	12	7.939	0.441	15.572	31.10	0.0	5.89	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.82	19.4	0.027780	0.027780	7.417	1.494	0.17	0.00	0.00	0.00	0.69	1.10
	DAM # 105 (Dam 3) IS LOCATED HERE RAISING DO BY 0.79 MG/L																												
105	13	7.901	0.441	15.572	31.10	0.0	6.68	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
106	13	7.864	0.441	15.572	31.10	0.0	6.68	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
107	13	7.826	0.441	15.572	31.10	0.0	6.68	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
108	13	7.788	0.441	15.572	31.10	0.0	6.68	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
109	13	7.750	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
110	13	7.713	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
111	13	7.675	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
112	13	7.637	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
113	13	7.600	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.73	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
114	13	7.562	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.73	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
115	13	7.524	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.73	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77

116	13	7.487	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.73	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
117	13	7.449	0.441	15.572	31.10	0.0	6.67	3.84	0.00	0.00	0.73	1.25	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
118	13	7.411	0.441	15.572	31.10	0.0	6.67	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
119	13	7.373	0.441	15.572	31.10	0.0	6.67	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
120	13	7.336	0.441	15.572	31.10	0.0	6.67	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
121	13	7.298	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
122	13	7.260	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
123	13	7.223	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
124	13	7.185	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
125	13	7.147	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
126	13	7.110	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
127	13	7.072	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
128	13	7.034	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
129	13	6.996	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
130	13	6.959	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
131	13	6.921	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
132	13	6.883	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.73	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
133	13	6.846	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.72	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
134	13	6.808	0.441	15.572	31.10	0.0	6.66	3.83	0.00	0.00	0.72	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
135	13	6.770	0.441	15.572	31.10	0.0	6.66	3.82	0.00	0.00	0.72	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
136	13	6.733	0.441	15.572	31.10	0.0	6.66	3.82	0.00	0.00	0.72	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
137	13	6.695	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.26	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
138	13	6.657	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
139	13	6.619	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
140	13	6.582	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
141	13	6.544	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
142	13	6.506	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
143	13	6.469	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
144	13	6.431	0.441	15.572	31.10	0.0	6.65	3.82	0.00	0.00	0.72	1.27	1.99	0.00	0.00	0.0	0.0	0.13	7.4	0.458356	0.458356	7.417	11.846	0.17	0.00	0.00	0.00	0.71	0.77
145	14	6.263	0.441	15.572	31.10	0.0	6.56	3.80	0.00	0.00	0.71	1.28	1.99	0.00	0.00	0.0	0.0	0.36	15.3	0.080299	0.080299	7.417	3.404	0.17	0.00	0.00	0.00	0.71	1.10
146	15	6.217	0.441	15.572	31.10	0.0	6.56	3.80	0.00	0.00	0.71	1.28	1.99	0.00	0.00	0.0	0.0	0.11	6.6	0.613064	0.613064	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77

CAPSULE SUMMARY FOR HEADWATER

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
147	16	6.163	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.71	1.28	1.99	0.00	0.00	0.0	0.0	0.20	13.1	0.164787	0.164787	7.417	5.992	0.17	0.00	0.00	0.00	0.71	1.10
148	17	6.122	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.28	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
149	17	6.082	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.28	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
150	17	6.041	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.28	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
151	17	6.000	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.28	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
152	17	5.960	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
153	17	5.919	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
154	17	5.878	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
155	17	5.838	0.441	15.572	31.10	0.0	6.54	3.80	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
156	17	5.797	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
157	17	5.757	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
158	17	5.716	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
159	17	5.675	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
160	17	5.635	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
161	17	5.594	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
162	17	5.553	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
163	17	5.513	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
164	17	5.472	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
165	17	5.431	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.70	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
166	17	5.391	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.69	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
167	17	5.350	0.441	15.572	31.10	0.0	6.54	3.79	0.00	0.00	0.69	1.29	1.99	0.00	0.00	0.0	0.0	0.19	5.4	0.434435	0.434435	7.417	8.374	0.17	0.00	0.00	0.00	0.71	0.77
168	18	5.068	0.441	15.572	31.10	0.0	6.38	3.76	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.55	12.4	0.065218	0.065218	7.417	2.249	0.17	0.00	0.00	0.00	0.70	1.10
	DAM # 169 (Dam 2) IS LOCATED HERE RAISING DO BY 0.42 MG/L																												
169	19	5.028	0.441	15.572	31.10	0.0	6.79	3.76	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
170	19	4.987	0.441	15.572	31.10	0.0	6.79	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77

171	19	4.947	0.441	15.572	31.10	0.0	6.79	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
172	19	4.907	0.441	15.572	31.10	0.0	6.79	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
173	19	4.867	0.441	15.572	31.10	0.0	6.78	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
174	19	4.826	0.441	15.572	31.10	0.0	6.78	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
175	19	4.786	0.441	15.572	31.10	0.0	6.78	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
176	19	4.746	0.441	15.572	31.10	0.0	6.78	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
177	19	4.705	0.441	15.572	31.10	0.0	6.78	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
178	19	4.665	0.441	15.572	31.10	0.0	6.78	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
179	19	4.625	0.441	15.572	31.10	0.0	6.77	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
180	19	4.584	0.441	15.572	31.10	0.0	6.77	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
181	19	4.544	0.441	15.572	31.10	0.0	6.77	3.75	0.00	0.00	0.67	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
182	19	4.504	0.441	15.572	31.10	0.0	6.77	3.75	0.00	0.00	0.66	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
183	19	4.464	0.441	15.572	31.10	0.0	6.77	3.75	0.00	0.00	0.66	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
184	19	4.423	0.441	15.572	31.10	0.0	6.77	3.75	0.00	0.00	0.66	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
185	19	4.383	0.441	15.572	31.10	0.0	6.76	3.75	0.00	0.00	0.66	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
186	19	4.343	0.441	15.572	31.10	0.0	6.76	3.75	0.00	0.00	0.66	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
187	19	4.302	0.441	15.572	31.10	0.0	6.76	3.75	0.00	0.00	0.66	1.32	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
188	19	4.262	0.441	15.572	31.10	0.0	6.76	3.74	0.00	0.00	0.66	1.33	1.99	0.00	0.00	0.0	0.0	0.16	5.2	0.512819	0.512819	7.417	9.849	0.17	0.00	0.00	0.00	0.71	0.77
189	20	3.866	0.441	15.572	31.10	0.0	6.34	3.66	0.00	0.00	0.60	1.39	1.99	0.00	0.00	0.0	0.0	0.75	18.4	0.031881	0.031881	7.417	1.629	0.17	0.00	0.00	0.00	0.70	1.10
DAM # 190 (Dam 1) IS LOCATED HERE RAISING DO BY 0.60 MG/L																														
190	21	3.815	0.441	15.572	31.10	0.0	6.94	3.66	0.00	0.00	0.60	1.39	1.99	0.00	0.00	0.0	0.0	0.46	1.4	0.688162	0.688162	7.417	4.229	0.17	0.00	0.00	0.00	0.71	0.77
191	21	3.763	0.441	15.572	31.10	0.0	6.93	3.66	0.00	0.00	0.60	1.39	1.99	0.00	0.00	0.0	0.0	0.46	1.4	0.688162	0.688162	7.417	4.229	0.17	0.00	0.00	0.00	0.71	0.77
192	21	3.712	0.441	15.572	31.10	0.0	6.93	3.66	0.00	0.00	0.60	1.39	1.99	0.00	0.00	0.0	0.0	0.46	1.4	0.688162	0.688162	7.417	4.229	0.17	0.00	0.00	0.00	0.71	0.77
193	21	3.660	0.441	15.572	31.10	0.0	6.93	3.65	0.00	0.00	0.60	1.39	1.99	0.00	0.00	0.0	0.0	0.46	1.4	0.688162	0.688162	7.417	4.229	0.17	0.00	0.00	0.00	0.71	0.77
194	21	3.609	0.441	15.572	31.10	0.0	6.93	3.65	0.00	0.00	0.60	1.39	1.99	0.00	0.00	0.0	0.0	0.46	1.4	0.688162	0.688162	7.417	4.229	0.17	0.00	0.00	0.00	0.71	0.77
195	22	3.335	0.441	15.572	31.10	0.0	6.82	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.37	9.6	0.123337	0.123337	7.417	3.293	0.17	0.00	0.00	0.00	0.71	1.10
196	23	3.302	0.441	15.572	31.10	0.0	6.82	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
197	23	3.270	0.441	15.572	31.10	0.0	6.81	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
198	23	3.237	0.441	15.572	31.10	0.0	6.81	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
199	23	3.204	0.441	15.572	31.10	0.0	6.81	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
200	23	3.172	0.441	15.572	31.10	0.0	6.80	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
201	23	3.139	0.441	15.572	31.10	0.0	6.80	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
202	23	3.106	0.441	15.572	31.10	0.0	6.80	3.64	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
203	23	3.074	0.441	15.572	31.10	0.0	6.79	3.63	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
204	23	3.041	0.441	15.572	31.10	0.0	6.79	3.63	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
205	23	3.009	0.441	15.572	31.10	0.0	6.79	3.63	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
206	23	2.976	0.441	15.572	31.10	0.0	6.78	3.63	0.00	0.00	0.59	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
207	23	2.943	0.441	15.572	31.10	0.0	6.78	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
208	23	2.911	0.441	15.572	31.10	0.0	6.78	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
209	23	2.878	0.441	15.572	31.10	0.0	6.78	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
210	23	2.845	0.441	15.572	31.10	0.0	6.77	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
211	23	2.813	0.441	15.572	31.10	0.0	6.77	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
212	23	2.780	0.441	15.572	31.10	0.0	6.77	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
213	23	2.747	0.441	15.572	31.10	0.0	6.76	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
214	23	2.715	0.441	15.572	31.10	0.0	6.76	3.63	0.00	0.00	0.58	1.40	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
215	23	2.682	0.441	15.572	31.10	0.0	6.76	3.63	0.00	0.00	0.58	1.41	1.99	0.00	0.00	0.0	0.0	0.09	10.0	0.468957	0.468957	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
216	24	2.314	0.441	15.572	31.10	0.0	6.49	3.58	0.00	0.00	0.55	1.44	1.99	0.00	0.00	0.0	0.0	0.59	15.4	0.048065	0.048065	7.417	2.063	0.17	0.00	0.00	0.00	0.70	1.10
217	25	2.271	0.441	15.572	31.10	0.0	6.49	3.58	0.00	0.00	0.55	1.44	1.99	0.00	0.00	0.0	0.0	0.08	10.1	0.544521	0.544521	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
218	25	2.229	0.441	15.572	31.10	0.0	6.49	3.58	0.00	0.00	0.55	1.44	1.99	0.00	0.00	0.0	0.0	0.08	10.1	0.544521	0.544521	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
219	25	2.186	0.441	15.572	31.10	0.0	6.49	3.57	0.00	0.00	0.55	1.44	1.99	0.00	0.00	0.0	0.0	0.08	10.1	0.544521	0.544521	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
220	25	2.144	0.441	15.572	31.10	0.0	6.49	3.57	0.00	0.00	0.55	1.44	1.99	0.00	0.00	0.0	0.0	0.08	10.1	0.544521	0.544521	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77

