ECT
Environmental Consulting & Technology, Inc.

February 18, 2011
ECT No. 100104-0300

Maryland Department of the Environment
Industrial Discharge Permit Division
1800 Washington Boulevard
Baltimore, Maryland 21230-1719

Re: Northeast Maryland Waste Disposal Authority
Frederick/Carroll County Renewable Waste-to-Energy Facility (FCCRWTE)
National Pollutant Discharge Elimination System (NPDES) Permit Application

Dear Sir/Madam:

Environmental Consulting & Technology, Inc., on behalf of Northeast Maryland Waste Disposal Authority and Wheelabrator Technologies, Inc., is submitting the enclosed three copies of an NPDES permit application for FCCRWTE, located in Frederick County, Maryland.

Questions regarding this NPDES permit application should be directed to Mr. Jim Connolly, Senior Manager, Environmental Permitting, Wheelabrator Technologies Inc., at 603/929-3267.

Sincerely,

**ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.**

Jeffrey L. Meling, P.E.
Senior Vice President

JLM/dlm

cc: A. Kays, Northeast Maryland Waste Disposal Authority
J. Connolly, Wheelabrator Technologies, Inc.

3701 Northwest
98th Street
Gainesville, FL
32606

(352)
332-0444

FAX (352)
332-6722

Y:\GDP-11\WHEEL\JLM0218.DOCX.1

An Equal Opportunity/Affirmative Action Employer

# FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

# NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT APPLICATION

**Prepared for:**

**Maryland Department of the Environment**
**Baltimore, Maryland**

**Prepared by:**

**Northeast Maryland Waste Disposal Authority**
**Baltimore, Maryland**

**and**

**Wheelabrator Technologies Inc.**
**Hampton, New Hampshire**

**ECT No. 100104-0300**

**February 2011**

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Form MDE/WMA/PER.069

# APPLICATION FORM 1

# GENERAL INFORMATION

Please print or type in the unshaded areas only. Form Approved. OMB No. 2040-0086.

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

# GENERAL INFORMATION

*Consolidated Permits Program*

*(Read the "General Instructions" before starting.)*

I. EPA I.D. NUMBER

| S | | T/A | C |
|---|---|---|---|
| F | | | D |
| 1 | 2 13 | 14 | 15 |

| LABEL ITEMS | PLEASE PLACE LABEL IN THIS SPACE |
|---|---|
| I. EPA I.D. NUMBER | |
| III. FACILITY NAME | |
| V. FACILITY MAILING ADDRESS | |
| VI. FACILITY LOCATION | |

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

## II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

| SPECIFIC QUESTIONS | Mark "X" YES | NO | FORM ATTACHED | SPECIFIC QUESTIONS | Mark "X" YES | NO | FORM ATTACHED |
|---|---|---|---|---|---|---|---|
| A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A) | | X | | B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B) | | X | |
| | 16 | 17 | 18 | | 19 | 20 | 21 |
| C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C) | | X | | D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D) | X | | X |
| | 22 | 23 | 24 | | 25 | 26 | 27 |
| E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3) | | X | | F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4) | | X | |
| | 28 | 29 | 30 | | 31 | 32 | 33 |
| G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4) | | X | | H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4) | | X | |
| | 34 | 35 | 36 | | 37 | 38 | 39 |
| I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5) | | X | | J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5) | X | | |
| | 40 | 41 | 42 | | 43 | 44 | 45 |

## III. NAME OF FACILITY

C 1 SKIP: Frederick/Carroll County Renewable Waste to Energy Facility

## IV. FACILITY CONTACT

| A. NAME & TITLE *(last, first, & title)* | B. PHONE *(area code & no.)* |
|---|---|
| C 2 Andrew Kays, Project Manager NEA | (410) 333-2730 |

## V. FACILTY MAILING ADDRESS

A. STREET OR P.O. BOX: C 3 Tower II, Suite 402 100 S. Charles Street

| B. CITY OR TOWN | C. STATE | D. ZIP CODE |
|---|---|---|
| C 4 Baltimore | MD | 21201 |

## VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER: C 5 4549 Metropolitan Court

B. COUNTY NAME: Frederick

| C. CITY OR TOWN | D. STATE | E. ZIP CODE | F. COUNTY CODE *(if known)* |
|---|---|---|---|
| C 6 Frederick | MD | 21701 | |



CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

**VII. SIC CODES** *(4-digit, in order of priority)*

| A. FIRST | B. SECOND |
|---|---|
| 7 4953 (specify) Refuse Systemes (Solid Waste Combustors) | 7 (specify) |
| **C. THIRD** | **D. FOURTH** |
| 7 (specify) | 7 (specify) |

**VIII. OPERATOR INFORMATION**

A. NAME: 8 Wheelabrator Frederick, Inc.

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☑ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box: if "Other," specify.)*

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*

P (specify)

D. PHONE *(area code & no.)*: A (603) 929-3000

E. STREET OR P.O. BOX: 4 Liberty Lane West

F. CITY OR TOWN: B Hampton

G. STATE: NH

H. ZIP CODE: 03842

**IX. INDIAN LAND**

Is the facility located on Indian lands? ☐ YES ☑ NO

**X. EXISTING ENVIRONMENTAL PERMITS**

| | |
|---|---|
| A. NPDES *(Discharges to Surface Water)*: 9 N NEW | D. PSD *(Air Emissions from Proposed Sources)*: 9 P NEW |
| B. UIC *(Underground Injection of Fluids)*: 9 U NA | E. OTHER *(specify)*: 9 (specify) |
| C. RCRA *(Hazardous Wastes)*: 9 R NA | E. OTHER *(specify)*: 9 (specify) |

**XI. MAP**

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area. See instructions for precise requirements.

**XII. NATURE OF BUSINESS** *(provide a brief description)*

REFER TO ATTACHMENT FORM 1, ITEM XII-NATURE OF BUSINESS

**XIII. CERTIFICATION** *(see instructions)*

*I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.*

| A. NAME & OFFICIAL TITLE *(type or print)* | B. SIGNATURE | C. DATE SIGNED |
|---|---|---|
| Robin Davidov, Executive Director NEA | Robin B. Davidov | 02/17/11 |

**COMMENTS FOR OFFICIAL USE ONLY**

C

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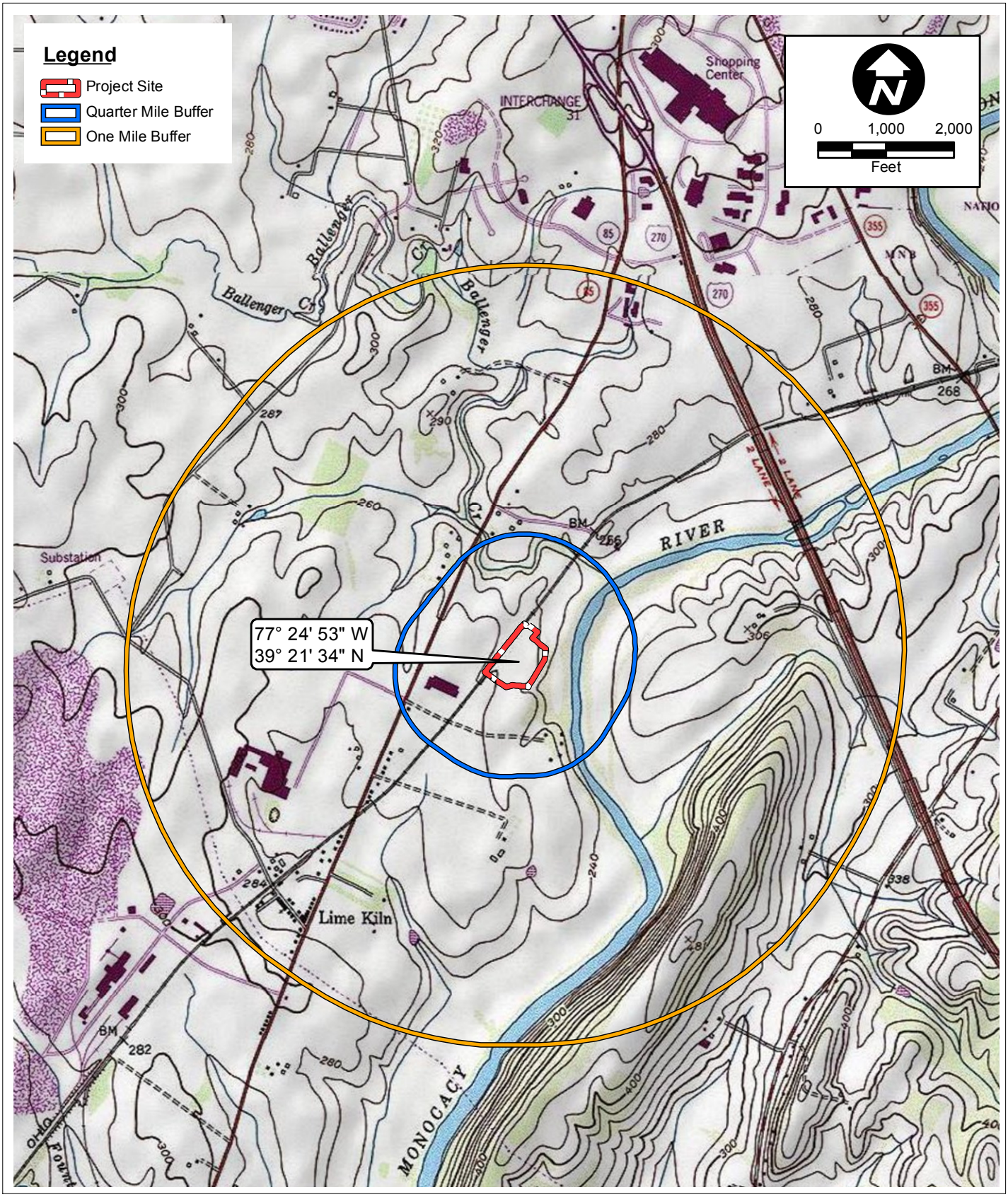


FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

NPDES FORM 1, ITEM XI Sheet 1 of 2
SITE LOCATION

Sources: USGS Quad, Buckeystown, MD, 1984; ECT, 2011.

Northeast Maryland Waste Disposal Authority

Wheelabrator Technologies Inc.
A Waste Management Company

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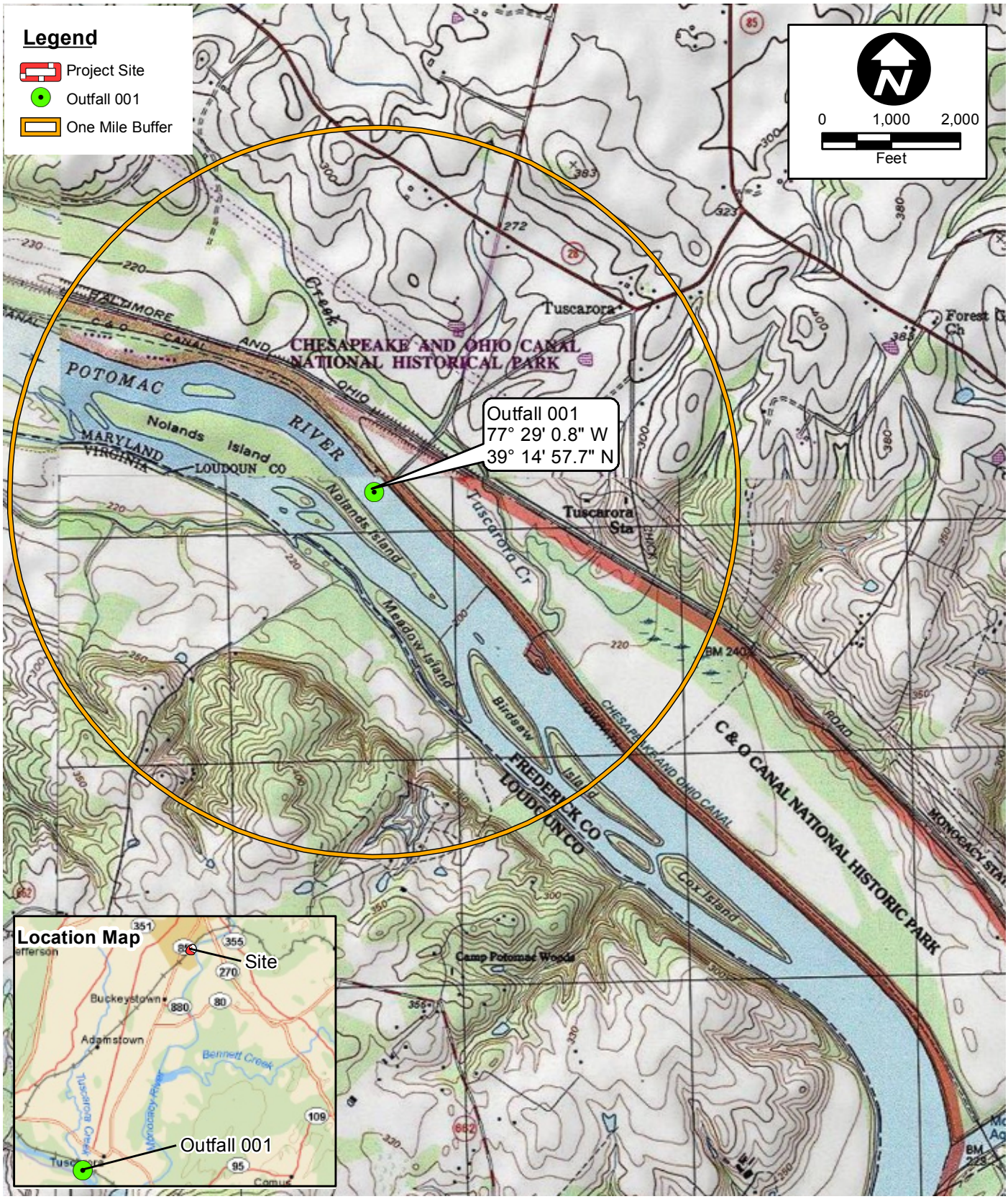


FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

NPDES FORM 1, ITEM XI Sheet 2 of 2

DISCHARGE LOCATION

Sources: USGS Quad, Buckeystown, and Pooleville, MD, 1984, 1995; NPDES # MD0061841, MDE, 2010; ECT, 2011.

Northeast Maryland Waste Disposal Authority

Wheelabrator Technologies Inc.

A Waste Management Company

**FORM 1, ITEM XII-NATURE OF BUSINESS**
**FREDERICK/CARROLL COUNTY RENEWABLE WASTE TO ENERGY FACILITY**
**FREDERICK, MD**

Wheelabrator Technologies, Inc. (WTI), has entered into a contract with the Northeast Maryland Waste Disposal Authority (NEA) to develop, construct, and operate the nominal 1,500-ton-per-day (tpd) Frederick/Carroll County Renewable Waste-to-Energy Facility (Facility or FCCRWTE) in Frederick County, Maryland. The Facility will serve the long-term solid waste disposal needs of Frederick and Carroll Counties (Counties), as well as produce approximately 55 megawatts (MW) gross (45 MW net) of electricity to meet the Counties' governmental energy needs. The Facility will be owned by the NEA.

The Facility will consist of two nominal 750-tpd municipal solid waste (MSW) combustors, which will combust municipal solid waste (MSW), sewage sludge, and tires. Waste deliveries will be made with solid waste route trucks and tractor trailers. The waste receiving areas (tipping bay, sewage sludge area, and refuse storage pit) will be totally enclosed structures with a negative air pressure system using the combustors' primary air system for odor control. The administration building, boiler building, turbine generator building, warehouse/maintenance building, and air quality control system building will also be totally enclosed structures. The water treatment building and ash and metal recovery building will be separate enclosed structures. Ancillary facility equipment includes emergency firewater pumps, a wet mechanical draft cooling tower, enclosed ash and material handling and storage equipment, and water treatment and storage facilities.

Construction of the Facility is currently scheduled to commence in the second quarter of 2012 and will include a continuous program of construction not to exceed 4 years. Both units are expected to be installed and operational by July 2015.

The Facility site will be located on an 11-acre parcel in the McKinney Industrial Park in Frederick County, Maryland, near the intersection of English Muffin Way and Buckeystown Pike (Maryland Route 85). The site is currently vacant and is bordered by railroad tracks on the west side, the Frederick County Ballenger-McKinney Wastewater Treatment Plant (BMWWTP) on the north side, the Monocacy River on the east side, and the Frederick County Division of Utilities and Solid Waste Management (DUSWM) office building on the south side.

County water will be used in the Facility potable water system, fire protection system, as service water, and makeup to the demineralizer systems. The makeup demineralizer system will treat the County water by means of reverse osmosis and electro-deionization to produce demineralized water suitable for makeup to the boiler-turbine cycle. Average County water use is estimated to be 35 gallons per minute (gpm) or 50,400 gallons per day (gpd).

Treated effluent from the Frederick County BMWWTP will be primarily used to make up for evaporation, drift, and blowdown losses in the wet mechanical draft cooling tower. The rate of cooling tower blowdown will be regulated to produce approximately three to six cycles of concentration. Cycles of concentration represents the accumulation of dissolved chemicals in the recirculating cooling water. Blowdown (i.e., the portion of the circulating water flow that is

removed) is used principally to control the buildup of these chemicals. A portion of the cooling tower blowdown will be sent to the wastewater tank as needed to supply the air quality control and ash handling systems. The remainder of cooling tower blowdown will be discharged to the Potomac River through an existing DUSWM diffuser. Average BMWWTP effluent water use is estimated to be between 677 and 846 gpm (1.0 to 1.2 million gpd).

Water chemistry in the cooling tower and cooling water system will be controlled by the addition of chemicals. Sodium hypochlorite will be added to prevent biological fouling, and sulfuric acid will be added to prevent scaling. A corrosion inhibitor will also be added.

The only wastewater to be discharged from the Facility will be cooling tower blowdown to be discharged to the Potomac River via the existing DUSWM McKinney discharge pipeline and associated diffuser structure. Cooling tower blowdown will be dechlorinated by addition of sodium bisulfate. The average cooling tower blowdown quantity is estimated to be between 83 and 252 gpm, (0.1 to 0.4 million gpd).

A wastewater tank will receive reject from reverse osmosis trains in the makeup demineralizer system, boiler blowdown, and a portion of the cooling tower blowdown. Water for the air quality control system (Turbosorp®) will be supplied from this tank. It will be evaporated in this system.

Water that may come into contact with ash, including floor and equipment wash down water and blowdown from ash area air scrubbers, will be collected and treated in a contact water treatment system. This water, as well as some water from the wastewater tank, will be used as makeup to the bottom ash and fly ash handling systems.

# APPLICATION FORM 2D

# NEW SOURCES AND NEW DISCHARGERS: APPLICATION FOR PERMIT TO DISCHARGE PROCESS WASTEWATER

Form Approved. OMB No. 2040-0086. Approval expires 8-31-98.

Please print or type in the unshaded areas only

EPA I.D. NUMBER (*copy from Item 1 of Form 1*)
NEW

Form **2D** NPDES

# New Sources and New Dischargers Application for Permit to Discharge Process Wastewater

## I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

| Outfall Number (*list*) | Latitude | | | Longitude | | | Receiving Water (*name*) |
|---|---|---|---|---|---|---|---|
| | Deg. | Min. | Sec. | Deg. | Min. | Sec. | |
| 001 | 77 | 29 | 0.8 | 39 | 14 | 57.7 | Potomac River via existing discharge structure with diffuser |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**II. Discharge Date** (When do you expect to begin discharging?)
07/01/2015

## III. Flows, Sources of Pollution, and Treatment Technologies

A. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

| Outfall Number | 1. Operations Contributing Flow (*List*) | 2. Average Flow (*Include Units*) | 3. Treatment (*Description or List codes from Table 2D-1*) |
|---|---|---|---|
| 001 | Cooling tower blowdown | 0.1 MGD (6 cycles) | 2E, 4A |
| | | 0.4 MGD (3 cycles) | |
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B. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item III-A. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g., for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

C. Except for storm runoff, leaks, or spills, will any of the discharges described in Items III-A be intermittent or seasonal?

☐ YES (*complete the following table*) ☑ NO (*go to Section IV*)

| Outfall Number | 1. Frequency | | 2. Flow | | |
|---|---|---|---|---|---|
| | a. Days Per Week (*specify average*) | b. Months Per Year (*specify average*) | a. Maximum Daily Flow Rate (*in mgd*) | b. Maximum Total Volume (*specify with units*) | c. Duration (*in days*) |
| | | | | | |

## IV. Production

If there is an applicable production-based effluent guideline or NSPS, for each outfall list the estimated level of production (projection of actual production level, not design), expressed in the terms and units used in the applicable effluent guideline or NSPS, for each of the first 3 years of operation. If production is likely to vary, you may also submit alternative estimates (attach a separate sheet).

| Year | A. Quantity Per Day | B. Units Of Measure | c. Operation, Product, Material, etc. (*specify*) |
|---|---|---|---|
| | | | NOT APPLICABLE |
| | | | |
| | | | |

 CONTINUE ON NEXT PAGE

| CONTINUED FROM THE FRONT | EPA I.D. NUMBER (*copy from Item 1 of Form 1*) | Outfall Number |
|---|---|---|
| | NEW | 001 |

**V. Effluent Characteristics**

A and B: These items require you to report estimated amounts (*both concentration and mass*) of the pollutants to be discharged from each of your outfalls. Each part of this item addresses a different set of pollutants and should be completed in accordance with the specific instructions for that part. Data for each outfall should be on a separate page. Attach additional sheets of paper if necessary.

**General Instructions** *(See table 2D-2 for Pollutants)*
Each part of this item requests you to provide an estimated daily maximum and average for certain pollutants and the source of information. Data for all pollutants in Group A, for all outfalls, must be submitted unless waived by the permitting authority. For all outfalls, data for pollutants in Group B should be reported only for pollutants which you believe will be present or are limited directly by an effluent limitations guideline or NSPS or indirectly through limitations on an indicator pollutant.

| 1. Pollutant | 2. Maximum Daily Value *(include units)* | 3. Average Daily Value *(include units)* | 4. Source *(see instructions)* |
|---|---|---|---|
| REFER TO ATTACHMENT | | | |
| FORM 2D, ITEM V | | | |
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| CONTINUED FROM THE FRONT | EPA I.D. NUMBER (*copy from Item 1 of Form 1*)<br>NEW | |
|---|---|---|

C. Use the space below to list any of the pollutants listed in Table 2D-3 of the instructions which you know or have reason to believe will be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it will be present.

| 1. Pollutant | 2. Reason for Discharge |
|---|---|
| NONE | |

**VI. Engineering Report on Wastewater Treatment**

A. If there is any technical evaluation concerning your wastewater treatment, including engineering reports or pilot plant studies, check the appropriate box below.

☑ Report Available ☐ No Report

B. Provide the name and location of any existing plant(s) which, to the best of your knowledge resembles this production facility with respect to production processes, wastewater constituents, or wastewater treatments.

| Name | Location |
|---|---|
| WHEELABRATOR BALTIMORE WASTE TO ENERGY FACILITY | 1801 ANNAPOLIS RD., BALTIMORE, MD 21230 |
| WHEELABRATOR FALLS WASTE TO ENERGY FACILITY | 1201 NEW FORD RD., MORRISVILLE, PA 19067 |


CONTINUE ON NEXT PAGE

| EPA I.D. NUMBER (*copy from Item 1 of Form 1*) |
|---|
| NEW |

**VII. Other Information** *(Optional)*

Use the space below to expand upon any of the above questions or to bring to the attention of the reviewer any other information you feel should be considered in establishing permit limitations for the proposed facility. Attach additional sheets if necessary.

A. Refer to Mixing Zone Analysis Report.

B. Since the approximately 10-mile discharge pipeline is also used by others to discharge into the Potomac River, the Facility will conduct onsite compliance monitoring of its discharge prior to its mixing with other dischargers' effluents.

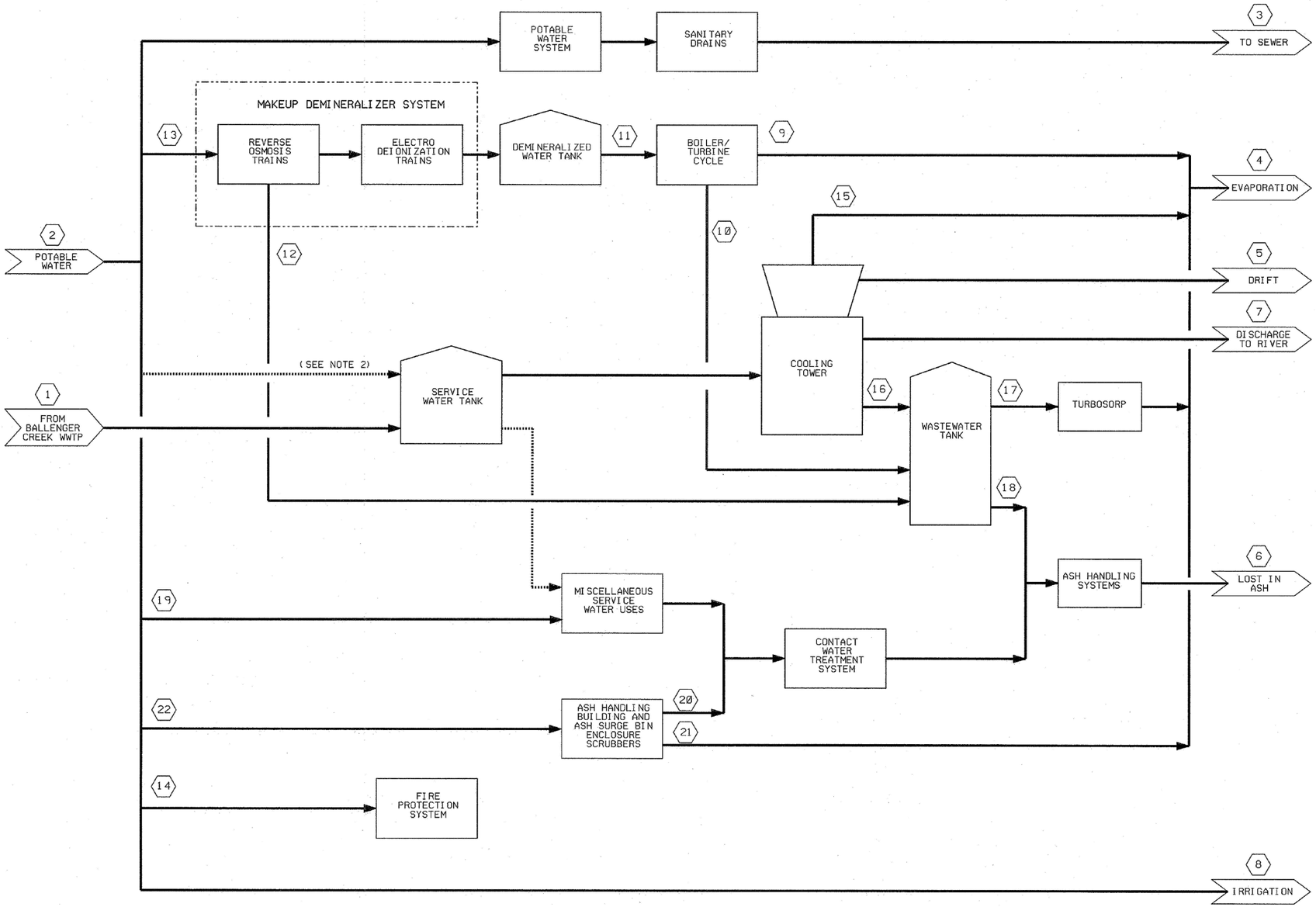
**VIII. CERTIFICATION**

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

| A. Name and Official Title (*type or print*) | B. Phone No. |
|---|---|
| ROBIN DAVIDOV, EXECUTIVE DIRECTOR NEA | (410) 333-2730 |
| C. Signature Robin Davidov | D. Date Signed 02/17/11 |

NOTES:

1. FOR WATER BALANCE DATA SCHEDULES SEE DRAWING SKM-050 SHEET 2.
2. ALTERNATE WATER SUPPLY.




FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

FIGURE NPDES FORM 2D, ITEM III.B (SHEET 1 of 2)
WATER BALANCE

SOURCE: Burns and Roe SKM-050 Sheet 1 of 2 Rev C, 2010; ECT, 2010.

Northeast Maryland Waste Disposal Authority

Wheelabrator Technologies Inc.
A Waste Management Company

| | SEASON/CASE<br>FLUE GAS TEMPERATURE<br>STEAM TURBINE | SUMMER MAXIMUM IN SERVICE | SUMMER MINIMUM IN SERVICE | WINTER MAXIMUM IN SERVICE | WINTER MINIMUM IN SERVICE | DAILY AVERAGE AVERAGE IN SERVICE | MAXIMUM MINIMUM BYPASSED |
|---|---|---|---|---|---|---|---|
| 1 | WATER SUPPY FROM BALLENGER CREEK WWTP | 896 | 896 | 796 | 796 | 846 | 1445 |
| 2 | COUNTY WATER SUPPLY | 35 | 35 | 35 | 35 | 35 | 35 |
| 3 | POTABLE WATER USE- DISCHARGE TO SEWER | 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | TOTAL EVAPORATION LOSSES | 661 | 626 | 594 | 560 | 606 | 993 |
| 5 | COOLING TOWER DRIFT | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| 6 | ASH HANDLING WATER LOST IN ASH | 19.4 | 19.4 | 19.4 | 19.4 | 19.4 | 19.4 |
| 7 | DISCHARGE TO POTOMAC RIVER | 247 | 281 | 214 | 248 | 252 | 465 |
| 8 | SITE IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | MISCELLANEOUS LOSSES FROM BOILER/TURBINE CYCLE | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 |
| 10 | BLOWDOWN FROM BOILERS | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| 11 | MAKEUP TO BOILER/TURBINE CYCLE | 20 | 20 | 20 | 20 | 20 | 20 |
| 12 | REVERSE OSMOSIS TRAIN REJECT | 7 | 7 | 7 | 7 | 7 | 7 |
| 13 | REVERSE OSMOSIS TRAIN INFLUENT | 27 | 27 | 27 | 27 | 27 | 27 |
| 14 | FIRE PROTECTION WATER | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | COOLING TOWER EVAPORATION | 597 | 597 | 531 | 531 | 564 | 964 |
| 16 | COOLING TOWER BLOWDOWN TO WASTEWATER TANK | 50 | 15 | 50 | 15 | 28 | 15 |
| 17 | TURBOSORP DILUTION WATER | 47.6 | 13.2 | 47.6 | 13.2 | 26.0 | 13.2 |
| 18 | WASTEWATER TANK TO ASH HANDLING | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 |
| 19 | MISCELLANEOUS SERVICE WATER USES | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| 20 | BLOWDOWN FROM ASH AREA SCRUBBERS | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 21 | EVAPORATION FROM ASH AREA SCRUBBERS | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 22 | MAKEUP TO ASH AREA SCRUBBERS | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

NOTE: 1. ALL FLOWS ARE AVERAGE GALLONS PER MINUTE
2. THE ABOVE IS BASED ON 3 CYCLES OF CONCENTRATION IN THE COOLING TOWER.

| | SEASON/CASE<br>FLUE GAS TEMPERATURE<br>STEAM TURBINE | SUMMER MAXIMUM IN SERVICE | SUMMER MINIMUM IN SERVICE | WINTER MAXIMUM IN SERVICE | WINTER MINIMUM IN SERVICE | DAILY AVERAGE AVERAGE IN SERVICE | MAXIMUM MINIMUM BYPASSED |
|---|---|---|---|---|---|---|---|
| 1 | WATER SUPPY FROM BALLENGER CREEK WWTP | 716 | 716 | 637 | 637 | 677 | 1156 |
| 2 | COUNTY WATER SUPPLY | 35 | 35 | 35 | 35 | 35 | 35 |
| 3 | POTABLE WATER USE- DISCHARGE TO SEWER | 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | TOTAL EVAPORATION LOSSES | 661 | 626 | 594 | 560 | 606 | 993 |
| 5 | COOLING TOWER DRIFT | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| 6 | ASH HANDLING WATER LOST IN ASH | 19.4 | 19.4 | 19.4 | 19.4 | 19.4 | 19.4 |
| 7 | DISCHARGE TO POTOMAC RIVER | 68 | 102 | 55 | 89 | 83 | 176 |
| 8 | SITE IRRIGATION | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | MISCELLANEOUS LOSSES FROM BOILER/TURBINE CYCLE | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 | 15.5 |
| 10 | BLOWDOWN FROM BOILERS | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 |
| 11 | MAKEUP TO BOILER/TURBINE CYCLE | 20 | 20 | 20 | 20 | 20 | 20 |
| 12 | REVERSE OSMOSIS TRAIN REJECT | 7 | 7 | 7 | 7 | 7 | 7 |
| 13 | REVERSE OSMOSIS TRAIN INFLUENT | 27 | 27 | 27 | 27 | 27 | 27 |
| 14 | FIRE PROTECTION WATER | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | COOLING TOWER EVAPORATION | 597 | 597 | 531 | 531 | 564 | 964 |
| 16 | COOLING TOWER BLOWDOWN TO WASTEWATER TANK | 50 | 15 | 50 | 15 | 28 | 15 |
| 17 | TURBOSORP DILUTION WATER | 47.6 | 13.2 | 47.6 | 13.2 | 26.0 | 13.2 |
| 18 | WASTEWATER TANK TO ASH HANDLING | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 |
| 19 | MISCELLANEOUS SERVICE WATER USES | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 |
| 20 | BLOWDOWN FROM ASH AREA SCRUBBERS | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 21 | EVAPORATION FROM ASH AREA SCRUBBERS | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| 22 | MAKEUP TO ASH AREA SCRUBBERS | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

NOTE: 1. ALL FLOWS ARE AVERAGE GALLONS PER MINUTE
2. THE ABOVE IS BASED ON 6 CYCLES OF CONCENTRATION IN THE COOLING TOWER.

FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

FIGURE NPDES FORM 2D, ITEM III.B (SHEET 2 of 2)
WATER BALANCE FLOWS FOR 3 AND 6 CYCLES OF CONCENTRATION IN THE COOLING TOWER

SOURCE: Burns and Roe SKM-050 Sheet 1 of 2 Rev C, 2010; ECT, 2010.

Northeast Maryland Waste Disposal Authority

Wheelabrator Technologies Inc.
A Waste Management Company

# OUTFALL 001
# ITEM V. EFFLUENT CHARACTERISTICS ESTIMATES

| 1. Pollutant | 3 Cycles of Concentraion | | | 6 Cycles of Concentration | | | BMWWTP Effluent‡ | 4. Source (see instructions) |
|---|---|---|---|---|---|---|---|---|
| | 2. Maximum Daily Value (include units). mg/L* | 2. Maximum Daily Value (include units). lb/day† | 3. Average Daily Value (include units) | 2. Maximum Daily Value (include units), mg/L* | 2. Maximum Daily Value (include units), lb/day† | 3. Average Daily Value (include units) | | |
| **GROUP A** | | | | | | | | |
| Flow, MGD | 0.7 MGD | NA | 0.4 | 0.3 | NA | 0.1 | NA | 1 |
| BOD | 9 | 53 | | 18 | 45 | | 3 | 1 |
| COD | 134.1 | 782.9 | | 268.2 | 671.0 | | 44.7 | 1 |
| TOC | 23.4 | 136.6 | | 46.8 | 117.1 | | 7.8 | 1 |
| TSS | 28 | 163 | | 31 | 78 | | 1 | 1 |
| Ammonia as N | 1.5 | 8.8 | | 3.0 | 7.5 | | 0.5 | 1 |
| Temperature (winter) | NA | NA | 55 °F | NA | NA | 55 °F | NA | 1 |
| Temperature (summer) | 90 °F | NA | 84 °F | 90 °F | NA | 84 °F | NA | 1 |
| pH | 8.0 to 8.5 SU | NA | | 8.0 to 8.5 | NA | | 6.5 to 8.5 | 1 |
| **GROUP B** | | | | | | | | |
| Bromide | 0.48 | 2.80 | | 0.96 | 5.60 | | | 1 |
| Total residual chlorine | < 0.1 | < 0.6 | | < 0.1 | < 0.3 | | < 0.1 | 1 |
| Color | 87 chloroplas | NA | | 174 chloroplas | NA | | 29 chloroplas | 1 |
| Fluoride | 2.43 | 14.19 | | 4.86 | 12.16 | | 0.81 | 1 |
| Nitrate-Nitrite as N | 3 | 18 | | 6 | 15 | | 1 | 1 |
| Oil & grease | < 15 | < 88 | | < 30 | < 75 | | < 5 | 1 |
| Total Phosphorus as P | 2.9 | 16.9 | | 3.8 | 9.5 | | 0.3 | 1 |
| Sulfate as $SO_4$ | 357 | 2084 | | 978 | 2447 | | 54 | 1 |
| Sulfide as S | < 0.3 | < 1.8 | | < 0.6 | < 1.5 | | < 0.1 | 1 |
| Surfactants | 2.01 | 11.73 | | 4.02 | 10.06 | | 0.67 | 1 |
| Total Aluminum | 0.075 | 0.438 | | 0.150 | 0.375 | | 0.025 | 1 |
| Total Barium | 0.09 | 0.53 | | 0.18 | 0.45 | | 0.03 | 1 |
| Total Boron | 0.6 | 3.5 | | 1.2 | 3.0 | | 0.2 | 1 |
| Total Cobalt | < 0.006 | < 0.035 | | < 0.012 | < 0.030 | | <0.002 | 1 |
| Total Iron | 0.33 | 1.93 | | 0.66 | 1.65 | | 0.11 | 1 |
| Total Magnesium | 30 | 175 | | 60 | 150 | | 10 | 1 |
| Total Manganese | 0.051 | 0.298 | | 0.102 | 0.255 | | 0.017 | 1 |
| Total Tin | < 0.15 | < 0.88 | | < 0.30 | < 0.75 | | < 0.05 | 1 |
| Total Titanium | < 0.006 | < 0.035 | | < 0.012 | < 0.030 | | < 0.002 | 1 |
| Total Antimony | < 0.015 | < 0.088 | | < 0.030 | < 0.075 | | < 0.005 | 1 |
| Total Beryllium | < 0.0015 | < 0.0088 | | < 0.0030 | < 0.0075 | | < 0.0005 | 1 |
| Total Chromium | < 0.0075 | < 0.0438 | | < 0.0150 | < 0.0375 | | < 0.0025 | 1 |
| Total Lead | < 0.015 | < 0.088 | | < 0.030 | < 0.075 | | < 0.005 | 1 |

## OUTFALL 001
## ITEM V. EFFLUENT CHARACTERISTICS ESTIMATES

| 1. Pollutant | 3 Cycles of Concentraion | | | 6 Cycles of Concentration | | | BMWWTP Effluent‡ | 4. Source (see instructions) |
|---|---|---|---|---|---|---|---|---|
| | 2. Maximum Daily Value (include units). mg/L* | 2. Maximum Daily Value (include units). lb/day† | 3. Average Daily Value (include units) | 2. Maximum Daily Value (include units), mg/L* | 2. Maximum Daily Value (include units), lb/day† | 3. Average Daily Value (include units) | | |
| Total Nickel | < 0.03 | < 0.18 | | < 0.06 | < 0.15 | | < 0.01 | 1 |
| Total Silver | < 0.0015 | < 0.0088 | | < 0.0030 | < 0.0075 | | < 0.0005 | 1 |
| Total Zinc | 0.336 | 1.962 | | 0.672 | 1.681 | | 0.112 | 1 |
| Total Phenols | 0.03 | 0.18 | | 0.06 | 0.15 | | 0.01 | 1 |
| Total Arsenic | < 0.015 | < 0.088 | | < 0.030 | < 0.075 | | < 0.005 | 1 |
| Total Cadmium | < 0.0015 | < 0.0088 | | < 0.0030 | < 0.0075 | | < 0.0005 | 1 |
| Total Copper | 0.0219 | 0.1279 | | 0.0438 | 0.1096 | | 0.0073 | 1 |
| Total Mercury | 0.0018 | 0.0105 | | 0.0036 | 0.0090 | | 0.0006 | 1 |
| Total Selenium | < 0.0096 | < 0.0560 | | < 0.0192 | < 0.0480 | | < 0.0032 | 1 |
| Total Thallium | < 0.006 | < 0.035 | | < 0.012 | < 0.030 | | < 0.002 | 1 |
| Total Cyanide | 0.03 | 0.18 | | 0.06 | 0.15 | | 0.01 | 1 |
| GC/MS Fraction-Volatile Compounds | ALL ND | ALL ND | | ALL ND | ALL ND | | ALL ND | 1 |
| GC/MS Fraction-Acid Compounds | ALL ND | ALL ND | | ALL ND | ALL ND | | ALL ND | 1 |
| GC/MS Fraction-Base/ Neutral Compounds | ALL ND | ALL ND | | ALL ND | ALL ND | | ALL ND | 1 |
| Total Alpha | <6.3 pci/L | NA | | <12.6 pci/L | NA | | <2.1 pci/L | 1 |
| Total Beta | 47.4 pci/L | NA | | 94.8 pci/L | NA | | 15.8 pci/L | 1 |
| Radium 226 | <0.6 pci/L | NA | | <1.2 pci/L | NA | | <0.2 pci/L | 1 |
| Total Radium | <3.6 pci/L | NA | | <7.2 pci/L | NA | | <1.2 pci/L | 1 |

*Values in mg/L unles otherwise identified.
†Values in lb/day unless otherwise identified.
‡BMWWTP average effluent water quality in mg/L unless otherwise identified.

Note: Corrosion inhibitor added to cooling tower system increase concentration of total phosphorus.
Sampling data indicated no GC/MS Fraction of volatile, acid, and base/neutral compounds in BMWWTP.

Source: 03055-001-ME-008 Rev. 1 and 03055-001-ME-009 Rev. 3, Burns and Roe, 2010.

# MIXING ZONE ANALYSIS REPORT

# FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

# POTOMAC RIVER MIXING ZONE ANALYSIS REPORT

**Prepared for:**

**Northeast Maryland Waste Disposal Authority**
**Baltimore, Maryland**

**and**

**Wheelabrator Technologies Inc.**
**Hampton, New Hampshire**

**Prepared by:**

***Environmental Consulting & Technology, Inc.***
***3701 Northwest 98th Street***
***Gainesville, Florida 32606***

**ECT No. 100104-0300**

**February 2011**

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 7Q10 | 7-day, consecutive low flow with a 10-year return period (lowest stream flow for 7 consecutive days expected to occur once in 10 years) |
| 30Q5 | 30-day, consecutive low flow with a 5-year return period (lowest stream flow for 30 consecutive days expected to occur once in 5 years) |
| °F | degree Fahrenheit |
| BMWWTP | Frederick County Ballenger-McKinney Wastewater Treatment Plant |
| BRE | Burns & Roe Enterprises, Inc. |
| cfs | cubic foot per second |
| COMAR | Code of Maryland Regulations |
| CORMIX | Cornell mixing zone expert system |
| Counties | Frederick and Carroll Counties, Maryland |
| DUSWM | Frederick County Division of Utilities and Solid Waste Management |
| EPA | U.S. Environmental Protection Agency |
| the Facility | Frederick/Carroll County Renewable Waste-to-Energy Facility |
| FCCRWTE | Frederick/Carroll County Renewable Waste-to-Energy Facility |
| ft | foot |
| gpd | gallon per day |
| gpm | gallon per minute |
| MDE | Maryland Department of the Environment |
| mg/L | milligram per liter |
| MW | megawatt |
| NEA | Northeast Maryland Waste Disposal Authority |
| SES | Spectrum Environmental Science, Inc. |
| tpd | ton per day |
| USGS | U.S. Geological Survey |
| WTI | Wheelabrator Technologies, Inc. |

# 1.0 INTRODUCTION

Wheelabrator Technologies, Inc. (WTI), has entered into a contract with the Northeast Maryland Waste Disposal Authority (NEA) to develop, construct, and operate the nominal 1,500-ton-per-day (tpd) Frederick/Carroll County Renewable Waste-to-Energy Facility (Facility or FCCRWTE) in Frederick County, Maryland. FCCRWTE will serve the long-term solid waste disposal needs of Frederick and Carroll Counties (Counties), as well as produce approximately 55 megawatts (MW) gross (45 MW net) of electricity to meet the Counties' governmental energy needs. The Facility will be owned by NEA.

FCCRWTE site will be located on an 11-acre parcel in the McKinney Industrial Park in Frederick County, Maryland, near the intersection of English Muffin Way and Buckeystown Pike (Maryland Route 85).

County water will be used in FCCRWTE's potable water system, fire protection system, as service water, and makeup to the demineralizer systems. The makeup demineralizer system will treat the water by means of reverse osmosis and electro-deionization to produce demineralized water suitable for makeup to the boiler-turbine cycle. Average County water use is estimated to be 35 gallons per minute (gpm) or 50,400 gallons per day (gpd).

Treated effluent from the Frederick County Ballenger-McKinney Wastewater Treatment Plant (BMWWTP) will be primarily used to make up for evaporation, drift, and blowdown losses in the wet mechanical draft cooling tower. The rate of cooling tower blowdown will be regulated to produce approximately three to six cycles of concentration. Cycles of concentration represent the accumulation of dissolved chemicals in the recirculating cooling water. Blowdown (i.e., the portion of the circulating water flow that is removed to maintain the amount of dissolved solids and other chemicals at an acceptable level) is used principally to control the buildup of these chemicals. A portion of the cooling tower blowdown will be sent to the wastewater tank as needed to supply the air quality control and ash handling systems. The remainder of cooling tower blowdown will be discharged to the Potomac River through an existing Frederick County Division of Utili-

ties and Solid Waste Management (DUSWM) diffuser. Average BMWWTP effluent water use is estimated to be between 677 and 846 gpm (1.0 to 1.2 million gpd).

Water chemistry in the cooling tower and cooling water system will be controlled by the addition of chemicals. Sodium hypochlorite will be added to prevent biological fouling, and sulfuric acid will be added to prevent scaling. A corrosion inhibitor will also be added.

The only wastewater to be discharged from FCCRWTE to the Potomac River will be cooling tower blowdown, which will be discharged via the existing DUSWM McKinney discharge pipeline and associated diffuser structure. The average cooling tower blowdown quantity is estimated to be between 83 and 252 gpm, (0.1 to 0.4 million gpd). Figure 1-1 illustrates the location of the existing diffuser.

The purpose of this report is to determine the need and size of the mixing zone in the Potomac River created by the proposed discharge.

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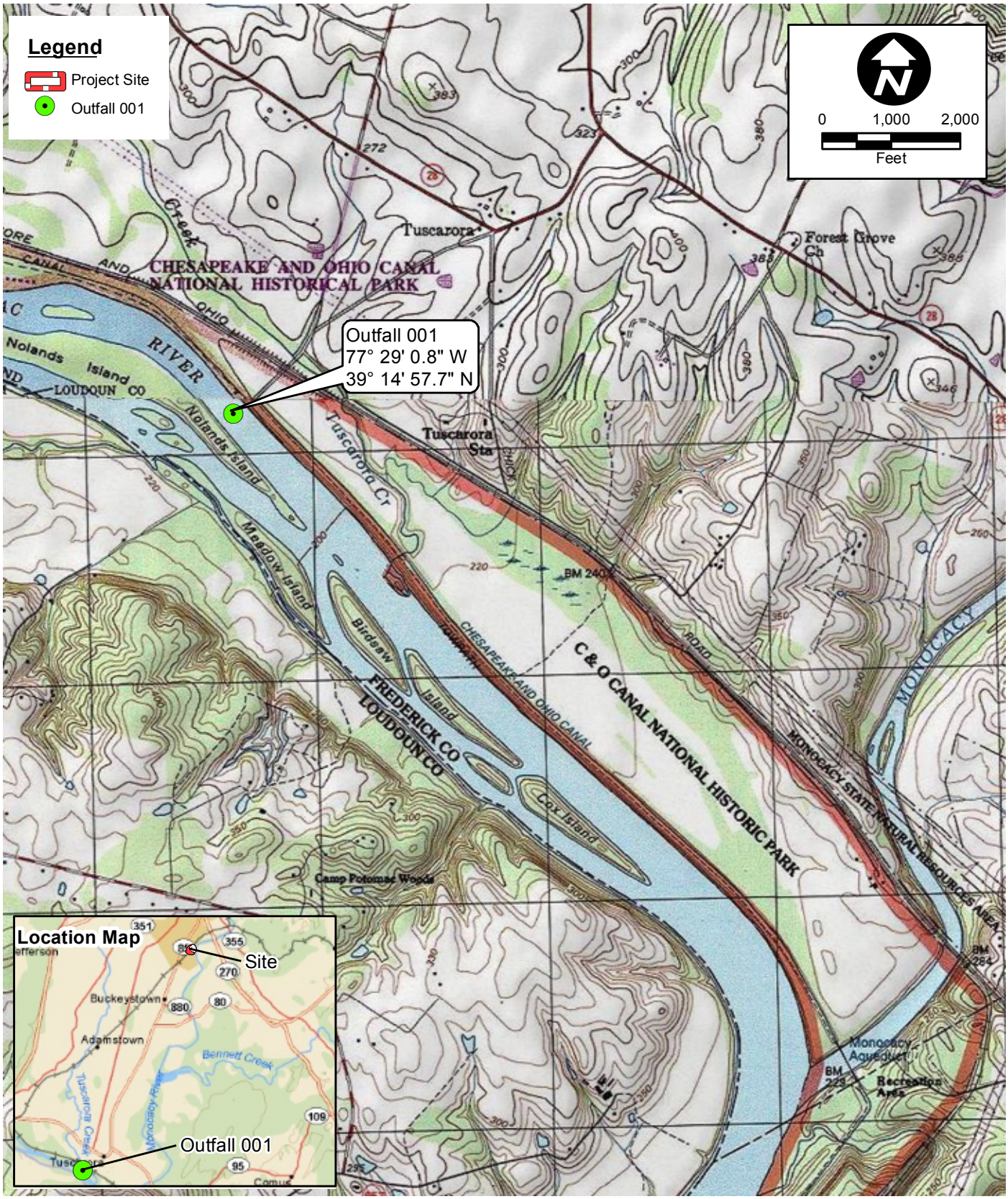


FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

FIGURE 1-1.
OUTFALL LOCATION

Sources: USGS Quad, Buckeystown, and Pooleville, MD, 1984, 1995; NPDES # MD0061841, MDE, 2010; ECT, 2011.

Northeast Maryland Waste Disposal Authority

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## 2.0 BACKGROUND INFORMATION

The following subsections describe the quantity and quality of the proposed effluent and the ambient Potomac River.

### 2.1 EFFLUENT WATER QUANTITY

Table 2-1 presents the projected average and maximum effluent discharge rate from the facility's cooling tower for three and six cycles of concentration operating conditions.

### 2.2 EFFLUENT WATER QUALITY

Table 2-2 presents the effluent water quality, projected by Burns and Roe Enterprises, Inc. (BRE) for three and six cycles of concentration operating condition. When the projected chemical concentration is expressed in the form of less than (<X), half of the chemical concentration (X ÷ 2) was used as the effluent concentration for mixing zone computation.

### 2.3 POTOMAC RIVER FLOW

Figure 2-1 illustrates the daily Potomac River flow data from 1930 to 2010 collected by the U.S. Geological Survey (USGS) at Station 016385 (Point of Rocks, Maryland; approximately 3 miles upstream of the proposed discharge location). The period of record is from 1895 to the present.

According to the Frederick County DUSWM New Design Road Water Treatment Plant (Application No. 10-DP-2296) Maryland Department of the Environment (MDE) summary report and fact sheet (June 24, 2010), the annual average flow; the 7-day, consecutive low flow with a 10-year return period (the lowest stream flow for 7 consecutive days expected to occur once in 10 years) (7Q10); and the 30-day, consecutive low flow with a 5-year return period (the lowest stream flow for 30 consecutive days expected to occur once in 5 years) (30Q5) at the Potomac River near the proposed outfall are presented in Table 2-3.

Table 2-1. FCCRWTE Expected Plant Effluent Discharge Quantity

| FCCRWTE Cooling Tower Operating Condition | Average Discharge (gpm) | Maximum Discharge (gpm) |
|---|---|---|
| Three cycles | 252 | 465 |
| Six cycles | 83 | 176 |

Note: gpm = gallon per minute.

Source: BRE, 2010.

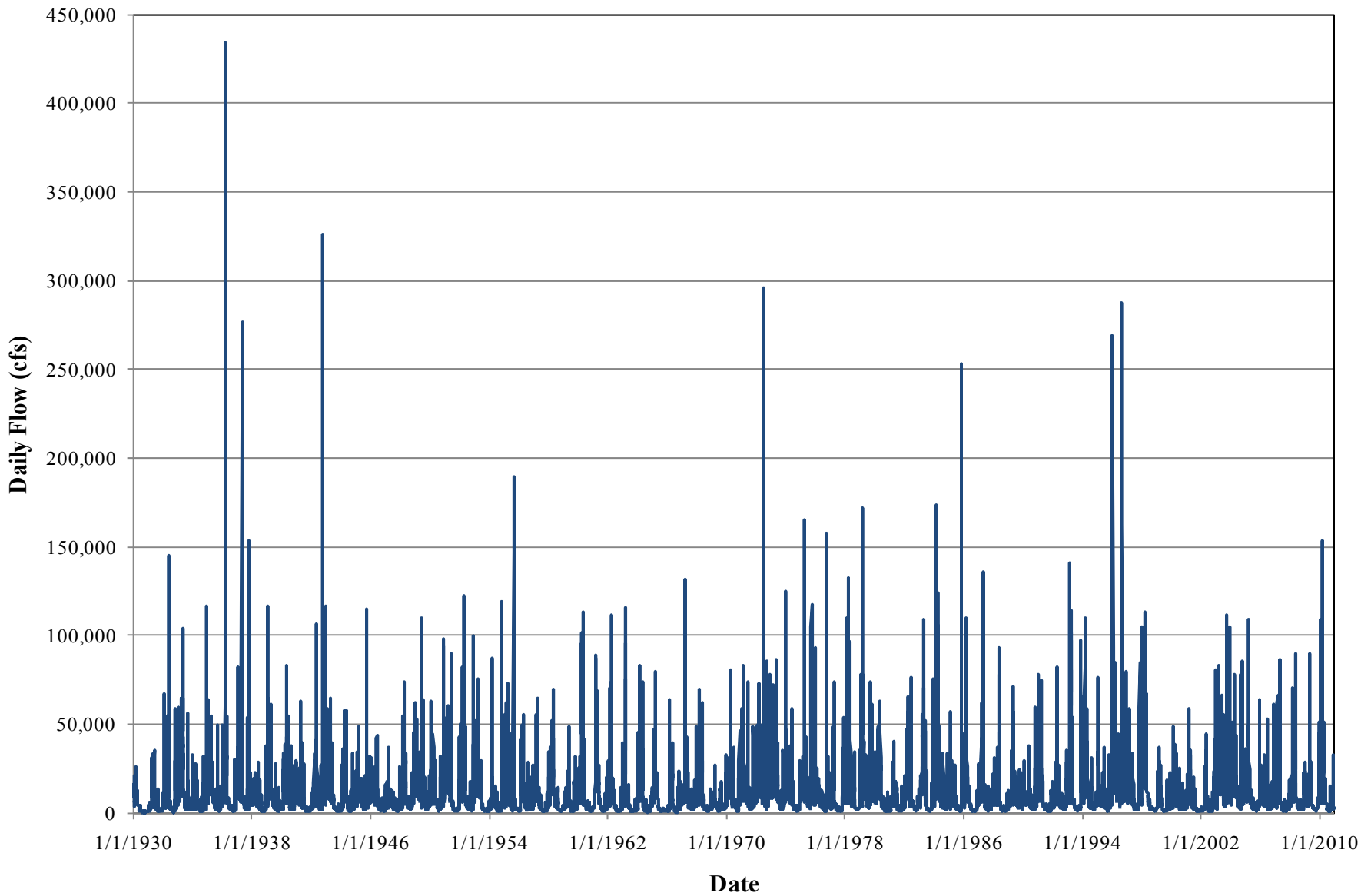
Table 2-2. FCCRWTE Expected Effluent Discharge Water Quality

| Parameter | Units | Effluent Discharge Water Quality | |
|---|---|---|---|
| | | Three Cycles | Six Cycles |
| Aluminum | mg/L | 0.075 | 0.15 |
| Antimony | mg/L | <0.015 | <0.03 |
| Arsenic | mg/L | <0.015 | <0.03 |
| Cadmium | mg/L | <0.0015 | <0.003 |
| Copper | mg/L | 0.0219 | 0.0438 |
| Lead | mg/L | <0.015 | <0.03 |
| Chromium VI | mg/L | <0.03 | <0.06 |
| Cyanide | mg/L | 0.03 | 0.06 |
| Mercury | mg/L | 0.0018 | 0.0036 |
| Selenium | mg/L | <0.0096 | <0.0192 |
| Thallium | mg/L | <0.006 | <0.012 |
| Total residual chlorine* | mg/L | <0.1 | <0.1 |
| Zinc | mg/L | 0.336 | 0.672 |
| Barium | mg/L | 0.09 | 0.18 |
| Beryllium | mg/L | <0.0015 | <0.003 |
| Chromium, total | mg/L | <0.0075 | <0.015 |
| Chromium III | mg/L | <0.006 | <0.012 |
| Nickel | mg/L | <0.03 | <0.06 |
| Silver | mg/L | <0.0015 | <0.003 |
| Temperature | | | |
| Summer average (normal) | °F | 82 | 82 |
| Summer average (turbine bypass) | °F | 84 | 84 |
| Summer maximum( normal) | °F | 90 | 90 |
| Winter average (normal) | °F | 55 | 55 |

Note: mg/L = milligram per liter.
°F = degree Fahrenheit.

*Based on the projection by WTI.

Source: BRE, 2010.




FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

FIGURE 2-1.

DAILY POTOMAC RIVER FLOW DATA AT POINT OF ROCKS, MARYLAND (1930 TO 2010)

Sources: USGS, 2011. ECT, 2011.

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Table 2-3. Potomac River Flow Characteristics

| Flow Characteristics | May through October (cfs) | November through April (cfs) | Annual (cfs) |
|---|---|---|---|
| 7Q10 | 890 | 1,226 | |
| 30Q5 | 1,220 | 2,020 | |
| Annual average | | | 9,510 |

Note: Flow data from 1895 to 2010 were used.

Source: MDE, 2010.

According to the USGS flow data, the Potomac River flow is three orders of magnitude (1,000 times) greater than the expected effluent quantity, even under 7Q10 low-flow conditions. To be conservative, the 7Q10 and 30Q5 low flows in dry months (May through October) were used for mixing zone assessment.

## 2.4 POTOMAC RIVER WATER QUALITY

To characterize the ambient Potomac River water quality data near the proposed outfall, Spectrum Environmental Science, Inc. (SES), conducted water quality sampling in the Potomac River approximately 500 feet (ft) upstream of the existing diffuser on September 16 and October 7, 2010, during a period of low to lower-than-average flow conditions. The recorded Potomac River flows at Point of Rocks on those two sampling dates were 1,320 and 4,330 cubic feet per second (cfs), respectively. Table 2-4 presents the ambient water quality data collected by SES.

For mixing zone calculations, half the laboratory detection limit was used as ambient water concentration if a nondetect sample was reported. If half the detection limit was greater than the most stringent water quality standard, half the most stringent water quality standard was used as the ambient water concentration.

## 2.5 POTOMAC RIVER BATHYMETRY

The Potomac River is divided primarily into two channels by Nolands Island near the proposed outfall (see Figure 2-2). The existing diffuser system is located in the north channel. The south channel is further divided by small unnamed islands. To determine the water depth of the Potomac River, SES conducted a bathymetric survey on September 16, 2010, crossing the entire Potomac River at the existing diffuser system. Figure 2-2 depicts the location of the bathymetric survey transect. Figure 2-3 provides the cross-sectional profile from the north bank to the south bank. The bathymetric survey indicated that the cross-section area of the north channel is approximately 58 percent of the total river cross-section. Therefore, the river flow in the north channel is approximately 58 percent of the total flow in the Potomac River. The computed 7Q10, 30Q5, and annual average flow in the north channel are approximately 516, 708, and 5,516 cfs, respectively.

Table 2-4. Potomac River Water Quality Data (Sampling Dates: September 16 and October 7, 2010) (mg/L)

| Parameter | Units | September 16, 2010 | October 7, 2010 |
|---|---|---|---|
| Potomac River flow at Point of Rocks* | cfs | 1,320 | 4,330 |
| Aluminum | mg/L | <0.05 | <0.05 |
| Antimony | mg/L | <0.001 | <0.001 |
| Arsenic | mg/L | <0.0005 | <0.0005 |
| Cadmium | mg/L | <0.0005 | <0.0005 |
| Copper | mg/L | 0.001 | 0.0012 |
| Lead | mg/L | <0.001 | <0.001 |
| Chromium VI | mg/L | <0.001 | <0.001 |
| Cyanide | mg/L | <0.025 | <0.025 |
| Mercury | mg/L | <0.0003 | 0.0003 |
| Selenium | mg/L | <0.001 | <0.001 |
| Thallium | mg/L | <0.0005 | <0.0005 |
| Chlorine | mg/L | <0.01 | <0.01 |
| Zinc | mg/L | <0.02 | <0.02 |
| Barium | mg/L | 0.043 | 0.052 |
| Beryllium | mg/L | <0.001 | <0.001 |
| Chromium, total | mg/L | <0.001 | <0.001 |
| Chromium III | mg/L | <0.001 | <0.001 |
| Nickel | mg/L | 0.0012 | <0.001 |
| Silver | mg/L | <0.001 | <0.001 |

*September 16, 2010, sampling was performed during low stream flow conditions. October 7, 2010, sampling was collected when the Potomac River flow was less than average.

Sources: SES, 2010.
Phase Separation Science, Inc., 2010.

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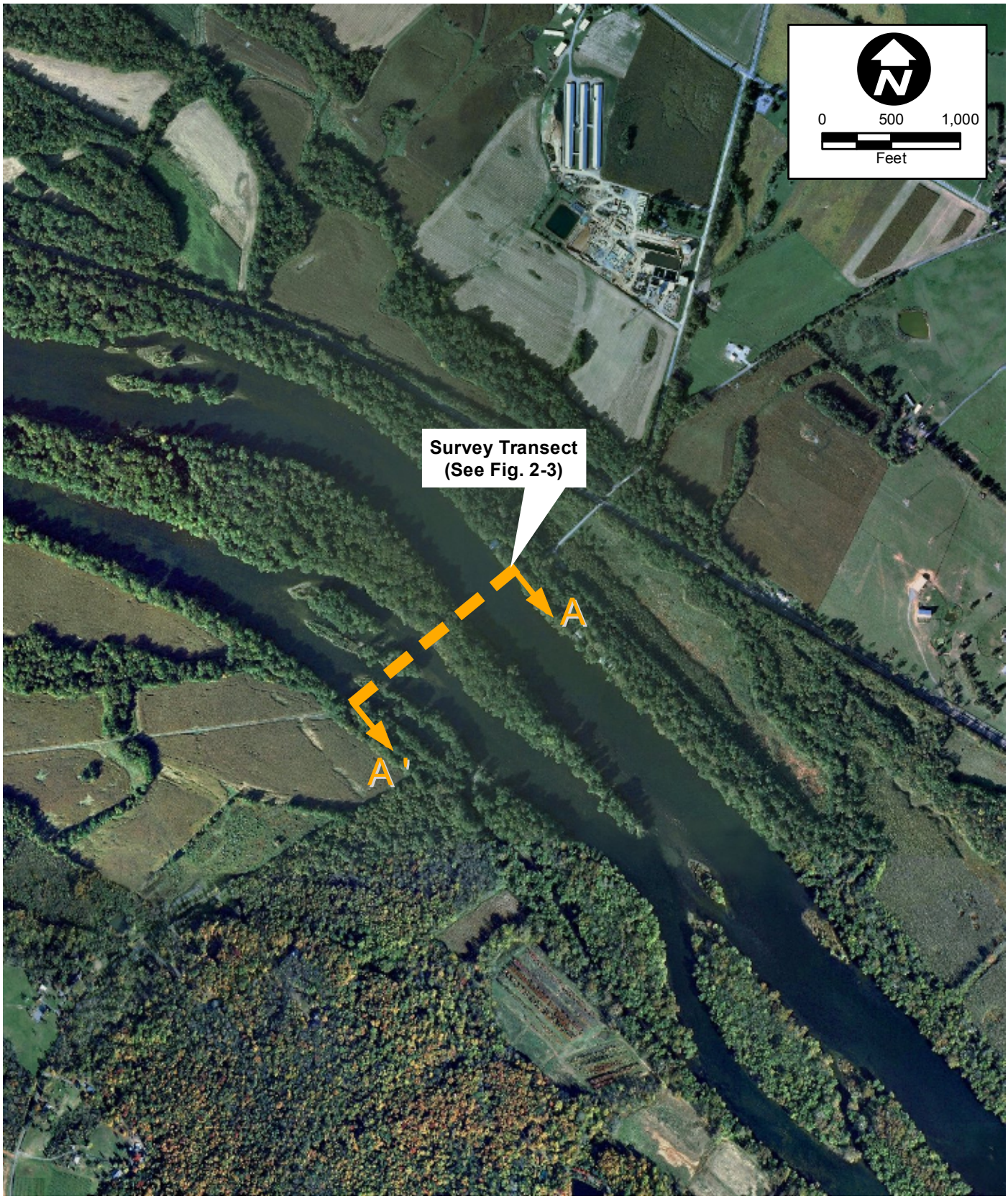


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FIGURE 2-2.

LOCATION OF POTOMAC RIVER SURVEY TRANSECT

Sources: AEX, 2008; Spectrum Environmental Sciences, Inc, 2010; ECT, 2011.