CAPSULE SUMMARY FOR HEADWATER

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
221	26	1.944	0.441	15.572	31.10	0.0	6.36	3.55	0.00	0.00	0.53	1.46	1.99	0.00	0.00	0.0	0.0	0.75	12.1	0.048682	0.048682	7.417	1.632	0.17	0.00	0.00	0.00	0.70	1.10
222	27	1.911	0.441	15.572	31.10	0.0	6.36	3.55	0.00	0.00	0.53	1.46	1.99	0.00	0.00	0.0	0.0	0.05	9.7	0.841021	0.841021	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
223	27	1.878	0.441	15.572	31.10	0.0	6.36	3.55	0.00	0.00	0.53	1.46	1.99	0.00	0.00	0.0	0.0	0.05	9.7	0.841021	0.841021	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
224	28	1.711	0.441	15.572	31.10	0.0	6.29	3.53	0.00	0.00	0.52	1.47	1.99	0.00	0.00	0.0	0.0	0.40	17.0	0.064821	0.064821	7.417	3.074	0.17	0.00	0.00	0.00	0.70	1.10
225	29	1.663	0.441	15.572	31.10	0.0	6.29	3.53	0.00	0.00	0.52	1.47	1.99	0.00	0.00	0.0	0.0	0.21	6.6	0.314171	0.314171	7.417	6.853	0.17	0.00	0.00	0.00	0.70	0.77

226	29	1.615	0.441	15.572	31.10	0.0	6.29	3.53	0.00	0.00	0.52	1.47	1.99	0.00	0.00	0.0	0.0	0.21	6.6	0.314171	0.314171	7.417	6.853	0.17	0.00	0.00	0.00	0.70	0.77
227	29	1.568	0.441	15.572	31.10	0.0	6.30	3.52	0.00	0.00	0.52	1.47	1.99	0.00	0.00	0.0	0.0	0.21	6.6	0.314171	0.314171	7.417	6.853	0.17	0.00	0.00	0.00	0.70	0.77
228	29	1.520	0.441	15.572	31.10	0.0	6.30	3.52	0.00	0.00	0.52	1.47	1.99	0.00	0.00	0.0	0.0	0.21	6.6	0.314171	0.314171	7.417	6.853	0.17	0.00	0.00	0.00	0.70	0.77
229	29	1.472	0.441	15.572	31.10	0.0	6.30	3.52	0.00	0.00	0.51	1.47	1.99	0.00	0.00	0.0	0.0	0.21	6.6	0.314171	0.314171	7.417	6.853	0.17	0.00	0.00	0.00	0.70	0.77
230	30	1.312	0.441	15.572	31.10	0.0	6.27	3.52	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.39	8.2	0.138682	0.138682	7.417	3.146	0.17	0.00	0.00	0.00	0.70	1.10
231	31	1.273	0.441	15.572	31.10	0.0	6.27	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
232	31	1.234	0.441	15.572	31.10	0.0	6.28	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
233	31	1.194	0.441	15.572	31.10	0.0	6.28	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
234	31	1.155	0.441	15.572	31.10	0.0	6.28	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
235	31	1.116	0.441	15.572	31.10	0.0	6.28	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
236	31	1.076	0.441	15.572	31.10	0.0	6.28	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
237	31	1.037	0.441	15.572	31.10	0.0	6.29	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
238	31	0.998	0.441	15.572	31.10	0.0	6.29	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
239	31	0.959	0.441	15.572	31.10	0.0	6.29	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
240	31	0.919	0.441	15.572	31.10	0.0	6.29	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
241	31	0.880	0.441	15.572	31.10	0.0	6.30	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
242	31	0.841	0.441	15.572	31.10	0.0	6.30	3.51	0.00	0.00	0.51	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
243	31	0.802	0.441	15.572	31.10	0.0	6.30	3.51	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
244	31	0.762	0.441	15.572	31.10	0.0	6.30	3.51	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
245	31	0.723	0.441	15.572	31.10	0.0	6.30	3.51	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
246	31	0.684	0.441	15.572	31.10	0.0	6.31	3.51	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
247	31	0.645	0.441	15.572	31.10	0.0	6.31	3.50	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
248	31	0.605	0.441	15.572	31.10	0.0	6.31	3.50	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
249	31	0.566	0.441	15.572	31.10	0.0	6.31	3.50	0.00	0.00	0.50	1.48	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
250	31	0.527	0.441	15.572	31.10	0.0	6.31	3.50	0.00	0.00	0.50	1.49	1.99	0.00	0.00	0.0	0.0	0.21	5.0	0.428577	0.428577	7.417	7.635	0.17	0.00	0.00	0.00	0.70	0.77
251	32	0.335	0.441	15.572	31.10	0.0	6.26	3.49	0.00	0.00	0.49	1.49	1.99	0.00	0.00	0.0	0.0	0.44	12.4	0.080696	0.080696	7.417	2.783	0.17	0.00	0.00	0.00	0.70	1.10
252	33	0.302	0.441	15.572	31.10	0.0	6.26	3.49	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
253	33	0.268	0.441	15.572	31.10	0.0	6.26	3.49	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
254	33	0.235	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
255	33	0.201	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
256	33	0.168	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
257	33	0.134	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
258	33	0.101	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
259	33	0.067	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
260	33	0.034	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77
261	33	0.000	0.441	15.572	31.10	0.0	6.26	3.48	0.00	0.00	0.49	1.50	1.99	0.00	0.00	0.0	0.0	0.34	4.5	0.285146	0.285146	7.417	4.372	0.17	0.00	0.00	0.00	0.70	0.77

.....EXECUTION COMPLETED

Appendix D: 15 MGD QUAL-TX Input File

```
CNTROL01     FORT WORTH, MARY'S CREEK
CNTROL02     10/5/2017 SUMMER, 15 MGD Discharge @ 5/2/6
CNTROL03 YES ECHO DATA INPUT
CNTROL04  NO INTERMEDIATE SUMMARY
CNTROL05 YES CAPSULE SUMMARY
CNTROL06 YES LOADING SUMMARY
CNTROL07 YES FINAL REPORT
CNTROL08  NO LINE PRINTER PLOT
CNTROL09  NO GRAPHICS CAPABILITY
CNTROL10 YES METRIC UNITS
CNTROL11 YES OXYGEN DEPENDENT RATES
CNTROL12  NO SENSITIVITY ANALYSIS
CNTROL13 YES SPECIAL REPORT
ENDATA01
MODOPT01  NO TEMPERATURE
MODOPT02  NO SALINITY
MODOPT03  NO CONSERVATIVE MATERIAL  I = CONDUCTIVITY (UMHOS/CM)
MODOPT04  NO CONSERVATIVE MATERIAL II = CHLORIDE  (MG/L)
MODOPT05 YES DISSOLVED OXYGEN
MODOPT06 YES BIOCHEMICAL OXYGEN DEMAND
MODOPT07 YES NITROGEN
MODOPT08  NO PHOSPHORUS
MODOPT09  NO CHLOROPHYLL A
MODOPT10  NO MACROPHYTES
MODOPT11  NO COLIFORM
MODOPT12  NO NONCONSERVATIVE MATERIAL =
ENDATA02
PROGRAM  BOD OXYGEN UPTAKE RATE             =  2.3
PROGRAM  MAXIMUM ITERATION LIMIT            =  500.
PROGRAM  K2 MAXIMUM                         =  10.
PROGRAM  LOGICAL UNIT NUMBER FOR SEQUENCING =  33
ENDATA03
ENDATA04
ENDATA05
ENDATA06
ENDATA07
REACH ID    1     DAM 10 POND (1-1)                  14.870    14.701   0.169
REACH ID    2     FREE (2-81)                        14.701    11.841   0.03575
REACH ID    3     DAM 9 POND (82-82)                 11.841    11.126   0.715
REACH ID    4     FREE (83-90)                       11.126    10.866   0.0325
REACH ID    5     DAM 8 POND (91-91)                 10.866    10.708   0.158
REACH ID    6     FREE(92-95)                        10.708    10.516   0.048
REACH ID    7     DAM 7 POND (96-96)                 10.516     9.866   0.65
REACH ID    8     DAM 6 POND (97-97)                  9.866     9.545   0.321
REACH ID    9     DAM 5 POND (98-98)                  9.545     9.227   0.318
REACH ID   10     DAM 4 POND (99-99)                  9.227     8.655   0.572
REACH ID   11     FREE (100-103)                      8.655     8.493   0.0405
REACH ID   12     DAM 3 POND (104-104)                8.493     7.939   0.554
REACH ID   13     FREE (105-144)                      7.939     6.431   0.0377
REACH ID   14     POOL A (145-145)                    6.431     6.263   0.168
REACH ID   15     FREE (146-146)                      6.263     6.217   0.046
REACH ID   16     POOL B (147-147)                    6.217     6.163   0.054
REACH ID   17     FREE (148-167)                      6.163     5.350   0.04065
REACH ID   18     DAM 2 POND (168-168)                5.350     5.068   0.282
REACH ID   19     FREE (169-188)                      5.068     4.262   0.0403
REACH ID   20     DAM 1 POND (189-189)                4.262     3.866   0.396
REACH ID   21     FREE (190-194)                      3.866     3.609   0.0514
REACH ID   22     POOL C (195-195)                    3.609     3.335   0.274
REACH ID   23     FREE (196-215)                      3.335     2.682   0.03265
REACH ID   24     POOL D (216-216)                    2.682     2.314   0.368
REACH ID   25     FREE (217-220)                      2.314     2.144   0.0425
REACH ID   26     POOL E (221-221)                    2.144     1.944   0.2
```

```
REACH ID   27     FREE (222-223)                        1.944     1.878   0.033
REACH ID   28     NATURAL DROP POND (224-224)           1.878     1.711   0.167
REACH ID   29     FREE (225-229)                        1.711     1.472   0.0478
REACH ID   30     POOL F (230-230)                      1.472     1.312   0.16
REACH ID   31     FREE (231-250)                        1.312     0.527   0.03925
REACH ID   32     POOL G (251-251)                      0.527     0.335   0.192
REACH ID   33     FREE (252-261)                        0.335     0.000   0.0335
ENDATA08
HYDR-1      1.     .0614     1.000     0.000     0.000     1.103  0.035
HYDR-1      2.     .5995     .2582     .1626     .3275     0.000  0.035
HYDR-1      3.     .0624     1.000     0.000     0.000     0.967  0.035
HYDR-1      4.     .6076     .2766     .1507     .4307     0.000  0.035
HYDR-1      5.     .0767     1.000     0.000     0.000     0.793  0.035
HYDR-1      6.     .6439     .2206     .1888     .2452     0.000  0.035
HYDR-1      7.     .0772     1.000     0.000     0.000     0.891  0.035
HYDR-1      8.     .0503     1.000     0.000     0.000     0.960  0.035
HYDR-1      9.     .0534     1.000     0.000     0.000     0.804  0.035
HYDR-1     10.     .0376     1.000     0.000     0.000     1.241  0.035
HYDR-1     11.     .4816     .3115     .1239     .2568     0.000  0.035
HYDR-1     12.     .0630     1.000     0.000     0.000     0.820  0.035
HYDR-1     13.     .5712     .2688     .1868     .4475     0.000  0.035
HYDR-1     14.     .1821     1.000     0.000     0.000     0.360  0.035
HYDR-1     15.     .7610     .2640     .1242     .1527     0.000  0.035
HYDR-1     16.     .3737     1.000     0.000     0.000     0.205  0.035
HYDR-1     17.     .5270     .2359     .2139     .1591     0.000  0.035
HYDR-1     18.     .1479     1.000     0.000     0.000     0.545  0.035
HYDR-1     19.     .6290     .2494     .1949     .2053     0.000  0.035
HYDR-1     20.     .0723     1.000     0.000     0.000     0.753  0.035
HYDR-1     21.     .8538     .2634     .5106     .1169     0.000  0.035
HYDR-1     22.     .2797     1.000     0.000     0.000     0.372  0.035
HYDR-1     23.     .5815     .2627     .1390     .4770     0.000  0.035
HYDR-1     24.     .1090     1.000     0.000     0.000     0.594  0.035
HYDR-1     25.     .6822     .2753     .1030     .3065     0.000  0.035
HYDR-1     26.     .1104     1.000     0.000     0.000     0.751  0.035
HYDR-1     27.     .9424     .1390     .0666     .2545     0.000  0.035
HYDR-1     28.     .1470     1.000     0.000     0.000     0.399  0.035
HYDR-1     29.     .3808     .2349     .2383     .1380     0.000  0.035
HYDR-1     30.     .3145     1.000     0.000     0.000     0.390  0.035
HYDR-1     31.     .5050     .2004     .2591     .2721     0.000  0.035
HYDR-1     32.     .1830     1.000     0.000     0.000     0.441  0.035
HYDR-1     33.     .3578     .2772     .3594     .0619     0.000  0.035
ENDATA09
HYDR-2      1.   0.0    0.0
HYDR-2      2.   0.0    0.0
HYDR-2      3.   0.0    0.0
HYDR-2      4.   0.0    0.0
HYDR-2      5.   0.0    0.0
HYDR-2      6.   0.0    0.0
HYDR-2      7.   0.0    0.0
HYDR-2      8.   0.0    0.0
HYDR-2      9.   0.0    0.0
HYDR-2     10.   0.0    0.0
HYDR-2     11.   0.0    0.0
HYDR-2     12.   0.0    0.0
HYDR-2     13.   0.0    0.0
HYDR-2     14.   0.0    0.0
HYDR-2     15.   0.0    0.0
HYDR-2     16.   0.0    0.0
HYDR-2     17.   0.0    0.0
HYDR-2     18.   0.0    0.0
HYDR-2     19.   0.0    0.0
HYDR-2     20.   0.0    0.0
```

```
HYDR-2     21.   0.0    0.0
HYDR-2     22.   0.0    0.0
HYDR-2     23.   0.0    0.0
HYDR-2     24.   0.0    0.0
HYDR-2     25.   0.0    0.0
HYDR-2     26.   0.0    0.0
HYDR-2     27.   0.0    0.0
HYDR-2     28.   0.0    0.0
HYDR-2     29.   0.0    0.0
HYDR-2     30.   0.0    0.0
HYDR-2     31.   0.0    0.0
HYDR-2     32.   0.0    0.0
HYDR-2     33.   0.0    0.0
ENDATA10
INITIAL     1.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     2.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     3.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     4.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     5.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     6.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     7.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     8.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL     9.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    10.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    11.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    12.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    13.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    14.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    15.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    16.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    17.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    18.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    19.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    20.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    21.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    22.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    23.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    24.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    25.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    26.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    27.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    28.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    29.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    30.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    31.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    32.     31.1  0.0       7.14    0.05     0.0      0.      0.
INITIAL    33.     31.1  0.0       7.14    0.05     0.0      0.      0.
ENDATA11
COEF-1      1.   1.  0.906                .50    0.1   0.0     1.0   0.00
COEF-1      2.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1      3.   1.  1.034                .50    0.1   0.0     1.0   0.00
COEF-1      4.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1      5.   1.  1.261                .50    0.1   0.0     1.0   0.00
COEF-1      6.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1      7.   1.  1.123                .50    0.1   0.0     1.0   0.00
COEF-1      8.   1.  1.042                .50    0.1   0.0     1.0   0.00
COEF-1      9.   1.  1.243                .50    0.1   0.0     1.0   0.00
COEF-1     10.   1.  0.806                .50    0.1   0.0     1.0   0.00
COEF-1     11.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1     12.   1.  1.219                .50    0.1   0.0     1.0   0.00
COEF-1     13.  11.  0.                   .35    0.1   0.0     1.0   0.00
COEF-1     14.   1.  2.777                .50    0.1   0.0     1.0   0.00
```

```
COEF-1     15.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     16.   1.  4.888                 .50    0.1   0.0     1.0   0.00
COEF-1     17.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     18.   1.  1.835                 .50    0.1   0.0     1.0   0.00
COEF-1     19.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     20.   1.  1.329                 .50    0.1   0.0     1.0   0.00
COEF-1     21.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     22.   1.  2.686                 .50    0.1   0.0     1.0   0.00
COEF-1     23.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     24.   1.  1.683                 .50    0.1   0.0     1.0   0.00
COEF-1     25.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     26.   1.  1.331                 .50    0.1   0.0     1.0   0.00
COEF-1     27.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     28.   1.  2.508                 .50    0.1   0.0     1.0   0.00
COEF-1     29.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     30.   1.  2.566                 .50    0.1   0.0     1.0   0.00
COEF-1     31.  11.  0.                    .35    0.1   0.0     1.0   0.00
COEF-1     32.   1.  2.270                 .50    0.1   0.0     1.0   0.00
COEF-1     33.  11.  0.                    .35    0.1   0.0     1.0   0.00
ENDATA12
COEF-2      1.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      2.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      3.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      4.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      5.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      6.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      7.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      8.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2      9.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     10.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     11.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     12.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     13.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     14.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     15.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     16.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     17.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     18.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     19.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     20.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     21.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     22.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     23.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     24.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     25.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     26.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     27.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     28.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     29.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     30.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     31.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     32.    0.00    0.0    1.0    0.3     0.     0.   0.00
COEF-2     33.    0.00    0.0    1.0    0.3     0.     0.   0.00
ENDATA13
ENDATA14
ENDATA15
ENDATA16
ENDATA17
ENDATA18
ENDATA19
HDWTR-1     1. HEADWATER                 0.00283    31.1      0.
ENDATA20
```

```
HDWTR-2     1.      7.14      1.3     0.00     0.05     0.00
ENDATA21
ENDATA22
ENDATA23
WSTLD-1    44. MCWWTP DSCH            0.6572     31.1
ENDATA24
WSTLD-2    44.      6.00      5.0                   2.00
ENDATA25
ENDATA26
LOWER BC TEMPERATURE                        = 31.1
LOWER BC SALINITY                           = 0.0
LOWER BC CONSERVATIVE MATERIAL I            = 0.0
LOWER BC CONSERVATIVE MATERIAL II           = 0.0
LOWER BC DISSOLVED OXYGEN                   = 7.14
LOWER BC BIOCHEMICAL OXYGEN DEMAND          = 1.3
LOWER BC ORGANIC NITROGEN                   = 0.0
LOWER BC AMMONIA NITROGEN                   = 0.05
LOWER BC NITRATE + NITRITE NITROGEN         = 0.0
LOWER BC PHOSPHORUS                         = 0.0
LOWER BC CHLOROPHYLL A                      = 0.0
LOWER BC COLIFORM                           = 0.0
LOWER BC NONCONSERVATIVE MATERIAL           = 0.0
ENDATA27
         83    Dam 9                 1     1.00    0.60    1.94
         92    Dam 8                 1     1.00    0.14    1.12
         97    Dam 7                 1     1.00    0.80    1.04
         98    Dam 6                 1     1.00    0.80    1.63
         99    Dam 5                 1     1.00    0.80    1.55
         100   Dam 4                 1     1.00    0.80    2.29
         105   Dam 3                 1     1.00    0.75    1.97
         169   Dam 2                 1     1.00    0.90    0.89
         190   Dam 1                 1     1.00    0.80    2.27
ENDATA28
ENDATA29
ENDATA30
ENDATA31
```

Appendix E: 15 MGD QUAL-TX Output File

```
QUAL-TX Version 9.32
Texas Commission on Environmental Quality

Input file is F:31859-01-0 Wrk Prod-8 MODELSTX0171005 Revised Mary's CreekRuns5 MGD_15MGD_x_5_BOD5_2_NH3_6_DO_15MGD_x_5_BOD5_2_NH3_6_DO.IN
Running in steady-state mode using TX defaults
Output produced at 12:48 on 10/25/2017

$$$ DATA TYPE 1 (TITLES AND CONTROL CARDS) $$$

CARD TYPE       CONTROL TITLES

TITLE01         FORT WORTH, MARY'S CREEK
TITLE02         10/5/2017 SUMMER, 15 MGD Discharge @ 5/2/6
CNTROL03  YES   ECHO DATA INPUT             <Notice: Obsolete control card - line  3 ignored>
CNTROL04   NO   INTERMEDIATE SUMMARY        <Notice: Obsolete control card - line  4 ignored>
CNTROL05  YES   CAPSULE SUMMARY             <Notice: Obsolete control card - line  5 ignored>
CNTROL06  YES   LOADING SUMMARY             <Notice: Obsolete control card - line  6 ignored>
CNTROL07  YES   FINAL REPORT                <Notice: Obsolete control card - line  7 ignored>
CNTROL08   NO   LINE PRINTER PLOT           <Notice: Obsolete control card - line  8 ignored>
CNTROL09   NO   GRAPHICS CAPABILITY         <Notice: Obsolete control card - line  9 ignored>
CNTROL10  YES   METRIC UNITS
CNTROL11  YES   OXYGEN DEPENDENT RATES      <Notice: Obsolete control card - line 11 ignored>
CNTROL12   NO   SENSITIVITY ANALYSIS        <Notice: Obsolete control card - line 12 ignored>
CNTROL13  YES   SPECIAL REPORT              <Notice: Obsolete control card - line 13 ignored>
ENDATA01

$$$ DATA TYPE 2 (MODEL OPTIONS) $$$

CARD TYPE       MODEL OPTION

MODOPT01   NO   TEMPERATURE
MODOPT02   NO   SALINITY
MODOPT03   NO   CONSERVATIVE MATERIAL  I = CONDUCTIVITY (UMHOS/CM)
MODOPT04   NO   CONSERVATIVE MATERIAL II = CHLORIDE  (MG/L)
MODOPT05  YES   DISSOLVED OXYGEN
MODOPT06  YES   BIOCHEMICAL OXYGEN DEMAND
MODOPT07  YES   NITROGEN
MODOPT08   NO   PHOSPHORUS
MODOPT09   NO   CHLOROPHYLL A
MODOPT10   NO   MACROPHYTES
MODOPT11   NO   COLIFORM
MODOPT12   NO   NONCONSERVATIVE MATERIAL =
ENDATA02

$$$ DATA TYPE 3 (PROGRAM CONSTANTS) $$$

CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

PROGRAM         BOD OXYGEN UPTAKE RATE             =         2.30000 mg O/mg BOD
PROGRAM         MAXIMUM ITERATION LIMIT            =       500.00000
PROGRAM         K2 MAXIMUM                         =        10.00000 per day
PROGRAM         LOGICAL UNIT NUMBER FOR SEQUENCING =        33.00000
ENDATA03

$$$ DATA TYPE 4 (TEMPERATURE CORRECTION CONSTANTS FOR RATE COEFFICIENTS) $$$

 CARD TYPE     RATE CODE     THETA VALUE

ENDATA04

$$$ CONSTANTS TYPE 5 (TEMPERATURE DATA) $$$
```

```
CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

ENDATA05

$$$ DATA TYPE 6 (PHYTOPLANKTON CONSTANTS) $$$

CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

ENDATA06

$$$ DATA TYPE 7 (PERIPHYTON CONSTANTS) $$$

CARD TYPE       DESCRIPTION OF CONSTANT                        VALUE

ENDATA07

$$$ DATA TYPE 8 (REACH IDENTIFICATION DATA) $$$
```