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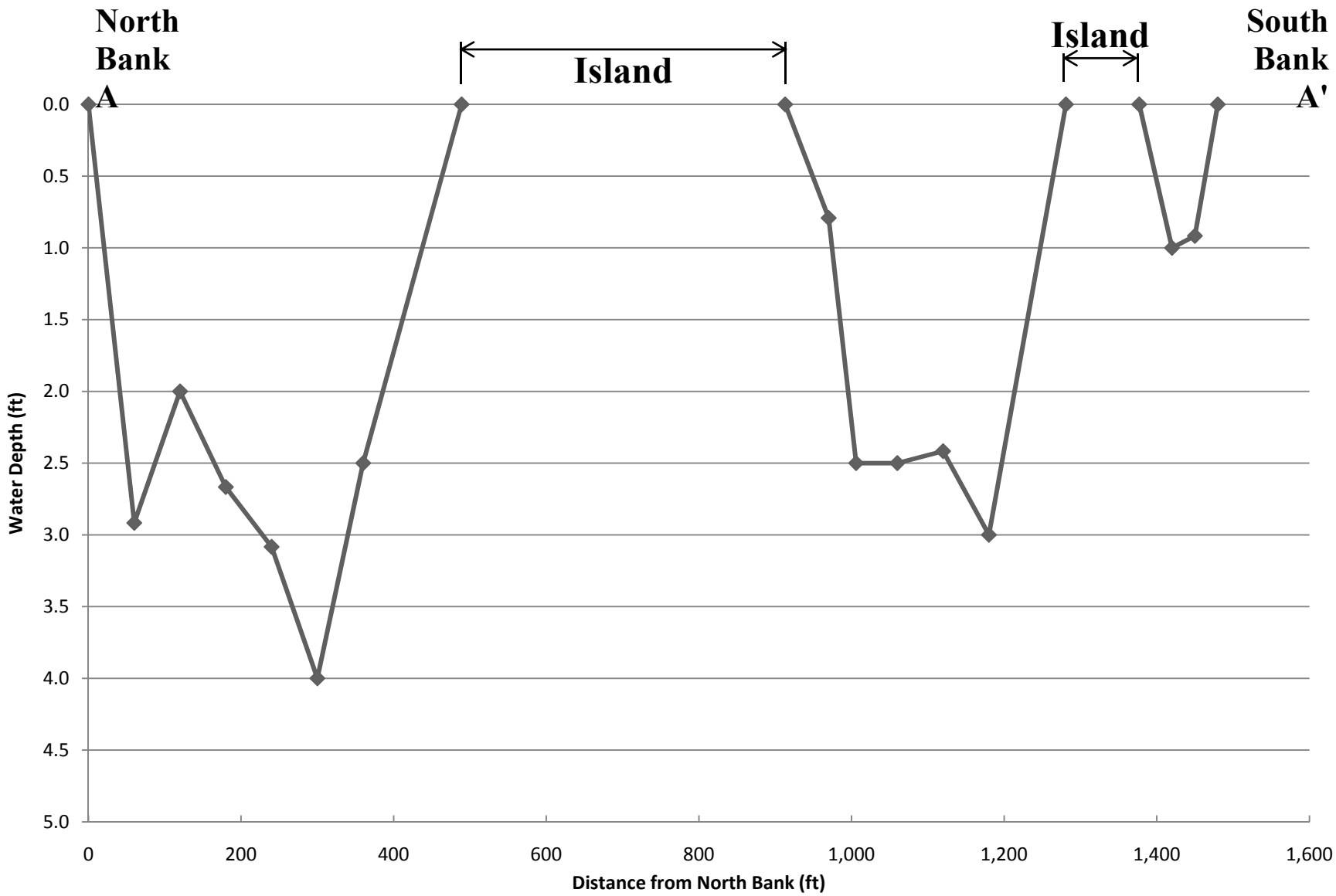


FREDERICK/CARROLL COUNTY RENEWABLE WASTE-TO-ENERGY FACILITY

FIGURE 2-3.

POTOMAC RIVER CROSS-SECTION A-A' NEAR THE EXISTING DIFFUSER (SEPTEMBER 16, 2010)

Source: Spectrum Environmental Sciences, Inc., 2010. ECT, 2011.

Northeast Maryland Waste Disposal Authority

Wheelabrator Technologies Inc.
A Waste Management Company

The north channel average depth on the date of the bathymetric survey (September 16, 2010) was approximately 2.9 ft when the Potomac River flow was 1,350 cfs. According to the stage/discharge relation at Point of Rocks, the average depths at the north channel near the proposed outfall during 7Q10, 30Q5, and annual average flows were computed to be 2.7, 2.9, and 5.5 ft, respectively. The water depths of the Potomac River at various flow conditions were computed according to the stage/discharge relation at Point of Rocks. The width of the north channel on the date of the bathymetric survey was 489 ft. The total surface width of the Potomac River, including the north and south channels, is approximately 960 ft.

## 2.6 EXISTING DIFFUSER STRUCTURE

According to Frederick County DUSWM records, a 1968 design drawing prepared by J.B. Ferguson & Company, Inc., shows the configuration of the existing diffuser in the Potomac River as follows:

- The discharge pipe diameter is 18 inches.
- The discharge pipe and diffuser system is perpendicular to the stream flow.
- There are 190 risers.
- Each riser consists of two discharge ports with a diameter of 2 inches each.
- The discharge port is oriented horizontally and in the direction of the discharge pipe.
- The spacing between the risers is 2.5 ft.
- The risers are covered by a 2-inch-thick layer of gravel.
- The total length of the discharge pipe in the river is 480 ft. The length of the diffuser system is 473 ft.

## 2.7 WATER QUALITY STANDARDS

The designated water use at the Potomac River near the outfall is classified as I-P (Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply) by MDE. Table 2-4 presents the surface water quality standards for water use IP based on Code of Maryland Regulations (COMAR) 26.08.02.03G(1).

Table 2-4. Water Quality Standard for the Potomac River near the FCCRWTE Project Site (MDE Water Use I-P)

| Parameter | Aquatic Life Criteria (mg/L) | | Human Health Criteria (mg/L) | | |
|---|---|---|---|---|---|
| | Acute | Chronic | Drinking Water and Organism | Organism Only | Drinking Water Maximum Criteria Limit |
| Aluminum | 0.75 | 0.087 | | | 0.05 to 0.2 |
| Antimony | | | 0.0056 | 0.64 | 0.006 |
| Arsenic | 0.34 | 0.15 | 0.00018 | 0.0014 | 0.01 |
| Barium | | | 1 | | 2 |
| Beryllium | | | 0.004 | | 0.004 |
| Cadmium | 0.002 | 0.00025 | 0.005 | | 0.005 |
| Total residual chlorine* | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Chromium, total | | | 0.1 | | 0.1 |
| Chromium III | 0.57 | 0.074 | | | |
| Chromium VI | 0.016 | 0.011 | | | |
| Copper | 0.013 | 0.009 | 1.3 | | 1.3 |
| Cyanide | 0.022 | 0.0052 | 0.14 | 0.14 | 0.2 |
| Lead | 0.065 | 0.0025 | | | 0.015 |
| Mercury | 0.0014 | 0.00077 | | | 0.002 |
| Nickel | 0.47 | 0.052 | 0.61 | 4.6 | |
| Selenium | 0.02 | 0.005 | 0.17 | 4.2 | 0.05 |
| Silver | 0.0032 | | | | 0.1 |
| Thallium | | | 0.00024 | 0.00047 | 0.002 |
| Zinc | 0.12 | 0.12 | 7.4 | 26 | |

*COMAR 26.08.03.06-C.

Sources: MDE, 2010.
COMAR 26.08.02.03-2G(1).



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The surface water temperature standard is not to exceed 90 degrees Fahrenheit (°F). According to the expected outfall water quality data presented in Table 2-1, the following parameters could exceed the water quality standard and, therefore, mixing zones are needed:

- Aluminum.
- Antimony.
- Arsenic.
- Cadmium.
- Copper.
- Lead.
- Chromium.
- Cyanide.
- Mercury.
- Selenium.
- Thallium.
- Zinc.

# 3.0 MIXING ZONE ASSESSMENT

## 3.1 REGULATORY REQUIREMENT

The mixing zone assessment was conducted according to the following regulatory requirements:

- The Potomac River near the proposed discharge is a freshwater stream with a designated water use of I-P (Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply) per MDE.
- The water quality at the outside of the mixing zone will comply with state water quality standards.
- The chronic mixing zone will not block more than one-third of the width of the receiving stream (960 ÷ 3 = 320 ft).
- The acute mixing zone length will not exceed 50 times the discharge length scale. The discharge length scale is defined as the square root of the cross-sectional area of the discharge port ($\sqrt{3.1416}$ = 1.77 inches). Therefore, the acute mixing zone length will not exceed 7.4 ft (1.77 × 50 ÷ 12).
- The acute mixing zone length will not exceed five times the local water depth (5 × 2.7 = 13.5 ft).

## 3.2 METHODOLOGY AND MODEL DESCRIPTION

A three-dimensional hydrodynamic model, CORMIX, was used to conduct the mixing zone analysis in the Potomac River. CORMIX simulates the turbulent entrainment, mixing, dispersion, and buoyant spreading of an effluent jet/plume in the receiving water.

The CORMIX model, also known as the Cornell University Mixing Zone Expert System, is a three-dimensional hydrodynamic mixing zone model originally developed by Doneker and Jirka (1990)[1] under the support of the U.S. Environmental Protection Agency

[1]Doneker, R.L., and Jirka, G.H. 1990. Expert System for Hydrodynamic Mixing Zone Analysis of Conventional and Toxic Submerged Single Port Discharges (CORMIX1). Prepared by DeFrees Hydraulics Laboratory, Cornell University; for Environmental Research Laboratory, U.S. Environmental Protection Agency, Athens, Georgia. Publication No. EPA/600/3-90/012, February.

(EPA). The model is widely used for mixing zone analysis and is approved by EPA. The model consists of three submodels that can simulate a single-port submerged outfall (CORMIX1), a multiport submerged diffuser system (CORMIX2), and surface discharge (CORMIX3). CORMIX can simulate different discharge structure configurations at various vertical discharge angles and horizontal orientations. It is also capable of considering the effects of ambient density stratification, surface heat transfer, and first-order decay of nonconservative substances. The model can simulate various stages of hydrodynamic processes when the effluent jet is transformed into a plume. These physical processes include jet entrainment, cross-flow interaction, turbulent diffusion, buoyant spreading, and surface heat loss.

CORMIX2 (Version 4.1 GT) was used to conduct the Potomac River mixing zone analysis because the proposed discharge enters the Potomac River via an existing diffuser system, which was described in Section 2.6.

CORMIX2 simulates a discharge plume that occurs when a surface effluent enters a larger water body laterally through a diffuser system at the river bottom. The model is suitable for positively or neutrally buoyant effluents. The model can handle various discharge geometries and orientations, including discharge pipe orientation and discharge port vertical and horizontal angles. The stream cross-section of the receiving water body is conceptualized as a rectangular uniform channel that may be bounded laterally or unbounded. The ambient velocity is assumed to be uniform within the stream cross-section.

The CORMIX2 model inputs include:

- Average receiving water depth.
- Receiving water width.
- Ambient water density.
- Ambient flow.
- Effluent discharge rate.
- Effluent temperature and density.
- Effluent concentration.
- Diffuser structure configuration (size, orientation angle, and exit condition).

The model outputs include:

- Plume centerline trajectory.
- Dilution factor at the plume centerline.
- Plume centerline concentration.
- Plume width.
- Plume thickness.

As described in Section 2.6, the 2-inch diameter diffuser ports are covered by a 2-inch-thick gravel layer, which reduces the jet velocity near the diffuser port. To account for the effect of the gravel layer, the model input uses a port diameter of 4 inches, which would decrease the jet velocity to 25 percent of its initial value.

## 3.3 MODEL SCENARIOS

The 7Q10, 30Q5, and average annual flows in the north channel of the Potomac River were used as the ambient flow conditions. The 7Q10 flow (516 cfs in the north channel) was used to evaluate the acute mixing zone; the 30Q5 flow (708 cfs in the north channel) was used to evaluate the chronic mixing zone; and the annual average flow (5,516 cfs in the north channel) was used to evaluate the human health mixing zone.

As described in Section 2.4, two water quality samples were taken in the Potomac River near the proposed outfall. The larger values of the two analytical results were used as the ambient water quality.

Four scenarios covering the expected range of wastewater discharge quality and quantity were considered by the CORMIX model:

- Three cycles of concentration, average discharge.
- Three cycles of concentration, maximum discharge.
- Six cycles of concentration, average discharge.
- Six cycles of concentration, maximum discharge.

For each of the wastewater flow and quality scenarios, mixing zone modeling was conducted for acute, chronic, and human health criteria.

The CORMIX model inputs are summarized in Table 3-1.

Table 3-1. CORMIX Model Data Inputs

| Data | Value | Source |
|---|---|---|
| 7Q10 flow | 516 cfs | MDE estimate as incorporated in Fact Sheet dated June 24, 2010 for the New Design Road Water Treatment Plant's Permit Application No. 10-DP-2296 |
| 30Q5 flow | 708 cfs | MDE estimate as incorporated in Fact Sheet dated June 24, 2010 for the New Design Road Water Treatment Plant's Permit Application No. 10-DP-2296 |
| Annual average flow | 5,516 cfs | MDE estimate as incorporated in Fact Sheet dated June 24, 2010 for the New Design Road Water Treatment Plant's Permit Application No. 10-DP-2296 |
| Stream width at Point-of-Discharge (POD) | 489 ft | Based on data from Spectrum Environmental Services (SES) Bathymetry Study, September and October 2010 |
| Stream depth at POD | | |
| 7Q10 flow condition | 2.7 ft | Estimated by ECT based on MDE estimates for flow condition and data from SES Bathymetry Study September and October 2010 |
| 30Q5 flow condition | 2.9 ft | Estimated by ECT based on MDE estimates for flow condition and data from SES Bathymetry Study September and October 2010 |
| Annual average flow condition | 5.5 ft | Estimated by ECT based on MDE estimates for flow condition and data from September/October 2010 SES Bathymetry Study |
| Manning's n | 0.03 | ECT best estimate based on J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Ambient water | Fresh water | SES Bathymetry Study September and October 2010 |
| Wind speed | 2 meters per second | CORMIX Model Default Value (conservative) |
| FCCRWTE effluent flow | | |
| 3 cycles of concentration, average | 252 cfs | Burns & Roe Enterprises, Inc. Calculation No. 03055-001-ME-008, Rev. 1, September 28, 2010 |
| 3 cycles of concentration, maximum | 465 cfs | Burns & Roe Enterprises, Inc. Calculation No. 03055-001-ME-008, Rev. 1, September 28, 2010 |
| 6 cycles of concentration, average | 83 cfs | Burns & Roe Enterprises, Inc. Calculation No. 03055-001-ME-008, Rev. 1, September 28, 2010 |



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Table 3-1. CORMIX Model Data Inputs (Continued, Page 2 of 2)

| Data | Value | Source |
|---|---|---|
| 6 cycles of concentration, maximum | 176 cfs | Burns & Roe Enterprises, Inc. Calculation No. 03055-001-ME-008, Rev. 1, September 28, 2010 |
| Diffuser | | |
| Line orientation | Perpendicular to river | J.B. Ferguson & Company diffuser design drawings |
| Length | 472.5 ft | Estimated by ECT based on J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Starting point to north bank distance | 8 ft | Estimated by ECT based on river width data at POD from September/October 2010 SES Study and on J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| End point to north bank distance | 480.5 ft | Estimated by ECT based on river width data at POD from SES Study (September and October 2010) and J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Port height from river bottom | 0 ft | ECT best estimate based on J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Port diameter | 4 inches | ECT best estimate based on J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) ; value doubled for conservative approach |
| Port vertical angle | 0 degree | J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Port horizontal orientation | Parallel to diffuser line | J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Total number of ports | 380 | J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Nozzle direction | Fanned out | J.B. Ferguson & Company diffuser design drawing (Frederick County Metropolitan Commission, Water Facilities for Eastalco Plant; Job 2206, Sheet 4, October 1, 1968) |
| Contraction ratio | 1 | CORMIX Model Default Value (conservative) |

Source: ECT, 2011.



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## 3.4 DILUTION ANALYSIS

To assure that sufficient ambient flow is available in the Potomac River to provide dilution (and a mixing zone would be feasible) to satisfy the regulatory requirement, a dilution requirement analysis was conducted. To be consistent with the nomenclature of the CORMIX model, the dilution factor at the edge of the mixing zone is:

$$C_{required} = \frac{Effluent\ concentration - Ambient\ concentration}{Water\ quality\ criteria - Ambient\ concentration}$$

Table 3-2 shows the results of the dilution requirement analysis. The available dilution factors in the Potomac River are also presented in Table 3-2. To be conservative, only one-third of the river flow in the north channel was considered to be available for mixing, because COMAR requires the mixing zone width not exceed one-third of the stream width. The dilution requirement analysis shows that the available dilution in the Potomac River is at least one order of magnitude (10 times) greater than the required dilution factor. For example, the largest dilution factor requirement is 165.7 (human health mixing zone for arsenic under six cycles of concentration and maximum discharge condition). In this case, the available dilution factor from the Potomac River is 8,088. Therefore, it is feasible to obtain a mixing zone in the Potomac River to satisfy regulatory requirements.

## 3.5 CORMIX MODEL RESULTS

Tables 3-3 through 3-6 present the projected mixing zone length (measured in the direction of stream flow) and the projected mixing zone thickness (measured from the river bottom) for three cycles of concentration and average discharge, three cycles of concentration and maximum discharge, six cycles of concentration and average discharge, and six cycles of concentration and maximum discharge, respectively. The results indicate that the Potomac River will provide abundant mixing and that, at 0.1 ft from the diffuser line, the in-stream chemical concentration complies with all water quality criteria. Similarly, at 0.1 ft above the river bottom, the plume concentration will be reduced to less than all water quality criteria. Although the diffuser line crosses almost the entire north channel of the Potomac River, the mixing zone is only limited to the bottommost 0.1-ft layer of the water column. Therefore, the mixing zone resulting from the expected discharge under all operating conditions will not create a barrier for fish passage.

The Appendix to this report provides the input and output of the CORMIX model.

Table 3-2. Summary for Dilution Requirement Analysis

| WTE Discharge and Water Quality Criteria Scenarios | Dilution Required at the Edge of the Mixing Zone | | | | | | | | | | | | Available Dilution† |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water Quality Parameters* | | | | | | | | | | | | |
| | Aluminum | Antimony | Arsenic | Cadmium | Copper | Lead | Chromium VI | Cyanide | Mercury | Selenium | Thallium | Zinc | |
| Three cycles of concentration, average discharge | | | | | | | | | | | | | |
| Acute criteria | N/A | N/A | N/A | N/A | 1.75 | N/A | N/A | 1.41 | 1.36 | N/A | N/A | 2.96 | 307 |
| Chronic criteria | N/A | N/A | N/A | 5.00 | 2.65 | 3.50 | 1.38 | 10.54 | 3.19 | N/A | N/A | 2.96 | 229 |
| Human health criteria | 2.00 | 1.37 | 82.33 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 24.00 | N/A | 922 |
| Three cycles of concentration, maximum discharge | | | | | | | | | | | | | |
| Acute criteria | N/A | N/A | N/A | N/A | 1.75 | N/A | N/A | 1.41 | 1.36 | N/A | N/A | 2.96 | 167 |
| Chronic criteria | N/A | N/A | N/A | 5.00 | 2.65 | 3.50 | 1.38 | 10.54 | 3.19 | N/A | N/A | 2.96 | 119 |
| Human health criteria | 2.00 | 1.37 | 82.33 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 24.00 | N/A | 572 |
| Six cycles of concentration, average discharge | | | | | | | | | | | | | |
| Acute criteria | N/A | N/A | N/A | N/A | 3.61 | N/A | 1.90 | 2.96 | 3.00 | N/A | N/A | 6.02 | 932 |
| Chronic criteria | 2.02 | N/A | N/A | 11.00 | 5.46 | 7.25 | 2.81 | 22.08 | 7.02 | 2.02 | N/A | 6.02 | 603 |
| Human health criteria | 5.00 | 2.84 | 165.67 | N/A | N/A | N/A | N/A | N/A | 1.94 | N/A | 49.00 | N/A | 1,155 |
| Six cycles of concentration, maximum discharge | | | | | | | | | | | | | |
| Acute criteria | N/A | N/A | N/A | N/A | 3.61 | N/A | 1.90 | 2.96 | 3.00 | N/A | N/A | 6.02 | 440 |
| Chronic criteria | 2.02 | N/A | N/A | 11.00 | 5.46 | 7.25 | 2.81 | 22.08 | 7.02 | 2.02 | N/A | 6.02 | 149 |
| Human health criteria | 5.00 | 2.84 | 165.67 | N/A | N/A | N/A | N/A | N/A | 1.94 | N/A | 49.00 | N/A | 717 |

Note: N/A = not applicable; mixing zone is not necessary.

*Method detection limits for ambient aluminum, arsenic, cyanide, thallium, and chlorine analyses were greater than twice the water quality criteria. Half of the water quality criteria was used as the ambient concentration.

†Only one-third of the river flow in the northern branch of the Potomac River was assumed to be available for dilution.

Source: ECT, 2011.



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Table 3-3. CORMIX Model Results—FCCRWTE Operating Condition: Three Cycles of Concentration, Average Discharge

| Water Quality Parameters | Acute Mixing Zone (ft) | | Chronic Mixing Zone (ft) | | Human Health Mixing Zone (ft) | |
|---|---|---|---|---|---|---|
| | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† |
| Aluminum | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Antimony | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Arsenic | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Cadmium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Copper | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Lead | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Chromium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Cyanide | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Mercury | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Selenium | N/A | N/A | N/A | N/A | N/A | N/A |
| Thallium | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Zinc | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |

*Length measured in the direction of the river flow.
†Mixing zone thickness measured from the bottom.

Note: N/A = not applicable; outfall water quality complies with water quality standard (mixing zone not needed).

Source: ECT, 2011.



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Table 3-4. CORMIX Model Results—FCCRWTE Operating Condition: Three Cycles of Concentration, Maximum Discharge

| Water Quality Parameters | Acute Mixing Zone (ft) | | Chronic Mixing Zone (ft) | | Human Health Mixing Zone (ft) | |
|---|---|---|---|---|---|---|
| | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† |
| Aluminum | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Antimony | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Arsenic | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Cadmium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Copper | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Lead | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Chromium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Cyanide | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Mercury | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Selenium | N/A | N/A | N/A | N/A | N/A | N/A |
| Thallium | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Zinc | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |

*Length measured in the direction of the river flow.
†Mixing zone thickness measured from the bottom.

Note: N/A = not applicable; outfall water quality complies with water quality standard (mixing zone not needed).

Source: ECT, 2011.



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Table 3-5. CORMIX Model Results—FCCRWTE Operating Condition: Six Cycles of Concentration, Average Discharge

| Water Quality Parameters | Acute Mixing Zone (ft) | | Chronic Mixing Zone (ft) | | Human Health Mixing Zone (ft) | |
|---|---|---|---|---|---|---|
| | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† |
| Aluminum | N/A | N/A | <0.1 | <0.1 | <0.1 | <0.1 |
| Antimony | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Arsenic | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Cadmium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Copper | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Lead | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Chromium | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Cyanide | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Mercury | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Selenium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Thallium | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Zinc | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |

*Length measured in the direction of the river flow.
†Mixing zone thickness measured from the bottom.

Note: N/A = not applicable; outfall water quality complies with water quality standard (mixing zone not needed).

Source: ECT, 2011.



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Table 3-6. CORMIX Model Results—FCCRWTE Operating Condition: Six Cycles of Concentration, Maximum Discharge

| Water Quality Parameters | Acute Mixing Zone (ft) | | Chronic Mixing Zone (ft) | | Human Health Mixing Zone (ft) | |
|---|---|---|---|---|---|---|
| | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† | Projected Length* | Projected Thickness† |
| Aluminum | N/A | N/A | <0.1 | <0.1 | <0.1 | <0.1 |
| Antimony | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Arsenic | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Cadmium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Copper | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Lead | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Chromium | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Cyanide | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |
| Mercury | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Selenium | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Thallium | N/A | N/A | N/A | N/A | <0.1 | <0.1 |
| Zinc | <0.1 | <0.1 | <0.1 | <0.1 | N/A | N/A |

*Length measured in the direction of the river flow.
†Mixing zone thickness measured from the bottom.

Note: N/A = not applicable; outfall water quality complies with water quality standard (mixing zone not needed).

Source: ECT, 2011.

## 4.0 CONCLUSIONS

The EPA-approved and widely used model CORMIX was used for this mixing zone analysis. To address the actual configuration of the discharge, the analysis used CORMIX2, which was specifically developed to model multiport submerged diffuser system such as the one being used for FCCRWTE's discharge. Data inputs to the model were carefully selected in accordance with regulatory requirements to address conservative discharge scenarios such as the required 7Q10, 30Q5, and average flow conditions in the Potomac River. The diffuser system was modeled to account for the 2-inch-thick gravel layer over the diffuser ports. In addition, the model considered only 58 percent of the regulatory flows to account for the fact that Nolands Island divides the Potomac River into primarily two channels. In other words, the model only accounted for 58 percent of the available flows to be conservative and at the same time representative of actual conditions. Finally, maximum discharge flow conditions were modeled to ascertain that a regulatory mixing zone was achievable even under *worst-case* discharge flow conditions.

The results of the mixing zone analysis conclude the following:

- A mixing zone may be needed in the Potomac River for aluminum, antimony, arsenic, cadmium, copper, lead, chromium, cyanide, mercury, selenium, thallium, and zinc.
- The Potomac River flow is three orders of magnitude (1,000 times) greater than the expected effluent quantity, even under 7Q10 low-flow conditions.
- The Potomac River flow will provide sufficient dilution to the proposed discharge. The available dilution in the north channel alone is at least one order of magnitude (10 times) greater than the required dilution that is needed to bring the instream concentration below water quality criteria.
- The length of the mixing zone, in the direction of the stream flow, is 0.1 ft or less, which is less than the mixing zone size limitation described in COMAR.
- The mixing zone thickness is less than 0.1 ft and will be limited to the river bottom. Therefore, the mixing zone will not create a barrier for fish passage.
- The proposed discharge will cause no significant adverse impacts to the water quality in the Potomac River.

# APPENDIX

# CORMIX MODEL INPUT AND OUTPUT

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       3 Cycles of Concentration, average flow, Acute Criteria
 FILE NAME:         C:\...CORMIX\Potomac Penpendicular\3C-Average-Acute.prd
 Time stamp:        Thu Jan  6 14:48:59 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    122.66  QA    =     14.61  ICHREG= 1
 HA    =      0.82  HD    =      0.82
 UA    =      0.119 F     =      0.075 USTAR =0.1156E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.005 Q0    =      0.016       =0.1590E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1104E-03  m0    =0.5699E-06  j0    =0.1751E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.02  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1590E-01  M0    =0.8207E-04  J0    =0.2521E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.17  Lm    =      0.08  Lb    =      0.01
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.89  FRD0  =      0.41  R     =      0.04
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.82  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.08 | -70.57 | 0.01 | 126.5 | 0.790E+00 | 0.07 | 1.49 |
| 0.16 | -69.13 | 0.02 | 178.5 | 0.560E+00 | 0.08 | 2.93 |
| 0.25 | -67.69 | 0.02 | 218.4 | 0.458E+00 | 0.10 | 4.37 |
| 0.33 | -66.25 | 0.03 | 252.0 | 0.397E+00 | 0.11 | 5.81 |
| 0.41 | -64.81 | 0.04 | 281.6 | 0.355E+00 | 0.13 | 7.25 |
| 0.49 | -63.37 | 0.05 | 308.4 | 0.324E+00 | 0.14 | 8.69 |
| 0.58 | -61.93 | 0.06 | 333.1 | 0.300E+00 | 0.16 | 10.13 |
| 0.66 | -60.49 | 0.07 | 356.0 | 0.281E+00 | 0.17 | 11.57 |
| 0.74 | -59.05 | 0.07 | 377.5 | 0.265E+00 | 0.19 | 13.01 |
| 0.82 | -57.61 | 0.08 | 397.9 | 0.251E+00 | 0.21 | 14.45 |
| 0.91 | -56.17 | 0.09 | 417.3 | 0.240E+00 | 0.22 | 15.89 |
| 0.99 | -54.73 | 0.10 | 435.8 | 0.229E+00 | 0.24 | 17.33 |
| 1.07 | -53.29 | 0.11 | 453.5 | 0.221E+00 | 0.25 | 18.77 |
| 1.15 | -51.85 | 0.12 | 470.6 | 0.212E+00 | 0.27 | 20.21 |
| 1.23 | -50.41 | 0.12 | 487.1 | 0.205E+00 | 0.28 | 21.65 |
| 1.32 | -48.96 | 0.13 | 503.0 | 0.199E+00 | 0.30 | 23.09 |
| 1.40 | -47.52 | 0.14 | 518.5 | 0.193E+00 | 0.31 | 24.53 |
| 1.48 | -46.08 | 0.15 | 533.5 | 0.187E+00 | 0.33 | 25.97 |
| 1.56 | -44.64 | 0.16 | 548.1 | 0.182E+00 | 0.34 | 27.41 |
| 1.65 | -43.20 | 0.16 | 562.3 | 0.178E+00 | 0.36 | 28.85 |
| 1.73 | -41.76 | 0.17 | 576.1 | 0.174E+00 | 0.38 | 30.29 |
| 1.81 | -40.32 | 0.18 | 589.7 | 0.170E+00 | 0.39 | 31.73 |
| 1.89 | -38.88 | 0.19 | 602.9 | 0.166E+00 | 0.41 | 33.17 |
| 1.98 | -37.44 | 0.20 | 615.8 | 0.162E+00 | 0.42 | 34.61 |
| 2.06 | -36.00 | 0.21 | 628.5 | 0.159E+00 | 0.44 | 36.05 |
| 2.14 | -34.56 | 0.21 | 640.9 | 0.156E+00 | 0.45 | 37.49 |
| 2.22 | -33.12 | 0.22 | 653.1 | 0.153E+00 | 0.47 | 38.93 |
| 2.30 | -31.68 | 0.23 | 665.1 | 0.150E+00 | 0.48 | 40.37 |
| 2.39 | -30.24 | 0.24 | 676.9 | 0.148E+00 | 0.50 | 41.81 |
| 2.47 | -28.80 | 0.25 | 688.4 | 0.145E+00 | 0.51 | 43.25 |
| 2.55 | -27.36 | 0.26 | 699.8 | 0.143E+00 | 0.53 | 44.69 |
| 2.63 | -25.92 | 0.26 | 711.0 | 0.141E+00 | 0.54 | 46.13 |
| 2.72 | -24.48 | 0.27 | 722.0 | 0.139E+00 | 0.56 | 47.57 |
| 2.80 | -23.04 | 0.28 | 732.8 | 0.136E+00 | 0.58 | 49.01 |
| 2.88 | -21.60 | 0.29 | 743.5 | 0.135E+00 | 0.59 | 50.45 |
| 2.96 | -20.16 | 0.30 | 754.0 | 0.133E+00 | 0.61 | 51.89 |
| 3.04 | -18.72 | 0.30 | 764.4 | 0.131E+00 | 0.62 | 53.33 |
| 3.13 | -17.28 | 0.31 | 774.7 | 0.129E+00 | 0.64 | 54.77 |
| 3.21 | -15.84 | 0.32 | 784.8 | 0.127E+00 | 0.65 | 56.21 |
| 3.29 | -14.40 | 0.33 | 794.8 | 0.126E+00 | 0.67 | 57.65 |
| 3.37 | -12.96 | 0.34 | 804.6 | 0.124E+00 | 0.68 | 59.09 |
| 3.46 | -11.52 | 0.35 | 814.4 | 0.123E+00 | 0.70 | 60.53 |
| 3.54 | -10.08 | 0.35 | 824.0 | 0.121E+00 | 0.71 | 61.97 |
| 3.62 | -8.64 | 0.36 | 833.5 | 0.120E+00 | 0.73 | 63.41 |
| 3.70 | -7.20 | 0.37 | 842.9 | 0.119E+00 | 0.75 | 64.85 |
| 3.79 | -5.76 | 0.38 | 852.2 | 0.117E+00 | 0.76 | 66.29 |
| 3.87 | -4.32 | 0.39 | 861.4 | 0.116E+00 | 0.78 | 67.73 |
| 3.95 | -2.88 | 0.40 | 870.5 | 0.115E+00 | 0.79 | 69.17 |
| 4.03 | -1.44 | 0.40 | 879.5 | 0.114E+00 | 0.81 | 70.61 |
| 4.11 | 0.00 | 0.41 | 888.5 | 0.113E+00 | 0.82 | 72.05 |