CARD TYPE	REACH ID	NAME	BEGIN REACH km		END REACH km	ELEM LENGTH km	REACH LENGTH km	BEGIN REACH mi		END REACH mi	ELEM LENGTH mi	REACH LENGTH mi	ELEMS PER RCH	BEGIN ELEM NUM	END ELEM NUM
REACH ID	1	DAM 10 POND (1-1)	14.87	to	14.70	0.1690	0.17	9.24	to	9.14	0.1050	0.11	1	1	1
REACH ID	2	FREE (2-81)	14.70	to	11.84	0.0358	2.86	9.14	to	7.36	0.0222	1.78	80	2	81
REACH ID	3	DAM 9 POND (82-82)	11.84	to	11.13	0.7150	0.71	7.36	to	6.91	0.4444	0.44	1	82	82
REACH ID	4	FREE (83-90)	11.13	to	10.87	0.0325	0.26	6.91	to	6.75	0.0202	0.16	8	83	90
REACH ID	5	DAM 8 POND (91-91)	10.87	to	10.71	0.1580	0.16	6.75	to	6.66	0.0982	0.10	1	91	91
REACH ID	6	FREE(92-95)	10.71	to	10.52	0.0480	0.19	6.66	to	6.54	0.0298	0.12	4	92	95
REACH ID	7	DAM 7 POND (96-96)	10.52	to	9.87	0.6500	0.65	6.54	to	6.13	0.4040	0.40	1	96	96
REACH ID	8	DAM 6 POND (97-97)	9.87	to	9.54	0.3210	0.32	6.13	to	5.93	0.1995	0.20	1	97	97
REACH ID	9	DAM 5 POND (98-98)	9.54	to	9.23	0.3180	0.32	5.93	to	5.73	0.1976	0.20	1	98	98
REACH ID	10	DAM 4 POND (99-99)	9.23	to	8.65	0.5720	0.57	5.73	to	5.38	0.3555	0.36	1	99	99
REACH ID	11	FREE (100-103)	8.65	to	8.49	0.0405	0.16	5.38	to	5.28	0.0252	0.10	4	100	103
REACH ID	12	DAM 3 POND (104-104)	8.49	to	7.94	0.5540	0.55	5.28	to	4.93	0.3443	0.34	1	104	104
REACH ID	13	FREE (105-144)	7.94	to	6.43	0.0377	1.51	4.93	to	4.00	0.0234	0.94	40	105	144
REACH ID	14	POOL A (145-145)	6.43	to	6.26	0.1680	0.17	4.00	to	3.89	0.1044	0.10	1	145	145
REACH ID	15	FREE (146-146)	6.26	to	6.22	0.0460	0.05	3.89	to	3.86	0.0286	0.03	1	146	146
REACH ID	16	POOL B (147-147)	6.22	to	6.16	0.0540	0.05	3.86	to	3.83	0.0336	0.03	1	147	147
REACH ID	17	FREE (148-167)	6.16	to	5.35	0.0406	0.81	3.83	to	3.33	0.0253	0.51	20	148	167
REACH ID	18	DAM 2 POND (168-168)	5.35	to	5.07	0.2820	0.28	3.33	to	3.15	0.1753	0.18	1	168	168
REACH ID	19	FREE (169-188)	5.07	to	4.26	0.0403	0.81	3.15	to	2.65	0.0250	0.50	20	169	188
REACH ID	20	DAM 1 POND (189-189)	4.26	to	3.87	0.3960	0.40	2.65	to	2.40	0.2461	0.25	1	189	189
REACH ID	21	FREE (190-194)	3.87	to	3.61	0.0514	0.26	2.40	to	2.24	0.0319	0.16	5	190	194
REACH ID	22	POOL C (195-195)	3.61	to	3.33	0.2740	0.27	2.24	to	2.07	0.1703	0.17	1	195	195
REACH ID	23	FREE (196-215)	3.33	to	2.68	0.0327	0.65	2.07	to	1.67	0.0203	0.41	20	196	215
REACH ID	24	POOL D (216-216)	2.68	to	2.31	0.3680	0.37	1.67	to	1.44	0.2287	0.23	1	216	216
REACH ID	25	FREE (217-220)	2.31	to	2.14	0.0425	0.17	1.44	to	1.33	0.0264	0.11	4	217	220
REACH ID	26	POOL E (221-221)	2.14	to	1.94	0.2000	0.20	1.33	to	1.21	0.1243	0.12	1	221	221
REACH ID	27	FREE (222-223)	1.94	to	1.88	0.0330	0.07	1.21	to	1.17	0.0205	0.04	2	222	223
REACH ID	28	NATURAL DROP POND (224-224)	1.88	to	1.71	0.1670	0.17	1.17	to	1.06	0.1038	0.10	1	224	224
REACH ID	29	FREE (225-229)	1.71	to	1.47	0.0478	0.24	1.06	to	0.91	0.0297	0.15	5	225	229
REACH ID	30	POOL F (230-230)	1.47	to	1.31	0.1600	0.16	0.91	to	0.82	0.0994	0.10	1	230	230
REACH ID	31	FREE (231-250)	1.31	to	0.53	0.0393	0.79	0.82	to	0.33	0.0244	0.49	20	231	250
REACH ID	32	POOL G (251-251)	0.53	to	0.34	0.1920	0.19	0.33	to	0.21	0.1193	0.12	1	251	251
REACH ID	33	FREE (252-261)	0.34	to	0.00	0.0335	0.34	0.21	to	0.00	0.0208	0.21	10	252	261

```
ENDATA08

$$$ DATA TYPE 9 (ADVECTIVE HYDRAULIC COEFFICIENTS) $$$

CARD TYPE  REACH  ID       VELOCITY       VELOCITY          DEPTH          DEPTH          DEPTH        MANNINGS          EVAP
                              "a"            "b"            "d"            "e"            "f"            "n"
                           coeff.(m)      exp.of Q       coeff.(m)      exp.of Q       const.(m)                        cm/d
```

```
HYDR-1        1          0.06140000         1.0000         0.0000         0.0000         1.1030          0.035        0.00000
HYDR-1        2          0.59950000         0.2582         0.1626         0.3275         0.0000          0.035        0.00000
HYDR-1        3          0.06240000         1.0000         0.0000         0.0000         0.9670          0.035        0.00000
HYDR-1        4          0.60759997         0.2766         0.1507         0.4307         0.0000          0.035        0.00000
HYDR-1        5          0.07670000         1.0000         0.0000         0.0000         0.7930          0.035        0.00000
HYDR-1        6          0.64389998         0.2206         0.1888         0.2452         0.0000          0.035        0.00000
HYDR-1        7          0.07720000         1.0000         0.0000         0.0000         0.8910          0.035        0.00000
HYDR-1        8          0.05030000         1.0000         0.0000         0.0000         0.9600          0.035        0.00000
HYDR-1        9          0.05340000         1.0000         0.0000         0.0000         0.8040          0.035        0.00000
HYDR-1       10          0.03760000         1.0000         0.0000         0.0000         1.2410          0.035        0.00000
HYDR-1       11          0.48159999         0.3115         0.1239         0.2568         0.0000          0.035        0.00000
HYDR-1       12          0.06300000         1.0000         0.0000         0.0000         0.8200          0.035        0.00000
HYDR-1       13          0.57120001         0.2688         0.1868         0.4475         0.0000          0.035        0.00000
HYDR-1       14          0.18210000         1.0000         0.0000         0.0000         0.3600          0.035        0.00000
HYDR-1       15          0.76099998         0.2640         0.1242         0.1527         0.0000          0.035        0.00000
HYDR-1       16          0.37369999         1.0000         0.0000         0.0000         0.2050          0.035        0.00000
HYDR-1       17          0.52700001         0.2359         0.2139         0.1591         0.0000          0.035        0.00000
HYDR-1       18          0.14790000         1.0000         0.0000         0.0000         0.5450          0.035        0.00000
HYDR-1       19          0.62900001         0.2494         0.1949         0.2053         0.0000          0.035        0.00000
HYDR-1       20          0.07230000         1.0000         0.0000         0.0000         0.7530          0.035        0.00000
HYDR-1       21          0.85380000         0.2634         0.5106         0.1169         0.0000          0.035        0.00000
HYDR-1       22          0.27970001         1.0000         0.0000         0.0000         0.3720          0.035        0.00000
HYDR-1       23          0.58149999         0.2627         0.1390         0.4770         0.0000          0.035        0.00000
HYDR-1       24          0.10900000         1.0000         0.0000         0.0000         0.5940          0.035        0.00000
HYDR-1       25          0.68220001         0.2753         0.1030         0.3065         0.0000          0.035        0.00000
HYDR-1       26          0.11040000         1.0000         0.0000         0.0000         0.7510          0.035        0.00000
HYDR-1       27          0.94239998         0.1390         0.0666         0.2545         0.0000          0.035        0.00000
HYDR-1       28          0.14700000         1.0000         0.0000         0.0000         0.3990          0.035        0.00000
HYDR-1       29          0.38080001         0.2349         0.2383         0.1380         0.0000          0.035        0.00000
HYDR-1       30          0.31450000         1.0000         0.0000         0.0000         0.3900          0.035        0.00000
HYDR-1       31          0.50500000         0.2004         0.2591         0.2721         0.0000          0.035        0.00000
HYDR-1       32          0.18300000         1.0000         0.0000         0.0000         0.4410          0.035        0.00000
HYDR-1       33          0.35780001         0.2772         0.3594         0.0619         0.0000          0.035        0.00000
ENDATA09

$$$ DATA TYPE 10 (DISPERSIVE HYDRAULIC COEFFICIENTS) $$$

CARD TYPE  REACH  ID     TIDAL     DISPERSION     DISPERSION     DISPERSION     DISPERSION
                         RANGE        "a"            "b"            "c"            "d"
                       frac(0-1)  const.(m²/s)

HYDR-2        1           0.00        0.000          0.000          0.000          0.000
HYDR-2        2           0.00        0.000          0.000          0.000          0.000
HYDR-2        3           0.00        0.000          0.000          0.000          0.000
HYDR-2        4           0.00        0.000          0.000          0.000          0.000
HYDR-2        5           0.00        0.000          0.000          0.000          0.000
HYDR-2        6           0.00        0.000          0.000          0.000          0.000
HYDR-2        7           0.00        0.000          0.000          0.000          0.000
HYDR-2        8           0.00        0.000          0.000          0.000          0.000
HYDR-2        9           0.00        0.000          0.000          0.000          0.000
HYDR-2       10           0.00        0.000          0.000          0.000          0.000
HYDR-2       11           0.00        0.000          0.000          0.000          0.000
HYDR-2       12           0.00        0.000          0.000          0.000          0.000
HYDR-2       13           0.00        0.000          0.000          0.000          0.000
HYDR-2       14           0.00        0.000          0.000          0.000          0.000
HYDR-2       15           0.00        0.000          0.000          0.000          0.000
HYDR-2       16           0.00        0.000          0.000          0.000          0.000
HYDR-2       17           0.00        0.000          0.000          0.000          0.000
HYDR-2       18           0.00        0.000          0.000          0.000          0.000
HYDR-2       19           0.00        0.000          0.000          0.000          0.000
HYDR-2       20           0.00        0.000          0.000          0.000          0.000
HYDR-2       21           0.00        0.000          0.000          0.000          0.000
```

```
HYDR-2       22          0.00        0.000         0.000         0.000         0.000
HYDR-2       23          0.00        0.000         0.000         0.000         0.000
HYDR-2       24          0.00        0.000         0.000         0.000         0.000
HYDR-2       25          0.00        0.000         0.000         0.000         0.000
HYDR-2       26          0.00        0.000         0.000         0.000         0.000
HYDR-2       27          0.00        0.000         0.000         0.000         0.000
HYDR-2       28          0.00        0.000         0.000         0.000         0.000
HYDR-2       29          0.00        0.000         0.000         0.000         0.000
HYDR-2       30          0.00        0.000         0.000         0.000         0.000
HYDR-2       31          0.00        0.000         0.000         0.000         0.000
HYDR-2       32          0.00        0.000         0.000         0.000         0.000
HYDR-2       33          0.00        0.000         0.000         0.000         0.000
ENDATA10

$$$ DATA TYPE 11 (INITIAL CONDITIONS) $$$

CARD TYPE      REACH  ID     TEMP    SALIN       DO    NH3-N    NO3-N    PO4-P    CHL A    PERIP     BOD1     BOD2    ORG-N    ORG-P     COLI      NCM     CM-1     CM-2
                             deg C      ppt     mg/L     mg/L     mg/L     mg/L     µg/L     g/m²     mg/L     mg/L     mg/L     mg/L  #/100mL

INITIAL          1         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          2         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          3         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          4         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          5         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          6         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          7         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          8         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL          9         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         10         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         11         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         12         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         13         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         14         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         15         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         16         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         17         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         18         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         19         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         20         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         21         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         22         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         23         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         24         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         25         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         26         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         27         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         28         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         29         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         30         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         31         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         32         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
INITIAL         33         31.10     0.00     7.14     0.05     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
ENDATA11

$$$ DATA TYPE 12 (REAERATION, SEDIMENT OXYGEN DEMAND, BOD COEFFICIENTS) $$$
                                                                    AEROB                  SETTLD     ANAER     AEROB                          ANAER      BOD2
CARD     RCH  RCH  K2                      K2        K2        K2    BKGRND       BOD       BOD       SOD       BOD      BOD2      BOD2                BOD2   HYDR TO
TYPE     NUM   ID  OPT                    "a"       "b"       "c"       SOD     DECAY      SETT     AVAIL     DECAY     DECAY      SETT               DECAY      BOD1
                                                                     g/m²/d   per day       m/d      frac   per day   per day       m/d             per day   per day

COEF-1     1        1 K2=a             0.906     0.000     0.000     0.500     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
COEF-1     2       11 TEXAS            0.000     0.000     0.000     0.350     0.100     0.000     1.000     0.000     0.000     0.000               0.000     0.000
```

COEF-1	3	1	K2=a	1.034	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	4	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	5	1	K2=a	1.261	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	6	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	7	1	K2=a	1.123	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	8	1	K2=a	1.042	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	9	1	K2=a	1.243	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	10	1	K2=a	0.806	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	11	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	12	1	K2=a	1.219	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	13	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	14	1	K2=a	2.777	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	15	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	16	1	K2=a	4.888	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	17	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	18	1	K2=a	1.835	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	19	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	20	1	K2=a	1.329	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	21	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	22	1	K2=a	2.686	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	23	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	24	1	K2=a	1.683	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	25	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	26	1	K2=a	1.331	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	27	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	28	1	K2=a	2.508	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	29	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	30	1	K2=a	2.566	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	31	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	32	1	K2=a	2.270	0.000	0.000	0.500	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000
COEF-1	33	11	TEXAS	0.000	0.000	0.000	0.350	0.100	0.000	1.000	0.000	0.000	0.000	0.000	0.000

ENDATA12

$$$ DATA TYPE 13 (NITROGEN AND PHOSPHORUS COEFFICIENTS) $$$

CARD TYPE	REACH ID	ORG-N DECA per day	ORG-N SETT m/d	SETTLD ORGN AVAIL frac	NH3 DECA per day	BKGRND NH3 SRCE g/m²/d	BKGRND PO4 SRCE g/m²/d	DENIT RATE per day	ORGP DECA per day	ORGP SETT m/d	SETTLD ORGP AVAIL frac
COEF-2	1	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	2	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	3	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	4	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	5	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	6	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	7	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	8	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	9	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	10	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	11	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	12	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	13	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	14	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	15	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	16	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	17	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	18	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	19	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	20	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	21	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	22	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000
COEF-2	23	0.000	0.000	1.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000

```
COEF-2          24          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          25          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          26          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          27          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          28          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          29          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          30          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          31          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          32          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
COEF-2          33          0.000     0.000     1.000     0.300     0.000     0.000     0.000     0.000     0.000     0.000
ENDATA13

$$$ DATA TYPE 14 (ALGAE PHYTOPLANKTON AND PERIPHYTON COEFFICIENTS) $$$
                                                                  MAX                                   MAX
CARD TYPE      REACH  ID      SECCHI    CHL A:     PHYTO     PHYTO     PHYTO     PHYTO     PERIP     PERIP     PERIP      BANK
                              DEPTH     ALGAE      SETT     DEATH      GROW      RESP     DEATH      GROW      RESP   SHADING
                                  m      frac       m/d   per day   per day   per day   per day   per day   per day      frac

ENDATA14

$$$ DATA TYPE 15 (COLIFORM AND NONCONSERVATIVE COEFFICIENTS) $$$

CARD TYPE      REACH  ID    COLIFORM       NCM       NCM
                            DIE-OFF     DECAY      SETT
                            per day   per day       m/d

ENDATA15

$$$ DATA TYPE 16 (INCREMENTAL DATA FOR FLOW, TEMPERATURE, SALINITY, AND CONSERVATIVES) $$$

CARD TYPE      REACH  ID      OUTFLOW      OUTFLOW      INFLOW      INFLOW      TEMP     SALIN      CM-1      CM-2  OUT/DIST  OUT/DIST   IN/DIST   IN/DIST
                                m³/s         cfs         m³/s         cfs     deg C       ppt                          cms/km    cfs/mi    cms/km    cfs/mi

ENDATA16

$$$ DATA TYPE 17 (INCREMENTAL DATA FOR DO, BOD, AND NITROGEN) $$$

CARD TYPE      REACH  ID          DO      BOD1     ORG-N     NH3-N     NO3-N      BOD2
                              mg/L      mg/L      mg/L      mg/L      mg/L      mg/L

ENDATA17

$$$ DATA TYPE 18 (INCREMENTAL DATA FOR PHOSPHORUS, PHYTOPLANKTON, COLIFORM, AND NONCONSERVATIVES) $$$
                                     PHYTO
 CARD TYPE      REACH  ID        PO4     CHL A      COLI       NCM      ORGP
                              mg/L      µg/L   #/100mL                mg/L

ENDATA18

$$$ DATA TYPE 19 (NONPOINT SOURCE DATA) $$$

CARD TYPE      REACH  ID        BOD1     ORG-N      COLI       NCM        DO      BOD2     ORG-P       NH3       NO3       PO4
                              kg/d      kg/d     #/day                kg/d      kg/d      kg/d      kg/d      kg/d      kg/d

ENDATA19

$$$ DATA TYPE 20 (HEADWATER FOR FLOW, TEMPERATURE, SALINITY AND CONSERVATIVES) $$$
                                                                                                                  HDW DISP
CARD TYPE     ELEMENT   NAME                  UNIT     FLOW       FLOW    TEMP    SALIN      CM-1      CM-2     EXCHG
                                                        m³/s        cfs   deg C      ppt                          frac

HDWTR-1           1     HEADWATER               0   0.00283    0.09994   31.10     0.00     0.000     0.000     0.000
```

```
ENDATA20

$$$ DATA TYPE 21 (HEADWATER DATA FOR DO, BOD, AND NITROGEN) $$$

CARD TYPE     ELEMENT   NAME                        DO      BOD1     ORG-N     NH3-N     NO3-N      BOD2
                                                   mg/L      mg/L      mg/L      mg/L      mg/L      mg/L

HDWTR-2           1     HEADWATER                 7.14      1.30      0.00      0.05      0.00      0.00
ENDATA21

$$$ DATA TYPE 22 (HEADWATER DATA FOR PHOSPHORUS, PHYTOPLANKTON, COLIFORM, AND NONCONSERVATIVES) $$$
                                                                PHYTO
CARD TYPE     ELEMENT   NAME                     PO4-P     CHL A      COLI       NCM     ORG-P
                                                  mg/L      µg/L   #/100mL                mg/L

ENDATA22

$$$ DATA TYPE 23 (JUNCTION DATA) $$$

CARD TYPE   JUNCTION   UPSTRM     RIVER     NAME
             ELEMENT  ELEMENT     KILOM

ENDATA23

$$$ DATA TYPE 24 (WASTELOAD DATA FOR FLOW, TEMPERATURE, SALINITY, AND CONSERVATIVES) $$$

CARD TYPE  ELEMENT    RKILO  NAME                    FLOW       FLOW     FLOW    TEMP    SALIN      CM-1      CM-2
                                                     m³/s        cfs      MGD   deg C      ppt

WSTLD-1       44      13.20  MCWWTP DSCH           0.65720   23.20867   15.000   31.10     0.00     0.000     0.000
ENDATA24

$$$ DATA TYPE 25 (WASTELOAD DATA FOR DO, BOD, AND NITROGEN) $$$

CARD TYPE     ELEMENT   NAME                        DO      BOD1     % BOD     ORG-N     NH3-N       %       NO3-N      BOD2
                                                   mg/L      mg/L      RMVL      mg/L      mg/L    NITRIF      mg/L      mg/L

WSTLD-2          44     MCWWTP DSCH                6.00      5.00      0.00      0.00      2.00      0.00      0.00      0.00
ENDATA25

$$$ DATA TYPE 26 (WASTELOAD DATA FOR PHOSPHORUS, PHYTOPLANTON, COLIFORM, AND NONCONSERVATIVES) $$$
                                                                PHYTO
CARD TYPE     ELEMENT   NAME                     PO4-P     CHL A      COLI       NCM     ORG-P
                                                  mg/L      µg/L   #/100mL                mg/L

ENDATA26

$$$ DATA TYPE 27 (LOWER BOUNDARY CONDITIONS) $$$

CARD TYPE    CONSTITUENT                    CONCENTRATION

LOWER BC     TEMPERATURE                       =     31.100     deg C
LOWER BC     SALINITY                          =      0.000     ppt
LOWER BC     CONSERVATIVE MATERIAL I           =      0.000
LOWER BC     CONSERVATIVE MATERIAL II          =      0.000
LOWER BC     DISSOLVED OXYGEN                  =      7.140     mg/L
LOWER BC     BIOCHEMICAL OXYGEN DEMAND         =      1.300     mg/L
LOWER BC     ORGANIC NITROGEN                  =      0.000     mg/L
LOWER BC     AMMONIA NITROGEN                  =      0.050     mg/L
LOWER BC     NITRATE + NITRITE NITROGEN        =      0.000     mg/L
LOWER BC     PHOSPHORUS                        =      0.000     mg/L
LOWER BC     CHLOROPHYLL A                     =      0.000     µg/L
```

```
LOWER BC     COLIFORM                          =      0.000     #/100 mL
LOWER BC     NONCONSERVATIVE MATERIAL          =      0.000
ENDATA27

$$$ DATA TYPE 28 (DAM DATA) $$$

CARD TYPE     ELEMENT   DAM NAME              DAM REAERATION EQUATION       "a"       "b"       "H"

                 83     Dam 9                1 BUTTS-EVANS (1983)        1.000     0.600     1.940
                 92     Dam 8                1 BUTTS-EVANS (1983)        1.000     0.140     1.120
                 97     Dam 7                1 BUTTS-EVANS (1983)        1.000     0.800     1.040
                 98     Dam 6                1 BUTTS-EVANS (1983)        1.000     0.800     1.630
                 99     Dam 5                1 BUTTS-EVANS (1983)        1.000     0.800     1.550
                100     Dam 4                1 BUTTS-EVANS (1983)        1.000     0.800     2.290
                105     Dam 3                1 BUTTS-EVANS (1983)        1.000     0.750     1.970
                169     Dam 2                1 BUTTS-EVANS (1983)        1.000     0.900     0.890
                190     Dam 1                1 BUTTS-EVANS (1983)        1.000     0.800     2.270
ENDATA28

$$$ DATA TYPE 29 (SENSITIVITY ANALYSIS DATA) $$$

CARD TYPE       PARAMETER     COL 1     COL 2     COL 3     COL 4     COL 5     COL 6     COL 7     COL 8

ENDATA29

$$$ DATA TYPE 30 (PLOT CONTROL CARDS) $$$

ENDATA30

$$$ DATA TYPE 31 (OVERLAY PLOT DATA) $$$

ENDATA31


CONCENTRATION ADJUSTMENTS RESULTING FROM USING EFFECTIVE CONCENTRATIONS

  ELEM  HEADWATER NAME           CHL A  EBOD1   BOD1  EBOD2   BOD2  EORGN   ORGN  EORGP   ORGP

     1  HEADWATER                  0.0   1.30   1.30   0.00   0.00   0.00   0.00   0.00   0.00
   LBC                              0.0   1.30   1.30   0.00   0.00   0.00   0.00   0.00   0.00



     .....NO FATAL ERRORS DETECTED IN INPUT DATA
     .....MODEL CONTAINS   1 HEADWATERS,  33 REACHES,  261 ELEMENTS, AND   1 WASTELOADS
     .....HYDRAULIC CALCULATIONS COMPLETED
     .....TRIDIAGONAL MATRIX TERMS INITIALIZED
     .....OXYGEN DEPENDENT RATES CONVERGENT IN    8 ITERATIONS
     .....CONSTITUENT CALCULATIONS COMPLETED
     .....CONCENTRATIONS IN LAST ELEMENT WRITTEN TO UNIT 33
_
CAPSULE SUMMARY FOR HEADWATER
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                
```