Cumulative travel time = 35. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.191E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.238E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.20     0.00    0.82   888.5 0.113E+00   0.82    72.05    0.82    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    115.95     0.00    0.82   889.1 0.112E+00   0.82    72.10    0.82    0.00
    227.71     0.00    0.82   889.7 0.112E+00   0.82    72.14    0.82    0.00
    339.46     0.00    0.82   890.3 0.112E+00   0.82    72.19    0.82    0.00
    451.21     0.00    0.82   890.9 0.112E+00   0.82    72.24    0.82    0.00
    562.97     0.00    0.82   891.4 0.112E+00   0.82    72.29    0.82    0.00
    674.72     0.00    0.82   892.0 0.112E+00   0.82    72.34    0.82    0.00
    786.48     0.00    0.82   892.6 0.112E+00   0.82    72.39    0.82    0.00
    898.23     0.00    0.82   893.2 0.112E+00   0.82    72.44    0.82    0.00
   1009.99     0.00    0.82   893.8 0.112E+00   0.82    72.48    0.82    0.00
   1121.74     0.00    0.82   894.4 0.112E+00   0.82    72.53    0.82    0.00
   1233.49     0.00    0.82   895.0 0.112E+00   0.82    72.58    0.82    0.00
   1345.25     0.00    0.82   895.6 0.112E+00   0.82    72.63    0.82    0.00
   1457.00     0.00    0.82   896.2 0.112E+00   0.82    72.68    0.82    0.00
   1568.76     0.00    0.82   896.8 0.112E+00   0.82    72.73    0.82    0.00
   1680.51     0.00    0.82   897.4 0.111E+00   0.82    72.77    0.82    0.00
   1792.27     0.00    0.82   898.0 0.111E+00   0.82    72.82    0.82    0.00
   1904.02     0.00    0.82   898.6 0.111E+00   0.82    72.87    0.82    0.00
   2015.77     0.00    0.82   899.2 0.111E+00   0.82    72.92    0.82    0.00
   2127.53     0.00    0.82   899.8 0.111E+00   0.82    72.97    0.82    0.00
   2239.28     0.00    0.82   900.4 0.111E+00   0.82    73.02    0.82    0.00
   2351.04     0.00    0.82   901.0 0.111E+00   0.82    73.06    0.82    0.00
   2462.79     0.00    0.82   901.6 0.111E+00   0.82    73.11    0.82    0.00
   2574.55     0.00    0.82   902.2 0.111E+00   0.82    73.16    0.82    0.00
   2686.30     0.00    0.82   902.8 0.111E+00   0.82    73.21    0.82    0.00
   2798.05     0.00    0.82   903.3 0.111E+00   0.82    73.26    0.82    0.00
   2909.81     0.00    0.82   903.9 0.111E+00   0.82    73.30    0.82    0.00
   3021.56     0.00    0.82   904.5 0.111E+00   0.82    73.35    0.82    0.00
   3133.32     0.00    0.82   905.1 0.110E+00   0.82    73.40    0.82    0.00
   3245.07     0.00    0.82   905.7 0.110E+00   0.82    73.45    0.82    0.00
   3356.83     0.00    0.82   906.3 0.110E+00   0.82    73.49    0.82    0.00
   3468.58     0.00    0.82   906.9 0.110E+00   0.82    73.54    0.82    0.00
   3580.34     0.00    0.82   907.5 0.110E+00   0.82    73.59    0.82    0.00
   3692.09     0.00    0.82   908.1 0.110E+00   0.82    73.64    0.82    0.00
   3803.84     0.00    0.82   908.7 0.110E+00   0.82    73.69    0.82    0.00
   3915.60     0.00    0.82   909.2 0.110E+00   0.82    73.73    0.82    0.00
   4027.35     0.00    0.82   909.8 0.110E+00   0.82    73.78    0.82    0.00
   4139.11     0.00    0.82   910.4 0.110E+00   0.82    73.83    0.82    0.00
   4250.86     0.00    0.82   911.0 0.110E+00   0.82    73.88    0.82    0.00
   4362.62     0.00    0.82   911.6 0.110E+00   0.82    73.92    0.82    0.00
   4474.37     0.00    0.82   912.2 0.110E+00   0.82    73.97    0.82    0.00
   4586.12     0.00    0.82   912.8 0.110E+00   0.82    74.02    0.82    0.00
   4697.88     0.00    0.82   913.3 0.109E+00   0.82    74.07    0.82    0.00
   4809.63     0.00    0.82   913.9 0.109E+00   0.82    74.11    0.82    0.00
   4921.39     0.00    0.82   914.5 0.109E+00   0.82    74.16    0.82    0.00
   5033.14     0.00    0.82   915.1 0.109E+00   0.82    74.21    0.82    0.00
   5144.90     0.00    0.82   915.7 0.109E+00   0.82    74.26    0.82    0.00
   5256.65     0.00    0.82   916.3 0.109E+00   0.82    74.30    0.82    0.00
   5368.41     0.00    0.82   916.8 0.109E+00   0.82    74.35    0.82    0.00
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   5480.16     0.00    0.82   917.4 0.109E+00   0.82    74.40    0.82    0.00
   5591.91     0.00    0.82   918.0 0.109E+00   0.82    74.44    0.82    0.00
 Cumulative travel time =       46891. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5591.91    74.45    0.82   918.0 0.109E+00   0.82   148.89    0.82    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    6347.48 m.
   7480.08    74.45    0.82   920.5 0.109E+00   0.82   149.05    0.82    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9368.24    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  11256.40    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  13144.56    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  15032.72    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  16920.89    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  18809.05    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  20697.21    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  22585.37    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  24473.54    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  26361.70    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  28249.86    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  30138.02    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  32026.18    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  33914.34    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  35802.50    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  37690.66    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  39578.82    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  41466.98    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  43355.14    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  45243.30    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  47131.46    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  49019.62    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  50907.79    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  52795.95    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  54684.11    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  56572.27    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  58460.43    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  60348.59    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  62236.75    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  64124.91    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  66013.07    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  67901.23    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  69789.40    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  71677.56    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  73565.73    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  75453.89    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  77342.05    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  79230.22    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  81118.38    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  83006.55    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  84894.71    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  86782.87    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  88671.04    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  90559.20    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  92447.37    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  94335.53    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  96223.70    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
  98111.86    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
 100000.02    74.45    0.82   919.0 0.109E+00   0.82   149.05    0.82    0.00
 Cumulative travel time =      838562. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
```

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       3 Cycles of Concentration, avg flow, Chronic Criteria
 FILE NAME:         C:\...RMIX\Potomac Penpendicular\3C-Average-Chronic.prd
 Time stamp:        Thu Jan  6 14:50:16 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    131.75  QA    =     20.05  ICHREG= 1
 HA    =      0.88  HD    =      0.88
 UA    =      0.152 F     =      0.074 USTAR =0.1459E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.005 Q0    =      0.016       =0.1590E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1104E-03  m0    =0.5699E-06  j0    =0.1751E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.02  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1590E-01  M0    =0.8207E-04  J0    =0.2521E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.17  Lm    =      0.06  Lb    =      0.01
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.89  FRD0  =      0.41  R     =      0.03
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.88  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.09 | -70.57 | 0.01 | 173.3 | 0.577E+00 | 0.07 | 1.49 |
| 0.18 | -69.13 | 0.02 | 244.6 | 0.409E+00 | 0.08 | 2.93 |
| 0.27 | -67.69 | 0.03 | 299.4 | 0.334E+00 | 0.10 | 4.37 |
| 0.35 | -66.25 | 0.04 | 345.5 | 0.289E+00 | 0.12 | 5.81 |
| 0.44 | -64.81 | 0.04 | 386.2 | 0.259E+00 | 0.13 | 7.25 |
| 0.53 | -63.37 | 0.05 | 422.9 | 0.236E+00 | 0.15 | 8.69 |
| 0.62 | -61.93 | 0.06 | 456.7 | 0.219E+00 | 0.17 | 10.13 |
| 0.71 | -60.49 | 0.07 | 488.2 | 0.205E+00 | 0.18 | 11.57 |
| 0.80 | -59.05 | 0.08 | 517.8 | 0.193E+00 | 0.20 | 13.01 |
| 0.88 | -57.61 | 0.09 | 545.7 | 0.183E+00 | 0.22 | 14.45 |
| 0.97 | -56.17 | 0.10 | 572.3 | 0.175E+00 | 0.23 | 15.89 |
| 1.06 | -54.73 | 0.11 | 597.7 | 0.167E+00 | 0.25 | 17.33 |
| 1.15 | -53.29 | 0.11 | 622.1 | 0.161E+00 | 0.27 | 18.77 |
| 1.24 | -51.85 | 0.12 | 645.5 | 0.155E+00 | 0.28 | 20.21 |
| 1.33 | -50.41 | 0.13 | 668.1 | 0.150E+00 | 0.30 | 21.65 |
| 1.41 | -48.97 | 0.14 | 690.0 | 0.145E+00 | 0.32 | 23.09 |
| 1.50 | -47.53 | 0.15 | 711.2 | 0.141E+00 | 0.33 | 24.53 |
| 1.59 | -46.09 | 0.16 | 731.8 | 0.137E+00 | 0.35 | 25.97 |
| 1.68 | -44.64 | 0.17 | 751.8 | 0.133E+00 | 0.37 | 27.41 |
| 1.77 | -43.20 | 0.18 | 771.4 | 0.130E+00 | 0.38 | 28.85 |
| 1.86 | -41.76 | 0.19 | 790.4 | 0.127E+00 | 0.40 | 30.29 |
| 1.94 | -40.32 | 0.19 | 809.0 | 0.124E+00 | 0.42 | 31.73 |
| 2.03 | -38.88 | 0.20 | 827.1 | 0.121E+00 | 0.43 | 33.17 |
| 2.12 | -37.44 | 0.21 | 844.9 | 0.118E+00 | 0.45 | 34.61 |
| 2.21 | -36.00 | 0.22 | 862.3 | 0.116E+00 | 0.47 | 36.05 |
| 2.30 | -34.56 | 0.23 | 879.3 | 0.114E+00 | 0.48 | 37.49 |
| 2.39 | -33.12 | 0.24 | 896.1 | 0.112E+00 | 0.50 | 38.93 |
| 2.47 | -31.68 | 0.25 | 912.5 | 0.110E+00 | 0.52 | 40.37 |
| 2.56 | -30.24 | 0.26 | 928.6 | 0.108E+00 | 0.53 | 41.81 |
| 2.65 | -28.80 | 0.27 | 944.5 | 0.106E+00 | 0.55 | 43.25 |
| 2.74 | -27.36 | 0.27 | 960.1 | 0.104E+00 | 0.57 | 44.69 |
| 2.83 | -25.92 | 0.28 | 975.4 | 0.103E+00 | 0.58 | 46.13 |
| 2.92 | -24.48 | 0.29 | 990.5 | 0.101E+00 | 0.60 | 47.57 |
| 3.01 | -23.04 | 0.30 | 1005.4 | 0.995E-01 | 0.62 | 49.01 |
| 3.09 | -21.60 | 0.31 | 1020.1 | 0.980E-01 | 0.63 | 50.45 |
| 3.18 | -20.16 | 0.32 | 1034.5 | 0.967E-01 | 0.65 | 51.89 |
| 3.27 | -18.72 | 0.33 | 1048.8 | 0.953E-01 | 0.67 | 53.33 |
| 3.36 | -17.28 | 0.34 | 1062.9 | 0.941E-01 | 0.68 | 54.77 |
| 3.45 | -15.84 | 0.34 | 1076.7 | 0.929E-01 | 0.70 | 56.21 |
| 3.54 | -14.40 | 0.35 | 1090.4 | 0.917E-01 | 0.72 | 57.65 |
| 3.62 | -12.96 | 0.36 | 1104.0 | 0.906E-01 | 0.73 | 59.09 |
| 3.71 | -11.52 | 0.37 | 1117.3 | 0.895E-01 | 0.75 | 60.53 |
| 3.80 | -10.08 | 0.38 | 1130.6 | 0.885E-01 | 0.77 | 61.97 |
| 3.89 | -8.64 | 0.39 | 1143.6 | 0.874E-01 | 0.78 | 63.41 |
| 3.98 | -7.20 | 0.40 | 1156.5 | 0.865E-01 | 0.80 | 64.85 |
| 4.07 | -5.76 | 0.41 | 1169.3 | 0.855E-01 | 0.82 | 66.29 |
| 4.15 | -4.32 | 0.42 | 1181.9 | 0.846E-01 | 0.83 | 67.73 |
| 4.24 | -2.88 | 0.42 | 1194.4 | 0.837E-01 | 0.85 | 69.17 |
| 4.33 | -1.44 | 0.43 | 1206.8 | 0.829E-01 | 0.87 | 70.61 |
| 4.42 | 0.00 | 0.44 | 1219.0 | 0.820E-01 | 0.88 | 72.05 |

Cumulative travel time = 29. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.258E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.323E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.51     0.00    0.88  1219.0 0.820E-01   0.88    72.05    0.88    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    109.97     0.00    0.88  1219.9 0.820E-01   0.88    72.10    0.88    0.00
    215.44     0.00    0.88  1220.7 0.819E-01   0.88    72.14    0.88    0.00
    320.90     0.00    0.88  1221.5 0.819E-01   0.88    72.19    0.88    0.00
    426.36     0.00    0.88  1222.3 0.818E-01   0.88    72.24    0.88    0.00
    531.83     0.00    0.88  1223.1 0.818E-01   0.88    72.29    0.88    0.00
    637.29     0.00    0.88  1224.0 0.817E-01   0.88    72.34    0.88    0.00
    742.76     0.00    0.88  1224.8 0.816E-01   0.88    72.39    0.88    0.00
    848.22     0.00    0.88  1225.6 0.816E-01   0.88    72.44    0.88    0.00
    953.68     0.00    0.88  1226.4 0.815E-01   0.88    72.48    0.88    0.00
   1059.15     0.00    0.88  1227.3 0.815E-01   0.88    72.53    0.88    0.00
   1164.61     0.00    0.88  1228.1 0.814E-01   0.88    72.58    0.88    0.00
   1270.08     0.00    0.88  1228.9 0.814E-01   0.88    72.63    0.88    0.00
   1375.54     0.00    0.88  1229.7 0.813E-01   0.88    72.68    0.88    0.00
   1481.00     0.00    0.88  1230.5 0.813E-01   0.88    72.73    0.88    0.00
   1586.47     0.00    0.88  1231.3 0.812E-01   0.88    72.77    0.88    0.00
   1691.93     0.00    0.88  1232.2 0.812E-01   0.88    72.82    0.88    0.00
   1797.40     0.00    0.88  1233.0 0.811E-01   0.88    72.87    0.88    0.00
   1902.86     0.00    0.88  1233.8 0.811E-01   0.88    72.92    0.88    0.00
   2008.32     0.00    0.88  1234.6 0.810E-01   0.88    72.97    0.88    0.00
   2113.79     0.00    0.88  1235.4 0.809E-01   0.88    73.02    0.88    0.00
   2219.25     0.00    0.88  1236.2 0.809E-01   0.88    73.06    0.88    0.00
   2324.72     0.00    0.88  1237.0 0.808E-01   0.88    73.11    0.88    0.00
   2430.18     0.00    0.88  1237.9 0.808E-01   0.88    73.16    0.88    0.00
   2535.64     0.00    0.88  1238.7 0.807E-01   0.88    73.21    0.88    0.00
   2641.11     0.00    0.88  1239.5 0.807E-01   0.88    73.26    0.88    0.00
   2746.57     0.00    0.88  1240.3 0.806E-01   0.88    73.30    0.88    0.00
   2852.04     0.00    0.88  1241.1 0.806E-01   0.88    73.35    0.88    0.00
   2957.50     0.00    0.88  1241.9 0.805E-01   0.88    73.40    0.88    0.00
   3062.97     0.00    0.88  1242.7 0.805E-01   0.88    73.45    0.88    0.00
   3168.43     0.00    0.88  1243.5 0.804E-01   0.88    73.50    0.88    0.00
   3273.89     0.00    0.88  1244.3 0.804E-01   0.88    73.54    0.88    0.00
   3379.36     0.00    0.88  1245.2 0.803E-01   0.88    73.59    0.88    0.00
   3484.82     0.00    0.88  1246.0 0.803E-01   0.88    73.64    0.88    0.00
   3590.29     0.00    0.88  1246.8 0.802E-01   0.88    73.69    0.88    0.00
   3695.75     0.00    0.88  1247.6 0.802E-01   0.88    73.73    0.88    0.00
   3801.21     0.00    0.88  1248.4 0.801E-01   0.88    73.78    0.88    0.00
   3906.68     0.00    0.88  1249.2 0.801E-01   0.88    73.83    0.88    0.00
   4012.14     0.00    0.88  1250.0 0.800E-01   0.88    73.88    0.88    0.00
   4117.61     0.00    0.88  1250.8 0.799E-01   0.88    73.92    0.88    0.00
   4223.07     0.00    0.88  1251.6 0.799E-01   0.88    73.97    0.88    0.00
   4328.53     0.00    0.88  1252.4 0.798E-01   0.88    74.02    0.88    0.00
   4434.00     0.00    0.88  1253.2 0.798E-01   0.88    74.07    0.88    0.00
   4539.46     0.00    0.88  1254.0 0.797E-01   0.88    74.11    0.88    0.00
   4644.93     0.00    0.88  1254.8 0.797E-01   0.88    74.16    0.88    0.00
   4750.39     0.00    0.88  1255.6 0.796E-01   0.88    74.21    0.88    0.00
   4855.85     0.00    0.88  1256.4 0.796E-01   0.88    74.26    0.88    0.00
   4961.32     0.00    0.88  1257.2 0.795E-01   0.88    74.30    0.88    0.00
   5066.78     0.00    0.88  1258.0 0.795E-01   0.88    74.35    0.88    0.00
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   5172.24     0.00    0.88  1258.8 0.794E-01   0.88    74.40    0.88    0.00
   5277.71     0.00    0.88  1259.6 0.794E-01   0.88    74.45    0.88    0.00
 Cumulative travel time =       34654. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5277.71    74.45    0.88  1259.6 0.794E-01   0.88   148.89    0.88    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    5977.05 m.
   7172.15    74.45    0.88  1263.2 0.792E-01   0.88   149.05    0.88    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9066.60    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  10961.04    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  12855.49    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  14749.94    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  16644.38    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  18538.83    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  20433.27    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  22327.72    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  24222.16    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  26116.61    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  28011.05    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  29905.50    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  31799.94    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  33694.39    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  35588.84    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  37483.28    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  39377.73    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  41272.17    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  43166.62    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  45061.06    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  46955.51    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  48849.95    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  50744.40    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  52638.84    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  54533.29    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  56427.73    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  58322.18    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  60216.62    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  62111.07    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  64005.52    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  65899.96    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  67794.41    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  69688.85    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  71583.30    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  73477.74    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  75372.19    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  77266.63    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  79161.08    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  81055.52    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  82949.97    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  84844.41    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  86738.86    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  88633.30    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  90527.75    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  92422.20    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  94316.64    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  96211.09    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  98105.53    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
  99999.98    74.45    0.88  1260.9 0.793E-01   0.88   149.05    0.88    0.00
 Cumulative travel time =      656620. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
```

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       3 Cycles of Concentration, avg flow, Human Criteria
 FILE NAME:         C:\...CORMIX\Potomac Penpendicular\3C-Average-Human.prd
 Time stamp:        Thu Jan  6 14:51:08 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    249.86  QA    =    156.20  ICHREG= 1
 HA    =      1.68  HD    =      1.68
 UA    =      0.625 F     =      0.059 USTAR =0.5389E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.005 Q0    =      0.016       =0.1590E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.1104E-03  m0    =0.5699E-06  j0    =0.1751E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.02  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1590E-01  M0    =0.8207E-04  J0    =0.2521E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.17  Lm    =      0.01  Lb    =      0.00
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.89  FRD0  =      0.41  R     =      0.01
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     1.68  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.17 | -70.57 | 0.02 | 1344.0 | 0.744E-01 | 0.08 | 1.49 |
| 0.34 | -69.13 | 0.03 | 1900.3 | 0.526E-01 | 0.12 | 2.93 |
| 0.50 | -67.69 | 0.05 | 2327.1 | 0.430E-01 | 0.15 | 4.37 |
| 0.67 | -66.25 | 0.07 | 2687.0 | 0.372E-01 | 0.18 | 5.81 |
| 0.84 | -64.81 | 0.08 | 3004.0 | 0.333E-01 | 0.21 | 7.25 |
| 1.01 | -63.37 | 0.10 | 3290.6 | 0.304E-01 | 0.25 | 8.69 |
| 1.17 | -61.93 | 0.12 | 3554.2 | 0.281E-01 | 0.28 | 10.13 |
| 1.34 | -60.49 | 0.13 | 3799.5 | 0.263E-01 | 0.31 | 11.57 |
| 1.51 | -59.05 | 0.15 | 4030.0 | 0.248E-01 | 0.34 | 13.01 |
| 1.68 | -57.61 | 0.17 | 4247.9 | 0.235E-01 | 0.38 | 14.45 |
| 1.84 | -56.17 | 0.18 | 4455.2 | 0.224E-01 | 0.41 | 15.89 |
| 2.01 | -54.73 | 0.20 | 4653.2 | 0.215E-01 | 0.44 | 17.33 |
| 2.18 | -53.29 | 0.22 | 4843.2 | 0.206E-01 | 0.47 | 18.77 |
| 2.35 | -51.85 | 0.23 | 5026.0 | 0.199E-01 | 0.51 | 20.21 |
| 2.51 | -50.41 | 0.25 | 5202.4 | 0.192E-01 | 0.54 | 21.65 |
| 2.68 | -48.97 | 0.27 | 5373.0 | 0.186E-01 | 0.57 | 23.09 |
| 2.85 | -47.53 | 0.28 | 5538.3 | 0.181E-01 | 0.60 | 24.53 |
| 3.02 | -46.09 | 0.30 | 5698.8 | 0.175E-01 | 0.64 | 25.97 |
| 3.19 | -44.65 | 0.32 | 5854.9 | 0.171E-01 | 0.67 | 27.41 |
| 3.35 | -43.21 | 0.34 | 6007.0 | 0.166E-01 | 0.70 | 28.85 |
| 3.52 | -41.77 | 0.35 | 6155.3 | 0.162E-01 | 0.73 | 30.29 |
| 3.69 | -40.33 | 0.37 | 6300.2 | 0.159E-01 | 0.77 | 31.73 |
| 3.86 | -38.88 | 0.39 | 6441.7 | 0.155E-01 | 0.80 | 33.17 |
| 4.02 | -37.44 | 0.40 | 6580.3 | 0.152E-01 | 0.83 | 34.61 |
| 4.19 | -36.00 | 0.42 | 6715.9 | 0.149E-01 | 0.86 | 36.05 |
| 4.36 | -34.56 | 0.44 | 6848.9 | 0.146E-01 | 0.90 | 37.49 |
| 4.53 | -33.12 | 0.45 | 6979.4 | 0.143E-01 | 0.93 | 38.93 |
| 4.69 | -31.68 | 0.47 | 7107.4 | 0.141E-01 | 0.96 | 40.37 |
| 4.86 | -30.24 | 0.49 | 7233.2 | 0.138E-01 | 0.99 | 41.81 |
| 5.03 | -28.80 | 0.50 | 7356.8 | 0.136E-01 | 1.03 | 43.25 |
| 5.20 | -27.36 | 0.52 | 7478.4 | 0.134E-01 | 1.06 | 44.69 |
| 5.36 | -25.92 | 0.54 | 7598.1 | 0.132E-01 | 1.09 | 46.13 |
| 5.53 | -24.48 | 0.55 | 7715.9 | 0.130E-01 | 1.12 | 47.57 |
| 5.70 | -23.04 | 0.57 | 7831.9 | 0.128E-01 | 1.16 | 49.01 |
| 5.87 | -21.60 | 0.59 | 7946.2 | 0.126E-01 | 1.19 | 50.45 |
| 6.04 | -20.16 | 0.60 | 8058.9 | 0.124E-01 | 1.22 | 51.89 |
| 6.20 | -18.72 | 0.62 | 8170.1 | 0.122E-01 | 1.25 | 53.33 |
| 6.37 | -17.28 | 0.64 | 8279.7 | 0.121E-01 | 1.29 | 54.77 |
| 6.54 | -15.84 | 0.65 | 8388.0 | 0.119E-01 | 1.32 | 56.21 |
| 6.71 | -14.40 | 0.67 | 8494.8 | 0.118E-01 | 1.35 | 57.65 |
| 6.87 | -12.96 | 0.69 | 8600.3 | 0.116E-01 | 1.38 | 59.09 |
| 7.04 | -11.52 | 0.70 | 8704.6 | 0.115E-01 | 1.42 | 60.53 |
| 7.21 | -10.08 | 0.72 | 8807.6 | 0.114E-01 | 1.45 | 61.97 |
| 7.38 | -8.64 | 0.74 | 8909.4 | 0.112E-01 | 1.48 | 63.41 |
| 7.54 | -7.20 | 0.75 | 9010.0 | 0.111E-01 | 1.51 | 64.85 |
| 7.71 | -5.76 | 0.77 | 9109.6 | 0.110E-01 | 1.55 | 66.29 |
| 7.88 | -4.32 | 0.79 | 9208.1 | 0.109E-01 | 1.58 | 67.73 |
| 8.05 | -2.88 | 0.80 | 9305.5 | 0.107E-01 | 1.61 | 69.17 |
| 8.21 | -1.44 | 0.82 | 9401.9 | 0.106E-01 | 1.64 | 70.61 |
| 8.38 | 0.00 | 0.84 | 9497.4 | 0.105E-01 | 1.68 | 72.05 |

Cumulative travel time = 13. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **

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BEGIN MOD241: BUOYANT AMBIENT SPREADING

Discharge is non-buoyant or weakly buoyant.
Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING

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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = 0.181E-01 m^2/s
Horizontal diffusivity (initial value) = 0.226E-01 m^2/s

The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

Profile definitions:
BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to layer depth, if fully mixed
BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

| X | Y | Z | S | C | BV | BH | ZU | ZL |
|---|---|---|---|---|---|---|---|---|
| 8.55 | 0.00 | 1.68 | 9497.4 | 0.105E-01 | 1.68 | 72.05 | 1.68 | 0.00 |
| 70.51 | 0.00 | 1.68 | 9503.8 | 0.105E-01 | 1.68 | 72.10 | 1.68 | 0.00 |
| 132.47 | 0.00 | 1.68 | 9510.2 | 0.105E-01 | 1.68 | 72.14 | 1.68 | 0.00 |
| 194.42 | 0.00 | 1.68 | 9516.6 | 0.105E-01 | 1.68 | 72.19 | 1.68 | 0.00 |
| 256.38 | 0.00 | 1.68 | 9523.1 | 0.105E-01 | 1.68 | 72.24 | 1.68 | 0.00 |
| 318.34 | 0.00 | 1.68 | 9529.5 | 0.105E-01 | 1.68 | 72.29 | 1.68 | 0.00 |
| 380.30 | 0.00 | 1.68 | 9535.9 | 0.105E-01 | 1.68 | 72.34 | 1.68 | 0.00 |
| 442.26 | 0.00 | 1.68 | 9542.3 | 0.105E-01 | 1.68 | 72.39 | 1.68 | 0.00 |
| 504.22 | 0.00 | 1.68 | 9548.7 | 0.105E-01 | 1.68 | 72.44 | 1.68 | 0.00 |
| 566.17 | 0.00 | 1.68 | 9555.1 | 0.105E-01 | 1.68 | 72.48 | 1.68 | 0.00 |
| 628.13 | 0.00 | 1.68 | 9561.5 | 0.105E-01 | 1.68 | 72.53 | 1.68 | 0.00 |
| 690.09 | 0.00 | 1.68 | 9567.9 | 0.105E-01 | 1.68 | 72.58 | 1.68 | 0.00 |
| 752.05 | 0.00 | 1.68 | 9574.3 | 0.104E-01 | 1.68 | 72.63 | 1.68 | 0.00 |
| 814.01 | 0.00 | 1.68 | 9580.6 | 0.104E-01 | 1.68 | 72.68 | 1.68 | 0.00 |
| 875.97 | 0.00 | 1.68 | 9587.0 | 0.104E-01 | 1.68 | 72.73 | 1.68 | 0.00 |
| 937.92 | 0.00 | 1.68 | 9593.4 | 0.104E-01 | 1.68 | 72.78 | 1.68 | 0.00 |
| 999.88 | 0.00 | 1.68 | 9599.8 | 0.104E-01 | 1.68 | 72.82 | 1.68 | 0.00 |
| 1061.84 | 0.00 | 1.68 | 9606.1 | 0.104E-01 | 1.68 | 72.87 | 1.68 | 0.00 |
| 1123.80 | 0.00 | 1.68 | 9612.5 | 0.104E-01 | 1.68 | 72.92 | 1.68 | 0.00 |
| 1185.76 | 0.00 | 1.68 | 9618.8 | 0.104E-01 | 1.68 | 72.97 | 1.68 | 0.00 |
| 1247.71 | 0.00 | 1.68 | 9625.2 | 0.104E-01 | 1.68 | 73.02 | 1.68 | 0.00 |
| 1309.67 | 0.00 | 1.68 | 9631.5 | 0.104E-01 | 1.68 | 73.06 | 1.68 | 0.00 |
| 1371.63 | 0.00 | 1.68 | 9637.9 | 0.104E-01 | 1.68 | 73.11 | 1.68 | 0.00 |
| 1433.59 | 0.00 | 1.68 | 9644.2 | 0.104E-01 | 1.68 | 73.16 | 1.68 | 0.00 |
| 1495.55 | 0.00 | 1.68 | 9650.6 | 0.104E-01 | 1.68 | 73.21 | 1.68 | 0.00 |
| 1557.51 | 0.00 | 1.68 | 9656.9 | 0.104E-01 | 1.68 | 73.26 | 1.68 | 0.00 |
| 1619.46 | 0.00 | 1.68 | 9663.2 | 0.103E-01 | 1.68 | 73.30 | 1.68 | 0.00 |
| 1681.42 | 0.00 | 1.68 | 9669.5 | 0.103E-01 | 1.68 | 73.35 | 1.68 | 0.00 |
| 1743.38 | 0.00 | 1.68 | 9675.9 | 0.103E-01 | 1.68 | 73.40 | 1.68 | 0.00 |
| 1805.34 | 0.00 | 1.68 | 9682.2 | 0.103E-01 | 1.68 | 73.45 | 1.68 | 0.00 |
| 1867.30 | 0.00 | 1.68 | 9688.5 | 0.103E-01 | 1.68 | 73.50 | 1.68 | 0.00 |
| 1929.26 | 0.00 | 1.68 | 9694.8 | 0.103E-01 | 1.68 | 73.54 | 1.68 | 0.00 |
| 1991.21 | 0.00 | 1.68 | 9701.1 | 0.103E-01 | 1.68 | 73.59 | 1.68 | 0.00 |
| 2053.17 | 0.00 | 1.68 | 9707.4 | 0.103E-01 | 1.68 | 73.64 | 1.68 | 0.00 |
| 2115.13 | 0.00 | 1.68 | 9713.7 | 0.103E-01 | 1.68 | 73.69 | 1.68 | 0.00 |
| 2177.09 | 0.00 | 1.68 | 9720.0 | 0.103E-01 | 1.68 | 73.74 | 1.68 | 0.00 |
| 2239.05 | 0.00 | 1.68 | 9726.2 | 0.103E-01 | 1.68 | 73.78 | 1.68 | 0.00 |
| 2301.00 | 0.00 | 1.68 | 9732.5 | 0.103E-01 | 1.68 | 73.83 | 1.68 | 0.00 |
| 2362.96 | 0.00 | 1.68 | 9738.8 | 0.103E-01 | 1.68 | 73.88 | 1.68 | 0.00 |
| 2424.92 | 0.00 | 1.68 | 9745.1 | 0.103E-01 | 1.68 | 73.93 | 1.68 | 0.00 |
| 2486.88 | 0.00 | 1.68 | 9751.3 | 0.103E-01 | 1.68 | 73.97 | 1.68 | 0.00 |
| 2548.84 | 0.00 | 1.68 | 9757.6 | 0.102E-01 | 1.68 | 74.02 | 1.68 | 0.00 |
| 2610.80 | 0.00 | 1.68 | 9763.9 | 0.102E-01 | 1.68 | 74.07 | 1.68 | 0.00 |
| 2672.75 | 0.00 | 1.68 | 9770.1 | 0.102E-01 | 1.68 | 74.12 | 1.68 | 0.00 |
| 2734.71 | 0.00 | 1.68 | 9776.4 | 0.102E-01 | 1.68 | 74.16 | 1.68 | 0.00 |
| 2796.67 | 0.00 | 1.68 | 9782.6 | 0.102E-01 | 1.68 | 74.21 | 1.68 | 0.00 |
| 2858.63 | 0.00 | 1.68 | 9788.9 | 0.102E-01 | 1.68 | 74.26 | 1.68 | 0.00 |
| 2920.59 | 0.00 | 1.68 | 9795.1 | 0.102E-01 | 1.68 | 74.31 | 1.68 | 0.00 |
| 2982.55 | 0.00 | 1.68 | 9801.4 | 0.102E-01 | 1.68 | 74.35 | 1.68 | 0.00 |
| 3044.50 | 0.00 | 1.68 | 9807.6 | 0.102E-01 | 1.68 | 74.40 | 1.68 | 0.00 |

```
  3106.46     0.00    1.68  9813.8 0.102E-01   1.68    74.45    1.68    0.00
 Cumulative travel time =        4969. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
  3106.46    74.45    1.68  9813.8 0.102E-01   1.68   148.89    1.68    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    3506.41 m.
  5044.33    74.45    1.68  9862.4 0.101E-01   1.68   149.05    1.68    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
  6982.20    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
  8920.07    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 10857.95    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 12795.82    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 14733.69    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 16671.56    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 18609.43    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 20547.30    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 22485.17    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 24423.04    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 26360.91    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 28298.79    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 30236.66    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 32174.53    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 34112.40    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 36050.27    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 37988.14    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 39926.01    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 41863.88    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 43801.75    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 45739.62    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 47677.50    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 49615.37    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 51553.24    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 53491.11    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 55428.98    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 57366.85    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 59304.72    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 61242.59    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 63180.46    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 65118.34    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 67056.20    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 68994.07    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 70931.94    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 72869.80    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 74807.67    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 76745.54    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 78683.41    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 80621.27    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 82559.14    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 84497.01    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 86434.87    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 88372.74    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 90310.61    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 92248.48    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 94186.34    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 96124.21    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 98062.08    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 99999.95    74.45    1.68  9823.9 0.102E-01   1.68   149.05    1.68    0.00
 Cumulative travel time =      159951. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       3 Cycles of Concentration, max flow, Acute Criteria
 FILE NAME:         C:\...WTE\CORMIX\Potomac Penpendicular\3C-Max-Acute.prd
 Time stamp:        Thu Jan  6 14:52:09 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    122.66  QA    =     14.61  ICHREG= 1
 HA    =      0.82  HD    =      0.82
 UA    =      0.119 F     =      0.075 USTAR =0.1156E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.010 Q0    =      0.029       =0.2934E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.2037E-03  m0    =0.1940E-05  j0    =0.3230E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.04  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2934E-01  M0    =0.2794E-03  J0    =0.4652E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.32  Lm    =      0.14  Lb    =      0.03
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      1.64  FRD0  =      0.75  R     =      0.08
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.82  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.08 | -70.57 | 0.01 | 69.0 | 0.145E+01 | 0.07 | 1.49 |
| 0.16 | -69.13 | 0.02 | 97.1 | 0.103E+01 | 0.08 | 2.93 |
| 0.25 | -67.69 | 0.02 | 118.7 | 0.842E+00 | 0.10 | 4.37 |
| 0.33 | -66.25 | 0.03 | 136.9 | 0.730E+00 | 0.11 | 5.81 |
| 0.41 | -64.81 | 0.04 | 153.0 | 0.654E+00 | 0.13 | 7.25 |
| 0.49 | -63.37 | 0.05 | 167.5 | 0.597E+00 | 0.14 | 8.69 |
| 0.58 | -61.93 | 0.06 | 180.8 | 0.553E+00 | 0.16 | 10.13 |
| 0.66 | -60.49 | 0.07 | 193.2 | 0.518E+00 | 0.17 | 11.57 |
| 0.74 | -59.05 | 0.07 | 204.9 | 0.488E+00 | 0.19 | 13.01 |
| 0.82 | -57.60 | 0.08 | 215.9 | 0.463E+00 | 0.21 | 14.45 |
| 0.91 | -56.16 | 0.09 | 226.4 | 0.442E+00 | 0.22 | 15.89 |
| 0.99 | -54.72 | 0.10 | 236.4 | 0.423E+00 | 0.24 | 17.33 |
| 1.07 | -53.28 | 0.11 | 246.0 | 0.406E+00 | 0.25 | 18.77 |
| 1.15 | -51.84 | 0.12 | 255.3 | 0.392E+00 | 0.27 | 20.21 |
| 1.23 | -50.40 | 0.12 | 264.2 | 0.379E+00 | 0.28 | 21.65 |
| 1.32 | -48.96 | 0.13 | 272.8 | 0.367E+00 | 0.30 | 23.09 |
| 1.40 | -47.52 | 0.14 | 281.2 | 0.356E+00 | 0.31 | 24.53 |
| 1.48 | -46.08 | 0.15 | 289.3 | 0.346E+00 | 0.33 | 25.97 |
| 1.56 | -44.64 | 0.16 | 297.2 | 0.336E+00 | 0.34 | 27.41 |
| 1.65 | -43.20 | 0.16 | 304.9 | 0.328E+00 | 0.36 | 28.85 |
| 1.73 | -41.76 | 0.17 | 312.4 | 0.320E+00 | 0.38 | 30.29 |
| 1.81 | -40.32 | 0.18 | 319.7 | 0.313E+00 | 0.39 | 31.73 |
| 1.89 | -38.88 | 0.19 | 326.9 | 0.306E+00 | 0.41 | 33.17 |
| 1.98 | -37.44 | 0.20 | 333.9 | 0.299E+00 | 0.42 | 34.61 |
| 2.06 | -36.00 | 0.21 | 340.8 | 0.293E+00 | 0.44 | 36.05 |
| 2.14 | -34.56 | 0.21 | 347.5 | 0.288E+00 | 0.45 | 37.49 |
| 2.22 | -33.12 | 0.22 | 354.1 | 0.282E+00 | 0.47 | 38.93 |
| 2.30 | -31.68 | 0.23 | 360.6 | 0.277E+00 | 0.48 | 40.37 |
| 2.39 | -30.24 | 0.24 | 367.0 | 0.273E+00 | 0.50 | 41.81 |
| 2.47 | -28.80 | 0.25 | 373.2 | 0.268E+00 | 0.51 | 43.25 |
| 2.55 | -27.36 | 0.26 | 379.4 | 0.264E+00 | 0.53 | 44.69 |
| 2.63 | -25.92 | 0.26 | 385.4 | 0.259E+00 | 0.54 | 46.13 |
| 2.72 | -24.48 | 0.27 | 391.4 | 0.256E+00 | 0.56 | 47.57 |
| 2.80 | -23.03 | 0.28 | 397.2 | 0.252E+00 | 0.58 | 49.01 |
| 2.88 | -21.59 | 0.29 | 403.0 | 0.248E+00 | 0.59 | 50.45 |
| 2.96 | -20.15 | 0.30 | 408.7 | 0.245E+00 | 0.61 | 51.89 |
| 3.04 | -18.71 | 0.30 | 414.4 | 0.241E+00 | 0.62 | 53.33 |
| 3.13 | -17.27 | 0.31 | 419.9 | 0.238E+00 | 0.64 | 54.77 |
| 3.21 | -15.83 | 0.32 | 425.4 | 0.235E+00 | 0.65 | 56.21 |
| 3.29 | -14.39 | 0.33 | 430.8 | 0.232E+00 | 0.67 | 57.65 |
| 3.37 | -12.95 | 0.34 | 436.1 | 0.229E+00 | 0.68 | 59.09 |
| 3.46 | -11.51 | 0.35 | 441.4 | 0.227E+00 | 0.70 | 60.53 |
| 3.54 | -10.07 | 0.35 | 446.6 | 0.224E+00 | 0.71 | 61.97 |
| 3.62 | -8.63 | 0.36 | 451.8 | 0.221E+00 | 0.73 | 63.41 |
| 3.70 | -7.19 | 0.37 | 456.9 | 0.219E+00 | 0.75 | 64.85 |
| 3.79 | -5.75 | 0.38 | 461.9 | 0.216E+00 | 0.76 | 66.29 |
| 3.87 | -4.31 | 0.39 | 466.9 | 0.214E+00 | 0.78 | 67.73 |
| 3.95 | -2.87 | 0.40 | 471.8 | 0.212E+00 | 0.79 | 69.17 |
| 4.03 | -1.43 | 0.40 | 476.7 | 0.210E+00 | 0.81 | 70.61 |
| 4.11 | 0.01 | 0.41 | 481.5 | 0.208E+00 | 0.82 | 72.05 |

Cumulative travel time = 35. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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-------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.191E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.238E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.20     0.01    0.82   481.5 0.208E+00   0.82    72.05    0.82    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    115.57     0.01    0.82   481.8 0.208E+00   0.82    72.10    0.82    0.00
    226.94     0.01    0.82   482.2 0.207E+00   0.82    72.15    0.82    0.00
    338.30     0.01    0.82   482.5 0.207E+00   0.82    72.19    0.82    0.00
    449.67     0.01    0.82   482.8 0.207E+00   0.82    72.24    0.82    0.00
    561.04     0.01    0.82   483.1 0.207E+00   0.82    72.29    0.82    0.00
    672.41     0.01    0.82   483.5 0.207E+00   0.82    72.34    0.82    0.00
    783.78     0.01    0.82   483.8 0.207E+00   0.82    72.39    0.82    0.00
    895.15     0.01    0.82   484.1 0.207E+00   0.82    72.44    0.82    0.00
   1006.52     0.01    0.82   484.4 0.206E+00   0.82    72.48    0.82    0.00
   1117.89     0.01    0.82   484.8 0.206E+00   0.82    72.53    0.82    0.00
   1229.26     0.01    0.82   485.1 0.206E+00   0.82    72.58    0.82    0.00
   1340.63     0.01    0.82   485.4 0.206E+00   0.82    72.63    0.82    0.00
   1452.00     0.01    0.82   485.7 0.206E+00   0.82    72.68    0.82    0.00
   1563.37     0.01    0.82   486.0 0.206E+00   0.82    72.73    0.82    0.00
   1674.74     0.01    0.82   486.4 0.206E+00   0.82    72.77    0.82    0.00
   1786.11     0.01    0.82   486.7 0.205E+00   0.82    72.82    0.82    0.00
   1897.47     0.01    0.82   487.0 0.205E+00   0.82    72.87    0.82    0.00
   2008.84     0.01    0.82   487.3 0.205E+00   0.82    72.92    0.82    0.00
   2120.21     0.01    0.82   487.6 0.205E+00   0.82    72.97    0.82    0.00
   2231.58     0.01    0.82   488.0 0.205E+00   0.82    73.01    0.82    0.00
   2342.95     0.01    0.82   488.3 0.205E+00   0.82    73.06    0.82    0.00
   2454.32     0.01    0.82   488.6 0.205E+00   0.82    73.11    0.82    0.00
   2565.69     0.01    0.82   488.9 0.205E+00   0.82    73.16    0.82    0.00
   2677.06     0.01    0.82   489.2 0.204E+00   0.82    73.20    0.82    0.00
   2788.43     0.01    0.82   489.6 0.204E+00   0.82    73.25    0.82    0.00
   2899.80     0.01    0.82   489.9 0.204E+00   0.82    73.30    0.82    0.00
   3011.17     0.01    0.82   490.2 0.204E+00   0.82    73.35    0.82    0.00
   3122.54     0.01    0.82   490.5 0.204E+00   0.82    73.40    0.82    0.00
   3233.91     0.01    0.82   490.8 0.204E+00   0.82    73.44    0.82    0.00
   3345.28     0.01    0.82   491.2 0.204E+00   0.82    73.49    0.82    0.00
   3456.65     0.01    0.82   491.5 0.203E+00   0.82    73.54    0.82    0.00
   3568.02     0.01    0.82   491.8 0.203E+00   0.82    73.59    0.82    0.00
   3679.38     0.01    0.82   492.1 0.203E+00   0.82    73.63    0.82    0.00
   3790.75     0.01    0.82   492.4 0.203E+00   0.82    73.68    0.82    0.00
   3902.12     0.01    0.82   492.7 0.203E+00   0.82    73.73    0.82    0.00
   4013.49     0.01    0.82   493.1 0.203E+00   0.82    73.78    0.82    0.00
   4124.86     0.01    0.82   493.4 0.203E+00   0.82    73.82    0.82    0.00
   4236.23     0.01    0.82   493.7 0.203E+00   0.82    73.87    0.82    0.00
   4347.60     0.01    0.82   494.0 0.202E+00   0.82    73.92    0.82    0.00
   4458.97     0.01    0.82   494.3 0.202E+00   0.82    73.96    0.82    0.00
   4570.34     0.01    0.82   494.6 0.202E+00   0.82    74.01    0.82    0.00
   4681.71     0.01    0.82   495.0 0.202E+00   0.82    74.06    0.82    0.00
   4793.08     0.01    0.82   495.3 0.202E+00   0.82    74.11    0.82    0.00
   4904.45     0.01    0.82   495.6 0.202E+00   0.82    74.15    0.82    0.00
   5015.81     0.01    0.82   495.9 0.202E+00   0.82    74.20    0.82    0.00
   5127.18     0.01    0.82   496.2 0.202E+00   0.82    74.25    0.82    0.00
   5238.55     0.01    0.82   496.5 0.201E+00   0.82    74.29    0.82    0.00
   5349.92     0.01    0.82   496.8 0.201E+00   0.82    74.34    0.82    0.00
```

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   5461.29     0.01    0.82   497.2 0.201E+00   0.82    74.39    0.82    0.00
   5572.66     0.01    0.82   497.5 0.201E+00   0.82    74.44    0.82    0.00
 Cumulative travel time =       46687. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5572.66    74.45    0.82   497.5 0.201E+00   0.82   148.87    0.82    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    6409.12 m.
   7461.21    74.45    0.82   498.8 0.200E+00   0.82   149.05    0.82    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9349.75    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  11238.30    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  13126.85    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  15015.39    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  16903.94    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  18792.49    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  20681.04    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  22569.58    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  24458.13    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  26346.68    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  28235.22    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  30123.77    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  32012.32    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  33900.86    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  35789.41    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  37677.96    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  39566.50    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  41455.05    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  43343.60    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  45232.14    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  47120.69    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  49009.24    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  50897.79    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  52786.33    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  54674.88    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  56563.43    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  58451.97    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  60340.52    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  62229.07    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  64117.61    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  66006.16    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  67894.70    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  69783.25    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  71671.80    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  73560.34    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  75448.89    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  77337.44    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  79225.98    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  81114.53    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  83003.08    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  84891.62    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  86780.17    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  88668.72    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  90557.27    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  92445.81    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  94334.36    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  96222.91    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
  98111.45    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
 100000.00    74.45    0.82   498.1 0.201E+00   0.82   149.05    0.82    0.00
 Cumulative travel time =      837793. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       3 Cycles of Concentration, max flow, Chronic Criteria
 FILE NAME:         C:\...E\CORMIX\Potomac Penpendicular\3C-Max-Chronic.prd
 Time stamp:        Thu Jan  6 14:53:07 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    131.75  QA    =     20.05  ICHREG= 1
 HA    =      0.88  HD    =      0.88
 UA    =      0.152 F     =      0.074 USTAR =0.1459E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.010 Q0    =      0.029       =0.2934E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.2037E-03  m0    =0.1940E-05  j0    =0.3230E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.04  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2934E-01  M0    =0.2794E-03  J0    =0.4652E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.32  Lm    =      0.11  Lb    =      0.01
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      1.64  FRD0  =      0.75  R     =      0.06
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.88  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.09 | -70.57 | 0.01 | 94.3 | 0.106E+01 | 0.07 | 1.49 |
| 0.18 | -69.13 | 0.02 | 132.9 | 0.752E+00 | 0.08 | 2.93 |
| 0.27 | -67.69 | 0.03 | 162.6 | 0.615E+00 | 0.10 | 4.37 |
| 0.35 | -66.25 | 0.04 | 187.6 | 0.533E+00 | 0.12 | 5.81 |
| 0.44 | -64.81 | 0.04 | 209.6 | 0.477E+00 | 0.13 | 7.25 |
| 0.53 | -63.37 | 0.05 | 229.5 | 0.436E+00 | 0.15 | 8.69 |
| 0.62 | -61.93 | 0.06 | 247.8 | 0.404E+00 | 0.17 | 10.13 |
| 0.71 | -60.49 | 0.07 | 264.9 | 0.378E+00 | 0.18 | 11.57 |
| 0.80 | -59.05 | 0.08 | 280.9 | 0.356E+00 | 0.20 | 13.01 |
| 0.88 | -57.61 | 0.09 | 296.0 | 0.338E+00 | 0.22 | 14.45 |
| 0.97 | -56.17 | 0.10 | 310.4 | 0.322E+00 | 0.23 | 15.89 |
| 1.06 | -54.73 | 0.11 | 324.2 | 0.308E+00 | 0.25 | 17.33 |
| 1.15 | -53.28 | 0.11 | 337.4 | 0.296E+00 | 0.27 | 18.77 |
| 1.24 | -51.84 | 0.12 | 350.1 | 0.286E+00 | 0.28 | 20.21 |
| 1.33 | -50.40 | 0.13 | 362.3 | 0.276E+00 | 0.30 | 21.65 |
| 1.41 | -48.96 | 0.14 | 374.2 | 0.267E+00 | 0.32 | 23.09 |
| 1.50 | -47.52 | 0.15 | 385.7 | 0.259E+00 | 0.33 | 24.53 |
| 1.59 | -46.08 | 0.16 | 396.8 | 0.252E+00 | 0.35 | 25.97 |
| 1.68 | -44.64 | 0.17 | 407.7 | 0.245E+00 | 0.37 | 27.41 |
| 1.77 | -43.20 | 0.18 | 418.2 | 0.239E+00 | 0.38 | 28.85 |
| 1.86 | -41.76 | 0.19 | 428.5 | 0.233E+00 | 0.40 | 30.29 |
| 1.94 | -40.32 | 0.19 | 438.6 | 0.228E+00 | 0.42 | 31.73 |
| 2.03 | -38.88 | 0.20 | 448.4 | 0.223E+00 | 0.43 | 33.17 |
| 2.12 | -37.44 | 0.21 | 458.0 | 0.218E+00 | 0.45 | 34.61 |
| 2.21 | -36.00 | 0.22 | 467.5 | 0.214E+00 | 0.47 | 36.05 |
| 2.30 | -34.56 | 0.23 | 476.7 | 0.210E+00 | 0.48 | 37.49 |
| 2.39 | -33.12 | 0.24 | 485.8 | 0.206E+00 | 0.50 | 38.93 |
| 2.47 | -31.68 | 0.25 | 494.7 | 0.202E+00 | 0.52 | 40.37 |
| 2.56 | -30.24 | 0.26 | 503.4 | 0.199E+00 | 0.53 | 41.81 |
| 2.65 | -28.80 | 0.27 | 512.0 | 0.195E+00 | 0.55 | 43.25 |
| 2.74 | -27.36 | 0.27 | 520.4 | 0.192E+00 | 0.57 | 44.69 |
| 2.83 | -25.92 | 0.28 | 528.7 | 0.189E+00 | 0.58 | 46.13 |
| 2.92 | -24.48 | 0.29 | 536.9 | 0.186E+00 | 0.60 | 47.57 |
| 3.01 | -23.04 | 0.30 | 545.0 | 0.183E+00 | 0.62 | 49.01 |
| 3.09 | -21.60 | 0.31 | 552.9 | 0.181E+00 | 0.63 | 50.45 |
| 3.18 | -20.16 | 0.32 | 560.8 | 0.178E+00 | 0.65 | 51.89 |
| 3.27 | -18.72 | 0.33 | 568.5 | 0.176E+00 | 0.67 | 53.33 |
| 3.36 | -17.28 | 0.34 | 576.1 | 0.174E+00 | 0.68 | 54.77 |
| 3.45 | -15.84 | 0.34 | 583.6 | 0.171E+00 | 0.70 | 56.21 |
| 3.54 | -14.40 | 0.35 | 591.0 | 0.169E+00 | 0.72 | 57.65 |
| 3.62 | -12.96 | 0.36 | 598.4 | 0.167E+00 | 0.73 | 59.09 |
| 3.71 | -11.52 | 0.37 | 605.6 | 0.165E+00 | 0.75 | 60.53 |
| 3.80 | -10.08 | 0.38 | 612.8 | 0.163E+00 | 0.77 | 61.97 |
| 3.89 | -8.64 | 0.39 | 619.8 | 0.161E+00 | 0.78 | 63.41 |
| 3.98 | -7.19 | 0.40 | 626.8 | 0.160E+00 | 0.80 | 64.85 |
| 4.07 | -5.75 | 0.41 | 633.7 | 0.158E+00 | 0.82 | 66.29 |
| 4.15 | -4.31 | 0.42 | 640.6 | 0.156E+00 | 0.83 | 67.73 |
| 4.24 | -2.87 | 0.42 | 647.4 | 0.154E+00 | 0.85 | 69.17 |
| 4.33 | -1.43 | 0.43 | 654.1 | 0.153E+00 | 0.87 | 70.61 |
| 4.42 | 0.01 | 0.44 | 660.7 | 0.151E+00 | 0.88 | 72.05 |

Cumulative travel time = 29. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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-------------------------------------------------------------------------------
BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.258E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.323E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.51     0.01    0.88   660.7 0.151E+00   0.88    72.05    0.88    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    109.78     0.01    0.88   661.1 0.151E+00   0.88    72.10    0.88    0.00
    215.05     0.01    0.88   661.6 0.151E+00   0.88    72.15    0.88    0.00
    320.32     0.01    0.88   662.0 0.151E+00   0.88    72.19    0.88    0.00
    425.60     0.01    0.88   662.5 0.151E+00   0.88    72.24    0.88    0.00
    530.87     0.01    0.88   662.9 0.151E+00   0.88    72.29    0.88    0.00
    636.14     0.01    0.88   663.4 0.151E+00   0.88    72.34    0.88    0.00
    741.41     0.01    0.88   663.8 0.151E+00   0.88    72.39    0.88    0.00
    846.69     0.01    0.88   664.2 0.151E+00   0.88    72.44    0.88    0.00
    951.96     0.01    0.88   664.7 0.150E+00   0.88    72.48    0.88    0.00
   1057.23     0.01    0.88   665.1 0.150E+00   0.88    72.53    0.88    0.00
   1162.50     0.01    0.88   665.6 0.150E+00   0.88    72.58    0.88    0.00
   1267.77     0.01    0.88   666.0 0.150E+00   0.88    72.63    0.88    0.00
   1373.05     0.01    0.88   666.5 0.150E+00   0.88    72.68    0.88    0.00
   1478.32     0.01    0.88   666.9 0.150E+00   0.88    72.73    0.88    0.00
   1583.59     0.01    0.88   667.3 0.150E+00   0.88    72.77    0.88    0.00
   1688.86     0.01    0.88   667.8 0.150E+00   0.88    72.82    0.88    0.00
   1794.14     0.01    0.88   668.2 0.150E+00   0.88    72.87    0.88    0.00
   1899.41     0.01    0.88   668.7 0.150E+00   0.88    72.92    0.88    0.00
   2004.68     0.01    0.88   669.1 0.149E+00   0.88    72.97    0.88    0.00
   2109.95     0.01    0.88   669.5 0.149E+00   0.88    73.01    0.88    0.00
   2215.22     0.01    0.88   670.0 0.149E+00   0.88    73.06    0.88    0.00
   2320.50     0.01    0.88   670.4 0.149E+00   0.88    73.11    0.88    0.00
   2425.77     0.01    0.88   670.9 0.149E+00   0.88    73.16    0.88    0.00
   2531.04     0.01    0.88   671.3 0.149E+00   0.88    73.21    0.88    0.00
   2636.31     0.01    0.88   671.7 0.149E+00   0.88    73.25    0.88    0.00
   2741.58     0.01    0.88   672.2 0.149E+00   0.88    73.30    0.88    0.00
   2846.86     0.01    0.88   672.6 0.149E+00   0.88    73.35    0.88    0.00
   2952.13     0.01    0.88   673.1 0.149E+00   0.88    73.40    0.88    0.00
   3057.40     0.01    0.88   673.5 0.148E+00   0.88    73.45    0.88    0.00
   3162.67     0.01    0.88   673.9 0.148E+00   0.88    73.49    0.88    0.00
   3267.95     0.01    0.88   674.4 0.148E+00   0.88    73.54    0.88    0.00
   3373.22     0.01    0.88   674.8 0.148E+00   0.88    73.59    0.88    0.00
   3478.49     0.01    0.88   675.2 0.148E+00   0.88    73.64    0.88    0.00
   3583.76     0.01    0.88   675.7 0.148E+00   0.88    73.68    0.88    0.00
   3689.03     0.01    0.88   676.1 0.148E+00   0.88    73.73    0.88    0.00
   3794.31     0.01    0.88   676.5 0.148E+00   0.88    73.78    0.88    0.00
   3899.58     0.01    0.88   677.0 0.148E+00   0.88    73.83    0.88    0.00
   4004.85     0.01    0.88   677.4 0.148E+00   0.88    73.87    0.88    0.00
   4110.12     0.01    0.88   677.9 0.148E+00   0.88    73.92    0.88    0.00
   4215.40     0.01    0.88   678.3 0.147E+00   0.88    73.97    0.88    0.00
   4320.67     0.01    0.88   678.7 0.147E+00   0.88    74.02    0.88    0.00
   4425.94     0.01    0.88   679.2 0.147E+00   0.88    74.06    0.88    0.00
   4531.21     0.01    0.88   679.6 0.147E+00   0.88    74.11    0.88    0.00
   4636.48     0.01    0.88   680.0 0.147E+00   0.88    74.16    0.88    0.00
   4741.76     0.01    0.88   680.5 0.147E+00   0.88    74.20    0.88    0.00
   4847.03     0.01    0.88   680.9 0.147E+00   0.88    74.25    0.88    0.00
   4952.30     0.01    0.88   681.3 0.147E+00   0.88    74.30    0.88    0.00
   5057.57     0.01    0.88   681.8 0.147E+00   0.88    74.35    0.88    0.00
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   5162.84     0.01    0.88   682.2 0.147E+00   0.88    74.39    0.88    0.00
   5268.12     0.01    0.88   682.6 0.146E+00   0.88    74.44    0.88    0.00
 Cumulative travel time =       34568. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5268.12    74.45    0.88   682.6 0.146E+00   0.88   148.88    0.88    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    6011.05 m.
   7162.75    74.45    0.88   684.6 0.146E+00   0.88   149.05    0.88    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9057.39    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  10952.03    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  12846.67    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  14741.30    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  16635.94    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  18530.58    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  20425.21    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  22319.85    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  24214.49    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  26109.12    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  28003.76    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  29898.40    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  31793.04    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  33687.67    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  35582.31    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  37476.95    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  39371.58    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  41266.22    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  43160.86    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  45055.49    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  46950.13    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  48844.77    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  50739.40    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  52634.04    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  54528.68    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  56423.31    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  58317.95    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  60212.59    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  62107.22    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  64001.86    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  65896.50    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  67791.14    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  69685.78    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  71580.42    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  73475.06    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  75369.70    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  77264.34    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  79158.98    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  81053.62    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  82948.27    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  84842.91    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  86737.55    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  88632.19    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  90526.83    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  92421.47    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  94316.11    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  96210.75    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
  98105.39    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
 100000.03    74.45    0.88   683.4 0.146E+00   0.88   149.05    0.88    0.00
 Cumulative travel time =      656180. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
```

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       3 Cycles of Concentration, max flow, Human Criteria
 FILE NAME:         C:\...WTE\CORMIX\Potomac Penpendicular\3C-Max-Human.prd
 Time stamp:        Thu Jan  6 14:53:38 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    249.86  QA    =    156.20  ICHREG= 1
 HA    =      1.68  HD    =      1.68
 UA    =      0.625 F     =      0.059 USTAR =0.5389E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.010 Q0    =      0.029       =0.2934E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.2037E-03  m0    =0.1940E-05  j0    =0.3230E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.04  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.2934E-01  M0    =0.2794E-03  J0    =0.4652E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.32  Lm    =      0.03  Lb    =      0.00
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      1.64  FRD0  =      0.75  R     =      0.02
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     1.68  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.17 | -70.57 | 0.02 | 728.8 | 0.137E+00 | 0.08 | 1.49 |
| 0.34 | -69.13 | 0.03 | 1030.3 | 0.971E-01 | 0.12 | 2.93 |
| 0.50 | -67.69 | 0.05 | 1261.6 | 0.793E-01 | 0.15 | 4.37 |
| 0.67 | -66.25 | 0.07 | 1456.6 | 0.687E-01 | 0.18 | 5.81 |
| 0.84 | -64.81 | 0.08 | 1628.4 | 0.614E-01 | 0.21 | 7.25 |
| 1.01 | -63.37 | 0.10 | 1783.7 | 0.561E-01 | 0.25 | 8.69 |
| 1.17 | -61.93 | 0.12 | 1926.6 | 0.519E-01 | 0.28 | 10.13 |
| 1.34 | -60.49 | 0.13 | 2059.5 | 0.486E-01 | 0.31 | 11.57 |
| 1.51 | -59.05 | 0.15 | 2184.4 | 0.458E-01 | 0.34 | 13.01 |
| 1.68 | -57.61 | 0.17 | 2302.5 | 0.434E-01 | 0.38 | 14.45 |
| 1.84 | -56.17 | 0.18 | 2414.8 | 0.414E-01 | 0.41 | 15.89 |
| 2.01 | -54.73 | 0.20 | 2522.1 | 0.396E-01 | 0.44 | 17.33 |
| 2.18 | -53.29 | 0.22 | 2625.1 | 0.381E-01 | 0.47 | 18.77 |
| 2.35 | -51.85 | 0.23 | 2724.1 | 0.367E-01 | 0.51 | 20.21 |
| 2.51 | -50.41 | 0.25 | 2819.7 | 0.355E-01 | 0.54 | 21.65 |
| 2.68 | -48.97 | 0.27 | 2912.2 | 0.343E-01 | 0.57 | 23.09 |
| 2.85 | -47.53 | 0.28 | 3001.8 | 0.333E-01 | 0.60 | 24.53 |
| 3.02 | -46.09 | 0.30 | 3088.8 | 0.324E-01 | 0.64 | 25.97 |
| 3.19 | -44.65 | 0.32 | 3173.4 | 0.315E-01 | 0.67 | 27.41 |
| 3.35 | -43.21 | 0.34 | 3255.8 | 0.307E-01 | 0.70 | 28.85 |
| 3.52 | -41.77 | 0.35 | 3336.2 | 0.300E-01 | 0.73 | 30.29 |
| 3.69 | -40.32 | 0.37 | 3414.6 | 0.293E-01 | 0.77 | 31.73 |
| 3.86 | -38.88 | 0.39 | 3491.4 | 0.286E-01 | 0.80 | 33.17 |
| 4.02 | -37.44 | 0.40 | 3566.4 | 0.280E-01 | 0.83 | 34.61 |
| 4.19 | -36.00 | 0.42 | 3640.0 | 0.275E-01 | 0.86 | 36.05 |
| 4.36 | -34.56 | 0.44 | 3712.0 | 0.269E-01 | 0.90 | 37.49 |
| 4.53 | -33.12 | 0.45 | 3782.7 | 0.264E-01 | 0.93 | 38.93 |
| 4.69 | -31.68 | 0.47 | 3852.1 | 0.260E-01 | 0.96 | 40.37 |
| 4.86 | -30.24 | 0.49 | 3920.3 | 0.255E-01 | 0.99 | 41.81 |
| 5.03 | -28.80 | 0.50 | 3987.3 | 0.251E-01 | 1.03 | 43.25 |
| 5.20 | -27.36 | 0.52 | 4053.2 | 0.247E-01 | 1.06 | 44.69 |
| 5.36 | -25.92 | 0.54 | 4118.0 | 0.243E-01 | 1.09 | 46.13 |
| 5.53 | -24.48 | 0.55 | 4181.8 | 0.239E-01 | 1.12 | 47.57 |
| 5.70 | -23.04 | 0.57 | 4244.7 | 0.236E-01 | 1.16 | 49.01 |
| 5.87 | -21.60 | 0.59 | 4306.7 | 0.232E-01 | 1.19 | 50.45 |
| 6.04 | -20.16 | 0.60 | 4367.7 | 0.229E-01 | 1.22 | 51.89 |
| 6.20 | -18.72 | 0.62 | 4428.0 | 0.226E-01 | 1.25 | 53.33 |
| 6.37 | -17.28 | 0.64 | 4487.4 | 0.223E-01 | 1.29 | 54.77 |
| 6.54 | -15.84 | 0.65 | 4546.1 | 0.220E-01 | 1.32 | 56.21 |
| 6.71 | -14.40 | 0.67 | 4604.0 | 0.217E-01 | 1.35 | 57.65 |
| 6.87 | -12.96 | 0.69 | 4661.1 | 0.215E-01 | 1.38 | 59.09 |
| 7.04 | -11.52 | 0.70 | 4717.6 | 0.212E-01 | 1.42 | 60.53 |
| 7.21 | -10.08 | 0.72 | 4773.4 | 0.209E-01 | 1.45 | 61.97 |
| 7.38 | -8.64 | 0.74 | 4828.6 | 0.207E-01 | 1.48 | 63.41 |
| 7.54 | -7.20 | 0.75 | 4883.2 | 0.205E-01 | 1.51 | 64.85 |
| 7.71 | -5.76 | 0.77 | 4937.1 | 0.203E-01 | 1.55 | 66.29 |
| 7.88 | -4.32 | 0.79 | 4990.5 | 0.200E-01 | 1.58 | 67.73 |
| 8.05 | -2.88 | 0.80 | 5043.3 | 0.198E-01 | 1.61 | 69.17 |
| 8.21 | -1.44 | 0.82 | 5095.5 | 0.196E-01 | 1.64 | 70.61 |
| 8.38 | 0.00 | 0.84 | 5147.3 | 0.194E-01 | 1.68 | 72.05 |

Cumulative travel time = 13. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **

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BEGIN MOD241: BUOYANT AMBIENT SPREADING

Discharge is non-buoyant or weakly buoyant.
Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING

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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = 0.181E-01 m^2/s
Horizontal diffusivity (initial value) = 0.226E-01 m^2/s

The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

Profile definitions:
BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to layer depth, if fully mixed
BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

| X | Y | Z | S | C | BV | BH | ZU | ZL |
|---|---|---|---|---|---|---|---|---|
| 8.55 | 0.00 | 1.68 | 5147.3 | 0.194E-01 | 1.68 | 72.05 | 1.68 | 0.00 |
| 70.51 | 0.00 | 1.68 | 5150.7 | 0.194E-01 | 1.68 | 72.10 | 1.68 | 0.00 |
| 132.48 | 0.00 | 1.68 | 5154.2 | 0.194E-01 | 1.68 | 72.14 | 1.68 | 0.00 |
| 194.44 | 0.00 | 1.68 | 5157.7 | 0.194E-01 | 1.68 | 72.19 | 1.68 | 0.00 |
| 256.40 | 0.00 | 1.68 | 5161.2 | 0.194E-01 | 1.68 | 72.24 | 1.68 | 0.00 |
| 318.36 | 0.00 | 1.68 | 5164.7 | 0.194E-01 | 1.68 | 72.29 | 1.68 | 0.00 |
| 380.33 | 0.00 | 1.68 | 5168.1 | 0.193E-01 | 1.68 | 72.34 | 1.68 | 0.00 |
| 442.29 | 0.00 | 1.68 | 5171.6 | 0.193E-01 | 1.68 | 72.39 | 1.68 | 0.00 |
| 504.25 | 0.00 | 1.68 | 5175.1 | 0.193E-01 | 1.68 | 72.44 | 1.68 | 0.00 |
| 566.21 | 0.00 | 1.68 | 5178.5 | 0.193E-01 | 1.68 | 72.48 | 1.68 | 0.00 |
| 628.18 | 0.00 | 1.68 | 5182.0 | 0.193E-01 | 1.68 | 72.53 | 1.68 | 0.00 |
| 690.14 | 0.00 | 1.68 | 5185.5 | 0.193E-01 | 1.68 | 72.58 | 1.68 | 0.00 |
| 752.10 | 0.00 | 1.68 | 5188.9 | 0.193E-01 | 1.68 | 72.63 | 1.68 | 0.00 |
| 814.07 | 0.00 | 1.68 | 5192.4 | 0.193E-01 | 1.68 | 72.68 | 1.68 | 0.00 |
| 876.03 | 0.00 | 1.68 | 5195.8 | 0.192E-01 | 1.68 | 72.73 | 1.68 | 0.00 |
| 937.99 | 0.00 | 1.68 | 5199.3 | 0.192E-01 | 1.68 | 72.78 | 1.68 | 0.00 |
| 999.95 | 0.00 | 1.68 | 5202.8 | 0.192E-01 | 1.68 | 72.82 | 1.68 | 0.00 |
| 1061.92 | 0.00 | 1.68 | 5206.2 | 0.192E-01 | 1.68 | 72.87 | 1.68 | 0.00 |
| 1123.88 | 0.00 | 1.68 | 5209.6 | 0.192E-01 | 1.68 | 72.92 | 1.68 | 0.00 |
| 1185.84 | 0.00 | 1.68 | 5213.1 | 0.192E-01 | 1.68 | 72.97 | 1.68 | 0.00 |
| 1247.81 | 0.00 | 1.68 | 5216.5 | 0.192E-01 | 1.68 | 73.02 | 1.68 | 0.00 |
| 1309.77 | 0.00 | 1.68 | 5220.0 | 0.192E-01 | 1.68 | 73.06 | 1.68 | 0.00 |
| 1371.73 | 0.00 | 1.68 | 5223.4 | 0.191E-01 | 1.68 | 73.11 | 1.68 | 0.00 |
| 1433.69 | 0.00 | 1.68 | 5226.8 | 0.191E-01 | 1.68 | 73.16 | 1.68 | 0.00 |
| 1495.66 | 0.00 | 1.68 | 5230.3 | 0.191E-01 | 1.68 | 73.21 | 1.68 | 0.00 |
| 1557.62 | 0.00 | 1.68 | 5233.7 | 0.191E-01 | 1.68 | 73.26 | 1.68 | 0.00 |
| 1619.58 | 0.00 | 1.68 | 5237.1 | 0.191E-01 | 1.68 | 73.30 | 1.68 | 0.00 |
| 1681.55 | 0.00 | 1.68 | 5240.6 | 0.191E-01 | 1.68 | 73.35 | 1.68 | 0.00 |
| 1743.51 | 0.00 | 1.68 | 5244.0 | 0.191E-01 | 1.68 | 73.40 | 1.68 | 0.00 |
| 1805.47 | 0.00 | 1.68 | 5247.4 | 0.191E-01 | 1.68 | 73.45 | 1.68 | 0.00 |
| 1867.43 | 0.00 | 1.68 | 5250.8 | 0.190E-01 | 1.68 | 73.50 | 1.68 | 0.00 |
| 1929.40 | 0.00 | 1.68 | 5254.2 | 0.190E-01 | 1.68 | 73.54 | 1.68 | 0.00 |
| 1991.36 | 0.00 | 1.68 | 5257.7 | 0.190E-01 | 1.68 | 73.59 | 1.68 | 0.00 |
| 2053.32 | 0.00 | 1.68 | 5261.1 | 0.190E-01 | 1.68 | 73.64 | 1.68 | 0.00 |
| 2115.28 | 0.00 | 1.68 | 5264.5 | 0.190E-01 | 1.68 | 73.69 | 1.68 | 0.00 |
| 2177.25 | 0.00 | 1.68 | 5267.9 | 0.190E-01 | 1.68 | 73.74 | 1.68 | 0.00 |
| 2239.21 | 0.00 | 1.68 | 5271.3 | 0.190E-01 | 1.68 | 73.78 | 1.68 | 0.00 |
| 2301.17 | 0.00 | 1.68 | 5274.7 | 0.190E-01 | 1.68 | 73.83 | 1.68 | 0.00 |
| 2363.14 | 0.00 | 1.68 | 5278.1 | 0.189E-01 | 1.68 | 73.88 | 1.68 | 0.00 |
| 2425.10 | 0.00 | 1.68 | 5281.5 | 0.189E-01 | 1.68 | 73.93 | 1.68 | 0.00 |
| 2487.06 | 0.00 | 1.68 | 5284.9 | 0.189E-01 | 1.68 | 73.97 | 1.68 | 0.00 |
| 2549.02 | 0.00 | 1.68 | 5288.3 | 0.189E-01 | 1.68 | 74.02 | 1.68 | 0.00 |
| 2610.99 | 0.00 | 1.68 | 5291.7 | 0.189E-01 | 1.68 | 74.07 | 1.68 | 0.00 |
| 2672.95 | 0.00 | 1.68 | 5295.1 | 0.189E-01 | 1.68 | 74.12 | 1.68 | 0.00 |
| 2734.91 | 0.00 | 1.68 | 5298.5 | 0.189E-01 | 1.68 | 74.16 | 1.68 | 0.00 |
| 2796.88 | 0.00 | 1.68 | 5301.9 | 0.189E-01 | 1.68 | 74.21 | 1.68 | 0.00 |
| 2858.84 | 0.00 | 1.68 | 5305.2 | 0.188E-01 | 1.68 | 74.26 | 1.68 | 0.00 |
| 2920.80 | 0.00 | 1.68 | 5308.6 | 0.188E-01 | 1.68 | 74.31 | 1.68 | 0.00 |
| 2982.77 | 0.00 | 1.68 | 5312.0 | 0.188E-01 | 1.68 | 74.35 | 1.68 | 0.00 |
| 3044.73 | 0.00 | 1.68 | 5315.4 | 0.188E-01 | 1.68 | 74.40 | 1.68 | 0.00 |