6	2	14.522	0.003	0.100	31.10	0.0	6.12	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
7	2	14.486	0.003	0.100	31.10	0.0	6.07	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
8	2	14.451	0.003	0.100	31.10	0.0	6.02	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
9	2	14.415	0.003	0.100	31.10	0.0	5.97	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
10	2	14.379	0.003	0.100	31.10	0.0	5.93	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
11	2	14.343	0.003	0.100	31.10	0.0	5.88	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
12	2	14.308	0.003	0.100	31.10	0.0	5.84	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
13	2	14.272	0.003	0.100	31.10	0.0	5.80	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
14	2	14.236	0.003	0.100	31.10	0.0	5.76	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
15	2	14.200	0.003	0.100	31.10	0.0	5.72	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
16	2	14.165	0.003	0.100	31.10	0.0	5.69	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
17	2	14.129	0.003	0.100	31.10	0.0	5.65	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
18	2	14.093	0.003	0.100	31.10	0.0	5.62	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.69	0.77
19	2	14.057	0.003	0.100	31.10	0.0	5.59	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
20	2	14.022	0.003	0.100	31.10	0.0	5.56	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
21	2	13.986	0.003	0.100	31.10	0.0	5.53	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
22	2	13.950	0.003	0.100	31.10	0.0	5.50	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
23	2	13.914	0.003	0.100	31.10	0.0	5.47	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
24	2	13.879	0.003	0.100	31.10	0.0	5.44	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
25	2	13.843	0.003	0.100	31.10	0.0	5.42	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
26	2	13.807	0.003	0.100	31.10	0.0	5.39	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
27	2	13.771	0.003	0.100	31.10	0.0	5.37	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
28	2	13.736	0.003	0.100	31.10	0.0	5.35	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
29	2	13.700	0.003	0.100	31.10	0.0	5.33	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
30	2	13.664	0.003	0.100	31.10	0.0	5.30	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
31	2	13.628	0.003	0.100	31.10	0.0	5.28	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
32	2	13.593	0.003	0.100	31.10	0.0	5.26	0.45	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
33	2	13.557	0.003	0.100	31.10	0.0	5.24	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.68	0.77
34	2	13.521	0.003	0.100	31.10	0.0	5.23	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
35	2	13.485	0.003	0.100	31.10	0.0	5.21	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
36	2	13.450	0.003	0.100	31.10	0.0	5.19	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
37	2	13.414	0.003	0.100	31.10	0.0	5.18	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
38	2	13.378	0.003	0.100	31.10	0.0	5.16	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
39	2	13.342	0.003	0.100	31.10	0.0	5.14	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
40	2	13.307	0.003	0.100	31.10	0.0	5.13	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
41	2	13.271	0.003	0.100	31.10	0.0	5.12	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
42	2	13.235	0.003	0.100	31.10	0.0	5.10	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
43	2	13.199	0.003	0.100	31.10	0.0	5.09	0.44	0.00	0.00	0.01	0.04	0.05	0.00	0.00	0.0	0.0	0.02	0.9	0.131777	0.131777	7.417	12.259	0.17	0.00	0.00	0.00	0.67	0.77
WASTELOAD # 044 (MCWWTP DSCH) ENTERS HERE																														
44	2	13.164	0.660	23.309	31.10	0.0	6.00	4.98	0.00	0.00	1.99	0.00	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
45	2	13.128	0.660	23.309	31.10	0.0	6.00	4.98	0.00	0.00	1.99	0.00	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
46	2	13.092	0.660	23.309	31.10	0.0	6.00	4.98	0.00	0.00	1.99	0.00	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
47	2	13.056	0.660	23.309	31.10	0.0	6.00	4.98	0.00	0.00	1.99	0.00	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
48	2	13.021	0.660	23.309	31.10	0.0	6.01	4.98	0.00	0.00	1.99	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
49	2	12.985	0.660	23.309	31.10	0.0	6.01	4.98	0.00	0.00	1.99	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
50	2	12.949	0.660	23.309	31.10	0.0	6.01	4.98	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
51	2	12.913	0.660	23.309	31.10	0.0	6.01	4.98	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
52	2	12.878	0.660	23.309	31.10	0.0	6.02	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
53	2	12.842	0.660	23.309	31.10	0.0	6.02	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
54	2	12.806	0.660	23.309	31.10	0.0	6.02	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
55	2	12.770	0.660	23.309	31.10	0.0	6.02	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
56	2	12.735	0.660	23.309	31.10	0.0	6.02	4.97	0.00	0.00	1.98	0.01	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
57	2	12.699	0.660	23.309	31.10	0.0	6.03	4.97	0.00	0.00	1.98	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
58	2	12.663	0.660	23.309	31.10	0.0	6.03	4.97	0.00	0.00	1.98	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
59	2	12.627	0.660	23.309	31.10	0.0	6.03	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
60	2	12.592	0.660	23.309	31.10	0.0	6.03	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
61	2	12.556	0.660	23.309	31.10	0.0	6.03	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
62	2	12.520	0.660	23.309	31.10	0.0	6.03	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
63	2	12.484	0.660	23.309	31.10	0.0	6.04	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
64	2	12.449	0.660	23.309	31.10	0.0	6.04	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
65	2	12.413	0.660	23.309	31.10	0.0	6.04	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
66	2	12.377	0.660	23.309	31.10	0.0	6.04	4.97	0.00	0.00	1.97	0.02	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
67	2	12.341	0.660	23.309	31.10	0.0	6.04	4.97	0.00	0.00	1.97	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
68	2	12.306	0.660	23.309	31.10	0.0	6.05	4.96	0.00	0.00	1.97	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
69	2	12.270	0.660	23.309	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
70	2	12.234	0.660	23.309	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.69	0.77
71	2	12.198	0.660	23.309	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
72	2	12.163	0.660	23.309	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77