```
   3106.69     0.00    1.68  5318.8 0.188E-01   1.68    74.45    1.68    0.00
 Cumulative travel time =        4969. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   3106.69    74.45    1.68  5318.8 0.188E-01   1.68   148.89    1.68    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    3506.67 m.
   5044.56    74.45    1.68  5345.1 0.187E-01   1.68   149.05    1.68    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   6982.42    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
   8920.29    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  10858.16    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  12796.02    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  14733.89    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  16671.75    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  18609.62    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  20547.49    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  22485.36    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  24423.22    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  26361.09    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  28298.96    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  30236.82    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  32174.69    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  34112.56    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  36050.43    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  37988.29    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  39926.16    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  41864.03    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  43801.89    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  45739.76    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  47677.63    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  49615.50    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  51553.36    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  53491.23    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  55429.10    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  57366.96    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  59304.83    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  61242.70    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  63180.57    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  65118.43    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  67056.30    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  68994.16    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  70932.03    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  72869.90    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  74807.77    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  76745.63    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  78683.50    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  80621.37    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  82559.23    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  84497.10    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  86434.97    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  88372.84    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  90310.70    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  92248.57    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  94186.44    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  96124.30    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
  98062.17    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
 100000.04    74.45    1.68  5324.2 0.188E-01   1.68   149.05    1.68    0.00
 Cumulative travel time =      159937. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       6 Cycles of Concentration, average flow, Acute Criteria
 FILE NAME:         C:\...CORMIX\Potomac Penpendicular\6C-Average-Acute.prd
 Time stamp:        Thu Jan  6 14:54:22 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    122.66  QA    =     14.61  ICHREG= 1
 HA    =      0.82  HD    =      0.82
 UA    =      0.119 F     =      0.075 USTAR =0.1156E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.002 Q0    =      0.005       =0.5236E-02
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.3635E-04  m0    =0.6179E-07  j0    =0.5765E-07  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.00  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.5236E-02  M0    =0.8899E-05  J0    =0.8302E-05
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.06  Lm    =      0.03  Lb    =      0.00
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.29  FRD0  =      0.13  R     =      0.01
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.82  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.08 | -70.57 | 0.01 | 382.4 | 0.261E+00 | 0.07 | 1.49 |
| 0.16 | -69.13 | 0.02 | 540.4 | 0.185E+00 | 0.08 | 2.93 |
| 0.25 | -67.69 | 0.02 | 661.6 | 0.151E+00 | 0.10 | 4.37 |
| 0.33 | -66.25 | 0.03 | 763.8 | 0.131E+00 | 0.11 | 5.81 |
| 0.41 | -64.81 | 0.04 | 853.9 | 0.117E+00 | 0.13 | 7.25 |
| 0.49 | -63.37 | 0.05 | 935.3 | 0.107E+00 | 0.14 | 8.69 |
| 0.58 | -61.93 | 0.06 | 1010.1 | 0.990E-01 | 0.16 | 10.13 |
| 0.66 | -60.49 | 0.07 | 1079.8 | 0.926E-01 | 0.17 | 11.57 |
| 0.74 | -59.05 | 0.07 | 1145.3 | 0.873E-01 | 0.19 | 13.01 |
| 0.82 | -57.61 | 0.08 | 1207.2 | 0.828E-01 | 0.21 | 14.45 |
| 0.91 | -56.17 | 0.09 | 1266.0 | 0.790E-01 | 0.22 | 15.89 |
| 0.99 | -54.73 | 0.10 | 1322.3 | 0.756E-01 | 0.24 | 17.33 |
| 1.07 | -53.29 | 0.11 | 1376.2 | 0.727E-01 | 0.25 | 18.77 |
| 1.15 | -51.85 | 0.12 | 1428.1 | 0.700E-01 | 0.27 | 20.21 |
| 1.23 | -50.41 | 0.12 | 1478.2 | 0.676E-01 | 0.28 | 21.65 |
| 1.32 | -48.97 | 0.13 | 1526.7 | 0.655E-01 | 0.30 | 23.09 |
| 1.40 | -47.53 | 0.14 | 1573.6 | 0.635E-01 | 0.31 | 24.53 |
| 1.48 | -46.09 | 0.15 | 1619.2 | 0.618E-01 | 0.33 | 25.97 |
| 1.56 | -44.65 | 0.16 | 1663.6 | 0.601E-01 | 0.34 | 27.41 |
| 1.65 | -43.21 | 0.16 | 1706.8 | 0.586E-01 | 0.36 | 28.85 |
| 1.73 | -41.77 | 0.17 | 1748.9 | 0.572E-01 | 0.38 | 30.29 |
| 1.81 | -40.32 | 0.18 | 1790.0 | 0.559E-01 | 0.39 | 31.73 |
| 1.89 | -38.88 | 0.19 | 1830.2 | 0.546E-01 | 0.41 | 33.17 |
| 1.98 | -37.44 | 0.20 | 1869.6 | 0.535E-01 | 0.42 | 34.61 |
| 2.06 | -36.00 | 0.21 | 1908.1 | 0.524E-01 | 0.44 | 36.05 |
| 2.14 | -34.56 | 0.21 | 1945.9 | 0.514E-01 | 0.45 | 37.49 |
| 2.22 | -33.12 | 0.22 | 1982.9 | 0.504E-01 | 0.47 | 38.93 |
| 2.30 | -31.68 | 0.23 | 2019.3 | 0.495E-01 | 0.48 | 40.37 |
| 2.39 | -30.24 | 0.24 | 2055.0 | 0.487E-01 | 0.50 | 41.81 |
| 2.47 | -28.80 | 0.25 | 2090.1 | 0.478E-01 | 0.51 | 43.25 |
| 2.55 | -27.36 | 0.26 | 2124.7 | 0.471E-01 | 0.53 | 44.69 |
| 2.63 | -25.92 | 0.26 | 2158.6 | 0.463E-01 | 0.54 | 46.13 |
| 2.72 | -24.48 | 0.27 | 2192.1 | 0.456E-01 | 0.56 | 47.57 |
| 2.80 | -23.04 | 0.28 | 2225.0 | 0.449E-01 | 0.58 | 49.01 |
| 2.88 | -21.60 | 0.29 | 2257.5 | 0.443E-01 | 0.59 | 50.45 |
| 2.96 | -20.16 | 0.30 | 2289.5 | 0.437E-01 | 0.61 | 51.89 |
| 3.04 | -18.72 | 0.30 | 2321.1 | 0.431E-01 | 0.62 | 53.33 |
| 3.13 | -17.28 | 0.31 | 2352.2 | 0.425E-01 | 0.64 | 54.77 |
| 3.21 | -15.84 | 0.32 | 2383.0 | 0.420E-01 | 0.65 | 56.21 |
| 3.29 | -14.40 | 0.33 | 2413.3 | 0.414E-01 | 0.67 | 57.65 |
| 3.37 | -12.96 | 0.34 | 2443.3 | 0.409E-01 | 0.68 | 59.09 |
| 3.46 | -11.52 | 0.35 | 2472.9 | 0.404E-01 | 0.70 | 60.53 |
| 3.54 | -10.08 | 0.35 | 2502.1 | 0.400E-01 | 0.71 | 61.97 |
| 3.62 | -8.64 | 0.36 | 2531.0 | 0.395E-01 | 0.73 | 63.41 |
| 3.70 | -7.20 | 0.37 | 2559.6 | 0.391E-01 | 0.75 | 64.85 |
| 3.79 | -5.76 | 0.38 | 2587.9 | 0.386E-01 | 0.76 | 66.29 |
| 3.87 | -4.32 | 0.39 | 2615.9 | 0.382E-01 | 0.78 | 67.73 |
| 3.95 | -2.88 | 0.40 | 2643.6 | 0.378E-01 | 0.79 | 69.17 |
| 4.03 | -1.44 | 0.40 | 2670.9 | 0.374E-01 | 0.81 | 70.61 |
| 4.11 | 0.00 | 0.41 | 2698.0 | 0.371E-01 | 0.82 | 72.05 |

Cumulative travel time = 35. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.191E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.238E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.20     0.00    0.82  2698.0 0.371E-01   0.82    72.05    0.82    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    116.07     0.00    0.82  2699.9 0.370E-01   0.82    72.10    0.82    0.00
    227.94     0.00    0.82  2701.7 0.370E-01   0.82    72.14    0.82    0.00
    339.81     0.00    0.82  2703.5 0.370E-01   0.82    72.19    0.82    0.00
    451.68     0.00    0.82  2705.3 0.370E-01   0.82    72.24    0.82    0.00
    563.55     0.00    0.82  2707.2 0.369E-01   0.82    72.29    0.82    0.00
    675.42     0.00    0.82  2709.0 0.369E-01   0.82    72.34    0.82    0.00
    787.29     0.00    0.82  2710.8 0.369E-01   0.82    72.39    0.82    0.00
    899.16     0.00    0.82  2712.6 0.369E-01   0.82    72.44    0.82    0.00
   1011.03     0.00    0.82  2714.4 0.368E-01   0.82    72.48    0.82    0.00
   1122.90     0.00    0.82  2716.3 0.368E-01   0.82    72.53    0.82    0.00
   1234.76     0.00    0.82  2718.1 0.368E-01   0.82    72.58    0.82    0.00
   1346.63     0.00    0.82  2719.9 0.368E-01   0.82    72.63    0.82    0.00
   1458.50     0.00    0.82  2721.7 0.367E-01   0.82    72.68    0.82    0.00
   1570.37     0.00    0.82  2723.5 0.367E-01   0.82    72.73    0.82    0.00
   1682.24     0.00    0.82  2725.3 0.367E-01   0.82    72.78    0.82    0.00
   1794.11     0.00    0.82  2727.1 0.367E-01   0.82    72.82    0.82    0.00
   1905.98     0.00    0.82  2728.9 0.366E-01   0.82    72.87    0.82    0.00
   2017.85     0.00    0.82  2730.7 0.366E-01   0.82    72.92    0.82    0.00
   2129.72     0.00    0.82  2732.6 0.366E-01   0.82    72.97    0.82    0.00
   2241.59     0.00    0.82  2734.4 0.366E-01   0.82    73.02    0.82    0.00
   2353.46     0.00    0.82  2736.2 0.365E-01   0.82    73.06    0.82    0.00
   2465.33     0.00    0.82  2738.0 0.365E-01   0.82    73.11    0.82    0.00
   2577.20     0.00    0.82  2739.8 0.365E-01   0.82    73.16    0.82    0.00
   2689.07     0.00    0.82  2741.6 0.365E-01   0.82    73.21    0.82    0.00
   2800.94     0.00    0.82  2743.4 0.365E-01   0.82    73.26    0.82    0.00
   2912.81     0.00    0.82  2745.2 0.364E-01   0.82    73.30    0.82    0.00
   3024.68     0.00    0.82  2747.0 0.364E-01   0.82    73.35    0.82    0.00
   3136.55     0.00    0.82  2748.8 0.364E-01   0.82    73.40    0.82    0.00
   3248.42     0.00    0.82  2750.5 0.364E-01   0.82    73.45    0.82    0.00
   3360.29     0.00    0.82  2752.3 0.363E-01   0.82    73.50    0.82    0.00
   3472.16     0.00    0.82  2754.1 0.363E-01   0.82    73.54    0.82    0.00
   3584.03     0.00    0.82  2755.9 0.363E-01   0.82    73.59    0.82    0.00
   3695.90     0.00    0.82  2757.7 0.363E-01   0.82    73.64    0.82    0.00
   3807.77     0.00    0.82  2759.5 0.362E-01   0.82    73.69    0.82    0.00
   3919.64     0.00    0.82  2761.3 0.362E-01   0.82    73.74    0.82    0.00
   4031.51     0.00    0.82  2763.1 0.362E-01   0.82    73.78    0.82    0.00
   4143.38     0.00    0.82  2764.9 0.362E-01   0.82    73.83    0.82    0.00
   4255.25     0.00    0.82  2766.6 0.361E-01   0.82    73.88    0.82    0.00
   4367.12     0.00    0.82  2768.4 0.361E-01   0.82    73.93    0.82    0.00
   4478.99     0.00    0.82  2770.2 0.361E-01   0.82    73.97    0.82    0.00
   4590.86     0.00    0.82  2772.0 0.361E-01   0.82    74.02    0.82    0.00
   4702.73     0.00    0.82  2773.8 0.361E-01   0.82    74.07    0.82    0.00
   4814.60     0.00    0.82  2775.5 0.360E-01   0.82    74.12    0.82    0.00
   4926.47     0.00    0.82  2777.3 0.360E-01   0.82    74.16    0.82    0.00
   5038.34     0.00    0.82  2779.1 0.360E-01   0.82    74.21    0.82    0.00
   5150.21     0.00    0.82  2780.9 0.360E-01   0.82    74.26    0.82    0.00
   5262.08     0.00    0.82  2782.6 0.359E-01   0.82    74.31    0.82    0.00
   5373.95     0.00    0.82  2784.4 0.359E-01   0.82    74.35    0.82    0.00
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   5485.82     0.00    0.82  2786.2 0.359E-01   0.82    74.40    0.82    0.00
   5597.69     0.00    0.82  2787.9 0.359E-01   0.82    74.45    0.82    0.00
 Cumulative travel time =       46974. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5597.69    74.45    0.82  2787.9 0.359E-01   0.82   148.89    0.82    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    6319.82 m.
   7485.73    74.45    0.82  2795.4 0.358E-01   0.82   149.05    0.82    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9373.78    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  11261.82    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  13149.87    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  15037.92    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  16925.96    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  18814.01    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  20702.06    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  22590.10    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  24478.15    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  26366.20    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  28254.24    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  30142.29    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  32030.34    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  33918.38    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  35806.43    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  37694.48    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  39582.52    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  41470.57    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  43358.62    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  45246.66    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  47134.71    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  49022.76    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  50910.80    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  52798.85    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  54686.90    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  56574.95    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  58462.99    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  60351.04    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  62239.09    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  64127.13    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  66015.18    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  67903.23    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  69791.27    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  71679.32    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  73567.37    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  75455.41    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  77343.46    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  79231.51    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  81119.55    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  83007.60    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  84895.65    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  86783.70    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  88671.74    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  90559.79    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  92447.84    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  94335.88    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  96223.93    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
  98111.98    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
 100000.02    74.45    0.82  2790.8 0.358E-01   0.82   149.05    0.82    0.00
 Cumulative travel time =      839174. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       6 Cycles of Concentration, avg flow, Chronic Criteria
 FILE NAME:         C:\...RMIX\Potomac Penpendicular\6C-Average-Chronic.prd
 Time stamp:        Thu Jan  6 14:57:16 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    131.75  QA    =     20.05  ICHREG= 1
 HA    =      0.88  HD    =      0.88
 UA    =      0.152 F     =      0.074 USTAR =0.1459E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.002 Q0    =      0.005       =0.5236E-02
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.3635E-04  m0    =0.6179E-07  j0    =0.5765E-07  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.00  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.5236E-02  M0    =0.8899E-05  J0    =0.8302E-05
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.06  Lm    =      0.02  Lb    =      0.00
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.29  FRD0  =      0.13  R     =      0.01
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.88  2
 2222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.09 | -70.57 | 0.01 | 524.4 | 0.191E+00 | 0.07 | 1.49 |
| 0.18 | -69.13 | 0.02 | 741.2 | 0.135E+00 | 0.08 | 2.93 |
| 0.27 | -67.69 | 0.03 | 907.5 | 0.110E+00 | 0.10 | 4.37 |
| 0.35 | -66.25 | 0.04 | 1047.8 | 0.954E-01 | 0.12 | 5.81 |
| 0.44 | -64.81 | 0.04 | 1171.3 | 0.854E-01 | 0.13 | 7.25 |
| 0.53 | -63.37 | 0.05 | 1283.0 | 0.779E-01 | 0.15 | 8.69 |
| 0.62 | -61.93 | 0.06 | 1385.8 | 0.722E-01 | 0.17 | 10.13 |
| 0.71 | -60.49 | 0.07 | 1481.4 | 0.675E-01 | 0.18 | 11.57 |
| 0.80 | -59.05 | 0.08 | 1571.2 | 0.636E-01 | 0.20 | 13.01 |
| 0.88 | -57.61 | 0.09 | 1656.1 | 0.604E-01 | 0.22 | 14.45 |
| 0.97 | -56.17 | 0.10 | 1736.9 | 0.576E-01 | 0.23 | 15.89 |
| 1.06 | -54.73 | 0.11 | 1814.1 | 0.551E-01 | 0.25 | 17.33 |
| 1.15 | -53.29 | 0.11 | 1888.1 | 0.530E-01 | 0.27 | 18.77 |
| 1.24 | -51.85 | 0.12 | 1959.3 | 0.510E-01 | 0.28 | 20.21 |
| 1.33 | -50.41 | 0.13 | 2028.1 | 0.493E-01 | 0.30 | 21.65 |
| 1.41 | -48.97 | 0.14 | 2094.6 | 0.477E-01 | 0.32 | 23.09 |
| 1.50 | -47.53 | 0.15 | 2159.0 | 0.463E-01 | 0.33 | 24.53 |
| 1.59 | -46.09 | 0.16 | 2221.6 | 0.450E-01 | 0.35 | 25.97 |
| 1.68 | -44.65 | 0.17 | 2282.4 | 0.438E-01 | 0.37 | 27.41 |
| 1.77 | -43.21 | 0.18 | 2341.7 | 0.427E-01 | 0.38 | 28.85 |
| 1.86 | -41.77 | 0.19 | 2399.5 | 0.417E-01 | 0.40 | 30.29 |
| 1.94 | -40.32 | 0.19 | 2455.9 | 0.407E-01 | 0.42 | 31.73 |
| 2.03 | -38.88 | 0.20 | 2511.1 | 0.398E-01 | 0.43 | 33.17 |
| 2.12 | -37.44 | 0.21 | 2565.1 | 0.390E-01 | 0.45 | 34.61 |
| 2.21 | -36.00 | 0.22 | 2618.0 | 0.382E-01 | 0.47 | 36.05 |
| 2.30 | -34.56 | 0.23 | 2669.8 | 0.375E-01 | 0.48 | 37.49 |
| 2.39 | -33.12 | 0.24 | 2720.6 | 0.368E-01 | 0.50 | 38.93 |
| 2.47 | -31.68 | 0.25 | 2770.5 | 0.361E-01 | 0.52 | 40.37 |
| 2.56 | -30.24 | 0.26 | 2819.5 | 0.355E-01 | 0.53 | 41.81 |
| 2.65 | -28.80 | 0.27 | 2867.7 | 0.349E-01 | 0.55 | 43.25 |
| 2.74 | -27.36 | 0.27 | 2915.1 | 0.343E-01 | 0.57 | 44.69 |
| 2.83 | -25.92 | 0.28 | 2961.7 | 0.338E-01 | 0.58 | 46.13 |
| 2.92 | -24.48 | 0.29 | 3007.7 | 0.332E-01 | 0.60 | 47.57 |
| 3.01 | -23.04 | 0.30 | 3052.9 | 0.328E-01 | 0.62 | 49.01 |
| 3.09 | -21.60 | 0.31 | 3097.4 | 0.323E-01 | 0.63 | 50.45 |
| 3.18 | -20.16 | 0.32 | 3141.3 | 0.318E-01 | 0.65 | 51.89 |
| 3.27 | -18.72 | 0.33 | 3184.7 | 0.314E-01 | 0.67 | 53.33 |
| 3.36 | -17.28 | 0.34 | 3227.4 | 0.310E-01 | 0.68 | 54.77 |
| 3.45 | -15.84 | 0.34 | 3269.6 | 0.306E-01 | 0.70 | 56.21 |
| 3.54 | -14.40 | 0.35 | 3311.2 | 0.302E-01 | 0.72 | 57.65 |
| 3.62 | -12.96 | 0.36 | 3352.3 | 0.298E-01 | 0.73 | 59.09 |
| 3.71 | -11.52 | 0.37 | 3393.0 | 0.295E-01 | 0.75 | 60.53 |
| 3.80 | -10.08 | 0.38 | 3433.1 | 0.291E-01 | 0.77 | 61.97 |
| 3.89 | -8.64 | 0.39 | 3472.8 | 0.288E-01 | 0.78 | 63.41 |
| 3.98 | -7.20 | 0.40 | 3512.0 | 0.285E-01 | 0.80 | 64.85 |
| 4.07 | -5.76 | 0.41 | 3550.8 | 0.282E-01 | 0.82 | 66.29 |
| 4.15 | -4.32 | 0.42 | 3589.2 | 0.279E-01 | 0.83 | 67.73 |
| 4.24 | -2.88 | 0.42 | 3627.2 | 0.276E-01 | 0.85 | 69.17 |
| 4.33 | -1.44 | 0.43 | 3664.7 | 0.273E-01 | 0.87 | 70.61 |
| 4.42 | 0.00 | 0.44 | 3701.9 | 0.270E-01 | 0.88 | 72.05 |