CAPSULE SUMMARY FOR HEADWATER

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
73	2	12.127	0.660	23.309	31.10	0.0	6.05	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
74	2	12.091	0.660	23.309	31.10	0.0	6.06	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
75	2	12.055	0.660	23.309	31.10	0.0	6.06	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
76	2	12.020	0.660	23.309	31.10	0.0	6.06	4.96	0.00	0.00	1.96	0.03	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
77	2	11.984	0.660	23.309	31.10	0.0	6.06	4.96	0.00	0.00	1.96	0.04	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
78	2	11.948	0.660	23.309	31.10	0.0	6.06	4.96	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
79	2	11.912	0.660	23.309	31.10	0.0	6.07	4.96	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
80	2	11.877	0.660	23.309	31.10	0.0	6.07	4.96	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
81	2	11.841	0.660	23.309	31.10	0.0	6.07	4.96	0.00	0.00	1.95	0.04	1.99	0.00	0.00	0.0	0.0	0.14	8.6	0.538518	0.538518	7.417	11.406	0.17	0.00	0.00	0.00	0.70	0.77
82	3	11.126	0.660	23.309	31.10	0.0	5.07	4.80	0.00	0.00	1.72	0.27	1.99	0.00	0.00	0.0	0.0	0.97	16.6	0.041186	0.041186	7.417	1.268	0.17	0.00	0.00	0.00	0.67	1.10
DAM # 083 (Dam 9) IS LOCATED HERE RAISING DO BY 1.08 MG/L																													
83	4	11.094	0.660	23.309	31.10	0.0	6.14	4.80	0.00	0.00	1.72	0.27	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
84	4	11.061	0.660	23.309	31.10	0.0	6.15	4.79	0.00	0.00	1.72	0.27	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
85	4	11.028	0.660	23.309	31.10	0.0	6.15	4.79	0.00	0.00	1.72	0.27	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
86	4	10.996	0.660	23.309	31.10	0.0	6.15	4.79	0.00	0.00	1.72	0.28	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
87	4	10.963	0.660	23.309	31.10	0.0	6.15	4.79	0.00	0.00	1.72	0.28	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
88	4	10.931	0.660	23.309	31.10	0.0	6.15	4.79	0.00	0.00	1.71	0.28	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
89	4	10.898	0.660	23.309	31.10	0.0	6.15	4.79	0.00	0.00	1.71	0.28	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
90	4	10.866	0.660	23.309	31.10	0.0	6.16	4.79	0.00	0.00	1.71	0.28	1.99	0.00	0.00	0.0	0.0	0.13	9.7	0.541638	0.541638	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
91	5	10.708	0.660	23.309	31.10	0.0	5.94	4.76	0.00	0.00	1.67	0.32	1.99	0.00	0.00	0.0	0.0	0.79	16.4	0.050624	0.050624	7.417	1.546	0.17	0.00	0.00	0.00	0.69	1.10
DAM # 092 (Dam 8) IS LOCATED HERE RAISING DO BY 0.17 MG/L																													
92	6	10.660	0.660	23.309	31.10	0.0	6.11	4.76	0.00	0.00	1.67	0.32	1.99	0.00	0.00	0.0	0.0	0.17	6.6	0.587508	0.587508	7.417	9.912	0.17	0.00	0.00	0.00	0.70	0.77
93	6	10.612	0.660	23.309	31.10	0.0	6.11	4.76	0.00	0.00	1.67	0.32	1.99	0.00	0.00	0.0	0.0	0.17	6.6	0.587508	0.587508	7.417	9.912	0.17	0.00	0.00	0.00	0.70	0.77
94	6	10.564	0.660	23.309	31.10	0.0	6.11	4.76	0.00	0.00	1.67	0.32	1.99	0.00	0.00	0.0	0.0	0.17	6.6	0.587508	0.587508	7.417	9.912	0.17	0.00	0.00	0.00	0.70	0.77
95	6	10.516	0.660	23.309	31.10	0.0	6.11	4.76	0.00	0.00	1.67	0.32	1.99	0.00	0.00	0.0	0.0	0.17	6.6	0.587508	0.587508	7.417	9.912	0.17	0.00	0.00	0.00	0.70	0.77
96	7	9.866	0.660	23.309	31.10	0.0	5.42	4.65	0.00	0.00	1.51	0.48	1.99	0.00	0.00	0.0	0.0	0.89	14.5	0.050954	0.050954	7.417	1.377	0.17	0.00	0.00	0.00	0.68	1.10
DAM # 097 (Dam 7) IS LOCATED HERE RAISING DO BY 0.81 MG/L																													
97	8	9.545	0.660	23.309	31.10	0.0	5.68	4.56	0.00	0.00	1.41	0.59	1.99	0.00	0.00	0.0	0.0	0.96	20.7	0.033200	0.033200	7.417	1.277	0.17	0.00	0.00	0.00	0.69	1.10
DAM # 098 (Dam 6) IS LOCATED HERE RAISING DO BY 0.86 MG/L																													
98	9	9.227	0.660	23.309	31.10	0.0	6.03	4.48	0.00	0.00	1.31	0.68	1.99	0.00	0.00	0.0	0.0	0.80	23.3	0.035246	0.035246	7.417	1.524	0.17	0.00	0.00	0.00	0.69	1.10
DAM # 099 (Dam 5) IS LOCATED HERE RAISING DO BY 0.68 MG/L																													
99	10	8.655	0.660	23.309	31.10	0.0	5.62	4.29	0.00	0.00	1.11	0.88	1.99	0.00	0.00	0.0	0.0	1.24	21.4	0.024817	0.024817	7.417	0.988	0.17	0.00	0.00	0.00	0.69	1.10
DAM # 100 (Dam 4) IS LOCATED HERE RAISING DO BY 1.00 MG/L																													
100	11	8.615	0.660	23.309	31.10	0.0	6.62	4.29	0.00	0.00	1.11	0.88	1.99	0.00	0.00	0.0	0.0	0.11	14.0	0.423137	0.423137	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
101	11	8.574	0.660	23.309	31.10	0.0	6.62	4.29	0.00	0.00	1.11	0.88	1.99	0.00	0.00	0.0	0.0	0.11	14.0	0.423137	0.423137	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
102	11	8.534	0.660	23.309	31.10	0.0	6.62	4.29	0.00	0.00	1.11	0.89	1.99	0.00	0.00	0.0	0.0	0.11	14.0	0.423137	0.423137	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
103	11	8.493	0.660	23.309	31.10	0.0	6.62	4.29	0.00	0.00	1.11	0.89	1.99	0.00	0.00	0.0	0.0	0.11	14.0	0.423137	0.423137	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
104	12	7.939	0.660	23.309	31.10	0.0	6.02	4.18	0.00	0.00	1.00	0.99	1.99	0.00	0.00	0.0	0.0	0.82	19.4	0.041582	0.041582	7.417	1.494	0.17	0.00	0.00	0.00	0.69	1.10
DAM # 105 (Dam 3) IS LOCATED HERE RAISING DO BY 0.72 MG/L																													
105	13	7.901	0.660	23.309	31.10	0.0	6.74	4.18	0.00	0.00	1.00	0.99	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
106	13	7.864	0.660	23.309	31.10	0.0	6.74	4.18	0.00	0.00	1.00	0.99	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
107	13	7.826	0.660	23.309	31.10	0.0	6.74	4.18	0.00	0.00	1.00	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
108	13	7.788	0.660	23.309	31.10	0.0	6.73	4.18	0.00	0.00	1.00	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
109	13	7.750	0.660	23.309	31.10	0.0	6.73	4.18	0.00	0.00	1.00	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
110	13	7.713	0.660	23.309	31.10	0.0	6.73	4.18	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
111	13	7.675	0.660	23.309	31.10	0.0	6.73	4.18	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
112	13	7.637	0.660	23.309	31.10	0.0	6.72	4.18	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
113	13	7.600	0.660	23.309	31.10	0.0	6.72	4.18	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
114	13	7.562	0.660	23.309	31.10	0.0	6.72	4.18	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
115	13	7.524	0.660	23.309	31.10	0.0	6.72	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77

116	13	7.487	0.660	23.309	31.10	0.0	6.72	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
117	13	7.449	0.660	23.309	31.10	0.0	6.71	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
118	13	7.411	0.660	23.309	31.10	0.0	6.71	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
119	13	7.373	0.660	23.309	31.10	0.0	6.71	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
120	13	7.336	0.660	23.309	31.10	0.0	6.71	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
121	13	7.298	0.660	23.309	31.10	0.0	6.71	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
122	13	7.260	0.660	23.309	31.10	0.0	6.70	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
123	13	7.223	0.660	23.309	31.10	0.0	6.70	4.17	0.00	0.00	0.99	1.00	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
124	13	7.185	0.660	23.309	31.10	0.0	6.70	4.17	0.00	0.00	0.99	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
125	13	7.147	0.660	23.309	31.10	0.0	6.70	4.17	0.00	0.00	0.99	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
126	13	7.110	0.660	23.309	31.10	0.0	6.70	4.17	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
127	13	7.072	0.660	23.309	31.10	0.0	6.70	4.17	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
128	13	7.034	0.660	23.309	31.10	0.0	6.69	4.17	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
129	13	6.996	0.660	23.309	31.10	0.0	6.69	4.17	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
130	13	6.959	0.660	23.309	31.10	0.0	6.69	4.17	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
131	13	6.921	0.660	23.309	31.10	0.0	6.69	4.17	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
132	13	6.883	0.660	23.309	31.10	0.0	6.69	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
133	13	6.846	0.660	23.309	31.10	0.0	6.69	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
134	13	6.808	0.660	23.309	31.10	0.0	6.68	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
135	13	6.770	0.660	23.309	31.10	0.0	6.68	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
136	13	6.733	0.660	23.309	31.10	0.0	6.68	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
137	13	6.695	0.660	23.309	31.10	0.0	6.68	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
138	13	6.657	0.660	23.309	31.10	0.0	6.68	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
139	13	6.619	0.660	23.309	31.10	0.0	6.68	4.16	0.00	0.00	0.98	1.01	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
140	13	6.582	0.660	23.309	31.10	0.0	6.67	4.16	0.00	0.00	0.98	1.02	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
141	13	6.544	0.660	23.309	31.10	0.0	6.67	4.16	0.00	0.00	0.98	1.02	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
142	13	6.506	0.660	23.309	31.10	0.0	6.67	4.16	0.00	0.00	0.98	1.02	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
143	13	6.469	0.660	23.309	31.10	0.0	6.67	4.16	0.00	0.00	0.97	1.02	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
144	13	6.431	0.660	23.309	31.10	0.0	6.67	4.16	0.00	0.00	0.97	1.02	1.99	0.00	0.00	0.0	0.0	0.16	8.3	0.510842	0.510842	7.417	10.384	0.17	0.00	0.00	0.00	0.71	0.77
145	14	6.263	0.660	23.309	31.10	0.0	6.59	4.15	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.36	15.3	0.120191	0.120191	7.417	3.404	0.17	0.00	0.00	0.00	0.71	1.10
146	15	6.217	0.660	23.309	31.10	0.0	6.59	4.15	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.12	8.3	0.681945	0.681945	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77

CAPSULE SUMMARY FOR HEADWATER

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
147	16	6.163	0.660	23.309	31.10	0.0	6.58	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	13.1	0.246653	0.246653	7.417	5.992	0.17	0.00	0.00	0.00	0.71	1.10
148	17	6.122	0.660	23.309	31.10	0.0	6.58	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
149	17	6.082	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
150	17	6.041	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
151	17	6.000	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
152	17	5.960	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
153	17	5.919	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.03	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
154	17	5.878	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
155	17	5.838	0.660	23.309	31.10	0.0	6.57	4.14	0.00	0.00	0.96	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
156	17	5.797	0.660	23.309	31.10	0.0	6.56	4.14	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
157	17	5.757	0.660	23.309	31.10	0.0	6.56	4.14	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
158	17	5.716	0.660	23.309	31.10	0.0	6.56	4.14	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
159	17	5.675	0.660	23.309	31.10	0.0	6.56	4.14	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
160	17	5.635	0.660	23.309	31.10	0.0	6.56	4.14	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
161	17	5.594	0.660	23.309	31.10	0.0	6.56	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
162	17	5.553	0.660	23.309	31.10	0.0	6.56	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
163	17	5.513	0.660	23.309	31.10	0.0	6.55	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
164	17	5.472	0.660	23.309	31.10	0.0	6.55	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
165	17	5.431	0.660	23.309	31.10	0.0	6.55	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
166	17	5.391	0.660	23.309	31.10	0.0	6.55	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
167	17	5.350	0.660	23.309	31.10	0.0	6.55	4.13	0.00	0.00	0.95	1.04	1.99	0.00	0.00	0.0	0.0	0.20	6.9	0.477800	0.477800	7.417	8.115	0.17	0.00	0.00	0.00	0.71	0.77
168	18	5.068	0.660	23.309	31.10	0.0	6.41	4.11	0.00	0.00	0.93	1.07	1.99	0.00	0.00	0.0	0.0	0.55	12.4	0.097618	0.097618	7.417	2.249	0.17	0.00	0.00	0.00	0.70	1.10
	DAM # 169 (Dam 2) IS LOCATED HERE RAISING DO BY 0.40 MG/L																												
169	19	5.028	0.660	23.309	31.10	0.0	6.81	4.11	0.00	0.00	0.93	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
170	19	4.987	0.660	23.309	31.10	0.0	6.81	4.11	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77