Cumulative travel time = 29. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.258E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.323E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.51     0.00    0.88   3701.9 0.270E-01   0.88    72.05    0.88    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    110.02     0.00    0.88   3704.4 0.270E-01   0.88    72.10    0.88    0.00
    215.54     0.00    0.88   3706.9 0.270E-01   0.88    72.14    0.88    0.00
    321.05     0.00    0.88   3709.4 0.270E-01   0.88    72.19    0.88    0.00
    426.57     0.00    0.88   3711.9 0.269E-01   0.88    72.24    0.88    0.00
    532.08     0.00    0.88   3714.5 0.269E-01   0.88    72.29    0.88    0.00
    637.60     0.00    0.88   3716.9 0.269E-01   0.88    72.34    0.88    0.00
    743.11     0.00    0.88   3719.4 0.269E-01   0.88    72.39    0.88    0.00
    848.63     0.00    0.88   3721.9 0.269E-01   0.88    72.44    0.88    0.00
    954.14     0.00    0.88   3724.4 0.268E-01   0.88    72.48    0.88    0.00
   1059.65     0.00    0.88   3726.9 0.268E-01   0.88    72.53    0.88    0.00
   1165.17     0.00    0.88   3729.4 0.268E-01   0.88    72.58    0.88    0.00
   1270.68     0.00    0.88   3731.9 0.268E-01   0.88    72.63    0.88    0.00
   1376.20     0.00    0.88   3734.4 0.268E-01   0.88    72.68    0.88    0.00
   1481.71     0.00    0.88   3736.9 0.268E-01   0.88    72.73    0.88    0.00
   1587.23     0.00    0.88   3739.4 0.267E-01   0.88    72.78    0.88    0.00
   1692.74     0.00    0.88   3741.8 0.267E-01   0.88    72.82    0.88    0.00
   1798.26     0.00    0.88   3744.3 0.267E-01   0.88    72.87    0.88    0.00
   1903.77     0.00    0.88   3746.8 0.267E-01   0.88    72.92    0.88    0.00
   2009.29     0.00    0.88   3749.3 0.267E-01   0.88    72.97    0.88    0.00
   2114.80     0.00    0.88   3751.8 0.267E-01   0.88    73.02    0.88    0.00
   2220.32     0.00    0.88   3754.2 0.266E-01   0.88    73.06    0.88    0.00
   2325.83     0.00    0.88   3756.7 0.266E-01   0.88    73.11    0.88    0.00
   2431.34     0.00    0.88   3759.2 0.266E-01   0.88    73.16    0.88    0.00
   2536.86     0.00    0.88   3761.6 0.266E-01   0.88    73.21    0.88    0.00
   2642.37     0.00    0.88   3764.1 0.266E-01   0.88    73.26    0.88    0.00
   2747.89     0.00    0.88   3766.6 0.265E-01   0.88    73.30    0.88    0.00
   2853.40     0.00    0.88   3769.0 0.265E-01   0.88    73.35    0.88    0.00
   2958.92     0.00    0.88   3771.5 0.265E-01   0.88    73.40    0.88    0.00
   3064.43     0.00    0.88   3774.0 0.265E-01   0.88    73.45    0.88    0.00
   3169.95     0.00    0.88   3776.4 0.265E-01   0.88    73.50    0.88    0.00
   3275.46     0.00    0.88   3778.9 0.265E-01   0.88    73.54    0.88    0.00
   3380.98     0.00    0.88   3781.3 0.264E-01   0.88    73.59    0.88    0.00
   3486.49     0.00    0.88   3783.8 0.264E-01   0.88    73.64    0.88    0.00
   3592.01     0.00    0.88   3786.2 0.264E-01   0.88    73.69    0.88    0.00
   3697.52     0.00    0.88   3788.7 0.264E-01   0.88    73.74    0.88    0.00
   3803.04     0.00    0.88   3791.1 0.264E-01   0.88    73.78    0.88    0.00
   3908.55     0.00    0.88   3793.6 0.264E-01   0.88    73.83    0.88    0.00
   4014.06     0.00    0.88   3796.0 0.263E-01   0.88    73.88    0.88    0.00
   4119.58     0.00    0.88   3798.5 0.263E-01   0.88    73.93    0.88    0.00
   4225.09     0.00    0.88   3800.9 0.263E-01   0.88    73.97    0.88    0.00
   4330.61     0.00    0.88   3803.4 0.263E-01   0.88    74.02    0.88    0.00
   4436.12     0.00    0.88   3805.8 0.263E-01   0.88    74.07    0.88    0.00
   4541.64     0.00    0.88   3808.3 0.263E-01   0.88    74.12    0.88    0.00
   4647.15     0.00    0.88   3810.7 0.262E-01   0.88    74.16    0.88    0.00
   4752.67     0.00    0.88   3813.1 0.262E-01   0.88    74.21    0.88    0.00
   4858.18     0.00    0.88   3815.6 0.262E-01   0.88    74.26    0.88    0.00
   4963.70     0.00    0.88   3818.0 0.262E-01   0.88    74.31    0.88    0.00
   5069.21     0.00    0.88   3820.4 0.262E-01   0.88    74.35    0.88    0.00
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   5174.73     0.00    0.88  3822.9 0.262E-01   0.88    74.40    0.88    0.00
   5280.24     0.00    0.88  3825.3 0.261E-01   0.88    74.45    0.88    0.00
 Cumulative travel time =       34689. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5280.24    74.45    0.88  3825.3 0.261E-01   0.88   148.89    0.88    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    5961.35 m.
   7174.64    74.45    0.88  3836.2 0.261E-01   0.88   149.05    0.88    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9069.03    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  10963.43    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  12857.82    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  14752.22    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  16646.61    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  18541.01    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  20435.40    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  22329.79    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  24224.19    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  26118.58    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  28012.98    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  29907.37    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  31801.77    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  33696.16    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  35590.56    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  37484.95    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  39379.35    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  41273.74    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  43168.14    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  45062.53    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  46956.93    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  48851.32    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  50745.71    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  52640.11    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  54534.50    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  56428.90    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  58323.29    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  60217.69    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  62112.08    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  64006.48    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  65900.87    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  67795.27    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  69689.67    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  71584.07    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  73478.47    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  75372.87    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  77267.27    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  79161.66    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  81056.06    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  82950.46    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  84844.86    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  86739.26    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  88633.66    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  90528.05    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  92422.45    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  94316.85    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  96211.25    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
  98105.65    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
 100000.05    74.45    0.88  3829.2 0.261E-01   0.88   149.05    0.88    0.00
 Cumulative travel time =      656969. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
2222222222222222222222222222222222222222222222222222222222222222222222222222
```

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       6 Cycles of Concentration, avg flow, Human Criteria
 FILE NAME:         C:\...CORMIX\Potomac Penpendicular\6C-Average-Human.prd
 Time stamp:        Thu Jan  6 14:57:58 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    249.86  QA    =    156.20  ICHREG= 1
 HA    =      1.68  HD    =      1.68
 UA    =      0.625 F     =      0.059 USTAR =0.5389E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.002 Q0    =      0.005       =0.5236E-02
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.3635E-04  m0    =0.6179E-07  j0    =0.5765E-07  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.00  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.5236E-02  M0    =0.8899E-05  J0    =0.8302E-05
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.06  Lm    =      0.00  Lb    =      0.00
                                        Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.29  FRD0  =      0.13  R     =      0.00
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     1.68  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.17 | -70.57 | 0.02 | 4080.1 | 0.245E-01 | 0.08 | 1.49 |
| 0.34 | -69.13 | 0.03 | 5769.7 | 0.173E-01 | 0.12 | 2.93 |
| 0.50 | -67.69 | 0.05 | 7066.1 | 0.142E-01 | 0.15 | 4.37 |
| 0.67 | -66.25 | 0.07 | 8159.1 | 0.123E-01 | 0.18 | 5.81 |
| 0.84 | -64.81 | 0.08 | 9122.1 | 0.110E-01 | 0.21 | 7.25 |
| 1.01 | -63.37 | 0.10 | 9992.6 | 0.100E-01 | 0.25 | 8.69 |
| 1.17 | -61.93 | 0.12 | 10793.2 | 0.927E-02 | 0.28 | 10.13 |
| 1.34 | -60.49 | 0.13 | 11538.3 | 0.867E-02 | 0.31 | 11.57 |
| 1.51 | -59.05 | 0.15 | 12238.2 | 0.817E-02 | 0.34 | 13.01 |
| 1.68 | -57.61 | 0.17 | 12900.1 | 0.775E-02 | 0.38 | 14.45 |
| 1.84 | -56.17 | 0.18 | 13529.7 | 0.739E-02 | 0.41 | 15.89 |
| 2.01 | -54.73 | 0.20 | 14131.3 | 0.708E-02 | 0.44 | 17.33 |
| 2.18 | -53.29 | 0.22 | 14708.3 | 0.680E-02 | 0.47 | 18.77 |
| 2.35 | -51.85 | 0.23 | 15263.5 | 0.655E-02 | 0.51 | 20.21 |
| 2.51 | -50.41 | 0.25 | 15799.1 | 0.633E-02 | 0.54 | 21.65 |
| 2.68 | -48.97 | 0.27 | 16317.2 | 0.613E-02 | 0.57 | 23.09 |
| 2.85 | -47.53 | 0.28 | 16819.4 | 0.595E-02 | 0.60 | 24.53 |
| 3.02 | -46.09 | 0.30 | 17307.0 | 0.578E-02 | 0.64 | 25.97 |
| 3.19 | -44.65 | 0.32 | 17781.2 | 0.562E-02 | 0.67 | 27.41 |
| 3.35 | -43.21 | 0.34 | 18243.1 | 0.548E-02 | 0.70 | 28.85 |
| 3.52 | -41.77 | 0.35 | 18693.6 | 0.535E-02 | 0.73 | 30.29 |
| 3.69 | -40.33 | 0.37 | 19133.5 | 0.523E-02 | 0.77 | 31.73 |
| 3.86 | -38.88 | 0.39 | 19563.5 | 0.511E-02 | 0.80 | 33.17 |
| 4.02 | -37.44 | 0.40 | 19984.2 | 0.500E-02 | 0.83 | 34.61 |
| 4.19 | -36.00 | 0.42 | 20396.3 | 0.490E-02 | 0.86 | 36.05 |
| 4.36 | -34.56 | 0.44 | 20800.2 | 0.481E-02 | 0.90 | 37.49 |
| 4.53 | -33.12 | 0.45 | 21196.4 | 0.472E-02 | 0.93 | 38.93 |
| 4.69 | -31.68 | 0.47 | 21585.4 | 0.463E-02 | 0.96 | 40.37 |
| 4.86 | -30.24 | 0.49 | 21967.4 | 0.455E-02 | 0.99 | 41.81 |
| 5.03 | -28.80 | 0.50 | 22342.9 | 0.448E-02 | 1.03 | 43.25 |
| 5.20 | -27.36 | 0.52 | 22712.3 | 0.440E-02 | 1.06 | 44.69 |
| 5.36 | -25.92 | 0.54 | 23075.7 | 0.433E-02 | 1.09 | 46.13 |
| 5.53 | -24.48 | 0.55 | 23433.4 | 0.427E-02 | 1.12 | 47.57 |
| 5.70 | -23.04 | 0.57 | 23785.8 | 0.420E-02 | 1.16 | 49.01 |
| 5.87 | -21.60 | 0.59 | 24133.1 | 0.414E-02 | 1.19 | 50.45 |
| 6.04 | -20.16 | 0.60 | 24475.4 | 0.409E-02 | 1.22 | 51.89 |
| 6.20 | -18.72 | 0.62 | 24813.0 | 0.403E-02 | 1.25 | 53.33 |
| 6.37 | -17.28 | 0.64 | 25146.0 | 0.398E-02 | 1.29 | 54.77 |
| 6.54 | -15.84 | 0.65 | 25474.7 | 0.393E-02 | 1.32 | 56.21 |
| 6.71 | -14.40 | 0.67 | 25799.3 | 0.388E-02 | 1.35 | 57.65 |
| 6.87 | -12.96 | 0.69 | 26119.7 | 0.383E-02 | 1.38 | 59.09 |
| 7.04 | -11.52 | 0.70 | 26436.3 | 0.378E-02 | 1.42 | 60.53 |
| 7.21 | -10.08 | 0.72 | 26749.2 | 0.374E-02 | 1.45 | 61.97 |
| 7.38 | -8.64 | 0.74 | 27058.4 | 0.370E-02 | 1.48 | 63.41 |
| 7.54 | -7.20 | 0.75 | 27364.2 | 0.365E-02 | 1.51 | 64.85 |
| 7.71 | -5.76 | 0.77 | 27666.6 | 0.361E-02 | 1.55 | 66.29 |
| 7.88 | -4.32 | 0.79 | 27965.6 | 0.358E-02 | 1.58 | 67.73 |
| 8.05 | -2.88 | 0.80 | 28261.6 | 0.354E-02 | 1.61 | 69.17 |
| 8.21 | -1.44 | 0.82 | 28554.4 | 0.350E-02 | 1.64 | 70.61 |
| 8.38 | 0.00 | 0.84 | 28844.3 | 0.347E-02 | 1.68 | 72.05 |

Cumulative travel time = 13. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **

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BEGIN MOD241: BUOYANT AMBIENT SPREADING

Discharge is non-buoyant or weakly buoyant.
Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING

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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = 0.181E-01 m^2/s
Horizontal diffusivity (initial value) = 0.226E-01 m^2/s

The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

Profile definitions:
BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to layer depth, if fully mixed
BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

| X | Y | Z | S | C | BV | BH | ZU | ZL |
|---|---|---|---|---|---|---|---|---|
| 8.55 | 0.00 | 1.68 | 28844.3 | 0.347E-02 | 1.68 | 72.05 | 1.68 | 0.00 |
| 70.50 | 0.00 | 1.68 | 28863.9 | 0.346E-02 | 1.68 | 72.10 | 1.68 | 0.00 |
| 132.46 | 0.00 | 1.68 | 28883.4 | 0.346E-02 | 1.68 | 72.14 | 1.68 | 0.00 |
| 194.41 | 0.00 | 1.68 | 28902.9 | 0.346E-02 | 1.68 | 72.19 | 1.68 | 0.00 |
| 256.37 | 0.00 | 1.68 | 28922.4 | 0.346E-02 | 1.68 | 72.24 | 1.68 | 0.00 |
| 318.32 | 0.00 | 1.68 | 28941.9 | 0.346E-02 | 1.68 | 72.29 | 1.68 | 0.00 |
| 380.27 | 0.00 | 1.68 | 28961.3 | 0.345E-02 | 1.68 | 72.34 | 1.68 | 0.00 |
| 442.23 | 0.00 | 1.68 | 28980.8 | 0.345E-02 | 1.68 | 72.39 | 1.68 | 0.00 |
| 504.18 | 0.00 | 1.68 | 29000.2 | 0.345E-02 | 1.68 | 72.44 | 1.68 | 0.00 |
| 566.14 | 0.00 | 1.68 | 29019.7 | 0.345E-02 | 1.68 | 72.48 | 1.68 | 0.00 |
| 628.09 | 0.00 | 1.68 | 29039.1 | 0.344E-02 | 1.68 | 72.53 | 1.68 | 0.00 |
| 690.05 | 0.00 | 1.68 | 29058.5 | 0.344E-02 | 1.68 | 72.58 | 1.68 | 0.00 |
| 752.00 | 0.00 | 1.68 | 29077.9 | 0.344E-02 | 1.68 | 72.63 | 1.68 | 0.00 |
| 813.95 | 0.00 | 1.68 | 29097.3 | 0.344E-02 | 1.68 | 72.68 | 1.68 | 0.00 |
| 875.91 | 0.00 | 1.68 | 29116.6 | 0.343E-02 | 1.68 | 72.73 | 1.68 | 0.00 |
| 937.86 | 0.00 | 1.68 | 29136.0 | 0.343E-02 | 1.68 | 72.78 | 1.68 | 0.00 |
| 999.82 | 0.00 | 1.68 | 29155.3 | 0.343E-02 | 1.68 | 72.82 | 1.68 | 0.00 |
| 1061.77 | 0.00 | 1.68 | 29174.7 | 0.343E-02 | 1.68 | 72.87 | 1.68 | 0.00 |
| 1123.73 | 0.00 | 1.68 | 29194.0 | 0.343E-02 | 1.68 | 72.92 | 1.68 | 0.00 |
| 1185.68 | 0.00 | 1.68 | 29213.3 | 0.342E-02 | 1.68 | 72.97 | 1.68 | 0.00 |
| 1247.63 | 0.00 | 1.68 | 29232.6 | 0.342E-02 | 1.68 | 73.02 | 1.68 | 0.00 |
| 1309.59 | 0.00 | 1.68 | 29251.8 | 0.342E-02 | 1.68 | 73.06 | 1.68 | 0.00 |
| 1371.54 | 0.00 | 1.68 | 29271.1 | 0.342E-02 | 1.68 | 73.11 | 1.68 | 0.00 |
| 1433.50 | 0.00 | 1.68 | 29290.4 | 0.341E-02 | 1.68 | 73.16 | 1.68 | 0.00 |
| 1495.45 | 0.00 | 1.68 | 29309.6 | 0.341E-02 | 1.68 | 73.21 | 1.68 | 0.00 |
| 1557.41 | 0.00 | 1.68 | 29328.8 | 0.341E-02 | 1.68 | 73.26 | 1.68 | 0.00 |
| 1619.36 | 0.00 | 1.68 | 29348.0 | 0.341E-02 | 1.68 | 73.30 | 1.68 | 0.00 |
| 1681.31 | 0.00 | 1.68 | 29367.2 | 0.341E-02 | 1.68 | 73.35 | 1.68 | 0.00 |
| 1743.27 | 0.00 | 1.68 | 29386.4 | 0.340E-02 | 1.68 | 73.40 | 1.68 | 0.00 |
| 1805.22 | 0.00 | 1.68 | 29405.6 | 0.340E-02 | 1.68 | 73.45 | 1.68 | 0.00 |
| 1867.18 | 0.00 | 1.68 | 29424.8 | 0.340E-02 | 1.68 | 73.50 | 1.68 | 0.00 |
| 1929.13 | 0.00 | 1.68 | 29443.9 | 0.340E-02 | 1.68 | 73.54 | 1.68 | 0.00 |
| 1991.08 | 0.00 | 1.68 | 29463.1 | 0.339E-02 | 1.68 | 73.59 | 1.68 | 0.00 |
| 2053.04 | 0.00 | 1.68 | 29482.2 | 0.339E-02 | 1.68 | 73.64 | 1.68 | 0.00 |
| 2114.99 | 0.00 | 1.68 | 29501.3 | 0.339E-02 | 1.68 | 73.69 | 1.68 | 0.00 |
| 2176.95 | 0.00 | 1.68 | 29520.4 | 0.339E-02 | 1.68 | 73.74 | 1.68 | 0.00 |
| 2238.90 | 0.00 | 1.68 | 29539.5 | 0.339E-02 | 1.68 | 73.78 | 1.68 | 0.00 |
| 2300.86 | 0.00 | 1.68 | 29558.6 | 0.338E-02 | 1.68 | 73.83 | 1.68 | 0.00 |
| 2362.81 | 0.00 | 1.68 | 29577.6 | 0.338E-02 | 1.68 | 73.88 | 1.68 | 0.00 |
| 2424.76 | 0.00 | 1.68 | 29596.7 | 0.338E-02 | 1.68 | 73.93 | 1.68 | 0.00 |
| 2486.72 | 0.00 | 1.68 | 29615.7 | 0.338E-02 | 1.68 | 73.97 | 1.68 | 0.00 |
| 2548.67 | 0.00 | 1.68 | 29634.7 | 0.337E-02 | 1.68 | 74.02 | 1.68 | 0.00 |
| 2610.63 | 0.00 | 1.68 | 29653.8 | 0.337E-02 | 1.68 | 74.07 | 1.68 | 0.00 |
| 2672.58 | 0.00 | 1.68 | 29672.8 | 0.337E-02 | 1.68 | 74.12 | 1.68 | 0.00 |
| 2734.53 | 0.00 | 1.68 | 29691.7 | 0.337E-02 | 1.68 | 74.16 | 1.68 | 0.00 |
| 2796.49 | 0.00 | 1.68 | 29710.7 | 0.337E-02 | 1.68 | 74.21 | 1.68 | 0.00 |
| 2858.44 | 0.00 | 1.68 | 29729.7 | 0.336E-02 | 1.68 | 74.26 | 1.68 | 0.00 |
| 2920.40 | 0.00 | 1.68 | 29748.6 | 0.336E-02 | 1.68 | 74.31 | 1.68 | 0.00 |
| 2982.35 | 0.00 | 1.68 | 29767.6 | 0.336E-02 | 1.68 | 74.35 | 1.68 | 0.00 |
| 3044.30 | 0.00 | 1.68 | 29786.5 | 0.336E-02 | 1.68 | 74.40 | 1.68 | 0.00 |

```
   3106.26     0.00    1.68 29805.4 0.336E-02   1.68    74.45    1.68    0.00
 Cumulative travel time =        4969. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   3106.26    74.45    1.68 29805.4 0.336E-02   1.68   148.89    1.68    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    3506.18 m.
   5044.13    74.45    1.68 29953.0 0.334E-02   1.68   149.05    1.68    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   6982.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
   8919.88    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  10857.76    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  12795.63    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  14733.51    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  16671.38    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  18609.26    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  20547.13    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  22485.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  24422.88    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  26360.76    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  28298.63    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  30236.51    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  32174.38    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  34112.26    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  36050.13    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  37988.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  39925.88    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  41863.76    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  43801.63    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  45739.51    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  47677.38    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  49615.26    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  51553.13    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  53491.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  55428.88    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  57366.76    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  59304.63    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  61242.51    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  63180.38    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  65118.26    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  67056.13    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  68994.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  70931.88    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  72869.76    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  74807.63    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  76745.51    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  78683.38    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  80621.26    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  82559.13    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  84497.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  86434.88    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  88372.76    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  90310.63    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  92248.51    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  94186.38    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  96124.26    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
  98062.13    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
 100000.01    74.45    1.68 29835.9 0.335E-02   1.68   149.05    1.68    0.00
 Cumulative travel time =      159962. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       6 Cycles of Concentration, max flow, Acute Criteria
 FILE NAME:         C:\...WTE\CORMIX\Potomac Penpendicular\6C-Max-Acute.prd
 Time stamp:        Thu Jan  6 14:58:41 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    122.66  QA    =     14.61  ICHREG= 1
 HA    =      0.82  HD    =      0.82
 UA    =      0.119 F     =      0.075 USTAR =0.1156E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.004 Q0    =      0.011       =0.1110E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7709E-04  m0    =0.2779E-06  j0    =0.1222E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.01  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1110E-01  M0    =0.4002E-04  J0    =0.1760E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.12  Lm    =      0.05  Lb    =      0.01
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.62  FRD0  =      0.28  R     =      0.03
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.82  2
 2222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.08 | -70.57 | 0.01 | 180.8 | 0.553E+00 | 0.07 | 1.49 |
| 0.16 | -69.13 | 0.02 | 255.3 | 0.392E+00 | 0.08 | 2.93 |
| 0.25 | -67.69 | 0.02 | 312.4 | 0.320E+00 | 0.10 | 4.37 |
| 0.33 | -66.25 | 0.03 | 360.6 | 0.277E+00 | 0.11 | 5.81 |
| 0.41 | -64.81 | 0.04 | 403.0 | 0.248E+00 | 0.13 | 7.25 |
| 0.49 | -63.37 | 0.05 | 441.4 | 0.227E+00 | 0.14 | 8.69 |
| 0.58 | -61.93 | 0.06 | 476.7 | 0.210E+00 | 0.16 | 10.13 |
| 0.66 | -60.49 | 0.07 | 509.5 | 0.196E+00 | 0.17 | 11.57 |
| 0.74 | -59.05 | 0.07 | 540.4 | 0.185E+00 | 0.19 | 13.01 |
| 0.82 | -57.61 | 0.08 | 569.6 | 0.176E+00 | 0.21 | 14.45 |
| 0.91 | -56.17 | 0.09 | 597.3 | 0.167E+00 | 0.22 | 15.89 |
| 0.99 | -54.73 | 0.10 | 623.8 | 0.160E+00 | 0.24 | 17.33 |
| 1.07 | -53.29 | 0.11 | 649.3 | 0.154E+00 | 0.25 | 18.77 |
| 1.15 | -51.85 | 0.12 | 673.7 | 0.148E+00 | 0.27 | 20.21 |
| 1.23 | -50.41 | 0.12 | 697.4 | 0.143E+00 | 0.28 | 21.65 |
| 1.32 | -48.97 | 0.13 | 720.2 | 0.139E+00 | 0.30 | 23.09 |
| 1.40 | -47.53 | 0.14 | 742.3 | 0.135E+00 | 0.31 | 24.53 |
| 1.48 | -46.09 | 0.15 | 763.8 | 0.131E+00 | 0.33 | 25.97 |
| 1.56 | -44.64 | 0.16 | 784.7 | 0.127E+00 | 0.34 | 27.41 |
| 1.65 | -43.20 | 0.16 | 805.1 | 0.124E+00 | 0.36 | 28.85 |
| 1.73 | -41.76 | 0.17 | 824.9 | 0.121E+00 | 0.38 | 30.29 |
| 1.81 | -40.32 | 0.18 | 844.3 | 0.118E+00 | 0.39 | 31.73 |
| 1.89 | -38.88 | 0.19 | 863.3 | 0.116E+00 | 0.41 | 33.17 |
| 1.98 | -37.44 | 0.20 | 881.8 | 0.113E+00 | 0.42 | 34.61 |
| 2.06 | -36.00 | 0.21 | 900.0 | 0.111E+00 | 0.44 | 36.05 |
| 2.14 | -34.56 | 0.21 | 917.8 | 0.109E+00 | 0.45 | 37.49 |
| 2.22 | -33.12 | 0.22 | 935.3 | 0.107E+00 | 0.47 | 38.93 |
| 2.30 | -31.68 | 0.23 | 952.4 | 0.105E+00 | 0.48 | 40.37 |
| 2.39 | -30.24 | 0.24 | 969.2 | 0.103E+00 | 0.50 | 41.81 |
| 2.47 | -28.80 | 0.25 | 985.8 | 0.101E+00 | 0.51 | 43.25 |
| 2.55 | -27.36 | 0.26 | 1002.1 | 0.998E-01 | 0.53 | 44.69 |
| 2.63 | -25.92 | 0.26 | 1018.1 | 0.982E-01 | 0.54 | 46.13 |
| 2.72 | -24.48 | 0.27 | 1033.9 | 0.967E-01 | 0.56 | 47.57 |
| 2.80 | -23.04 | 0.28 | 1049.4 | 0.953E-01 | 0.58 | 49.01 |
| 2.88 | -21.60 | 0.29 | 1064.7 | 0.939E-01 | 0.59 | 50.45 |
| 2.96 | -20.16 | 0.30 | 1079.8 | 0.926E-01 | 0.61 | 51.89 |
| 3.04 | -18.72 | 0.30 | 1094.7 | 0.914E-01 | 0.62 | 53.33 |
| 3.13 | -17.28 | 0.31 | 1109.3 | 0.901E-01 | 0.64 | 54.77 |
| 3.21 | -15.84 | 0.32 | 1123.8 | 0.890E-01 | 0.65 | 56.21 |
| 3.29 | -14.40 | 0.33 | 1138.1 | 0.879E-01 | 0.67 | 57.65 |
| 3.37 | -12.96 | 0.34 | 1152.3 | 0.868E-01 | 0.68 | 59.09 |
| 3.46 | -11.52 | 0.35 | 1166.2 | 0.857E-01 | 0.70 | 60.53 |
| 3.54 | -10.08 | 0.35 | 1180.0 | 0.847E-01 | 0.71 | 61.97 |
| 3.62 | -8.64 | 0.36 | 1193.6 | 0.838E-01 | 0.73 | 63.41 |
| 3.70 | -7.20 | 0.37 | 1207.1 | 0.828E-01 | 0.75 | 64.85 |
| 3.79 | -5.76 | 0.38 | 1220.4 | 0.819E-01 | 0.76 | 66.29 |
| 3.87 | -4.32 | 0.39 | 1233.6 | 0.811E-01 | 0.78 | 67.73 |
| 3.95 | -2.88 | 0.40 | 1246.7 | 0.802E-01 | 0.79 | 69.17 |
| 4.03 | -1.44 | 0.40 | 1259.6 | 0.794E-01 | 0.81 | 70.61 |
| 4.11 | 0.00 | 0.41 | 1272.4 | 0.786E-01 | 0.82 | 72.05 |

Cumulative travel time = 35. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.191E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.238E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.20     0.00    0.82  1272.4 0.786E-01   0.82    72.05    0.82    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    116.02     0.00    0.82  1273.2 0.785E-01   0.82    72.10    0.82    0.00
    227.84     0.00    0.82  1274.1 0.785E-01   0.82    72.14    0.82    0.00
    339.66     0.00    0.82  1274.9 0.784E-01   0.82    72.19    0.82    0.00
    451.48     0.00    0.82  1275.8 0.784E-01   0.82    72.24    0.82    0.00
    563.31     0.00    0.82  1276.7 0.783E-01   0.82    72.29    0.82    0.00
    675.13     0.00    0.82  1277.5 0.783E-01   0.82    72.34    0.82    0.00
    786.95     0.00    0.82  1278.4 0.782E-01   0.82    72.39    0.82    0.00
    898.77     0.00    0.82  1279.2 0.782E-01   0.82    72.44    0.82    0.00
   1010.59     0.00    0.82  1280.1 0.781E-01   0.82    72.48    0.82    0.00
   1122.42     0.00    0.82  1280.9 0.781E-01   0.82    72.53    0.82    0.00
   1234.24     0.00    0.82  1281.8 0.780E-01   0.82    72.58    0.82    0.00
   1346.06     0.00    0.82  1282.7 0.780E-01   0.82    72.63    0.82    0.00
   1457.88     0.00    0.82  1283.5 0.779E-01   0.82    72.68    0.82    0.00
   1569.70     0.00    0.82  1284.4 0.779E-01   0.82    72.73    0.82    0.00
   1681.53     0.00    0.82  1285.2 0.778E-01   0.82    72.77    0.82    0.00
   1793.35     0.00    0.82  1286.1 0.778E-01   0.82    72.82    0.82    0.00
   1905.17     0.00    0.82  1286.9 0.777E-01   0.82    72.87    0.82    0.00
   2016.99     0.00    0.82  1287.8 0.777E-01   0.82    72.92    0.82    0.00
   2128.81     0.00    0.82  1288.6 0.776E-01   0.82    72.97    0.82    0.00
   2240.63     0.00    0.82  1289.5 0.776E-01   0.82    73.02    0.82    0.00
   2352.46     0.00    0.82  1290.3 0.775E-01   0.82    73.06    0.82    0.00
   2464.28     0.00    0.82  1291.2 0.774E-01   0.82    73.11    0.82    0.00
   2576.10     0.00    0.82  1292.0 0.774E-01   0.82    73.16    0.82    0.00
   2687.92     0.00    0.82  1292.9 0.773E-01   0.82    73.21    0.82    0.00
   2799.74     0.00    0.82  1293.7 0.773E-01   0.82    73.26    0.82    0.00
   2911.56     0.00    0.82  1294.6 0.772E-01   0.82    73.30    0.82    0.00
   3023.39     0.00    0.82  1295.4 0.772E-01   0.82    73.35    0.82    0.00
   3135.21     0.00    0.82  1296.3 0.771E-01   0.82    73.40    0.82    0.00
   3247.03     0.00    0.82  1297.1 0.771E-01   0.82    73.45    0.82    0.00
   3358.85     0.00    0.82  1297.9 0.770E-01   0.82    73.50    0.82    0.00
   3470.67     0.00    0.82  1298.8 0.770E-01   0.82    73.54    0.82    0.00
   3582.50     0.00    0.82  1299.6 0.769E-01   0.82    73.59    0.82    0.00
   3694.32     0.00    0.82  1300.5 0.769E-01   0.82    73.64    0.82    0.00
   3806.14     0.00    0.82  1301.3 0.768E-01   0.82    73.69    0.82    0.00
   3917.96     0.00    0.82  1302.2 0.768E-01   0.82    73.73    0.82    0.00
   4029.78     0.00    0.82  1303.0 0.767E-01   0.82    73.78    0.82    0.00
   4141.60     0.00    0.82  1303.8 0.767E-01   0.82    73.83    0.82    0.00
   4253.43     0.00    0.82  1304.7 0.766E-01   0.82    73.88    0.82    0.00
   4365.25     0.00    0.82  1305.5 0.766E-01   0.82    73.92    0.82    0.00
   4477.07     0.00    0.82  1306.4 0.765E-01   0.82    73.97    0.82    0.00
   4588.89     0.00    0.82  1307.2 0.765E-01   0.82    74.02    0.82    0.00
   4700.71     0.00    0.82  1308.0 0.765E-01   0.82    74.07    0.82    0.00
   4812.54     0.00    0.82  1308.9 0.764E-01   0.82    74.11    0.82    0.00
   4924.36     0.00    0.82  1309.7 0.764E-01   0.82    74.16    0.82    0.00
   5036.18     0.00    0.82  1310.6 0.763E-01   0.82    74.21    0.82    0.00
   5148.00     0.00    0.82  1311.4 0.763E-01   0.82    74.26    0.82    0.00
   5259.82     0.00    0.82  1312.2 0.762E-01   0.82    74.30    0.82    0.00
   5371.64     0.00    0.82  1313.1 0.762E-01   0.82    74.35    0.82    0.00
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   5483.47     0.00    0.82  1313.9 0.761E-01   0.82    74.40    0.82    0.00
   5595.29     0.00    0.82  1314.7 0.761E-01   0.82    74.45    0.82    0.00
 Cumulative travel time =       46935. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5595.29    74.45    0.82  1314.7 0.761E-01   0.82   148.89    0.82    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    6333.54 m.
   7483.38    74.45    0.82  1318.2 0.759E-01   0.82   149.05    0.82    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9371.48    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  11259.57    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  13147.66    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  15035.76    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  16923.85    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  18811.95    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  20700.04    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  22588.13    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  24476.23    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  26364.32    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  28252.41    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  30140.51    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  32028.60    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  33916.70    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  35804.79    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  37692.88    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  39580.98    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  41469.07    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  43357.16    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  45245.26    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  47133.35    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  49021.45    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  50909.54    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  52797.63    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  54685.73    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  56573.82    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  58461.91    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  60350.01    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  62238.10    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  64126.20    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  66014.29    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  67902.38    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  69790.48    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  71678.57    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  73566.66    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  75454.76    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  77342.85    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  79230.95    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  81119.04    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  83007.13    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  84895.23    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  86783.32    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  88671.41    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  90559.51    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  92447.60    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  94335.70    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  96223.79    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  98111.88    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
  99999.98    74.45    0.82  1316.1 0.760E-01   0.82   149.05    0.82    0.00
 Cumulative travel time =      838837. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       6 Cycles of Concentration, max flow, Chronic Criteria
 FILE NAME:         C:\...E\CORMIX\Potomac Penpendicular\6C-Max-Chronic.prd
 Time stamp:        Thu Jan  6 14:59:11 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    131.75  QA    =     20.05  ICHREG= 1
 HA    =      0.88  HD    =      0.88
 UA    =      0.152 F     =      0.074 USTAR =0.1459E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.004 Q0    =      0.011       =0.1110E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7709E-04  m0    =0.2779E-06  j0    =0.1222E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.01  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1110E-01  M0    =0.4002E-04  J0    =0.1760E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.12  Lm    =      0.04  Lb    =      0.00
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.62  FRD0  =      0.28  R     =      0.02
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     0.88  2
 2222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.09 | -70.57 | 0.01 | 247.8 | 0.404E+00 | 0.07 | 1.49 |
| 0.18 | -69.13 | 0.02 | 350.0 | 0.286E+00 | 0.08 | 2.93 |
| 0.27 | -67.69 | 0.03 | 428.4 | 0.233E+00 | 0.10 | 4.37 |
| 0.35 | -66.25 | 0.04 | 494.5 | 0.202E+00 | 0.12 | 5.81 |
| 0.44 | -64.81 | 0.04 | 552.8 | 0.181E+00 | 0.13 | 7.25 |
| 0.53 | -63.37 | 0.05 | 605.4 | 0.165E+00 | 0.15 | 8.69 |
| 0.62 | -61.93 | 0.06 | 653.8 | 0.153E+00 | 0.17 | 10.13 |
| 0.71 | -60.49 | 0.07 | 698.9 | 0.143E+00 | 0.18 | 11.57 |
| 0.80 | -59.05 | 0.08 | 741.3 | 0.135E+00 | 0.20 | 13.01 |
| 0.88 | -57.61 | 0.09 | 781.3 | 0.128E+00 | 0.22 | 14.45 |
| 0.97 | -56.17 | 0.10 | 819.4 | 0.122E+00 | 0.23 | 15.89 |
| 1.06 | -54.73 | 0.11 | 855.8 | 0.117E+00 | 0.25 | 17.33 |
| 1.15 | -53.29 | 0.11 | 890.7 | 0.112E+00 | 0.27 | 18.77 |
| 1.24 | -51.85 | 0.12 | 924.3 | 0.108E+00 | 0.28 | 20.21 |
| 1.33 | -50.41 | 0.13 | 956.7 | 0.105E+00 | 0.30 | 21.65 |
| 1.41 | -48.97 | 0.14 | 988.0 | 0.101E+00 | 0.32 | 23.09 |
| 1.50 | -47.53 | 0.15 | 1018.4 | 0.982E-01 | 0.33 | 24.53 |
| 1.59 | -46.09 | 0.16 | 1047.9 | 0.954E-01 | 0.35 | 25.97 |
| 1.68 | -44.65 | 0.17 | 1076.6 | 0.929E-01 | 0.37 | 27.41 |
| 1.77 | -43.21 | 0.18 | 1104.5 | 0.905E-01 | 0.38 | 28.85 |
| 1.86 | -41.76 | 0.19 | 1131.8 | 0.884E-01 | 0.40 | 30.29 |
| 1.94 | -40.32 | 0.19 | 1158.4 | 0.863E-01 | 0.42 | 31.73 |
| 2.03 | -38.88 | 0.20 | 1184.4 | 0.844E-01 | 0.43 | 33.17 |
| 2.12 | -37.44 | 0.21 | 1209.8 | 0.827E-01 | 0.45 | 34.61 |
| 2.21 | -36.00 | 0.22 | 1234.8 | 0.810E-01 | 0.47 | 36.05 |
| 2.30 | -34.56 | 0.23 | 1259.2 | 0.794E-01 | 0.48 | 37.49 |
| 2.39 | -33.12 | 0.24 | 1283.2 | 0.779E-01 | 0.50 | 38.93 |
| 2.47 | -31.68 | 0.25 | 1306.7 | 0.765E-01 | 0.52 | 40.37 |
| 2.56 | -30.24 | 0.26 | 1329.8 | 0.752E-01 | 0.53 | 41.81 |
| 2.65 | -28.80 | 0.27 | 1352.5 | 0.739E-01 | 0.55 | 43.25 |
| 2.74 | -27.36 | 0.27 | 1374.9 | 0.727E-01 | 0.57 | 44.69 |
| 2.83 | -25.92 | 0.28 | 1396.8 | 0.716E-01 | 0.58 | 46.13 |
| 2.92 | -24.48 | 0.29 | 1418.5 | 0.705E-01 | 0.60 | 47.57 |
| 3.01 | -23.04 | 0.30 | 1439.8 | 0.695E-01 | 0.62 | 49.01 |
| 3.09 | -21.60 | 0.31 | 1460.8 | 0.685E-01 | 0.63 | 50.45 |
| 3.18 | -20.16 | 0.32 | 1481.5 | 0.675E-01 | 0.65 | 51.89 |
| 3.27 | -18.72 | 0.33 | 1501.9 | 0.666E-01 | 0.67 | 53.33 |
| 3.36 | -17.28 | 0.34 | 1522.1 | 0.657E-01 | 0.68 | 54.77 |
| 3.45 | -15.84 | 0.34 | 1542.0 | 0.649E-01 | 0.70 | 56.21 |
| 3.54 | -14.40 | 0.35 | 1561.6 | 0.640E-01 | 0.72 | 57.65 |
| 3.62 | -12.96 | 0.36 | 1581.0 | 0.633E-01 | 0.73 | 59.09 |
| 3.71 | -11.52 | 0.37 | 1600.1 | 0.625E-01 | 0.75 | 60.53 |
| 3.80 | -10.08 | 0.38 | 1619.1 | 0.618E-01 | 0.77 | 61.97 |
| 3.89 | -8.64 | 0.39 | 1637.8 | 0.611E-01 | 0.78 | 63.41 |
| 3.98 | -7.20 | 0.40 | 1656.3 | 0.604E-01 | 0.80 | 64.85 |
| 4.07 | -5.76 | 0.41 | 1674.6 | 0.597E-01 | 0.82 | 66.29 |
| 4.15 | -4.32 | 0.42 | 1692.6 | 0.591E-01 | 0.83 | 67.73 |
| 4.24 | -2.88 | 0.42 | 1710.5 | 0.585E-01 | 0.85 | 69.17 |
| 4.33 | -1.44 | 0.43 | 1728.3 | 0.579E-01 | 0.87 | 70.61 |
| 4.42 | 0.00 | 0.44 | 1745.8 | 0.573E-01 | 0.88 | 72.05 |