171	19	4.947	0.660	23.309	31.10	0.0	6.81	4.11	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
172	19	4.907	0.660	23.309	31.10	0.0	6.80	4.11	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
173	19	4.867	0.660	23.309	31.10	0.0	6.80	4.11	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
174	19	4.826	0.660	23.309	31.10	0.0	6.80	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
175	19	4.786	0.660	23.309	31.10	0.0	6.80	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
176	19	4.746	0.660	23.309	31.10	0.0	6.79	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
177	19	4.705	0.660	23.309	31.10	0.0	6.79	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
178	19	4.665	0.660	23.309	31.10	0.0	6.79	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
179	19	4.625	0.660	23.309	31.10	0.0	6.79	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
180	19	4.584	0.660	23.309	31.10	0.0	6.78	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
181	19	4.544	0.660	23.309	31.10	0.0	6.78	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
182	19	4.504	0.660	23.309	31.10	0.0	6.78	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
183	19	4.464	0.660	23.309	31.10	0.0	6.78	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
184	19	4.423	0.660	23.309	31.10	0.0	6.78	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
185	19	4.383	0.660	23.309	31.10	0.0	6.77	4.10	0.00	0.00	0.92	1.07	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
186	19	4.343	0.660	23.309	31.10	0.0	6.77	4.10	0.00	0.00	0.92	1.08	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
187	19	4.302	0.660	23.309	31.10	0.0	6.77	4.10	0.00	0.00	0.92	1.08	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
188	19	4.262	0.660	23.309	31.10	0.0	6.77	4.10	0.00	0.00	0.92	1.08	1.99	0.00	0.00	0.0	0.0	0.18	6.5	0.567087	0.567087	7.417	9.401	0.17	0.00	0.00	0.00	0.71	0.77
189	20	3.866	0.660	23.309	31.10	0.0	6.39	4.03	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	0.75	18.4	0.047720	0.047720	7.417	1.629	0.17	0.00	0.00	0.00	0.70	1.10
DAM # 190 (Dam 1) IS LOCATED HERE RAISING DO BY 0.57 MG/L																														
190	21	3.815	0.660	23.309	31.10	0.0	6.96	4.03	0.00	0.00	0.86	1.13	1.99	0.00	0.00	0.0	0.0	0.49	1.8	0.765296	0.765296	7.417	4.174	0.17	0.00	0.00	0.00	0.71	0.77
191	21	3.763	0.660	23.309	31.10	0.0	6.96	4.03	0.00	0.00	0.86	1.14	1.99	0.00	0.00	0.0	0.0	0.49	1.8	0.765296	0.765296	7.417	4.174	0.17	0.00	0.00	0.00	0.71	0.77
192	21	3.712	0.660	23.309	31.10	0.0	6.95	4.03	0.00	0.00	0.86	1.14	1.99	0.00	0.00	0.0	0.0	0.49	1.8	0.765296	0.765296	7.417	4.174	0.17	0.00	0.00	0.00	0.71	0.77
193	21	3.660	0.660	23.309	31.10	0.0	6.95	4.03	0.00	0.00	0.86	1.14	1.99	0.00	0.00	0.0	0.0	0.49	1.8	0.765296	0.765296	7.417	4.174	0.17	0.00	0.00	0.00	0.71	0.77
194	21	3.609	0.660	23.309	31.10	0.0	6.95	4.03	0.00	0.00	0.85	1.14	1.99	0.00	0.00	0.0	0.0	0.49	1.8	0.765296	0.765296	7.417	4.174	0.17	0.00	0.00	0.00	0.71	0.77
195	22	3.335	0.660	23.309	31.10	0.0	6.86	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.37	9.6	0.184610	0.184610	7.417	3.293	0.17	0.00	0.00	0.00	0.71	1.10
196	23	3.302	0.660	23.309	31.10	0.0	6.85	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
197	23	3.270	0.660	23.309	31.10	0.0	6.85	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
198	23	3.237	0.660	23.309	31.10	0.0	6.85	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
199	23	3.204	0.660	23.309	31.10	0.0	6.84	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
200	23	3.172	0.660	23.309	31.10	0.0	6.84	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
201	23	3.139	0.660	23.309	31.10	0.0	6.84	4.02	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
202	23	3.106	0.660	23.309	31.10	0.0	6.84	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
203	23	3.074	0.660	23.309	31.10	0.0	6.83	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
204	23	3.041	0.660	23.309	31.10	0.0	6.83	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
205	23	3.009	0.660	23.309	31.10	0.0	6.83	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
206	23	2.976	0.660	23.309	31.10	0.0	6.83	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
207	23	2.943	0.660	23.309	31.10	0.0	6.82	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
208	23	2.911	0.660	23.309	31.10	0.0	6.82	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
209	23	2.878	0.660	23.309	31.10	0.0	6.82	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
210	23	2.845	0.660	23.309	31.10	0.0	6.82	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
211	23	2.813	0.660	23.309	31.10	0.0	6.81	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
212	23	2.780	0.660	23.309	31.10	0.0	6.81	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
213	23	2.747	0.660	23.309	31.10	0.0	6.81	4.01	0.00	0.00	0.84	1.15	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
214	23	2.715	0.660	23.309	31.10	0.0	6.81	4.01	0.00	0.00	0.84	1.16	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
215	23	2.682	0.660	23.309	31.10	0.0	6.80	4.01	0.00	0.00	0.84	1.16	1.99	0.00	0.00	0.0	0.0	0.11	11.1	0.521374	0.521374	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
216	24	2.314	0.660	23.309	31.10	0.0	6.56	3.97	0.00	0.00	0.80	1.19	1.99	0.00	0.00	0.0	0.0	0.59	15.4	0.071943	0.071943	7.417	2.063	0.17	0.00	0.00	0.00	0.71	1.10
217	25	2.271	0.660	23.309	31.10	0.0	6.56	3.97	0.00	0.00	0.80	1.19	1.99	0.00	0.00	0.0	0.0	0.09	12.0	0.608468	0.608468	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
218	25	2.229	0.660	23.309	31.10	0.0	6.56	3.97	0.00	0.00	0.80	1.19	1.99	0.00	0.00	0.0	0.0	0.09	12.0	0.608468	0.608468	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
219	25	2.186	0.660	23.309	31.10	0.0	6.56	3.97	0.00	0.00	0.80	1.19	1.99	0.00	0.00	0.0	0.0	0.09	12.0	0.608468	0.608468	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77
220	25	2.144	0.660	23.309	31.10	0.0	6.56	3.97	0.00	0.00	0.80	1.19	1.99	0.00	0.00	0.0	0.0	0.09	12.0	0.608468	0.608468	7.417	12.259	0.17	0.00	0.00	0.00	0.71	0.77

CAPSULE SUMMARY FOR HEADWATER

IOR	REACH	DIST km	FLOW m³/s	FLOW cfs	TEMP deg C	SALN ppt	DO mg/L	BOD1 mg/L	BOD2 mg/L	ORG-N mg/L	NH3-N mg/L	NO3-N mg/L	TOT-N mg/L	ORG-P mg/L	PO4-P mg/L	CHLA µg/L	DISP m²/s	DEPTH m	WIDTH m	ADVEC VELO m/s	MEAN VELO m/s	DO SAT mg/L	REAER RATE 1/da	BOD1 DECA 1/da	BOD1 SETT 1/da	BOD2 DECA 1/da	BOD2 SETT 1/da	NH3 DECA 1/da	SOD g/m²/d
221	26	1.944	0.660	23.309	31.10	0.0	6.44	3.95	0.00	0.00	0.78	1.21	1.99	0.00	0.00	0.0	0.0	0.75	12.1	0.072867	0.072867	7.417	1.632	0.17	0.00	0.00	0.00	0.70	1.10
222	27	1.911	0.660	23.309	31.10	0.0	6.43	3.95	0.00	0.00	0.78	1.21	1.99	0.00	0.00	0.0	0.0	0.06	12.4	0.889518	0.889518	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
223	27	1.878	0.660	23.309	31.10	0.0	6.43	3.95	0.00	0.00	0.78	1.21	1.99	0.00	0.00	0.0	0.0	0.06	12.4	0.889518	0.889518	7.417	12.259	0.17	0.00	0.00	0.00	0.70	0.77
224	28	1.711	0.660	23.309	31.10	0.0	6.36	3.93	0.00	0.00	0.77	1.22	1.99	0.00	0.00	0.0	0.0	0.40	17.0	0.097024	0.097024	7.417	3.074	0.17	0.00	0.00	0.00	0.70	1.10
225	29	1.663	0.660	23.309	31.10	0.0	6.36	3.93	0.00	0.00	0.77	1.22	1.99	0.00	0.00	0.0	0.0	0.23	8.5	0.345392	0.345392	7.417	6.691	0.17	0.00	0.00	0.00	0.70	0.77

226	29	1.615	0.660	23.309	31.10	0.0	6.36	3.93	0.00	0.00	0.77	1.22	1.99	0.00	0.00	0.0	0.0	0.23	8.5	0.345392	0.345392	7.417	6.691	0.17	0.00	0.00	0.00	0.70	0.77
227	29	1.568	0.660	23.309	31.10	0.0	6.36	3.93	0.00	0.00	0.77	1.22	1.99	0.00	0.00	0.0	0.0	0.23	8.5	0.345392	0.345392	7.417	6.691	0.17	0.00	0.00	0.00	0.70	0.77
228	29	1.520	0.660	23.309	31.10	0.0	6.36	3.93	0.00	0.00	0.77	1.22	1.99	0.00	0.00	0.0	0.0	0.23	8.5	0.345392	0.345392	7.417	6.691	0.17	0.00	0.00	0.00	0.70	0.77
229	29	1.472	0.660	23.309	31.10	0.0	6.36	3.93	0.00	0.00	0.77	1.22	1.99	0.00	0.00	0.0	0.0	0.23	8.5	0.345392	0.345392	7.417	6.691	0.17	0.00	0.00	0.00	0.70	0.77
230	30	1.312	0.660	23.309	31.10	0.0	6.33	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.39	8.2	0.207579	0.207579	7.417	3.146	0.17	0.00	0.00	0.00	0.70	1.10
231	31	1.273	0.660	23.309	31.10	0.0	6.33	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
232	31	1.234	0.660	23.309	31.10	0.0	6.33	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
233	31	1.194	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
234	31	1.155	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
235	31	1.116	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
236	31	1.076	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
237	31	1.037	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
238	31	0.998	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
239	31	0.959	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
240	31	0.919	0.660	23.309	31.10	0.0	6.34	3.92	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
241	31	0.880	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.76	1.23	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
242	31	0.841	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.76	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
243	31	0.802	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.76	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
244	31	0.762	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.76	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
245	31	0.723	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.75	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
246	31	0.684	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.75	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
247	31	0.645	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.75	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
248	31	0.605	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.75	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
249	31	0.566	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.75	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
250	31	0.527	0.660	23.309	31.10	0.0	6.34	3.91	0.00	0.00	0.75	1.24	1.99	0.00	0.00	0.0	0.0	0.23	6.1	0.464656	0.464656	7.417	7.076	0.17	0.00	0.00	0.00	0.70	0.77
251	32	0.335	0.660	23.309	31.10	0.0	6.29	3.90	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.44	12.4	0.120785	0.120785	7.417	2.783	0.17	0.00	0.00	0.00	0.70	1.10
252	33	0.302	0.660	23.309	31.10	0.0	6.28	3.90	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
253	33	0.268	0.660	23.309	31.10	0.0	6.28	3.90	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
254	33	0.235	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
255	33	0.201	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
256	33	0.168	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
257	33	0.134	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
258	33	0.101	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
259	33	0.067	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
260	33	0.034	0.660	23.309	31.10	0.0	6.28	3.89	0.00	0.00	0.74	1.25	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77
261	33	0.000	0.660	23.309	31.10	0.0	6.27	3.89	0.00	0.00	0.74	1.26	1.99	0.00	0.00	0.0	0.0	0.35	5.9	0.318877	0.318877	7.417	4.408	0.17	0.00	0.00	0.00	0.70	0.77

.....EXECUTION COMPLETED