Cumulative travel time = 29. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **
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BEGIN MOD241: BUOYANT AMBIENT SPREADING

 Discharge is non-buoyant or weakly buoyant.
   Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING
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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

  Vertical diffusivity (initial value)   = 0.258E-02 m^2/s
  Horizontal diffusivity (initial value) = 0.323E-02 m^2/s

 Profile definitions:
   BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
      = or equal to layer depth, if fully mixed
   BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
        measured horizontally in Y-direction
   ZU = upper plume boundary (Z-coordinate)
   ZL = lower plume boundary (Z-coordinate)
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)

 Plume Stage 1 (not bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
      4.51     0.00    0.88  1745.8 0.573E-01   0.88    72.05    0.88    0.00
 Plume interacts with BOTTOM.
 The passive diffusion plume becomes VERTICALLY FULLY MIXED within this
   prediction interval.
    110.05     0.00    0.88  1747.0 0.572E-01   0.88    72.10    0.88    0.00
    215.58     0.00    0.88  1748.2 0.572E-01   0.88    72.14    0.88    0.00
    321.12     0.00    0.88  1749.3 0.572E-01   0.88    72.19    0.88    0.00
    426.66     0.00    0.88  1750.5 0.571E-01   0.88    72.24    0.88    0.00
    532.20     0.00    0.88  1751.7 0.571E-01   0.88    72.29    0.88    0.00
    637.74     0.00    0.88  1752.9 0.570E-01   0.88    72.34    0.88    0.00
    743.27     0.00    0.88  1754.1 0.570E-01   0.88    72.39    0.88    0.00
    848.81     0.00    0.88  1755.2 0.570E-01   0.88    72.44    0.88    0.00
    954.35     0.00    0.88  1756.4 0.569E-01   0.88    72.48    0.88    0.00
   1059.89     0.00    0.88  1757.6 0.569E-01   0.88    72.53    0.88    0.00
   1165.43     0.00    0.88  1758.8 0.569E-01   0.88    72.58    0.88    0.00
   1270.96     0.00    0.88  1759.9 0.568E-01   0.88    72.63    0.88    0.00
   1376.50     0.00    0.88  1761.1 0.568E-01   0.88    72.68    0.88    0.00
   1482.04     0.00    0.88  1762.3 0.567E-01   0.88    72.73    0.88    0.00
   1587.58     0.00    0.88  1763.4 0.567E-01   0.88    72.78    0.88    0.00
   1693.11     0.00    0.88  1764.6 0.567E-01   0.88    72.82    0.88    0.00
   1798.65     0.00    0.88  1765.8 0.566E-01   0.88    72.87    0.88    0.00
   1904.19     0.00    0.88  1767.0 0.566E-01   0.88    72.92    0.88    0.00
   2009.73     0.00    0.88  1768.1 0.566E-01   0.88    72.97    0.88    0.00
   2115.27     0.00    0.88  1769.3 0.565E-01   0.88    73.02    0.88    0.00
   2220.80     0.00    0.88  1770.5 0.565E-01   0.88    73.06    0.88    0.00
   2326.34     0.00    0.88  1771.6 0.564E-01   0.88    73.11    0.88    0.00
   2431.88     0.00    0.88  1772.8 0.564E-01   0.88    73.16    0.88    0.00
   2537.42     0.00    0.88  1774.0 0.564E-01   0.88    73.21    0.88    0.00
   2642.96     0.00    0.88  1775.1 0.563E-01   0.88    73.26    0.88    0.00
   2748.49     0.00    0.88  1776.3 0.563E-01   0.88    73.30    0.88    0.00
   2854.03     0.00    0.88  1777.4 0.563E-01   0.88    73.35    0.88    0.00
   2959.57     0.00    0.88  1778.6 0.562E-01   0.88    73.40    0.88    0.00
   3065.11     0.00    0.88  1779.8 0.562E-01   0.88    73.45    0.88    0.00
   3170.65     0.00    0.88  1780.9 0.562E-01   0.88    73.50    0.88    0.00
   3276.18     0.00    0.88  1782.1 0.561E-01   0.88    73.54    0.88    0.00
   3381.72     0.00    0.88  1783.2 0.561E-01   0.88    73.59    0.88    0.00
   3487.26     0.00    0.88  1784.4 0.560E-01   0.88    73.64    0.88    0.00
   3592.80     0.00    0.88  1785.6 0.560E-01   0.88    73.69    0.88    0.00
   3698.33     0.00    0.88  1786.7 0.560E-01   0.88    73.74    0.88    0.00
   3803.87     0.00    0.88  1787.9 0.559E-01   0.88    73.78    0.88    0.00
   3909.41     0.00    0.88  1789.0 0.559E-01   0.88    73.83    0.88    0.00
   4014.95     0.00    0.88  1790.2 0.559E-01   0.88    73.88    0.88    0.00
   4120.49     0.00    0.88  1791.3 0.558E-01   0.88    73.93    0.88    0.00
   4226.02     0.00    0.88  1792.5 0.558E-01   0.88    73.97    0.88    0.00
   4331.56     0.00    0.88  1793.6 0.558E-01   0.88    74.02    0.88    0.00
   4437.10     0.00    0.88  1794.8 0.557E-01   0.88    74.07    0.88    0.00
   4542.64     0.00    0.88  1795.9 0.557E-01   0.88    74.12    0.88    0.00
   4648.18     0.00    0.88  1797.1 0.556E-01   0.88    74.16    0.88    0.00
   4753.71     0.00    0.88  1798.2 0.556E-01   0.88    74.21    0.88    0.00
   4859.25     0.00    0.88  1799.4 0.556E-01   0.88    74.26    0.88    0.00
   4964.79     0.00    0.88  1800.5 0.555E-01   0.88    74.31    0.88    0.00
   5070.33     0.00    0.88  1801.7 0.555E-01   0.88    74.35    0.88    0.00
```

```
   5175.87     0.00    0.88  1802.8 0.555E-01   0.88    74.40    0.88    0.00
   5281.40     0.00    0.88  1804.0 0.554E-01   0.88    74.45    0.88    0.00
 Cumulative travel time =       34687. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   5281.40    74.45    0.88  1804.0 0.554E-01   0.88   148.89    0.88    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    5962.71 m.
   7175.78    74.45    0.88  1809.1 0.553E-01   0.88   149.05    0.88    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   9070.15    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  10964.52    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  12858.89    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  14753.26    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  16647.64    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  18542.01    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  20436.38    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  22330.75    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  24225.12    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  26119.49    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  28013.86    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  29908.23    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  31802.61    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  33696.98    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  35591.35    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  37485.72    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  39380.09    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  41274.46    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  43168.83    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  45063.20    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  46957.57    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  48851.95    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  50746.32    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  52640.69    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  54535.06    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  56429.43    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  58323.80    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  60218.17    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  62112.54    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  64006.91    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  65901.29    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  67795.66    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  69690.04    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  71584.41    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  73478.79    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  75373.16    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  77267.54    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  79161.91    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  81056.29    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  82950.66    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  84845.04    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  86739.41    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  88633.79    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  90528.16    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  92422.54    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  94316.91    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  96211.29    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
  98105.66    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
 100000.04    74.45    0.88  1805.8 0.554E-01   0.88   149.05    0.88    0.00
 Cumulative travel time =      656777. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
```

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CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222
                      CORNELL MIXING ZONE EXPERT SYSTEM
         Subsystem CORMIX2:  Submerged Multiport Diffuser Discharges
 CORMIX-GI Version 4.1GT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   FCCRWTE, MD
 Design case:       6 Cycles of Concentration, max flow, Human Criteria
 FILE NAME:         C:\...WTE\CORMIX\Potomac Penpendicular\6C-Max-Human.prd
 Time stamp:        Thu Jan  6 14:59:41 2011

ENVIRONMENT PARAMETERS (metric units)
 Bounded section
 BS    =    149.05  AS    =    249.86  QA    =    156.20  ICHREG= 1
 HA    =      1.68  HD    =      1.68
 UA    =      0.625 F     =      0.059 USTAR =0.5389E-01
 UW    =      2.000 UWSTAR=0.2198E-02
 Uniform density environment
 STRCND=  U         RHOAM =  996.1385

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= staged_perpendicular
 BANK  =  LEFT      DISTB =     74.45  YB1   =      2.44  YB2   =    146.46
 LD    =    144.02  NOPEN =  380       SPAC  =      0.76
 D0    =      0.102 A0    =      0.008 H0    =      0.00
 Nozzle/port arrangement:   staged
 GAMMA =     90.00  THETA =      0.00  SIGMA =     90.00  BETA  =      0.00
 U0    =      0.004 Q0    =      0.011       =0.1110E-01
 RHO0  =  995.9774  DRHO0 =0.1611E+00  GP0   =0.1586E-02
 C0    = 0.1000E+03 CUNITS=  mg/l
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.7709E-04  m0    =0.2779E-06  j0    =0.1222E-06  SIGNJ0=      1.0
 Associated 2-d length scales (meters)
 lQ=B  =      0.021 lM    =      0.01  lm    =      0.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1110E-01  M0    =0.4002E-04  J0    =0.1760E-04
 Associated 3-d length scales (meters)
 LQ    =      1.76  LM    =      0.12  Lm    =      0.01  Lb    =      0.00
                                       Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0   =      0.62  FRD0  =      0.28  R     =      0.01
 (slot)             (port/nozzle)

FLOW CLASSIFICATION
 2222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)      =    MU6    2
 2  Applicable layer depth HS =     1.68  2
 2222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0    = 0.1000E+03 CUNITS=  mg/l
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  = 100000.00  XMAX  = 100000.00

X-Y-Z COORDINATE SYSTEM:
    ORIGIN is located at the bottom and the diffuser mid-point:
        74.45 m  from the LEFT  bank/shore.
    X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 50 display intervals per module
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
BEGIN MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

 Due to complex near-field motions:  EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

 Profile definitions:
   BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory
   BH = Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
   S  = hydrodynamic centerline dilution
   C  = centerline concentration (includes reaction effects, if any)
```

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |

END OF MOD202: DISCHARGE MODULE (STAGED DIFFUSER)

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BEGIN MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

Because of the strong ambient current the diffuser plume of this crossflowing discharge gets RAPIDLY DEFLECTED.
A near-field zone is formed that is VERTICALLY FULLY MIXED over the entire layer depth. Full mixing is achieved at a downstream distance of about five (5) layer depths.

Profile definitions:
BV = layer depth (vertically mixed)
BH = top-hat half-width, measured horizontally in Y-direction
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

| X | Y | Z | S | C | BV | BH |
|---|---|---|---|---|---|---|
| 0.00 | -72.01 | 0.00 | 1.0 | 0.100E+03 | 0.05 | 0.05 |
| 0.17 | -70.57 | 0.02 | 1924.4 | 0.520E-01 | 0.08 | 1.49 |
| 0.34 | -69.13 | 0.03 | 2721.1 | 0.367E-01 | 0.12 | 2.93 |
| 0.50 | -67.69 | 0.05 | 3332.5 | 0.300E-01 | 0.15 | 4.37 |
| 0.67 | -66.25 | 0.07 | 3847.8 | 0.260E-01 | 0.18 | 5.81 |
| 0.84 | -64.81 | 0.08 | 4301.9 | 0.232E-01 | 0.21 | 7.25 |
| 1.01 | -63.37 | 0.10 | 4712.4 | 0.212E-01 | 0.25 | 8.69 |
| 1.17 | -61.93 | 0.12 | 5089.9 | 0.196E-01 | 0.28 | 10.13 |
| 1.34 | -60.49 | 0.13 | 5441.3 | 0.184E-01 | 0.31 | 11.57 |
| 1.51 | -59.05 | 0.15 | 5771.3 | 0.173E-01 | 0.34 | 13.01 |
| 1.68 | -57.61 | 0.17 | 6083.4 | 0.164E-01 | 0.38 | 14.45 |
| 1.84 | -56.17 | 0.18 | 6380.3 | 0.157E-01 | 0.41 | 15.89 |
| 2.01 | -54.73 | 0.20 | 6663.9 | 0.150E-01 | 0.44 | 17.33 |
| 2.18 | -53.29 | 0.22 | 6936.0 | 0.144E-01 | 0.47 | 18.77 |
| 2.35 | -51.85 | 0.23 | 7197.8 | 0.139E-01 | 0.51 | 20.21 |
| 2.51 | -50.41 | 0.25 | 7450.4 | 0.134E-01 | 0.54 | 21.65 |
| 2.68 | -48.97 | 0.27 | 7694.7 | 0.130E-01 | 0.57 | 23.09 |
| 2.85 | -47.53 | 0.28 | 7931.5 | 0.126E-01 | 0.60 | 24.53 |
| 3.02 | -46.09 | 0.30 | 8161.4 | 0.123E-01 | 0.64 | 25.97 |
| 3.19 | -44.65 | 0.32 | 8385.0 | 0.119E-01 | 0.67 | 27.41 |
| 3.35 | -43.21 | 0.34 | 8602.8 | 0.116E-01 | 0.70 | 28.85 |
| 3.52 | -41.77 | 0.35 | 8815.2 | 0.113E-01 | 0.73 | 30.29 |
| 3.69 | -40.33 | 0.37 | 9022.6 | 0.111E-01 | 0.77 | 31.73 |
| 3.86 | -38.88 | 0.39 | 9225.4 | 0.108E-01 | 0.80 | 33.17 |
| 4.02 | -37.44 | 0.40 | 9423.8 | 0.106E-01 | 0.83 | 34.61 |
| 4.19 | -36.00 | 0.42 | 9618.1 | 0.104E-01 | 0.86 | 36.05 |
| 4.36 | -34.56 | 0.44 | 9808.6 | 0.102E-01 | 0.90 | 37.49 |
| 4.53 | -33.12 | 0.45 | 9995.4 | 0.100E-01 | 0.93 | 38.93 |
| 4.69 | -31.68 | 0.47 | 10178.8 | 0.982E-02 | 0.96 | 40.37 |
| 4.86 | -30.24 | 0.49 | 10358.9 | 0.965E-02 | 0.99 | 41.81 |
| 5.03 | -28.80 | 0.50 | 10536.0 | 0.949E-02 | 1.03 | 43.25 |
| 5.20 | -27.36 | 0.52 | 10710.2 | 0.934E-02 | 1.06 | 44.69 |
| 5.36 | -25.92 | 0.54 | 10881.5 | 0.919E-02 | 1.09 | 46.13 |
| 5.53 | -24.48 | 0.55 | 11050.2 | 0.905E-02 | 1.12 | 47.57 |
| 5.70 | -23.04 | 0.57 | 11216.4 | 0.892E-02 | 1.16 | 49.01 |
| 5.87 | -21.60 | 0.59 | 11380.1 | 0.879E-02 | 1.19 | 50.45 |
| 6.04 | -20.16 | 0.60 | 11541.5 | 0.866E-02 | 1.22 | 51.89 |
| 6.20 | -18.72 | 0.62 | 11700.7 | 0.855E-02 | 1.25 | 53.33 |
| 6.37 | -17.28 | 0.64 | 11857.8 | 0.843E-02 | 1.29 | 54.77 |
| 6.54 | -15.84 | 0.65 | 12012.8 | 0.832E-02 | 1.32 | 56.21 |
| 6.71 | -14.40 | 0.67 | 12165.8 | 0.822E-02 | 1.35 | 57.65 |
| 6.87 | -12.96 | 0.69 | 12316.9 | 0.812E-02 | 1.38 | 59.09 |
| 7.04 | -11.52 | 0.70 | 12466.2 | 0.802E-02 | 1.42 | 60.53 |
| 7.21 | -10.08 | 0.72 | 12613.7 | 0.793E-02 | 1.45 | 61.97 |
| 7.38 | -8.64 | 0.74 | 12759.5 | 0.784E-02 | 1.48 | 63.41 |
| 7.54 | -7.20 | 0.75 | 12903.7 | 0.775E-02 | 1.51 | 64.85 |
| 7.71 | -5.76 | 0.77 | 13046.3 | 0.767E-02 | 1.55 | 66.29 |
| 7.88 | -4.32 | 0.79 | 13187.3 | 0.758E-02 | 1.58 | 67.73 |
| 8.05 | -2.88 | 0.80 | 13326.9 | 0.750E-02 | 1.61 | 69.17 |
| 8.21 | -1.44 | 0.82 | 13465.0 | 0.743E-02 | 1.64 | 70.61 |
| 8.38 | 0.00 | 0.84 | 13601.7 | 0.735E-02 | 1.68 | 72.05 |

Cumulative travel time = 13. sec
Plume centerline may exhibit slight discontinuities in transition to subsequent far-field module.

END OF MOD275: STAGED PERPENDICULAR DIFFUSER IN STRONG CURRENT

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** End of NEAR-FIELD REGION (NFR) **

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BEGIN MOD241: BUOYANT AMBIENT SPREADING

Discharge is non-buoyant or weakly buoyant.
Therefore BUOYANT SPREADING REGIME is ABSENT.

END OF MOD241: BUOYANT AMBIENT SPREADING

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BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = 0.181E-01 m^2/s
Horizontal diffusivity (initial value) = 0.226E-01 m^2/s

The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

Profile definitions:
BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to layer depth, if fully mixed
BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

| X | Y | Z | S | C | BV | BH | ZU | ZL |
|---|---|---|---|---|---|---|---|---|
| 8.55 | 0.00 | 1.68 | 13601.7 | 0.735E-02 | 1.68 | 72.05 | 1.68 | 0.00 |
| 70.51 | 0.00 | 1.68 | 13610.9 | 0.735E-02 | 1.68 | 72.10 | 1.68 | 0.00 |
| 132.46 | 0.00 | 1.68 | 13620.1 | 0.734E-02 | 1.68 | 72.14 | 1.68 | 0.00 |
| 194.42 | 0.00 | 1.68 | 13629.3 | 0.734E-02 | 1.68 | 72.19 | 1.68 | 0.00 |
| 256.38 | 0.00 | 1.68 | 13638.5 | 0.733E-02 | 1.68 | 72.24 | 1.68 | 0.00 |
| 318.33 | 0.00 | 1.68 | 13647.6 | 0.733E-02 | 1.68 | 72.29 | 1.68 | 0.00 |
| 380.29 | 0.00 | 1.68 | 13656.8 | 0.732E-02 | 1.68 | 72.34 | 1.68 | 0.00 |
| 442.25 | 0.00 | 1.68 | 13666.0 | 0.732E-02 | 1.68 | 72.39 | 1.68 | 0.00 |
| 504.20 | 0.00 | 1.68 | 13675.2 | 0.731E-02 | 1.68 | 72.44 | 1.68 | 0.00 |
| 566.16 | 0.00 | 1.68 | 13684.3 | 0.731E-02 | 1.68 | 72.48 | 1.68 | 0.00 |
| 628.12 | 0.00 | 1.68 | 13693.5 | 0.730E-02 | 1.68 | 72.53 | 1.68 | 0.00 |
| 690.07 | 0.00 | 1.68 | 13702.6 | 0.730E-02 | 1.68 | 72.58 | 1.68 | 0.00 |
| 752.03 | 0.00 | 1.68 | 13711.8 | 0.729E-02 | 1.68 | 72.63 | 1.68 | 0.00 |
| 813.98 | 0.00 | 1.68 | 13720.9 | 0.729E-02 | 1.68 | 72.68 | 1.68 | 0.00 |
| 875.94 | 0.00 | 1.68 | 13730.1 | 0.728E-02 | 1.68 | 72.73 | 1.68 | 0.00 |
| 937.90 | 0.00 | 1.68 | 13739.2 | 0.728E-02 | 1.68 | 72.78 | 1.68 | 0.00 |
| 999.85 | 0.00 | 1.68 | 13748.3 | 0.727E-02 | 1.68 | 72.82 | 1.68 | 0.00 |
| 1061.81 | 0.00 | 1.68 | 13757.4 | 0.727E-02 | 1.68 | 72.87 | 1.68 | 0.00 |
| 1123.77 | 0.00 | 1.68 | 13766.5 | 0.726E-02 | 1.68 | 72.92 | 1.68 | 0.00 |
| 1185.72 | 0.00 | 1.68 | 13775.6 | 0.726E-02 | 1.68 | 72.97 | 1.68 | 0.00 |
| 1247.68 | 0.00 | 1.68 | 13784.7 | 0.725E-02 | 1.68 | 73.02 | 1.68 | 0.00 |
| 1309.64 | 0.00 | 1.68 | 13793.8 | 0.725E-02 | 1.68 | 73.06 | 1.68 | 0.00 |
| 1371.59 | 0.00 | 1.68 | 13802.9 | 0.724E-02 | 1.68 | 73.11 | 1.68 | 0.00 |
| 1433.55 | 0.00 | 1.68 | 13812.0 | 0.724E-02 | 1.68 | 73.16 | 1.68 | 0.00 |
| 1495.51 | 0.00 | 1.68 | 13821.0 | 0.724E-02 | 1.68 | 73.21 | 1.68 | 0.00 |
| 1557.46 | 0.00 | 1.68 | 13830.1 | 0.723E-02 | 1.68 | 73.26 | 1.68 | 0.00 |
| 1619.42 | 0.00 | 1.68 | 13839.2 | 0.723E-02 | 1.68 | 73.30 | 1.68 | 0.00 |
| 1681.38 | 0.00 | 1.68 | 13848.2 | 0.722E-02 | 1.68 | 73.35 | 1.68 | 0.00 |
| 1743.33 | 0.00 | 1.68 | 13857.3 | 0.722E-02 | 1.68 | 73.40 | 1.68 | 0.00 |
| 1805.29 | 0.00 | 1.68 | 13866.3 | 0.721E-02 | 1.68 | 73.45 | 1.68 | 0.00 |
| 1867.25 | 0.00 | 1.68 | 13875.4 | 0.721E-02 | 1.68 | 73.50 | 1.68 | 0.00 |
| 1929.20 | 0.00 | 1.68 | 13884.4 | 0.720E-02 | 1.68 | 73.54 | 1.68 | 0.00 |
| 1991.16 | 0.00 | 1.68 | 13893.4 | 0.720E-02 | 1.68 | 73.59 | 1.68 | 0.00 |
| 2053.12 | 0.00 | 1.68 | 13902.4 | 0.719E-02 | 1.68 | 73.64 | 1.68 | 0.00 |
| 2115.07 | 0.00 | 1.68 | 13911.4 | 0.719E-02 | 1.68 | 73.69 | 1.68 | 0.00 |
| 2177.03 | 0.00 | 1.68 | 13920.4 | 0.718E-02 | 1.68 | 73.74 | 1.68 | 0.00 |
| 2238.99 | 0.00 | 1.68 | 13929.5 | 0.718E-02 | 1.68 | 73.78 | 1.68 | 0.00 |
| 2300.94 | 0.00 | 1.68 | 13938.4 | 0.717E-02 | 1.68 | 73.83 | 1.68 | 0.00 |
| 2362.90 | 0.00 | 1.68 | 13947.4 | 0.717E-02 | 1.68 | 73.88 | 1.68 | 0.00 |
| 2424.85 | 0.00 | 1.68 | 13956.4 | 0.717E-02 | 1.68 | 73.93 | 1.68 | 0.00 |
| 2486.81 | 0.00 | 1.68 | 13965.4 | 0.716E-02 | 1.68 | 73.97 | 1.68 | 0.00 |
| 2548.77 | 0.00 | 1.68 | 13974.4 | 0.716E-02 | 1.68 | 74.02 | 1.68 | 0.00 |
| 2610.72 | 0.00 | 1.68 | 13983.3 | 0.715E-02 | 1.68 | 74.07 | 1.68 | 0.00 |
| 2672.68 | 0.00 | 1.68 | 13992.3 | 0.715E-02 | 1.68 | 74.12 | 1.68 | 0.00 |
| 2734.64 | 0.00 | 1.68 | 14001.3 | 0.714E-02 | 1.68 | 74.16 | 1.68 | 0.00 |
| 2796.59 | 0.00 | 1.68 | 14010.2 | 0.714E-02 | 1.68 | 74.21 | 1.68 | 0.00 |
| 2858.55 | 0.00 | 1.68 | 14019.1 | 0.713E-02 | 1.68 | 74.26 | 1.68 | 0.00 |
| 2920.51 | 0.00 | 1.68 | 14028.1 | 0.713E-02 | 1.68 | 74.31 | 1.68 | 0.00 |
| 2982.46 | 0.00 | 1.68 | 14037.0 | 0.712E-02 | 1.68 | 74.35 | 1.68 | 0.00 |
| 3044.42 | 0.00 | 1.68 | 14045.9 | 0.712E-02 | 1.68 | 74.40 | 1.68 | 0.00 |

```
   3106.38     0.00    1.68 14054.9 0.711E-02   1.68    74.45    1.68    0.00
 Cumulative travel time =        4969. sec

-----------------------------------------------------------------------------
 Plume Stage 2 (bank attached):
       X        Y       Z        S       C       BV       BH      ZU      ZL
   3106.38    74.45    1.68 14054.9 0.711E-02   1.68   148.89    1.68    0.00
 The passive diffusion plume becomes LATERALLY FULLY MIXED over the channel
     width during the current prediction interval.
 The x-coordinate of bank attachment is    3506.31 m.
   5044.25    74.45    1.68 14124.4 0.708E-02   1.68   149.05    1.68    0.00
 Effluent is FULLY MIXED over the entire channel cross-section.
 Except for possible far-field decay or reaction processes, there are
     NO FURTHER CHANGES with downstream direction.
   6982.12    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
   8919.99    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  10857.87    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  12795.74    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  14733.61    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  16671.48    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  18609.36    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  20547.23    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  22485.10    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  24422.97    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  26360.85    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  28298.72    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  30236.59    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  32174.47    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  34112.34    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  36050.21    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  37988.08    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  39925.95    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  41863.82    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  43801.70    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  45739.57    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  47677.44    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  49615.31    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  51553.18    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  53491.05    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  55428.92    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  57366.79    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  59304.66    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  61242.54    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  63180.41    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  65118.28    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  67056.15    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  68994.02    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  70931.90    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  72869.77    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  74807.65    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  76745.52    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  78683.40    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  80621.27    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  82559.15    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  84497.02    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  86434.90    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  88372.77    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  90310.65    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  92248.52    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  94186.40    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  96124.27    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
  98062.15    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
 100000.02    74.45    1.68 14069.2 0.711E-02   1.68   149.05    1.68    0.00
 Cumulative travel time =      159956. sec

 Simulation limit based on maximum specified distance = 100000.00 m.
   This is the REGION OF INTEREST limitation.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
CORMIX2: Submerged Multiport Diffuser Discharges       End of Prediction File
22222222222222222222222222222222222222222222222222222222222222222222222222222
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# MISCELLANEOUS FORMS

# FORM MDE/WMA/PER.064

**MARYLAND DEPARTMENT OF THE ENVIRONMENT**
1800 Washington Blvd. ● Baltimore Maryland 21230
(410) 537-3000 ● 1-800-633-6101 ● http://www.mde.state.md.us

# WASTEWATER DISCHARGE PERMIT APPLICATION SUPPLEMENT:
## *INDUSTRIAL WASTEWATER TREATMENT PLANT CLASSIFICATION*

[1] Name of facility: Fredirick/Carroll County Waste to Energy Facility;

[2] Current State Discharge Permit Number (for renewals only): -DP- NA;

[3] What is the current classification of your industrial wastewater treatment system? *Please refer to the attached table (Table 1, Classification Of Industrial Wastewater Treatment Plants) and indicate the numeric classification as described in the table:*

CLASSIFICATION: 6;

[4] What type of treatment system, as referenced in *Table 1*, best describes your wastewater treatment system?

TYPE OF TREATMENT SYSTEM: EFFLUENT DECHLORINATION ;

[5] If your industrial wastewater operator or superintendent is certified, what is the classification? (See the certified operator's certificate).

OPERATOR CERTIFICATION: NEW FACILITY-CERTIFIED OPERATOR WILL BE HIRED ;

OR, If you believe that your process is one of the exempted facilities, see the attached table *(Table 2, Facilities Not Required To Have Certified Operators)*, please check the following box:

[ ] *Certified Operator Not Needed*

# *INDUSTRIAL WASTEWATER TREATMENT PLANT CLASSIFICATION*

*Table 1*

## CLASSIFICATION OF INDUSTRIAL WASTEWATER TREATMENT PLANTS

| Class of Plants | Type of Treatment Systems | Typical Processes Included in the System |
|---|---|---|
| **1** | Basic Treatment | Petroleum base oil separators, liquid cooling and pH control. |
| **2** | Physical Treatment | Sedimentation, screening, pH control and solids removal. |
| **3** | Land Treatment | Primary treatment, sedimentation, solids removal, pumping and land treatment. |
| **4** | Biological Lagoons | Aerobic or anaerobic waste stabilization lagoons, disinfection and chemical addition. |
| **5** | Activated Sludge | Primary treatment, sedimentation, activated sludge and sludge handling. |
| **6** | Physical Chemical Treatment | Reduction of chemical and toxic substances including but not limited to cyanide and chromium, acid-alkali neutralization, coagulation and flocculation. |
| **7** | Site Specific | Plants not covered under the first six types of treatment yet covered under these regulations. |

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*Table 2*

## FACILITIES NOT REQUIRED TO HAVE CERTIFIED OPERATORS

**Note: Generally speaking, the following categories of facilities are <u>not</u> required by the Code of Maryland Regulations (COMAR) to have certified operators:**

- Petroleum storage and distribution facilities
- Seafood processors
- Vehicle washing facilities
- Vehicle maintenance facilities
- Sand and gravel facilities
- Stone quarries
- Industries de-chlorinating supply water as their only treatment
- Industries discharging only storm water runoff
- Industries performing tank or pipe hydrostatic testing

# FORM MDE/WMA/PER.069

**MARYLAND DEPARTMENT OF THE ENVIRONMENT**
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101 • http://www.mde.state.md.us

# CERTIFICATION OF WORKERS' COMPENSATION INSURANCE COVERAGE

## INTRODUCTION

Section 1-202 of the Environment Article provides that the applicant for a permit or license to engage in any activity in which the applicant may employ a "covered employee", as defined in §9-101 of the Labor and Employment Article of the Annotated Code of Maryland ("LE"), shall provide to the Maryland Department of the Environment (the "Department") the policy or binder number of a valid workers' compensation insurance policy that has been issued to the applicant. Such a filing is required before the Department may issue any such license or permit.

Alternatively, the applicant shall file a Certificate of Compliance issued by the Maryland Workers' Compensation Commission only in cases where the applicant is either:
(a) A sole proprietorship with no employees;
(b) A partnership with no employees other than individual partners;
(c) A Farm Corporation, a Maryland Close Corporation, a Professional Corporation or a Limited Liability Company with no employees other than corporate officers or limited liability company members who have elected, under LE §9-206, to be excluded from workers' compensation coverage;
(d) A business that is an employer on only "casual employees" as provided under LE §9-205 and defined in Maryland Law; or
(e) A business that is the owner of a Class F (Tractor) vehicle who meets the requirements of exclusion as defined under LE §9-218.

Accordingly, as an applicant for a license or permit before the Department, the undersigned hereby certifies that the following is true and accurate to the best of his knowledge. This document will be incorporated by reference into the application that it supports. Check one of the appropriate lines below, entering the name and address of your insurance provider, and your insurance policy or binder number, if applicable. If certification is made that the applicant is eligible for a Certificate of Compliance, the reason or reasons listed above must be specified.

# MARYLAND DEPARTMENT OF THE ENVIRONMENT

## CERTIFICATION

X ____ I certify that the applicant is covered by workers' compensation insurance as required by Title 9 of the Labor and Employment Article.

Name of Insurance Provider:
Injured Worker's Insurance Fund

Address of Insurance Provider:
8722 Loch Raven Boulevard, Baltimore, Maryland 21286-2235

Insurance Policy or Binder Number:
2341816

____ I certify that the applicant is eligible to apply for a Certificate of Compliance from the Maryland Workers' Compensation Commission for the reason or reasons listed on the line below. I hereby request that the Maryland Department of the Environment provide to me an application form for said certificate.

Reason(s) for eligibility to receive Certificate of Compliance:

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and with all attachments hereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

| Name & Title (Please Print) | Phone Number |
|---|---|
| Robin Davidov, Executive Director of NEA | 410-333-2730 |
| Signature<br>Robin Davidov | Date Signed<br>02/17/11 |